ORIGINAL ARTICLES

POSTPARTUM INTRAUTERINE CONTRACEPTIVE DEVICE INSERTION IN CARDIAC PATIENTS

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ABSTRACT

Objective: To assess the acceptability and safety of immediate postpartum intrauterine contraceptive device insertion among parturient having cardiac disease and to determine gynecological and cardiac complications at follow up at four to six weeks and at six months.

Study Design: Prospective interventional study.

Place and Duration of Study: This study was conducted at obstetrics and gynecology ward of Armed Forces Institute of Cardiology/ national Institute of Heart Disease (AFIC/ NIHD) from Jan 2016 to Dec 2016.

Methodology: All consecutive cardiac patients delivering were evaluated and enrolled after consent. Patients were followed up for six months after placing post partum intrauterine contraceptive device (PPIUCD). Primary outcome was acceptance. Safety was assessed by occurrence of cardiac and gynecologic complications including perforation, expulsion, lost strings and pelvic infection. Cardiac complications studied were, arrhythmias, ischemic episodes, thromboembolism and infective endocarditis at follow up between 4-6 weeks and at six months.

Results: A total of 170 patients delivered during the study period. Of these women 108 (63.5%) were eligible for PPIUCD insertion and 42 (38.8%) accepted PPIUCD. Mean age and parity was 28 ±5 and P2 ± 1.5. Cardiac lesions amongst participants was Mitral valve disease in 58.8% followed by double valve replacement in 14.7%, dilated cardiomyopathy 11.76%, aortic valve involvement in 8.8% and supra ventricular tachycardia in 5.9% patients. Minor gynecological complications were reported in 11 (26.0%) and cardiac complications were 6 (14.0%). Long term safety at follow up was assessed at six months by continuation of method in 30 (85.7%). discontinuation in 4 (9.5%) due to bleeding, 2 (4.8%) were lost to follow up and there was 0 (%) pregnancy.

Conclusion: Postpartum intrauterine device insertion is a safe and valid option in selected cardiac patients who would benefit most from this long acting reversible contraceptive method. There is no increased risk in cardiac patients compared to general population.

Keywords: Cardiac disease, Contraception, Pregnancy.

INTRODUCTION

The number of women reaching reproductive age affected by cardiac disease is rising because more children with congenital heart disease are surviving to adulthood due to early diagnosis and expert care. Similar is the case with acquired heart diseases. Pregnancy is associated with hemodynamic, hemostatic and metabolic alterations that increase cardiovascular risks especially in cardiac patients. Cardiac disease is the leading cause of maternal death worldwide and complications for fetus like preterm delivery, congenital heart disease, growth restriction, stillbirth and deaths in infancy. Choosing the most appropriate contraceptive for women with cardiac disease requires consideration of the level of risk of pregnancy, method’s efficacy, risks associated with administration and long term use. In many of these high risk cases balancing these risks requires a multidisciplinary and individualized approach. This is the medical eligibility criteria (MEC) for contraceptive use in which the safety of each contraceptive method is determined by several considerations in the context of the medical condition, primarily and secondarily

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whether the medical circumstance makes the contraceptive method less effective. It is estimated that almost 115 million women worldwide have an unmet need for family planning, that is they express a desire to limit or space future births, but they are not currently using a family planning method. The countries with the highest percentage of unmet need are in Sub-Saharan Africa and Southeast Asia ranging between 30-42%. The appropriate spacing of births has positive impact on women’s health and on their social and economic well-being. The postpartum period presents an excellent window of opportunity to provide family planning counseling and methods to women especially in a country like Pakistan where generally the only encounter with a skilled health care provider is during childbirth. The best family planning method in this situation would be used immediately following childbirth thus preventing mistimed or unwanted pregnancies. Nowadays, PPIUCD has been established as an effective and reliable method of contraception as it offers numerous advantages like easy insertion, no adverse impact on breast-feeding, cost-effectiveness, relief of overcrowded outpatient facilities and protection against unwanted pregnancy and consequently abortion. Appropriate time for IUCD insertion in the postpartum period includes the post placental IUCD insertion, the immediate postpartum IUCD insertion within 48 hours and the transcesarean IUCD insertion. PPIUCD insertion is an opportunity not to be missed in developing countries like ours.

PPIUCD is a relatively new treatment option and is not being used in many hospitals. Therefore to see whether it is safe and effective in high risk cardiac patients is the reason for this study. This procedure is very safe and effective in non-cardiac patients so this research will help in establishing safety in cardiac patients.

**METHODOLOGY**

This was prospective interventional study done in Armed Forces Institute of Cardiology Rawalpindi from Jan 2016 to Dec 2016. Patients were enrolled by Consecutive purposive non probability sampling at ObGyn department. Approval for conducting the study was taken from institutional review board of AFIC/NHMD. Placing PPIUCD was also discussed with National committee of maternal and neonatal health Pakistan (NMCNH) PPIUCD initiative. Pregnant cardiac patients delivering vaginally and by lower segment cesarean section at obstetrics ward during study period were counseled and those who were eligible and consented were included. Counseling for postpartum family planning was offered during antenatal visits, and during admission for delivery. A written informed consent was taken. Patients having complex valvular heart disease, Complex Cyanotic heart disease, Fontans circulation and Eisenmenger syndrome, fever during labor and delivery, Pelvic infections, prolonged rupture of membranes, Uterine anomalies, myomas and postpartum hemorrhage due to atony were excluded. The post placental IUCD insertion was done immediately after expulsion of the placenta, following a vaginal delivery in labor room or within 48 hours of delivery and the transcesarean IUCD before the uterine incision was closed in operation theatre. The procedure was performed by a doctor with the assistance of a midwife in labor room with continuous hemodynamic monitoring with the help of cardiac monitor and facilities available for cardiopulmonary resuscitation.

Postnatal Insertion was performed by placing the patient in lithotomy position. Aseptic techniques were used throughout the procedure. Sim’s speculum was gently inserted and cervix visualized. The anterior lip of the cervix was then gently grasped with ring forceps. The IUCD was removed from the insertion sleeve and grasped with the Kelly’s forceps using a no-touch technique. The IUCD was then inserted through the dilated cervix to the level of the uterine fundus, as confirmed by palpation with a hand placed on the abdomen overlying the fundus. The forceps were opened to release the IUCD and...
removed without closing the forceps. The cervical os was then gently inspected with the Sims speculum for the strings. Trans cesarean intrauterine device was inserted through open uterine incision with the help of a rings forceps and left at fundus. Uterine incision closed without trimming the threads.

Upon discharge a PPIUCD follow up card was given which contained all the relevant information. Patients were discharged postnatally if they were clinically well, haemo-dynamically stable, fully mobilized with minimal bleeding and pain. Patients were explained warning signs like fever, abdominal pain, heavy bleeding and foul smelling discharge and were advised to report if they experience any warning sign or if the IUCD expelled. They were instructed to report cardiac symptoms like palpitations, difficulty in breathing, chest pain and dizziness. All women were offered a follow-up appointment with a doctor after four-six weeks.

At four weeks interval those women whom the PPIUCD was inserted were reassessed by checking their oral temperature. An abdominal examination for suprapubic tenderness and involution of the uterus was done. A digital vaginal examination was then done to assess for cervical motion tenderness. Expulsion was taken when IUCD was not visualized on followup or women reported visually witnessing expulsion confirmed by scan. Pelvic infection was oral temperature of 38 degree C or higher on two occasions with suprapubic tenderness, cervical motion pain, adnexal tenderness and palpable mass. A speculum examination was then performed to check if the strings were visible and any discharge noted. The visible IUCD strings were trimmed at approximately 3 cms. Lost strings were when strings were not visualized despite confirming that IUCD is in situ by USG. Acceptance and safety were the primary outcome measures and taken as parturient who agreed on insertion of PPIUCD within 48 hours of delivery. Safety was assessed by amount of blood loss, abdominal pain, and syncope. Gynecological complications including expulsion, perforation, lost strings and pelvic infection were studied.

![Figure-1: Postpartum intrauterine contraceptive devices insertion among patients.](image1)

![Figure-2: Gynecological complications among the patients.](image2)
Cardiac complications studied were arrhythmias, ischaemic episodes, thromboembolism and infective endocarditis. As a secondary outcome long term safety was assessed by pregnancy and continuation of PPIUCD method at 6 months post insertion.

Data were collected and analyzed using SPSS version 21. Continuous variables age and parity were described as mean ± SD. Categorical variables including acceptance, previous contraceptive use, reasons for declining PPIUCD were noted. Gynecological and cardiac complications including expulsion, perforation, lost strings and pelvic infection, arrhythmias, ischemic episodes, thromboembolism and infective endocarditis were expressed as percentages. Long term safety was assessed by pregnancy and continuation of PPIUCD method at 6 months. Descriptive statistics were used to describe the data, and frequency and percentage were calculated.

RESULTS

A total of 170 patients delivered during the study period. Of these women 108 (63.5%) were eligible for PPIUCD insertion according to eligibility criteria and 42 (38.8%) accepted PPIUCD as a method of contraception.

The reason for refusal were Fear of disease 20 (30.3%), Husband’s disapproval 10 (15.2%), preference of another method 28 (42.4%), no reason 08 (12.1%). Mean age and parity was 28 ± 5 and P2 ± 1.570% patients were educated till secondary level and 30% till primary. Patients with variety of cardiac lesions were amongst the participants. Mitral valve was the dominant valve involved in 58.8% followed by double valve replacement in 14.7%, dilated cardiomyopathy 11.76%, aortic valve involvement in 8.8% and supra ventricular tachycardia in 5.9% patients.

Previous contraceptive use was reported by only 15(35%) patients. Immediate safety was assessed by blood loss 150.32 ±50, pain (numeric 1-10 pain rating scale) of 1.86 ±1.68 and syncope in 1 (2.3%).

Gynecological complications were reported in 11 (26%) and cardiac complications were 6 (14%) (table-I). Long term safety at follow up was assessed at six months as 30 (85.7%) continued it,


**DISCUSSION**

Many contraceptive choices are available in Pakistan. There is some limitation in their use due to cardiac disease. But cardiac patients are the ones who would benefit most as mistimed and unplanned pregnancy is most dangerous in these high risk patients. Cardiac patients are unique considering they cannot be given conventional drugs like oral contraceptive pills and IUCD insertion is limited in certain structural heart disease but for most of cardiac lesions intrauterine devices are in MEC 1 or 2 making them a safe choice. A very few studies have addressed safety of contraceptive use in patients with cardiac disease so most of the evidence is drawn from generally healthy population. The World Health Organization recently revised guidelines on postpartum and newborn care includes provision of family planning counseling as a core component of postpartum care. The postpartum period is potentially an ideal time to begin contraception as women are more strongly motivated and also has the advantage of being convenient for both patients and health-care providers. Age and parity of the woman were 28 ± 5 years and P2 ± 1.570% which is comparable to other studies on PPIUCD insertion.

The acceptance of PPIUCD was high in the parturients studied 42 (38%) but comparable to other studies done globally in spite of it being a newer technique which show acceptance of 28.9% Reason for not accepting PPIUCD in this study was Fear of disease 20 (30.3%), preference of another method 28 (42.4%) followed by fear of disease progression in 20 (30.3%) comparable to another study in which fear of complications from PPIUCD were the main reason for refusal. Studies have shown that postpartum IUCD insertions, including those done immediately after placental delivery or cesarean section, are generally safe and effective and do not increase the risk of infection, bleeding, uterine perforation or endometritis. In a Cochrane Collaboration review of nine randomized controlled trials assessing the feasibility of immediate PPIUCD found out that expulsion rates were generally higher for the immediate postpartum than interval insertion. However, expulsion is less likely to occur with proper technique. Overall the PPIUCD insertion was safe and effective with minimal bleeding and pain like in this study (fig-1). The risks of pelvic infection appear to be no greater with postpartum insertion than with interval insertion. For immediate postpartum insertions the cumulative six-month pelvic inflammatory disease (PID) rate was 1.4 to 2 per 100 women as compared to 4.7% in this study. Absence of uterine perforation with extremely low rates of expulsion 2 (4.7%), and lost strings 5 (11%) are strong indicators of safety at follow up. Expulsion rate of 4.7% is quite low as in another study the expulsion rate was 9% postplacental and 37% if placed postpartum (fig-2). Cardiac complications are least with intrauterine devices including copper IUD’S and intrauterine levonorgesteral containing devices as shown in this study and also from faculty of sexual and reproductive healthcare clinical guidance for Contraceptive choices for women with cardiac disease (fig-3). Even postpartum insertion was not found to increase the risks like in general population. There were no terminations of PPIUCD on medical grounds. Long term safety was by continuation 30 (85.7%) and 0 (0%) pregnancy.

Limitations of This study were that it was conducted in a tertiary care cardiac centre therefore the findings may not adequately reflect the general population. Also the population studied had inherent medical risks so the complications and long term safety concerns might be over emphasized. Contribution of this study is giving confidence in widening contraceptive method choice in these high risk patients who would benefit most with this readily available safe and long acting contraceptive method.
CONCLUSION

Postpartum intrauterine device insertion is a safe and valid option in selected cardiac patients who would benefit most from this long acting reversible contraceptive method. There is no increased risk in cardiac patients compared to general population.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

CORRELATION OF ANGIOGRAPHIC FINDINGS AND SYNTAX SCORE WITH HIGH SENSITIVITY TROFON IN PATIENTS PRESENTING WITH NON ST ELEVATION MYOCARDIAL INFARCTION

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ABSTRACT

Objective: This study was done to find out how angiographic findings including severity, site, type of lesion, calcification and based on these findings the Syntax Score were related to the level of cardiac Troponin-I (cTnI) in patients of Non ST Elevation Myocardial Infarction.

Study Design: Cross sectional study.

Place and Duration of Study: Armed forces institute of Cardiology/ National Institute of Health Sciences Rawalpindi Pakistan, from July 2016 to Dec 2016.

Material and Methods: A total of 120 patients were studied over a period of 6 months. They were divided into two groups according to High sensitivity Trop I levels; high/ Group A (Troponin-I level >0.78ng/ml) and low Group B (Troponin-I 0.06-0.78 ng/ml). Thus 54 patients fell into Group A while 66 into Group B. The angiographic characteristics and Syntax Score of the two groups of patients were then compared.

Results: A total of 120 patients were studied. There were 86 (71.6%) males and 34 (28.3%) females with age range 29-77 years. cTnI was markedly raised in 59 (49%) patients i.e. Group A and lower in 61 (51%) i.e. Group B. High levels of cTnI were related to number of vessels involved p<0.001. Three vessel involvement was higher 34 (57%) of Group A in comparison with group B 4 (6.5%). While more patients had single vessel involvement in Group B vs Group A i.e. 38 (62%) and 5(8.4%). Type A lesions were more common in Group A than Group B; 44(72%) vs 11(18%). Thrombus burden was higher in Group A, Calcification frequency was more in Group A than B; 73% vs 11% p<0.001 and Syntax Score was >32 in 52% of Group A and in 3% of Group B p<0.05. Proximal lesions were more frequent in Group A 33(55%) than Group B 26(42%) but the correlation was insignificant p=0.48.

Conclusion: Patients of Non-ST elevation Myocardial Infarction with raised serum Troponin-I had more severe coronary disease and higher Syntax Score than those with lower serum Troponin-I.

Keywords: Angiographic profile, Syntax Score, Troponin-I.

INTRODUCTION

Ischemic heart disease is the leading killer in the world. More than 7 million patients suffer acute coronary syndromes annually a substantial number of which constitutes Non-ST ACS. With appropriate therapy the mortality reduced markedly in these patients. Early diagnosis is the key in management of these patients.

Cardiac troponins have superseded other biomarkers in terms of sensitivity. Since the inclusion of high sensitivity Trop I the patients could undergo testing well before other biomarkers are detectable in blood. A set of High sensitivity Trop I performed at 0 and 1 hour of presentation can rule in or rule out patients for Non ST elevation ACS and help in taking early decisions at ER. Patients who have high risk features including raised cardiac biomarkers are subjected to Early Invasive approach with favorable results. Trop I levels have found to be correlating in terms of severity of Angiographic lesions.

In comparison to patients with ST Elevation patients presenting with Non ST elevation M are known to have non obstructive plaque rupture and multi vessel involvement. A recent report of...
American College of Cardiology National Cardiovascular Database Registry reported multivessel involvement in NSTEMI as high as 42%. New AHA and ESC guidelines now endorse Cardiac Trop I Hs a marker of prognostic significance and all patients with markedly raised levels are considered high risk.

Fernandez and colleagues studied NSTEMI patients who underwent coronary angiography and stratified their study population into two groups based on the cardiac troponin I levels. They found patients with higher troponin I levels (> 10 folds ULN) had more three vessel CAD involvement (39%), p=0.001 on coronary angiography as compared to patients with troponin I levels <10 folds ULN.

It is essential to further adjudicate whether the degree of rise in troponin levels in the setting of NSTEMI equates with a greater proportion of such patients found to have severe multi-vessel CAD, proximal involvement of vessels and higher Syntax Score. This finding will have important therapeutic and prognostic implications as early identification of severe and extensive CAD and subsequent referral to early coronary revascularization would result in clinical benefit. It would also help in taking a guarded decision for early invasive approach if the levels are very high. This would also help to minimize the risk of major adverse cardiac events in the risky waiting period of initial medical therapy alone. To test this hypothesis, we sought to determine whether there is an association between cardiac troponin I levels and the disease severity in NSTEMI.

MATERIAL AND METHODS

We conducted a prospective, cross sectional study of 120 patients at AFIC/ NIHD Rawalpindi admitted with the diagnosis of non-ST-elevation myocardial infarction between July 2016 to Dec 2016. Patients included had history of chest pain or discomfort within the past 48 hours of presentation or angina equivalent symptoms with or without ECG changes and a positive high sensitivity cardiac troponin I test, defined as a level above the upper limit of normal (0.06 ng/ml) at admission. Those whose levels were > 0.06ng/ml but less than 0.78 ng/ml were designated as high Hs Trop I and placed in Group A while those with >0.78 ng/ml were labelled very high Hs trop I and labelled Group B. The exclusion criteria included ST-segment elevation on electrocardiography (ECG) indicative of acute ST elevation myocardial infarction, pathologic Q waves, new or presumed new left bundle branch block or paced rhythm, previous history of coronary artery disease, prior coronary revascularization procedures either CABG or angioplasty or coronary stenting, renal insufficiency-serum creatinine >1.4 mg/dl (upper limit of normal), serious intercurrent disease and patients who refused to undergo coronary angiography during the hospitalization. Written informed consent was obtained in all cases for recruitment in the study and the procedures. Study protocol was approved by the ethical review committee of the hospital. NSTEMI was defined as positive biomarkers of myocardial necrosis (Troponin-I) with or without electrocardiographic ST-segment depression (>0.5 mm) or prominent T wave inversion in the absence of ST-segment elevation. All patients received standard medical therapy for NSTEMI. Blood samples for cardiac troponin I were immediately drawn in lithium heparin bottles upon presentation to the emergency room and a second sample was drawn 3 hours later after admission. Cardiac troponin I was determined using Advia Troponin (Seimens Laboratories). The 99th percentile was 0.06 ng/ ml as described by the manufacturer. The assay was designed to have a precision <10% total coefficient of variation with 95% confidence. All assays were performed by technologists unaware of rest of the data. All recruited patients underwent invasive evaluation by coronary angiography within 72 hours of the same hospital admission. Diagnostic coronary angiography was performed via either the trans-femoral or trans-radial approach using standard techniques. Cine angiographic films were analyzed independently by two
experienced operators who had no knowledge of the patients' clinical information and cTnI status. Significant CAD was defined as >70% stenosis in any of the three major epicardial coronary arteries or a left main coronary artery stenosis >50. Angiograms revealing coronary artery stenosis <70% in major epicardial coronary arteries were termed as non-obstructive CAD. Extent of CAD was defined as significant single, two or three vessel CAD involvement. Other properties including calcification, thrombus burden, collateral circulation, location of the most severe stenosis and based on these findings the Syntax Score was calculated. A proforma was designed to record all the patient data including demographics and Angiographic characteristics. For each of comparison different variable were made into groups.

**Statistical Analysis**

### Table-I: Syntax score relationship to high sensitivity (Hs) trop I.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Hs TROP I</th>
<th>Syntax score</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt;22</td>
<td>22-32</td>
</tr>
<tr>
<td>1.</td>
<td>Group-I</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Group-II</td>
<td>41</td>
<td>18</td>
</tr>
</tbody>
</table>

### Table-II: Vessel involvement in relation to high sensitivity (HS)trop I.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Hs TROP I</th>
<th>Number of vessels involved</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>One</td>
<td>Two</td>
</tr>
<tr>
<td>1.</td>
<td>Group-I</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Group-II</td>
<td>38</td>
<td>15</td>
</tr>
</tbody>
</table>

The collected data were entered and analyzed by the Statistical Package for Social Sciences version 20.0 Software (SPSS v20). Chi-square test was used to evaluate the relation between cardiac troponin I levels and CAD extent, properties and Syntax Score in the two groups of cardiac troponin I. All significance tests were 2 sided, and the results were considered statistically significant when p-value<0.05.

### RESULTS

A total of 120 patients were studied. There were 86 (71.6%) males and 34 (28.3%) females with age range 29-77 years (fig). cTnI was markedly raised in 59 (49%) patients i.e. group A and lower in 61 (51%) i.e. group B (table-I). High levels of cTnI-I were related to number of vessels involved p<0.001. Three vessel involvement was higher 34 (57%) of group A in comparison with group B, 4 (6.5%) (table-I). While more patients had single vessel involvement in group BVs group A i.e.38(62%) and 5(8.4%). Type A lesions were more common in group A than group B; 44(72%) vs 11(18%) (table-II). Thrombus burden was higher ingroup A, Calcification frequency was more in group A than B; 73% vs 11% p=0.001 and Syntax Score was >32 in 52% of group A and in 3% of group B p<0.05. Proximal lesions were more frequent in group A 33(55%) than group B 26(42%) but the correlation was insignificant p-value 0.48.

### DISCUSSION

A considerable number of patients with Non ST Elevation Myocardial Infarction will have to undergo catheterization with possible Percutaneous Coronary Intervention. Cardiac...
specific troponins show small elevations above the ULN in small infarctions, e.g. in NSTEMI compared with large infarctions characteristic of STEMI in which troponin levels can be more than 20-50 times ULN. The degree of Trop I rise will help the treating physician in predicting the Coronary Anatomy of these patients. The present study provides insight into the association between the two cutoff levels of cardiac troponin I borderline raised and very high i.e. >10 times greater in NSTEMI in terms of the number of epicardial vessels involved, characteristics of the plaque lesions and the Syntax Score.

The study demonstrated that among patients with raised cTnI levels but <10 folds ULN the disease severity will vary considerably if the cTnI levels are >10 folds. 57% of patients with markedly raised CnT-I had three vessel disease whereas the proportion of patients having single vessel disease was higher in the other group B i.e. 62% vs 8%. We found a statistically significant relationship between cTnI level >10 folds ULN and severely affected three vessels CAD. Thrombus burden was also higher and the complexity in lesion was also higher in patients with higher Trop Levels. This is in accordance to other regionally and globally conducted studies. Several of which have identified a series of factors associated with elevated troponins in patients with NSTEACS. As compared to patients with normal troponin values, patients having troponin-positive have more extensive coronary disease, as well as more severe and more complex culprit lesions with a higher incidence of thrombus. In addition, patients with positive markers show more compromised flow (TIMI 0-1) in the artery causing the symptoms. In a substudy of the FRISC II investigation assessing the potential mechanism for the prognostic capability of troponin, Lindahl et al found that patients with markedly elevated troponin had presented more severe initial electrocardiographic alterations and showed a higher incidence of visible thrombus and complete occlusion of the circumflex artery on coronary angiography.

Despite the presence of studies which have evaluated the association of troponins to angiographic findings of culprit lesion morphology in the setting of ACS, studies evaluating angiographic correlations in terms of the number of significantly narrowed coronary arteries and the exact incidence of multivessel CAD and Syntax Score with different cardiac troponin levels have been extremely limited in international literature. Qadir et al demonstrated a similar outcome in terms of number and the type if vessels involved with >10 fold raise in trop I levels.

Since the landmark SYNTAX (Synergy between PCI with Taxus and Cardiac Surgery) Trial comparing CABG with PCI in patients with complex coronary artery disease (unprotected left main or de novo three vessel disease), numerous validation studies have confirmed the clinical validity of the SYNTAX Score for identifying higher-risk subjects and aiding decision-making between CABG and PCI in a broad range of patient types. The SYNTAX Score is now advocated in both the European and US revascularization guidelines for decision-making between CABG and PCI as part of a SYNTAX-pioneered heart team approach. Patients who have high >32 Syntax score would benefit more from Surgical Intervention. The association of higher Syntax Score with markedly raised Trop I has been suggested. Our study shows that patients with >10 fold higher Trop I raise are more likely to have a higher Syntax Score i.e. 52% Vs 3% when the Trop was only marginally raised. This could help making an informed decision before taking the patient to Cath lab.

Many other studies have noted absence of CAD as an uncommon finding in patients undergoing coronary angiography for ACS. Our study revealed that 3 (4.9%) patients with cTnI <10 folds ULN and none with the cTnI >0.78 ng/ml had a perfectly normal coronary angiogram. There were more females with normal coronary angiograms in the lower troponin I level group. The TACTICS-TIMI-18 sub study involving 895 patients revealed that in
patients who present with symptoms of ACS and have no critical epicardial CAD angiographically, the presence of an elevated troponin was still associated with an adverse prognosis. The use of angiography provides an invasive approach to risk stratification.

Overall, the results of our study suggest that elevated troponin I levels are associated with a greater severity and extent of myocardial ischemic territory and lesion complexity during the index event of NSTEMI. The limitations of this study include that it represents a single institution experience. The severity and location of the coronary lesions was based on the operator visual estimation without quantitative or physiological evaluation, however inter-observer agreement between angiographic images was taken into account in order to minimize bias. The study evaluated the extent of CAD in terms of the number of severely diseased major coronary arteries and was not designed to identify the culprit vessel or to assess the coronary lesion morphology-complex lesions. The conclusions of this study should not be extended to cardiac troponin T or to the other assays available for Troponin I without further validation.

CONCLUSION

Patients of Non-ST elevation Myocardial Infarctionwith raised serum Troponin-I had more severe coronary disease and higher Syntax Score than those with lower serum Troponin-I.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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COMPARISON OF RIGHT CORONARY ARTERY AND LEFT CIRCUMFLEX RELATED ACUTE INFERIOR WALL MYOCARDIAL INFARCTION IN PATIENTS UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION

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ABSTRACT

Objective: To compare right coronary artery and left circumflex related acute inferior wall MI in terms of clinical characteristics, severity markers, complications and mortality.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: This study was carried out at Armed Forces Institute of Cardiology Rawalpindi, from July 2015 to June 2016.

Material and Methods: All the patients presenting to AFIC Emergency department with a history of chest pain for less than 12 hours and diagnosed as acute inferior wall MI on ECG are included in the study.

Results: A total of 250 patients were included in the study. About 148 (59.2%) patients had Right Coronary Artery (RCA) as culprit artery lesion whereas 102 (41.1%) patients had left circumflex (LCX) as culprit artery. Cardiogenic shock was seen in 10 (6.8%) patients with RCA as culprit artery lesion and 23 (25.6%) patients with LCX as culprit artery lesion. Multivessel involvement was seen in 50 (33.8%) patients with RCA and 48 (47.1%) patients with LCX as culprit artery. Heart failure Killip class III and IV was seen in 8 (5.4%) patients with RCA and 10 (9.8%) patients with LCX as culprit artery lesion. Complete heart block was seen in 36 (24.1%) patients with RCA related acute inferior wall MI and 3 (2.9%) patients with LCX related acute inferior wall MI. In-hospital mortality was more prevalent and was seen in 9 (8.8%) patients with LCX as culprit artery and 4 (2.7%) patients with RCA as culprit artery.

Conclusion: This study shows that patients of acute inferior wall MI undergoing primary percutaneous coronary intervention (PCI) who have left circumflex artery as culprit vessel have a poor prognostic outcome as compared to patients having right coronary artery as culprit vessel.

Keywords: Inferior wall MI, Cardiogenic shock, LCX, Primary PCI, RCA.

INTRODUCTION

Acute myocardial infarction is one of the leading causes of morbidity and mortality worldwide, despite significant developments in prognosis over the past decade. The 2016 heart disease and stroke statistics update of American heart association AHA reported that more than 15.5 million people in US suffer from coronary artery disease. Acute myocardial infarction is responsible for almost one third of all deaths in people aged more than 35 years.

Acute inferior wall myocardial infarction represents 40% to 50 % of all myocardial infarctions. The culprit artery in inferior wall MI is either right coronary artery or left circumflex artery. Comparison between anterior and inferior wall MI has been extensively studied and results show a better outcome of inferior wall MI both in short and long term. The degree of myocardial injury in cases of acute left anterior descending artery (LAD) occlusion is much larger as compared to acute right coronary (RCA) or left circumflex (LCX) artery occlusion because LAD supplies a large myocardial area. However there is limited data regarding comparison between inferior wall MI caused by either RCA or LCX occlusion.

Myocardial infarction due to left circumflex artery LCx occlusion has been less studied in
trials regarding ST elevation MI; this is mainly due to the absence of significant ST segment elevation on ECG. Therefore the outcome of these patients is less known. Most of studies show less than 20% of patients have left circumflex artery as the culprit lesion. Little is known about the characteristics of LCX related inferior wall MI.

The purpose of this study was to compare RCA and LCX related acute inferior wall MI in terms of prognostic outcome in patients undergoing primary PCI.

**MATERIAL AND METHODS**

This was a cross sectional study, conducted at Armed Forces Institute of Cardiology Rawalpindi. Permission was taken from hospital

### Table-I: Baseline characteristics of both groups.

<table>
<thead>
<tr>
<th>Clinical characteristics</th>
<th>RCA as culprit vessel group 1</th>
<th>LCx as culprit vessel group 2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>29 (19.6%)</td>
<td>14 (13.7%)</td>
<td>0.22</td>
</tr>
<tr>
<td>Hypertension</td>
<td>43 (29.1%)</td>
<td>27 (26.5%)</td>
<td>0.66</td>
</tr>
<tr>
<td>Smoking</td>
<td>34 (24.4%)</td>
<td>25 (26.6%)</td>
<td>0.31</td>
</tr>
<tr>
<td>Chest pain</td>
<td>94 (71.8%)</td>
<td>72 (57.8%)</td>
<td>0.49</td>
</tr>
<tr>
<td>Age in years Mean ±SD</td>
<td>61.12 ±10.0</td>
<td>63.23 ±10.0</td>
<td>0.66</td>
</tr>
</tbody>
</table>

| Age in groups            | 0                            | 0                             | 0.18    |
|~20 yrs                  | 3 (2%)                       | 3 (3%)                       |
| 21-39                    | 39 (26.4%)                   | 20 (19.6%)                   |
| 40-59                    | 86 (58.1%)                   | 67 (65.6%)                   |
| 76+                      | 30 (13.5%)                   | 12 (11.8%)                   |

| Gender                   | 134 (90.5%)                  | 91 (89.2%)                   | 0.73    |
| Males                    | 14 (9.5%)                    | 11 (10.8%)                   |
| Females                  | 148                          | 102                          |

### Table-II: Comparison of prognostic determinants of right coronary artery and left circumflex related acute inferior wall myocardial infarction.

<table>
<thead>
<tr>
<th>Prognostic Determinants</th>
<th>RCA Culprit Vessel Group 1 (n=148)</th>
<th>LCx Culprit Vessel Group 2 (n=102)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiogenic shock</td>
<td>10 (6.8%)</td>
<td>23 (22.5%)</td>
<td>0.00</td>
</tr>
<tr>
<td>Heart failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Killip class I</td>
<td>121 (81.76%)</td>
<td>74 (72.5%)</td>
<td></td>
</tr>
<tr>
<td>Killip class II</td>
<td>6 (4.1%)</td>
<td>14 (13.7%)</td>
<td></td>
</tr>
<tr>
<td>Killip class III</td>
<td>8 (5.4%)</td>
<td>8 (7.8%)</td>
<td></td>
</tr>
<tr>
<td>Killip class IV</td>
<td>0</td>
<td>2 (2%)</td>
<td></td>
</tr>
<tr>
<td>Complete heart block</td>
<td>36 (24.3%)</td>
<td>3 (2.9%)</td>
<td>0.00</td>
</tr>
<tr>
<td>Cardiac enzymes (mean)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPK</td>
<td>482</td>
<td>663</td>
<td>0.79</td>
</tr>
<tr>
<td>CKMB</td>
<td>70</td>
<td>89</td>
<td>0.26</td>
</tr>
<tr>
<td>Ejection fraction (mean)</td>
<td>48.46%</td>
<td>41.8%</td>
<td>0.15</td>
</tr>
<tr>
<td>Creatinine mg/dl (mean)</td>
<td>1.2</td>
<td>1.4</td>
<td>0.62</td>
</tr>
<tr>
<td>Arrhythmias</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VT</td>
<td>3 (2.02%)</td>
<td>2 (1.96%)</td>
<td>0.85</td>
</tr>
<tr>
<td>VF</td>
<td>2 (1.4%)</td>
<td>1 (1.0%)</td>
<td></td>
</tr>
<tr>
<td>Multi vessel involvement</td>
<td>50 (33.8%)</td>
<td>48 (47.1%)</td>
<td>0.03</td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>4 (2.7%)</td>
<td>9 (8.8%)</td>
<td>0.03</td>
</tr>
</tbody>
</table>
ethical committee before conducting the study. Informed consent was taken from all the patients. All patients diagnosed with acute inferior wall MI on ECG basis with history of chest pain not exceeding 12 hours, enrolled for primary PCI were included in the study. Using WHO sample size calculator, confidence interval (CI) was 95%, sample size calculated was 250 patients. Of these patients with acute inferior wall MI caused by RCA occlusion were categorized as group 1 and those with LCx occlusion were categorized as group 2. Primary PCI was performed in cath lab by interventional cardiologist, after angiography all patients with stenosis of greater than 70% in infarct related artery underwent PCI. Baseline characteristics, culprit artery, multiple vessel disease, TPM requirement were documented. Determinants of prognostic outcomes like peak CPK, CKMB, Ejection fraction, serum Creatinine, cardiac failure, Cardiogenic shock (at presentation), in-hospital mortality in two groups was collected and documented.

Data analysis were done using SPSS version 24, frequency and analysis were carried out for qualitative variables that are gender, clinical characteristics, angiographic findings for culprit artery lesions, multiple vessel disease, and TPM requirement. Mean and standard deviations were calculated for quantitative variables such as age, ejection fraction, serum creatinine and cardiac enzymes.

**RESULTS**

A total of 250 patients were included in the study. About 148 (59.2%) patients had RCA as culprit artery lesion whereas 102 (41.1%) patients had LCx as culprit artery lesion. (Fig-1) Baseline characteristics including age, gender, and co morbid including DM, HTN smoking and symptoms at presentation were similar in both groups as shown in table-I. Cardiogenic shock and heart failure was more predominant in group 2 LCx related acute inferior wall MI. Prognostic determinants including Multivessel involvement, lower ejection fraction and increase release of cardiac biomarkers and in-hospital mortality were more prevalent in LCx related acute inferior wall MI. Ventricular arrhythmias were equally seen in both groups as shown in table-II. Cardiac enzymes were more raised in patients with left circumflex related acute inferior wall MI with a mean CPK of 663 (U/L) and CKMB of 89 (U/L), whereas in patients with RCA related acute inferior wall MI, CPK was 482 (U/L) and CKMB was 70 (U/L). Ejection fraction was reduced in patients with LCx as culprit artery lesion with a mean of 41.8% whereas in RCA related inferior wall MI means EF was 49.0% (fig).

**DISCUSSION**

Prognostic outcomes of patients with acute myocardial infarction due to left anterior descending artery LAD and right coronary artery RCA has been well studied but prognostic outcome of left circumflex artery LCx related acute inferior wall MI is not much clear. Acute MI due to left circumflex artery has been less studied in large randomized trials on STEMI. Most probable reason is that LCx related acute inferior wall MI presents with subtle ECG changes that are mostly under diagnosed. Very few studies
have been done on clinical characteristics of patients with LCx related inferior wall MI\textsuperscript{6,11}.

Inferior wall myocardial infarction is caused by either occlusion of RCA or LCx artery. Comparison in terms of prognostic outcome between Anterior and inferior wall MI has been studied extensively. But there are not many studies in literature comparing prognostic outcome of RCA and LCX artery related acute inferior wall MI\textsuperscript{12}.

Studies have shown that there is not much significant difference in RCA and LCx related acute inferior wall MI in terms of baseline characteristics\textsuperscript{7}. Age, gender risk factors such as diabetes mellitus, hypertension, and smoking were similar in both groups of our study.

A large prospective, single center study was carried out from 1991 to 2004 in Zwolle (Netherlands) it included all patients who underwent primary PCI and studied the association between prognostic impact of CK, LVEF and infarct location on 1 year outcome of these patients. Mortality within 1 year was high in patients who had an anterior infarct and those with a high CK levels and low LVEF\textsuperscript{8}. Rasoul et al study published in 2007 indicated that enzymatic infarct size was greater and LV ejection fraction was low (less than 45%) in LCx related acute inferior wall MI as compared to RCA related inferior wall MI. Also Cardiac mortality was significantly higher in patients with LCx as the culprit vessel\textsuperscript{5}.

In our study, mean CPK and CKMB was high for LCx related inferior wall MI as compared to RCA related acute inferior wall MI, with a value of 482/70 for group 1 patients with RCA as culprit vessel and a value of 663/90 for group 2 LCx as culprit vessel.

Left ventricular ejection fraction was low in LCx related group with a mean of 42.0% however in RCA related MI it was 48%. In hospital death was higher in group 2 LCx related inferior wall MI. A total of 9 (8.8%) patients died in group 2 having LCx as culprit vessel whereas in patients with RCA as culprit vessel mortality was seen in 4 (2.7%) patients.

Yip et al conducted a study Between May 1993 to October 2000, a total of 819 patients with acute MI were studied. The study showed that LCx related acute MI has unique clinical features. The presence of dominant LCx, cardiogenic shock, triple vessel involvement was seen more commonly in LCx related inferior wall MI and all were independent predictors of increased mortality at 30 days\textsuperscript{9,13}. In our study multivessel involvement was seen in 50 (33.8%) patients with RCA as culprit artery and 48 (47.1%) patients with LCX as culprit vessel.

Chen et al conducted a study from 2003 to 2009 demonstrated increased frequency of congestive heart failure, respiratory failure requiring mechanical ventilation in patients having left circumflex related MI however RV infarct and complete heart block was more prevalent in patients with RCA as culprit vessel. Prognostic outcome at 30 days was less favorable in LCx related inferior wall MI as compared to RCA related MI in patients who underwent primary PCI\textsuperscript{7,14}, in our study cardiogenic shock was seen in 23 (22.5%) of patients with LCx related MI and 10 (6.8%) patients with RCA related MI, hence being more prevalent in patients with LCX as culprit vessel. Complete heart block was seen in 3 (2.9%) patients with LCX as culprit vessel and 36 (24.3%) patients with RCA as culprit vessel. Hence more frequent in RCA related acute inferior wall MI\textsuperscript{15}.

**CONCLUSION**

Patients with acute inferior wall MI having ECG findings suggestive of LCx involvement should be considered as high risk and should be treated with an aggressive approach, in order to improve the outcome of patients with acute inferior wall MI.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.
REFERENCES

COMPARING CLINICAL CHARACTERISTICS AND OUTCOME OF PATIENTS OF ACUTE HEART FAILURE WITH REDUCED EJECTION FRACTION TO THOSE WITH PRESERVED EJECTION FRACTION

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Armed Forces Institute of Cardiology/ National Institute of Heart Diseases/ National University of Medical Sciences (NUMS)
Rawalpindi Pakistan

ABSTRACT

Objective: To compare profile, clinical characteristics and outcomes of patients admitted with acute heart failure and reduced ejection fraction to those patients with preserved ejection fraction.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: The study was carried out at Armed Forces Institute of Cardiology & National Institute of Heart Diseases from April to November 2016.

Material and Methods: All patients presenting to AFIC ER and diagnosed with acute heart failure were included in this study. Echocardiography was done for all the patients. Baseline characteristics, clinical profile, lab investigations and outcomes were documented.

Results: A total of 288 patients were included in this study, 223 (77.4%) patients had reduced ejection fraction (EF) <50% (HFrEF), 65 (22.5%) patients had preserved EF >50% (HFpEF). Significantly higher numbers of female patients were seen in HFpEF group (0.04). Patients with preserved EF were significantly more hypertensive than patients with reduced EF (75.5% vs 54.0%, p-value 0.05), similarly systolic blood pressure >161 mmHg and diastolic blood pressure >101 mmHg was observed in patients with preserved EF as compared to patients with reduced EF. Heart failure complications including valvular heart disease (severe MR) and atrial fibrillation were more frequent in patients with preserved EF as compared to patients with reduced EF (10.8% vs 2.6% p 0.05 and 9.0% vs 1.3% p 0.04). Cardiogenic shock was more commonly encountered in patients with reduced EF (30.1% vs 4.6% p 0.03). NSTEMI was diagnosed in 15.6 (35.0%) patients with reduced EF and 3 (4.61%) patients with preserved EF (p-value 0.04). In hospital mortality was similar for both groups.

Conclusion: Hypertension, valvular heart disease and atrial fibrillation is more commonly present in acute heart failure patients with preserved EF. However acute heart failure patients with reduced EF more frequently have ischemic heart disease and present with NSTEMI and cardiogenic shock. Whereas, mortality is same for both groups. Therefore patients presenting with acute heart failure and preserved EF should be treated as aggressively as those with reduced EF.

Keywords: Heart failure, Left ventricular failure, Mortality.

INTRODUCTION

Heart failure (HF) is a major cause of morbidity and mortality in western countries. In the United States, almost 5 million people have heart failure and each year 550,000 patients are newly diagnosed with this condition. Heart failure with preserved ejection fraction (HFpEF) is an increasingly recognized form, and accounts for almost 50% of all admissions for decompensate heart failure. Limited data is available on inhospital outcome of these patients with preserved ejection fraction. Acute heart failure is described as gradual or sudden worsening in sign and symptoms of heart failure requiring urgent therapy. These symptoms are primarily causes by pulmonary congestion due to increased LV filling pressures. A cute heart failure can occur with both preserved ejection fraction and reduced ejection fraction. Acute heart failure is precipitated by concurrent cardiovascular conditions, acute coronary syndrome, hypertension, valvular heart disease, a trial arrhythmias. Non cardiac conditions may also be

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S135
present such as renal dysfunction, anemia and diabetes.

Acute heart failure is a life threatening medical emergency, and it is one of the most common reasons for hospital admissions. One out of 10 patients with acute heart failure dies in hospital, and one in three dies after an episode of acute heart failure within one year. In spite of advances in long-term care, no new treatments for acute heart failure have been developed during the past two decades.

Based on the data from both ADHERE and OPTIMIZE HF trial the average risk of death during hospital admission is approximately 4%. Patients who are admitted with acute heart failure and require vasoactive drugs for low blood pressure have a poor outcome as compared to the rest. In the ADHERE trial mortality was 12 to 13% for patients who required ionotropic treatment.

The purpose of this study was to compare heart failure with preserved EF to patients of heart failure with preserved EF in terms of baseline characteristics and prognostic outcome.

**MATERIAL AND METHODS**

This is a cross sectional study, conducted at Armed Forces Institute of Cardiology Rawalpindi. Permission was obtained from hospital ethical committee prior to conducting the study. Informed Verbal consent was taken from all the patients. All patients diagnosed with acute heart failure on the basis of history and clinical examination are included in this study. Using WHO calculator a total of 288 patients were included in this study. All patients presenting with acute heart failure were divided into two groups: group-1 included patients with reduced EF (EF<50%) and group-2 included patients with preserved EF (EF>50%).

Baseline characteristics, hemodynamic profile, co morbid (diabetes mellitus, hypertension, chronic obstructive pulmonary disease, ischemic heart disease), were documented. ECG was done to investigate atrial fibrillation. ECHO was done to evaluate any

<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>group-1 (EF &lt; 50%) n=223</th>
<th>group-2 (EF &gt; 50%) n=65</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years mean ± sd</td>
<td>65.8 ± 12.4</td>
<td>68.9 ± 10.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Age in groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 years</td>
<td>1 (0.5%)</td>
<td>0</td>
<td>0.72</td>
</tr>
<tr>
<td>21-39</td>
<td>4 (1.8%)</td>
<td>1 (1.5%)</td>
<td>0.81</td>
</tr>
<tr>
<td>40-59</td>
<td>50 (22.4%)</td>
<td>7 (10.8%)</td>
<td>0.10</td>
</tr>
<tr>
<td>60-70</td>
<td>109 (43.0%)</td>
<td>30 (46.1%)</td>
<td>0.50</td>
</tr>
<tr>
<td>70+</td>
<td>72 (32.0%)</td>
<td>27 (41.5%)</td>
<td>0.50</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>183 (82.0%)</td>
<td>40 (61.0%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Females</td>
<td>40 (18.0%)</td>
<td>25 (39.0%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>105 (30.1%)</td>
<td>30 (46.9%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Hypertension</td>
<td>121 (54.0%)</td>
<td>49 (75.5%)</td>
<td>0.05</td>
</tr>
<tr>
<td>COPD</td>
<td>16 (7.4%)</td>
<td>6 (9.1%)</td>
<td>0.41</td>
</tr>
<tr>
<td>IHD</td>
<td>126 (56.5%)</td>
<td>22 (33.5%)</td>
<td>0.11</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>3 (1.3%)</td>
<td>6 (9.1%)</td>
<td>0.04</td>
</tr>
<tr>
<td>MR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>64 (28.6%)</td>
<td>3 (4.6%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Moderate</td>
<td>48 (21.5%)</td>
<td>5 (7.6%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Severe</td>
<td>6 (2.6%)</td>
<td>7 (10.8%)</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table-I: Demographic and clinical characteristics of acute heart failure patients with reduced and preserved ejection fraction.
valcular abnormality and to determine ejection fraction by eye balling method. Determinants of prognostic outcomes like peak CPK, CKMB, serum Creatinine, cardiogenic shock (at presentation), NSTEMI (diagnosed at admission) was noted. In-hospital mortality in two groups was collected and documented.

Data analysis were done using SPSS version 24. Frequency percentages were carried out for qualitative variables that are gender, clinical characteristics and in-hospital mortality. Mean and standard deviations were calculated for quantitative variables such as age, serum creatinine, sodium and cardiac enzymes.

**RESULTS**

A total no. of 288 patients were included in the study, out of which 223 (77.4%) patients had reduced EF (group-1) on Echo and 65 (22.5%) patients had preserved EF (group-2) of >50%. Mean age for patients with reduced EF was 65.8 ± 12.4 years and for patients with preserved EF was 68.9 ± 10.8 years. There were 183 (82.0%) and 40 (18.0%) males and females respectively in group-1, while 40 (61.0%) and 25 (39.0%) males and females respectively in group-2. A comparatively higher number of female patients were observed in HFpEF group (0.04). Patients with preserved EF were significantly more hypertensive than patients with reduced EF (75.5% vs. 54% p 0.05), similarly systolic blood pressure >161 mmHg and diastolic blood pressure >101 mmHg was observed in patients with preserved EF as compared to patients with reduced EF (fig). Heart failure complications including valvular heart disease (severe MR) and atrial fibrillation were more frequent in patients with preserved EF as compared to patients with reduced EF (10.8% vs. 2.6% p-value 0.05 and 9.0% vs. 1.3% p 0.04) as shown in table-I. Cardiogenic shock was more commonly encountered in patients with reduced EF (30.0% vs. 4.6% p 0.03). NSTEMI was diagnosed in 15.6 (35.0%) patients with reduced EF and 3 (4.61%) patients with preserved EF (p-value 0.04). Lab data (cardiac biomarkers, creatinine and serum sodium) and in-hospital mortality was similar for both groups (table-II).

<table>
<thead>
<tr>
<th>Prognostic Outcomes</th>
<th>Group-1 HFrEF (EF &lt;50%)</th>
<th>Group-2 HFpEF (EF&gt;50%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiogenic shock</td>
<td>67 (30.1%)</td>
<td>6 (9.0%)</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Systolic blood pressure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;140 mmHg</td>
<td>160 (71.8%)</td>
<td>37 (57.0%)</td>
<td>0.05</td>
</tr>
<tr>
<td>141-160 mmHg</td>
<td>38 (17%)</td>
<td>9 (13.8%)</td>
<td>0.11</td>
</tr>
<tr>
<td>&gt;161 mmHg</td>
<td>25 (11.2%)</td>
<td>19 (29.2%)</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Diastolic blood pressure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;90 mmHg</td>
<td>164 (73.7%)</td>
<td>37 (57.1%)</td>
<td>0.04</td>
</tr>
<tr>
<td>91-100 mmHg</td>
<td>41 (18.3%)</td>
<td>10 (15.3%)</td>
<td>0.10</td>
</tr>
<tr>
<td>&gt;101 mmHg</td>
<td>18 (8.1%)</td>
<td>18 (28.2%)</td>
<td>0.04</td>
</tr>
<tr>
<td>NSTEMI (dx during admission)</td>
<td>35 (15.6%)</td>
<td>3 (4.6%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Creatinine (mean)</td>
<td>3.0</td>
<td>2.0</td>
<td>0.51</td>
</tr>
<tr>
<td><strong>Cardiac enzymes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPK</td>
<td>442</td>
<td>337</td>
<td>0.72</td>
</tr>
<tr>
<td>CKMB</td>
<td>41</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Serum Sodium</td>
<td>135</td>
<td>134</td>
<td>0.91</td>
</tr>
<tr>
<td>In hospital mortality</td>
<td>50 (22.4%)</td>
<td>15 (23.0%)</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Table-II: Comparison of prognostic outcomes of acute heart failure patients with reduced and preserved ejection fraction.
DISCUSSION

Heart failure (HF) is a major cause of morbidity and mortality in western countries. In the United States, approximately 5 million people have heart failure and each year 550,000 are newly diagnosed with this condition. Acute heart failure is described as gradual or sudden worsening in sign and symptoms of heart failure requiring urgent therapy. According to European society of cardiology patients with acute heart failure can be divided into six possible categories. Overlap between these profiles can occur: (1) worsening of decompensate chronic heart failure (2) hypertensive acute heart failure syndrome (3) Cardiogenic pulmonary edema (4) Cardiogenic shock (5) isolated right heart failure (6) acute heart failure with acute coronary syndrome.

Heart failure with preserved EF (HFpEF) is clinical syndrome comprising of symptoms of heart failure but left ventricle ejection fraction is not decreased. HFpEF has become prime form of heart failure in the developing world. It is one of the most challenging clinical syndromes. Patients with heart failure preserved EF have multiple co-morbidities including diabetes, hypertension, atrial fibrillation, vasculopathy, renal disease, metabolic syndrome all having a major impact on mortality.

Trials on heart failure with preserved EF show that 50% of all cases of new onset heart failure occur in presence of preserved ejection fraction (>50%). Epidemiological studies demonstrated patients with HFpEF were older, more frequently females and mainly cause of heart failure in these patients was due to hypertension. In our study patients with HFpEF had a mean age of 68.9 ± 10.8 years and 25 (39.0%) of patients were females, 19 (29.2%) patients had systolic bp greater than 160mmHg and 28 (28.2%) had diastolic bp greater than 110mmHg. French data from the EFICA (Epidémiologie Francaise de l'Insuffisance Cardiaque Aiguë) study performed in patients with acute HF demonstrated Cardiogenic shock is more frequently seen in patients with reduced EF. There is significant co-relation between systolic blood pressure and in hospital outcome. In our study Cardiogenic shock was more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome. In our study atrial fibrillation was seen more frequently in patients with reduced EF, 67 (30.0%) patients with reduced EF had Cardiogenic shock whereas 6 (9.0%) patients with preserved EF had Cardiogenic shock. Atrial fibrillation at baseline is a predictor of poor outcome.

Previous studies demonstrated better outcome in patients with preserved EF, a study

Figure: Comparison of risk factors and outcomes between heart failure patients with and without reduced ejection fraction.
conducted in 2008 in France by Tribouilloy demonstrated reduced mortality in patients with preserved EF1.

However a cohort study conducted in South Asian population in 2015 demonstrated one year mortality was similar in patients with reduced EF and those with preserved EF. There was also no significant difference in 90-day Rehospitalization rates between the two groups9. In our study mortality was same for both groups.

Mitral regurgitation is associated with prognostic outcome in patients of acute heart failure. Even mild mitral regurgitation is associated with a poor prognostic outcome in patients having preserved EF however only moderate and severe MR is associated with poor outcome in patients with reduced EF10. In our study severe MR was more prevalent in patients with reduced EF, 7 (10.8%) patients with preserved EF and 6 (2.6%) patients with reduced EF had severe MR11,12.

The Japanese Cardiac Registry of Heart Failure in Cardiology (JCARE-CARD) studied the characteristics and treatment of patients with acute heart failure. The prevalence of cardiovascular death was similar in patients with HFrEF and HFpEF. In contrast, mortality due to non-cardiovascular causes was significantly higher in patients with HFpEF than those with HFrEF13,15. NSTEMI was diagnosed in 35 (15.6%) patients with reduced EF and 3 (4.6%) patients with preserved EF in our study.

In the Acute Decompensate Heart Failure Syndromes (ATTEND) registry in Japan, patients with acute heart failure were assessed to demonstrate the association of EF and clinical features and co-morbidities with all-cause mortality after admission. The all-cause mortality rate did not differ between the reduced EF and preserved EF groups. Patients with preserved EF had non ischemic and hypertension as cause of new onset heart failure. In contrast, influence of diabetes mellitus and anemia on risk of all cause mortality was higher in patients with reduced EF14. In our study hypertension was more prevalent in patients with preserved EF, 121 (54.0%) patients with reduced EF and 49 (75.5%) with preserved EF were hypertensive.

The OPTIMIZE HF registry also proves that majority of patients with acute heart failure have preserved EF there is no significant difference in terms of hospital stay and in patient mortality between patient with reduced EF and preserved EF15,16.

CONCLUSION

Hypertension, valvular heart disease and atrial fibrillation are more commonly present in acute heart failure patients with preserved EF. However acute heart failure patients with reduced EF more frequently have ischemic heart disease and present with NSTEMI and Cardiogenic shock. Whereas, mortality is same for both groups. Therefore patients presenting with acute heart failure and preserved EF should be treated as aggressively as those with reduced EF.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES


SIX YEARS EXPERIENCE OF TRANSCATHETER RELIEF OF CONGENITAL AORTIC VALVE STENOSIS IN PAEDIATRIC POPULATION AT ARMED FORCES INSTITUTE OF CARDIOLOGY RAWALPINDI


Armored Forces Institute of Cardiology/ National Institute of Heart Diseases/ National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Combined Military Hospital Kharian/ National University of Medical Sciences (NUMS) Pakistan, **Combined Military Hospital Quetta/ National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To determine the efficacy and safety of transcatheter balloon valvuloplasty in severe aortic stenosis in paediatric population.

Study Design: Observational study.

Place and Duration of Study: Catheterization lab at armed forces institute of cardiology, national institute of health Rawalpindi, from Jan 2011 to Dec 2016.

Material and Methods: All patients having age 1-12 years, who underwent balloon dilatation of severe aortic valve stenosis, were registered in the registry kept at catheterization laboratory. Complete patient profile, echocardiographic findings and pre and post balloon valvuloplasty findings were recorded. Procedure was considered successful if invasive gradient across aortic valve was reduced to less than 50% of original. The data was analyzed using SPSS version 23.

Results: A total of 75 patients undergone aortic balloon valvuloplasty during study period with mean age of 5.3 ± 3.3 years. All patients undergoing the procedure had severe aortic valve stenosis with the mean echo derived pressure gradient (PG) across the aortic valve of 70 ± 28 mmHg. The mean invasive PG across the aortic valve before and after balloon valvuloplasty was 71 ± 29 mmHg Vs. 22 ± 15 mm of Hg (p-value < 0.001). Procedure was successful in 72 cases (96%) while three patients had suboptimal result. Post valvuloplasty 8 patients (10.6%) patient had mild AR. No patients developed sever AR, pericardial effusion and mortality was found to be zero percent.

Conclusion: We conclude that balloon valvuloplasty is a safe and effective procedure with minimum complications in patients with isolated severe aortic stenosis.

Keywords: Aortic stenosis, Pressure gradient, Valvuloplasty.

INTRODUCTION

Aortic stenosis accounts for about 6% of congenital cardiac malformation in pediatric population. In one study the incidence was estimated to be 3.8/ 10,000 live births1,2. Valvular aortic stenosis is the most common form of left ventricular outflow tract (LVOT) obstruction in children, accounting for as many as 71% to 86% of patients and it is more common in males3,4. Based upon large retrospective autopsy studies, bicommissural aortic valve had been estimated to occur in 1 to 2 percent of the general population5. Critical aortic stenosis is a form which presents in early infancy with left ventricular failure and low cardiac output.

Aortic stenosis is diagnosed through transthoracic echocardiography which identifies both the site and severity of obstruction besides the associated anomalies6. Treatment options for severe aortic valve stenosis in young children includes balloon valvuloplasty, surgical valvotomy & surgical Ross procedure. Surgical valve replacement is generally not feasible in young children due to small annulus size. At our center we generally prefer balloon valvuloplasty as first choice unless it’s contraindicated. Left heart catheterization is performed in conjunction

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with aortic balloon valvuloplasty determines the magnitude of peak to peak pressure gradient from left ventricle to aorta. Balloon valvuloplasty is usually performed when peak to peak systolic pressure gradient between left ventricle and aorta exceeds 60 mmHg at rest. Associated aortic valve regurgitation is usually considered as contraindication to balloon valvuloplasty. The aim of our study was to evaluate the efficacy and short term results of balloon aortic valvuloplasty in children age 1-12 years.

**MATERIAL AND METHODS**

All patients aged between 1-12 years who had undergone Aortic balloon valvuloplasty were included in the study at AFIC-NIHD from January 2011 to December 2016. Infants were excluded as those cases are usually having critical aortic stenosis with some degree of left ventricular dysfunction.

Patients age less than 1-12 years, aortic valve stenosis with favorable morphology with no more than trivial regurgitation and peak instantaneous PG across aortic valve of >60 mmHg were included in the study.

The data of all these patients were entered in SPSS spread sheets at time of procedure. The data included name, date of birth, age, gender and date of procedure performed, diagnosis & relevant information. All patients were admitted on the day of procedure. After establishing vascular access, aortic root angiogram with pigtail catheter was done in left anterior-oblique to define the valve morphology and direction of the jet. In majority of cases, aortic valve was crossed in retrograde manner followed by BAV. Post procedural LV and aortic root angiogram routinely performed to specifically look for valve regurgitation and peak to peak pressure gradient across LVOT also recorded. Data before and after balloon valvuloplasty includes severity of aortic stenosis, anatomy of aortic valve, size of aortic annulus, mean PG across aortic valve, size of balloon used. It also included the immediate post catheterization complications like degree of aortic regurgitation, which is measures through post catheterization echocardiography, loss of limb pulses after catheterization and their management and mortality after balloon valvuloplasty. The analysis of the data is the basis of this study. Data were analyzed through SPSS version 23.

**RESULTS**

A total of 75 patients (58 male and 17 female) underwent aortic balloon valvuloplasty during study period. The mean age of patients undergoing balloon valvuloplasty was 5.3 ± 3.3 years. Mean height was 102 ± 21 cm and mean weight was 16 ± 7 Kg. All patients undergoing the procedure had severe aortic valve stenosis with the mean echo derived pressure gradient (PG) across the aortic valve of 70 ± 28 mmHg (fig-1).

Mean aortic valve annular size determined on echocardiography was 14.6 ± 2.5 mm. The mean diameter of balloon used was 13 ± 2.4 mm (fig-2). The mean invasive PG across the aortic valve before and after balloon valvuloplasty was 71 ± 29 mmHg Vs. 22 ± 15 mm Hg and p-value was <0.001. Mean procedural time was 44 ± 15 minutes while fluoroscopy time was 11 ± 7.5 min. Procedure was successful in 72 cases (96.0%) while three patients had suboptimal result. The three cases where result was suboptimal the PG reduced from 80mmHg to 55, 73 to 40 and in last one PG reduced from 60 to 44mmHg. Larger balloon was not used as it was anticipated to worsen the AR. In two case there was small PDA as well so was occluded with PDA occlude 8/6.
device. Post valvuloplasty, eight patients (10.6%) patient had some degree of aortic regurgitation (AR) but none of them required any surgical intervention immediately. No patients developed severe AR, pericardial effusion or required emergency surgery and mortality was found to be 0%. Transient lower limb pulses were lost in 15% of cases, out of which 10% required heparin infusion and 05% were given streptokinase infusion, to achieve normal pulse & perfusion at discharge.

**DISCUSSION**

Balloon valvuloplasty is indicated for moderate to severe aortic stenosis to prevent progressive left ventricular hypertrophy & dysfunction and risk of syncope or sudden death\(^9\). The long-term results of percutaneous aortic valvuloplasty for congenital aortic valve stenosis in pediatric patients and its efficacy in preventing or postponing aortic valve surgery are good\(^10\). Its reported that about two thirds of the patients are free from aortic valve surgery 10 years after balloon valvuloplasty\(^11\). In neonates Balloon valvuloplasty of aortic stenosis is generally revered as palliative procedure and carries high frequency of re-intervention but with good midterm survival is encouraging\(^12\).

Surgical aortic valvuloplasty (SAV) and balloon aortic valvuloplasty (BAV) for congenital critical aortic stenosis have near similar outcomes\(^13\). There is a greater likelihood of important aortic regurgitation with BAV and of residual stenosis with SAV\(^14\). There is no statistical difference in the long-term outcome in the adults and adolescents as compared to the children; in many centers BAV is considered as the treatment of choice with good long-term outcome\(^15\). A study carried out by Soulatges on 93 patients aged 1 day to 18 years, treated with BAV as first-line therapy for congenital aortic valve stenosis with mean age at procedure time was 2.4 years; 37 patients underwent BAV at age ≤30 days (neonates), 29 patients at age ≥1 month and <1 year (infants), and 27 patients were older than 1 year (children). The invasive BAV peak-to-peak aortic valve gradient (mean 59 ± 22 mmHg) was immediately reduced (mean 24 ± 12 mmHg). The observed diminution of gradient was similar for each age group. Freedom from surgery after BAV at 5, 10, and 20 years, respectively, was 82, 72, and 66%.

The study confirms BAV as primary treatment for congenital AS is an efficient and low-risk procedure in infants and children. Compared to this study, our study showed mean peak systolic pressure gradient across the aortic valve as 71 ± 29 mmHg Vs. 22 ± 15 mm Hg before and after valvuloplasty with p-valve <0.001.

In neonates, the prognosis is more severe and clearly related to "borderline LV"\(^16\). A study carried out by Torres A in 373 patients with aortic stenosis with median systolic pressure was 59 (50-71) mm of Hg before balloon valvuloplasty and 22 (15-30) after the procedure. Procedural success was achieved in 71 percent and 20 percent had severe complication. Overall complications observed in our study were 10 percent with no mortality\(^17\). A study carried out by Al Marshafawy H included 21 patients; 17 males, and 4 females. Their age ranged from the neonatal period to 10 years (mean age 5.6 ± 3.7 years). After the procedure, aortic valve regurgitation up to grade I were included. Significant reduction in pressure gradient was achieved (mean 66.7 ± 9.8 mmHg to 20.65 ± 2.99 mmHg) (p=0.001). Nine patients (42.8%) developed grade I AR, 2 patients (9.5%) developed grade II AR and 1 patient (4.8%) developed grade III AR. Two early deaths (9.5%); one died due to heart failure caused by grade IV
AR and a neonate died because of severely compromised LV function. One patient (4.8%) had femoral artery occlusion necessitating anticoagulation. Patients remained free from reintervention during follow up\(^\text{18}\). Compared to this study, our study shows that 10 percent developed some degree of AR but none developed severe AR. Femoral artery occlusion in our study was 15 percent, 10% requiring heparin and 05% patients requiring thrombolytic therapy.

**CONCLUSION**

Aortic balloon valvuloplasty is a safe and effective procedure for aortic stenosis in pediatric population. It has a very low morbidity and mortality so may be considered as the first line therapy for congenital aortic stenosis especially where Ross surgery is not very feasible due to lack of homograft conduits.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

ASSOCIATION OF AGE WITH HEMODYNAMIC RESPONSES TO THE HEAD-UP TILT TEST IN PATIENTS WITH VASOVAGAL SYNCOPE


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ABSTRACT

Objective: To access the end-result responses to the head-up tilt test in three different age groups explore the influence of age and gender on the head-up tilt test result in syncope patients.

Study Design: Cross sectional study design.

Place and Duration of Study: The data for this study was collected at Cardiac Electrophysiology department of AFIC/ NIHD from Jan to Jun 2016.

Material and Methods: Two hundred and seventy one patients were enrolled, presenting with syncope to the cardiac electrophysiology department who undertook conventional head-up tilt table test. Head up tilt test (HUTT) was reported to be negative for patients who successfully completed both the procedure without onset of syncope or near-syncope. Whereas the test was terminated on development of syncope or near-syncope at any stage of the test and was labeled to be positive.

Results: Patients were categorized in three age groups including <20 years (group A), 21-60 years (group B) and >60 years (group C). Overall, 24 (88.8%) patients had a positive HUTT in group A, 137 (79.6%) patients in group B and 62 (86.6%) patients in group C (p-value 0.04). The rate of cardio inhibitory syncope was significantly more common in younger age groups while decreased after middle age (p-value 0.04), similarly rate of vasodepressive syncope was relatively higher in elderly age group as compared to younger age groups (p-value 0.03).

Conclusion: The age of syncope patient was associated with type of hemodynamic response to the head up tilt test.

Keywords: Head-Up tilt table test, Vasovagal syncope.

INTRODUCTION

Vasovagal syncope also known as neurally mediated syncope is the most common type of syncope and it appears when autonomic nervous system fails to activate the compensatory reflexes. Vasovagal syncope usually occurs unexpectedly and recovers within few seconds to minutes. It is defined as a temporary loss of consciousness due to decreased blood flow to the brain, followed by a decrease in muscle tone which leads to patient knocking-down1. Various tests and procedures are involved in the work-up of vasovagal syncope. Head-up tilt test is a gold standard diagnostic tool for unexplained vasovagal syncope and is considered to be a safe, useful and cost-effective modality. The sensitivity and specificity of head up tilt table test is well recognized internationally2. There are various versions of tilt test methodology with variable tilt duration, angle of tilt and type and dose of medication used during active phase. At our cardiac center, Standard Italian Protocol3 of head up tilt test is being practiced, comprising of 30 minutes passive phase, 20 minutes active phase, a tilt angle of 70 degrees and 500 mcg sublingual nitroglycerine (Angised® - GSK) administration during the active phase4.

Vasovagal syncope can occur in any stage of life, but it is commonly reported (about 40%) in adults. Older people are more prone to undergo syncopal attacks due to physiological changes related to aging, multiple co morbidities and polypharmacy which predispose them to hypotension5,6. Very few studies have evaluated
the relationship between outcome of head up tilt table test and clinical characteristics of patients including age, gender, co morbidities, BMI etc. In this study we investigated the outcome responses of head up tilt test in vasovagal syncope patients presenting to Armed Forces Institute of Cardiology & National Institute of Heart Diseases, with an objective to explore any association between test outcomes, age and gender of the patient.

**PATIENTS AND METHODS**

Our study group comprised of 271 consecutive patients of all age groups. These patients presented with unexplained syncope with one or more attacks to the cardiac electrophysiology department of Armed Forces Institute of Cardiology & National Institute of Heart Diseases from January 2016 to June 2016. Patients with structural heart disease (coronary artery stenosis, mitral stenosis, left ventricular outflow obstruction), cardiomyopathies and/ or allergy to nitrates were excluded from the study. Detailed medical history was taken, physical examination including weight and height was done for each patient along with informed consent for participation in the study. Throughout the test beat to beat blood pressures, heart rate and surface electrocardiograph at a speed of 25 mm/ s were continuously recorded.

Enrolled patients undertook conventional head-up tilt table test using an electrically controlled tilt board with a foot rest for weight bearing. The test comprised of two phases; a passive and an active phase. During resting phase, supine blood pressure both systolic and diastolic, and heart rate were recorded electronically. After initial resting phase of 2 minutes, the patients were tilted to 70 degrees for 20 minutes in passive phase. Both systolic and
diastolic blood pressures and heart rate were recorded after every two minutes during the passive phase. The test then proceeded to active phase for further 30 minutes, where 500 micrograms of sublingual nitroglycerine (Angised® - GSK) was administered to the tilted patient with continuous monitoring of systolic diastolic blood pressures and heart rate.

Head up tilt test was reported to be negative for patients who successfully completed both the phases without onset of any syncopal symptom. Whereas the test was terminated on development of syncopal symptom at any stage and was labeled to be positive. The test was also

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**Table 1: Demographic and clinical characteristics of patients (n=271).**

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Characteristics</th>
<th>Group A (&lt;20 years) n = 27</th>
<th>Group B (21-60 years) n = 172</th>
<th>Group C (&gt;60 years) n = 72</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Males (n%)</td>
<td>15 (55%)</td>
<td>143 (83.1%)</td>
<td>60 (83.3%)</td>
</tr>
<tr>
<td></td>
<td>Females (n%)</td>
<td>12 (45%)</td>
<td>29 (16.8%)</td>
<td>12 (16.6%)</td>
</tr>
<tr>
<td>2.</td>
<td>Anthropometry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weight in kg (Mean ±SD)</td>
<td>45.8 ±10.2</td>
<td>68.7 ±7.8</td>
<td>65.2 ±5.5</td>
</tr>
<tr>
<td></td>
<td>Height in cm (Mean ±SD)</td>
<td>155 ±8.7</td>
<td>168 ±10.4</td>
<td>163 ±8.6</td>
</tr>
<tr>
<td>3.</td>
<td>Comorbidities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hypertension</td>
<td>-</td>
<td>17 (9.8%)</td>
<td>15 (20.8%)</td>
</tr>
<tr>
<td></td>
<td>Diabetes Mellitus</td>
<td>1 (3.7%)</td>
<td>10 (5.8%)</td>
<td>10 (13.8%)</td>
</tr>
<tr>
<td></td>
<td>Coronary Artery Disease</td>
<td>-</td>
<td>12 (6.9%)</td>
<td>10 (13.8%)</td>
</tr>
<tr>
<td>4.</td>
<td>Test outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>3 (11.1%)</td>
<td>35 (20.3%)</td>
<td>10 (13.8%)</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
<td>24 (88.8%)</td>
<td>137 (79.6%)</td>
<td>62 (86.6%)</td>
</tr>
</tbody>
</table>
terminated on development of any adverse event, arrhythmia or if requested by participant. Positive result was classified according to VASIS classification\textsuperscript{7} as mixed response (Type I), cardio inhibitory without a systole (Type II A and B), and vasodepressor (Type III):

- **Mixed type:** The heart rate falls at the time of syncope, but it does not fall to under 40 beats per minute (bpm) for less than 10 seconds.

- **Cardio Inhibitory Type:**
  a. Type IIA: Cardio inhibition without a systole occurs when the heart rate falls to a ventricular rate below 40 bpm for longer than 10 seconds but a systole of shorter than 3 seconds does not occur. The blood pressure drops prior to the fall of the heart rate.
  b. Type IIB: Cardio inhibition with a systole is defined as the occurrence of a systole for more than 3 seconds. The heart rate fall coincides with or precedes the blood pressure fall.

- **Vasodepressor type:** The heart rate does not fall more than 10% from its peak value at the time of syncope.

### Statistical Analysis

Data were entered and analyzed in software SPSS (version 22). Mean and standard deviation were presented for continuous data whereas frequency and percentage for the categorical data. Comparison between groups of continuous variables was calculated by independent samples t test. Statistical significance between categorical variables was explored by Chi Square test. A p-value of $\leq 0.05$ was considered to be significant.

### RESULTS

Two hundred and seventy one patients were enrolled in the study. Patients were categorized in three age groups including <20 years (group A), 21-60 years (group B) and >60 years (group C). There were 27 (10.0%), 172 (63.5%) and 72 (26.6%) patients in group A, B and C respectively with 55% vs 45%, 83.1% vs 16.8% and 83.3% vs 16.6% males vs females respectively. Patient's demographic and clinical characteristics were summarized in Table I.

**Table II: Comparison of hemodynamic parameters between age groups of syncope patients.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resting parameters</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic BP in mmHg (Mean ±SD)</td>
<td>112.1 ±9.5</td>
<td>122.7 ±13</td>
<td>137.5 ±20.7</td>
</tr>
<tr>
<td>Diastolic BP in mmHg (Mean ±SD)</td>
<td>66.8 ±8.2</td>
<td>75.8 ±9.2</td>
<td>80.6 ±10.6</td>
</tr>
<tr>
<td>Heart rate in bpm (Mean ±SD)</td>
<td>102.6 ±9.7</td>
<td>77.6 ±15.6</td>
<td>70.49 ±13.8</td>
</tr>
<tr>
<td><strong>Parameters at start of tilt phase</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic BP in mmHg (Mean ±SD)</td>
<td>102.6 ±9.7</td>
<td>111.2 ±11.3</td>
<td>110.2 ±17.1</td>
</tr>
<tr>
<td>Diastolic BP in mmHg (Mean ±SD)</td>
<td>61.6 ±8.9</td>
<td>71.7 ±9.0</td>
<td>65.7 ±12.1</td>
</tr>
<tr>
<td>Heart rate in bpm (Mean ±SD)</td>
<td>122.6 ±13</td>
<td>110.6 ±19.7</td>
<td>102.0 ±18.5</td>
</tr>
<tr>
<td><strong>Parameters at end of tilt phase</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic BP in mmHg (Mean ±SD)</td>
<td>109.4 ±10.1</td>
<td>112.7 ±12.3</td>
<td>114.0 ±12.7</td>
</tr>
<tr>
<td>Diastolic BP in mmHg (Mean ±SD)</td>
<td>62.4 ±8.2</td>
<td>67.1 ±8.5</td>
<td>68.2 ±9.5</td>
</tr>
<tr>
<td>Heart rate in bpm (Mean ±SD)</td>
<td>81.5 ±17.7</td>
<td>84.5 ±15.7</td>
<td>78.2 ±15.4</td>
</tr>
<tr>
<td><strong>Parameters at onset of syncope/near-syncope</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic BP in mmHg (Mean ±SD)</td>
<td>52.8 ±6.5</td>
<td>55.9 ±8.5</td>
<td>57.5 ±12.4</td>
</tr>
<tr>
<td>Diastolic BP in mmHg (Mean ±SD)</td>
<td>29.2 ±7.5</td>
<td>32.2 ±7.1</td>
<td>38.8 ±10.8</td>
</tr>
<tr>
<td>Heart rate in bpm (Mean ±SD)</td>
<td>35.5 ±6.6</td>
<td>37.4 ±8.0</td>
<td>82.8 ±12.2</td>
</tr>
</tbody>
</table>

The blood pressure falls before the heart rate falls.

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S147
Head up tilt test was found to be positive in 223 (82%) of the total 271 study population, where 24 (88.8%), 137 (79.6%) and 62 (86.6%) positive responses in group A, B and C respectively. No significant difference has been found between the negative and positive responses in terms of gender and age (p=0.7 and 0.1 respectively).

Among the group of patients with positive head up tilt test response, the rate of cardio inhibitory syncope was significantly more common in younger age groups while decreased after middle age (p=0.04), similarly rate of Vasodepressive syncope was relatively higher in elderly age group as compared to younger age groups (p=0.03). This trend of relationship between type of syncope and age is depicted in fig.

Passive phase positive responses were more commonly encountered in cardio inhibitory syncope, while active phase positive responses were more frequently observed in mixed type syncope (p 0.04). Physiological parameters were almost same in all patients at start of the test while they varied significantly later in the test procedure accordingly. Hemodynamic and physiological parameters are summarized in table-II.

**DISCUSSION**

In our study, we have observed head up tilt test responses for 271 syncope patients, out of which 223 (82%) developed positive response while remaining 48 (18.0%) had a negative response. Elderly patients significantly underwent Vasodepressive type of syncope as compared to youngsters. Similarly, cardio inhibitory syncope was significantly more common in younger age group as compared to elderly. However we failed to find any significant difference between gender and type of syncope based on head up tilt test results.

The results of two studies conducted by Kochiadakis and Kazemi reports that age has a significant association with type of syncope. These authors concluded that cardioinhibitory and mixed type syncope is observed in younger patients and Vasodepressive syncope in older patients8,9. Their conclusion is in line with the results of our present study. Another study conducted by Galetta in 2004 reported that 65% subjects developed Vasodepressive response which was the most frequent cause of syncope in older subjects, while vasovagal response is the commonest cause of syncope of young patients10. The reason for this mechanism, as reported by Louise can be the fact that elderly patients experience more blood pooling in lower extremities as compared to younger patients because of loss of muscle tone of blood vessels11. Another reason for Vasodepressive response to be more frequent in elderly group can be the inability of aging heart and autonomic nervous system to compensate for stress induced by orthostatic position during head up tilt test12,13.

Similarly, in our study frequency of cardio inhibitory response was significantly higher for
young patients, which is evident in results of studies conducted by Duan and Yozgat who have concluded that cardioinhibitory response is more common among young and pediatric patients\textsuperscript{14,15}.

\textbf{CONCLUSION}

It was concluded that the age of syncope patient is associated with type of hemodynamic response to the head up tilt test. More such studies are required to be carried out in order to fully establish the effect of age on pathophysiology of syncope.

\textbf{ACKNOWLEDGEMENT}

The author wishes to express profound gratitude and kind regards to Col Azmat Hayat, head of electrophysiology department AFIC, for his excellent supervision; and Brig Samina Javed for her continuous support and guidance. I would also like to thank Miss Hina Shafique of research & development department AFIC for assisting in data entry.

\textbf{CONFLICT OF INTEREST}

This study has no conflict of interest to declare by any author.

\textbf{REFERENCES}


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PREVALENCE OF CHRONIC TOTAL OCCLUSION IN A TERTIARY CARE CARDIAC CENTRE IN PAKISTAN

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ABSTRACT

Objective: To calculated the incidence of chronic total occlusion and frequency of involvement of various arteries along with different characteristics.

Study Design: Prospective study.

Place and Duration of Study: It was a six months prospective study in the Armed Forces Institute of Cardiology and National Institute of Heart Diseases Pakistan, from Jan 2016 till Jul 2016.

Material and Methods: All the consecutive patients who underwent coronary angiography in the Armed forces institute of cardiology/ National institute of heart diseases were reviewed for the presence of cto along with its arterial involvement and the type of lesion. Age, gender, presence or absence of co-morbid such as diabetes mellitus, hypertension and smoking were documented.

Results: Twenty percent of the total coronary angiograms conducted were found to have chronic total occlusions involving mostly the left anterior descending (LAD) followed by the right coronary artery (RCA) and left circumflex (LCX). With most of them having tapering ends and bridging collaterals. Our study will point out the disease burden of CTO and will work as a pilot to plan the future management strategy of CTO in our region.

Conclusion: Our study will help in the guidance of future management strategies for CTO in this region. Our study will also point out the disease burden of CTO and emphasize that percutaneous management of CTO PCI should be the next target of all the leading tertiary care cardiac centers in this region16.

Keywords: Chronic total occlusion, Coronary angiogram, TIMI.

INTRODUCTION

Chronic total occlusion (CTO) is defined as an occlusion in the coronary artery with Thrombolytic In Myocardial Infarction (TIMI) 0 flow of 3 months duration1. In the current era, incidence of CTO ranges from 15% to 30%2 depending on different scenarios in which those patients were being studied. This has lead to an increasing interest in its percutaneous management. This interest has also increased because of the advent of new techniques, such as the retrograde wire approach, parallel wire technique and introduction of devices specifically designed for the management of CTO3. CTO PCI is considered as the final frontier of interventional cardiology3.

CTO consists of a fibrotic or calcified proximal cap having a tapering or non tapering end. Most of the CTO, microscopically, have fibrous or calcified tissue, atheroma and local lymphocytic infiltrate4-6. On the other hand, distal cap of the occlusion has an increased incidence of tapering end, (78.9 vs. 48.4%) which paved the way for introduction of retrograde wire approach7,8.

Various centers have different frequency of the incidence of CTO and its management. The North American centers have an incidence of 29 and 33% yet they treat only 6 and 9% of these patients via percutaneous techniques9,10. On the other hand Japanese centers have an incidence of 19% CTOs and perform precutaneous procedures on 61.2% of these patients9,11.
No study has been published regarding the frequency of CTO from our region; therefore we calculated the incidence of CTO and frequency of involvement of various arteries along with different characteristics.

**MATERIAL AND METHODS**

A prospective study was conducted from January 2016 till July 2016. All the consecutive patients who underwent coronary angiography in the Armed forces institute of cardiology / National institute of heart diseases were reviewed for the presence of cto along with its arterial involvement and the type of lesion. Age, gender, presence or absence of co-morbid such as diabetes mellitus, hypertension and smoking were documented. Previous history of myocardial infarction, triple vessel coronary atherosclerosis and left ventricular ejection fraction were also documented. In patients who underwent multiple coronary angiographies, only the first procedure was included in the study. Patients who had their index study conducted before the time of commencement of this research were excluded. The study was approved by the institutional review board of the above mentioned hospital.

CTO was defined as a total coronary artery occlusion of more than 3 months duration with TIMI 0 flow.

**RESULTS**

Among 846 coronary angiographies conducted over a period of 6 months, 171 patients were found out to have CTO of one or more arteries, which were 20% of the total coronary angiograms (Table). The most frequent involvement of CTO was found in the left anterior descending (LAD) artery in 73 patients (42.7%) followed by the Right Coronary Artery...
(RCA) in 63 patients (36.8%) and the rest of 35 patients had CTO of left circumflex (LCX) Artery (fig).

More than 60% of the arteries involved in CTO had tapering ends and almost half of the arteries involved had bridging collaterals. More than 65% of CTO were of 5cm of less in length and more than 90% of the CTO were of 10cm or less in length. No fibrous cap was appreciated on the coronary angiogram in 63.2% of the CTO and most of the lesions had almost no evidence of calcification or minimum calcification (84.8%). Only 15% of the CTO had a bendy lesion and 63.2% of the CTO were in the osteo-proximal vessel. The distribution of disease according to coronary arterial involvement has been shown in figure.

Most of the patients were male. The frequency of diabetics in CTO was 54.4%. The presence of hypertension was found in 52% of the patients and 38.8% of the patients were smokers.

All the frequencies have been shown in a tabulated form in table.

**DISCUSSION**

In this study, we have found that a significant number of patients in Pakistan suffer from CTO. In one of the largest studies conducted for coronary atherosclerosis the incidence of CTO was found out to be 18.4% and the incidence increased when the patients under investigation had multiple co morbid, increased age or had a past history of coronary artery by-pass grafting (CABG).12.

Our study has also shown that almost half of our patients have bridging collaterals, the lesion themselves are generally small in size with tapering ends and without fibrous caps or bends. It was also found that many of our patients have none or minimally calcified lesions. All of these characteristics are consistent with an increased chance of successful intervention13. In one of the studies conducted in Japan, arteries having similar characteristics as most of our patients were found to have an initial success rate of more than 80% at the very least. These lesions were also found to have used less amount of contrast and less total fluoroscopic time14. Another study conducted in Pakistan showed the success rate of 94% of CTOs which were managed in their institute15.

**CONCLUSION**

As it has been observed that the successful opening of CTO leads to an improvement of anginal symptoms, decrease in the ischemic burden, an improvement of left ventricular ejection fraction7,8 with a Meta analysis of 13 studies showing an overall improvement of 44% in successful CTO PCI compared to unsuccessful CTO PCI. Our study will help in the guidance of future management strategies for CTO in this region. Our study will also point out the disease burden of CTO and emphasize that percutaneous management of CTO PCI should be the next target of all the leading tertiary care cardiac centers in this region16.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

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FAMILY WITNESSED RESUSCITATION: A DESCRIPTIVE STUDY ON THE PERCEPTION OF PAKISTAN ARMY NURSES

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ABSTRACT

Objective: To evaluate the perception and self-confidence of Pakistan Army nurses regarding family presence during resuscitation of a family member.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Inpatient departments of AFIC/NIHD, CMH and MH Rawalpindi Pakistan from 15th to 31st Mar 2016.

Material and Methods: A sample of 100 nurses was selected through purposive convenience sampling consisting of nurses from inpatient departments of AFIC/NIHD, CMH and MH Rawalpindi. A structured pre-tested questionnaire was applied including following variables: personal characteristics (Rank, name, age, and professional qualification), responses of participants towards family presence during resuscitation and the self-confidence of nurses at that time.

Results: Fifty three (53.0%) participants of the study were General nursing diploma holders and 47 (47.0%) were BScN Generic degree holders with a mean age of 29.95 ± 7.1 years. Nurses’ self-confidence and perceived benefit of family presence were statistically significant (p=0.01). Self-confidence was significantly greater in nurses who had completed training in BSc Nursing. Barriers to family presence included fear of interference by the patient’s family, lack of support for the family members, fear of emotional trauma to family members, and performance anxiety.

Conclusions: Changing the practice of family presence will require strengthening current policy, identifying a team member to attend the patient’s family during resuscitation, and requiring nurses to complete education on evidence that supports family presence and changes in clinical practice.

Keywords: Family presence, Perception, Resuscitation, Self-confidence.

INTRODUCTION

The practice of allowing family members to be present at the resuscitation or invasive procedure of their relative is one that has been discussed over the past few decades1. With the rise of family-centered care, family input into healthcare decisions has increased and strict visitation policies have relaxed, even including family at the bedside during invasive procedures and resuscitation. Involving patients’ families in routine patient care can improve patient safety and satisfaction and are accepted as common practice2. When emergencies occur, however, controversy exists among health care providers about family presence during resuscitation (FPDR). Research is needed to test the relationship between risks, benefits, and self-confidence in managing family presence during resuscitation1,2.

This concept was first presented in the early 1980’s when Foote Hospital in Michigan began a program to facilitate the practice of family member presence during resuscitation as a response to demands by families3,4. Despite of nurses’ professional obligation to meet the needs of patients and patients’ families, FPDR remains highly controversial among healthcare providers and thus is far from the norm in practice.
Supporters of FPDR tend to emphasize the basic human right of patients and patients’ families for the families to be present. Opponents of FPDR are concerned with possible disruption of the code team, traumatic memories for patients’ families, and the risk of litigation.

MATERIAL AND METHODS

This cross-sectional study was carried out at the inpatient departments of AFIC/NIHD, CMH and MH Rawalpindi Pakistan from 15th to 31st March, 2016. The study population consisted of Pakistan Army nurses working in inpatient departments of selected hospitals. Purposive convenience sampling was used and a sample of 100 nurses was recruited into the study over a period of two weeks. Data was gathered using two sets of comprehensive and pretested questionnaires. The questionnaires sought such information as socio-demographic characteristics like rank, age, name and professional qualification. Other information elicited from the participants included perceived risks, benefits and other related factors regarding family presence during resuscitation of a loved one. Self-confidence of the nurses during a resuscitation process with family present was also evaluated through their responses to the questions. Data analysis was done in SPSS version 21 software computer program. Pearson correlation significance test was applied to analyze the data. Cross tabulation of variables were made where feasible, to determine statistical significance of variables.

RESULTS

The study included total 100 nurses working at inpatient departments of selected hospitals. Mean age of the participants was 29.9 ± 7.18 years.

Maximum participants were in the age group of 25 to 30 years (fig-1). Amongst them 53 (53.0%) were general nursing diploma holders and 47 (47.0%) were BSc nursing degree holders. Nurses’ self-confidence and perceived benefit of family presence were statistically significant ($p=0.01$).

Self-confidence was significantly greater in nurses who had completed training in BSc Nursing (fig-2).

Barriers to family presence included fear of interference by the patient’s family, lack of support for the family members, fear of emotional trauma to family members, and performance anxiety (fig-3).

DISCUSSION

This study showed that most of the nurses were in favor of family centered care and supported the concept of family presence during resuscitation of a patient despite of limitations in practicing it. Nurses were also self-confident performing resuscitation of the patient including drug administration, electrical therapies, chest compressions and other related tasks in front of a family member. Most of the nurses in favor of FDPR were more self-confident while attending...
the patient during resuscitation with family members present. Most of the nurses who were in support of family witnessed resuscitation were holding a graduation degree in nursing which indicates that perception of nurses about family witnessed resuscitation is dependent on the level of education as well. During CPR, patients’ families seek information and proximity and expect staff to “do their job”. As staff controls events around CPR, families lose autonomy when negotiating their way into the resuscitation room. Denying access to patients’ families inhibits the families’ role to watch out for and protect their loved one\(^9,11\). Providing information to families during CPR is critical so that they can determine what is going on and cope effectively. However controversies exist in two groups of health care providers i.e. in favor of FPDR and against it\(^8,12\). Supporters may perceive benefits of family presence during resuscitation. According to supporters, family presence during resuscitation can provide an opportunity to educate the family about patient’s condition\(^9,10\). It may facilitate participation of patient’s family in care of patient and can allow patient’s family to support patient and staff. FDPR can remove doubt for patient’s family about what is happening to patient and reinforce that everything possible was done. By involving family during resuscitation of a patient, health care providers can reduce fear and anxiety among patient’s family members. It will remind the staff of patient’s personhood and encourage the staff members to behave professionally.

Bonding and connectedness of patient and family relationship is sustained and moreover it will facilitate the grieving process in the hospital and later at home\(^11\). People who are against this concept express their point of view many arguments like family might interfere with resuscitation efforts and show emotional and behavioral responses that may be disruptive\(^10,11\). Resuscitation team cannot care for patient and the family at the same time and someone in team needs to be assigned to care for the family\(^12,13\). Lack of public knowledge regarding what to expect at the time of resuscitation (blood, tubes, invasive instruments, and electrical therapies) can also be a reason for some health care providers to remain against the family presence during resuscitation\(^13-16\). At the same time, if resuscitation team or a member of team is not self-confident and is suffering from performance anxiety by attending the patient in front of family, risk of litigation might be increased.

**CONCLUSION**

The majority of attitudes toward family witnessed resuscitation were positive. FPDR appears to offer many benefits with few drawbacks or adverse effects to patients, patients’ family members, and healthcare providers. Policies against FPDR may not meet needs of patients’ family members. Routine exclusion of patients’ family members from the resuscitation room may no longer be appropriate. Nurses are challenged to take care of dying patients a step further. Attitudes of nursing staff are significantly affected by providing education on how to provide FPDR to patients’ families. Proper policy making, relevant education of staff members and resource allocation is recommended in this regard.

**ACKNOWLEDGEMENT**

The author wishes to express profound gratitude and deep regard to Brig Samina Javed for her exemplary support and guidance in carrying out this study. I would also like to give my sincere gratitude to all staff members of Emergency department AFIC/NIHD and Tanzeela Maqsood for their support and immense help throughout this research project.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

INTRODUCTION

Patent ductus arteriosus is one of the most common congenital cardiac anomalies and accounts for 5-10% in children. The symptoms appear early in infancy depending upon size of Patent ductus arteriosus (PDA). In case of moderate to large PDA there is failure to thrive, repeated episodes of chest infections, irritability and feeding difficulty so necessitates its closure. The exact defect size, type of PDA, its length, size of pulmonary arteries, coarctation of aorta, location of PDA and its relation with the surrounding structures are helpful in making decision for device closure. Percutaneous closure of PDA is being innovated gradually since 1968.

Device closure of patent ductus arteriosus is safe, effective and provides alternative way to surgical ligation/ interruption with shorter hospital stay. Transthoracic echocardiography is excellent guiding tool for device positioning, alignment and deployment. In Pakistan our institution is one of few centers that is providing interventional therapy for various congenital heart defects. We are using transthoracic echocardiography (TTE) as guiding tool for percutaneous PDA device closure in selected small infants to save arterial puncture which may lead to femoral artery thrombosis sometimes very difficult to regain circulation in spite of administering heparin post procedure. The use of streptokinase leads to excessive uncontrollable bleeding which is very difficult to manage in certain situations. In this study we focused on the feasibility, technique, selection of appropriate...
case and problems encountered during this new technique which is very rewarding and safe compared to surgery or using large sized arterial sheaths for large PDA especially in malnourished infants.

**MATERIAL AND METHODS**

All children between 3 months to 24 months with moderate to large PDA were assessed in outpatient department and those considered suitable for device closure were enrolled in this study. A detailed TTE was performed in all these selected infants with good acoustic window for the assessment of defect size, type, location, length, aortic arch with descending aorta, anatomy of aortic as well as pulmonary end of PDA, estimation of pulmonary artery pressure and any other associated congenital cardiac defects. The device size was selected in outdoor and all children were treated with VSD device which would otherwise need surgery for interruption of PDA.

Informed verbal consent was taken from all patients. Ethical committee approval was taken for this procedure through non-random convenience sampling following inclusion criteria was the infants less than 24 months of age, patients with moderate to large PDA, failure to thrive, repeated chest infection and cardiomegaly.

PDA with coarctation of aorta or other associated cardiac lesion and children more than 24 months and less than 1 month were excluded from the study.

All patients were called a day before the procedure and clinical examination with complete blood count and chest X-Ray was done to rule out infection. An approval from ethical committee of the institution as well as written consent was taken before the procedure. The procedure was carried out with general anaesthesia. After adequately sterilization of both groins, a femoral vein sheath 5F was placed under general anaesthesia. The PDA was crossed with exchange wire over 5F JR catheter and the exchange wire stabilized in the descending aorta, then 5F pigtail catheter was exchanged by wire (fig-1a and 1b). The aortogram was recorded by in right anterior oblique 30 degree and left anterior oblique 90 degree views. The final selection of device was decided based on both echocardiogram and aortogram views. The pigtail catheter was again exchanged with the wire and the femoral sheath was also withdrawn along with catheter. Following that an appropriate sized sheath was introduced over the exchange wire keeping the wire stiff during the cause of sheath placement. The sheath was finally

![Figure-1(a): Echo shows no residual flow across patent ductus arteriosus device.](image)

![Figure-1(b): Patent ductus arteriosus device closure visualize on echo.](image)
were precisely undertaken before releasing the device. All children were given (ceftriaxone) 50mg/ kg during the procedure followed by two additional doses. The patients were discharged after 24 hours and TTE was performed at the time of discharge. The patients were advised regular follow ups at 1, 3 & 6 months.

RESULTS

All of the 55 children (100%) had successful device closure of PDA including 60% (33) female and 40% (22) were male. The age of patients varied from 3 to 24 months (mean 9 ± 2.6 SD). TTE guidance was used in all children for device deployment during the procedure. The procedure was carried out under general anaesthesia in 100% (55) patients. The defect size ranged from 2-10mm (mean 4 ±2 SD) and the occluders (ADO II type; VSD device) used varied from 4-12 mm. The median procedure time was 45 minutes and while fluoroscopic time was 9 minutes. In two patients there was residual low velocity leak through the device that resolved within 24 hours. In one patient the device appeared small (12 mm) and replaced with larger one (14 mm) with good result. No emergency surgical exploration or death occurred during this period.

DISCUSSION

Percutaneous closure of the ductus arteriosus is the method of choice for treatment of this malformation in all age groups, except for the youngest patients, i.e. those whose weight is less than 5-6 kg. The surgical approach is still a standard method of treatment for them although there are reports of transcatheter arterial duct closure in premature babies of 1.7 kg and 2.2 kg body weight. The limitations in this age group are connected with the lack of suitable delivery systems small enough to be safe for such tiny vessels. It is also a rule that arterial ducts in this period of life are often much wider than in older groups, so they require the introduction of larger implants. In the presence of small diameter of the blood vessels it can lead to their narrowing or even occlusion and rupture.

The next problems that may occur are vascular complications connected with the arterial puncture. It is of great concern especially in patients with low body weight. In most of the cases it is possible to postpone the date of intervention until it is safe for the patient and allows one to avoid complications but in some cases the closure of the duct should not be postponed too long because of the danger of development of pulmonary hypertension or heart failure.

According to the data from the literature, vascular complications occur most frequently in patients with body weight below 10kg. More than 20 years ago about 60% of patients had impalpable or very weak pulse at punctured arterial site at the time of discharge. Low profile vascular sheaths, minimized delivery systems and implants reduced the percentage of vascular complications although it is still high in the youngest group of patients.

One patient (8 months) with 8mm PDA had severe malnutrition, repeated episodes of chest infection, irritability in whom surgical interruption was very risky, underwent successful PDA device closure by this procedure saving the femoral artery as well as surgical morbidity and mortality. In this particular infant 8 mm ventricular septal defect (VSD) device seemed to be very bulky with suspicion of obstruction in the descending aorta and left pulmonary artery but precise echocardiogram revealed no such finding and the device was released successfully. In two patients there was difficulty in crossing the sheath over the wire but placing the JR catheter over the wire within sheath could ease the sheath crossing from right ventricle to pulmonary artery and finally to aorta through PDA. So far there was no procedure failure or embolization of the device. The other complications were residual leak (n=4) transient heart block (n=2) which settled immediately without medication. The mean procedure time was 20 minutes.
The latest data show that arterial occlusion concerns about 16% of the patients with body weight lower than 10 kg and 5.5% of patients with higher body weight\textsuperscript{6}. Avoiding the arterial access eliminates all possible complications connected with arterial puncture: its occlusion, embolism, dissection, pseudo aneurysm formation, and bleeding. Certainly it does not exclude venous complications, which are as probable as arterial ones, but their consequences are definitely less important. The most serious arterial complications may end up with leg amputation or unequal development of lower extremities.

The new method of PDA occlusion seems to be an attractive therapeutic proposal. The biggest difficulty in this method is the lack of precise angiographic imaging immediately before deployment of the device. Based on our experience, good echocardiographic visualization is sufficient for the safety of the procedure. The experienced echocardiographer is able to determine precisely the location of the occluder. During the echo imaging we are able to estimate the flow in the aorta and in both pulmonary arteries in order to be sure that none of the vessels (especially the left pulmonary artery) are narrowed\textsuperscript{9}. An additional advantage of our method is the reduction of the volume of contrast medium. In one of the child of 40 days having congenital rubella syndrome with severe respiratory distress, PDA was closed with 8mm device even without aortogram but only under TTE.

Sometimes there are problems in passing the guide wire through the arterial duct from the pulmonary artery. In such situations it is not possible to perform the PDA closure only from the venous approach. It is far easier to go through the duct from the aortic side and in those patients it is unavoidable to puncture the femoral artery. Then after passing the guide wire from the aorta through the duct to the pulmonary artery we exteriorize it using a vascular goose neck wire. After that it is possible to introduce the delivery system with the occluder.

An additional complication that appeared in one of our patients was the vasoconstriction of the duct. The structure of this vessel may predispose to constriction as the reaction to different factors\textsuperscript{10}. We dealt with such a situation in our patient. The modified method of duct occlusion that we propose comprises additional manipulations within the duct and that was probably the reason for the temporary total constriction of a large arterial duct in 1 of our patients. Ten minutes after the removal of all devices from the lumen of the duct we saw the relaxation of the duct walls and then we were able to occlude the PDA effectively. Such reaction of the duct walls is more likely to happen in younger patients when fibrosis or calcification has not been developed. It is quite important to be aware of the possibility of such a complication and it should always be considered when the differences between the diameter of the duct before and during the procedure become substantial. It may end up with the choice of too small an occluder and, in consequence, the migration of the device.

**CONCLUSION**

Device closure of PDA without femoral arterial puncture under echocardiographic guidance is especially useful for small infants with large PDA in which femoral puncture can be limb threatening due to prolonged large size femoral arterial sheath.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**


COMPARATIVE STUDY OF NUTRITIONAL INTAKE AND OPTIMUM NUTRITIONAL REQUIREMENTS IN PEDIATRIC INTENSIVE CARE OF A TERTIARY CARE HOSPITAL IN RAWALPINDI

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ABSTRACT

Objective: To compare the difference in caloric and protein intake versus optimum protein and caloric requirements at pediatric ITC of AFIC. To see the difference in protein and caloric intake in patients on oral intake versus nasogastric feeding.

Study Design: Retrospective observational study.

Place and Duration of Study: Armed Forces institute of Cardiology and National Institute of Heart Diseases from 1st Feb 2015 to 1st Jul 2015.

Methodology: This retrospective study was conducted on post operative patients of pediatric ITC of AFIC. Total 102 patients who met the study criterion were included in the study sample. Data was collected from hospital records and FFQ.

Result: Mean caloric intake on 1st, 2nd and 3rd post operative day was 353,438,570 k/cals respectively where as mean protein was 11,11,12 grams on 1st, 2nd and 3rd post operative day respectively. The difference in the mean caloric intake on 1st, 2nd and 3rd post operative day were statistically significant whereas difference in the mean protein intake was not significant statistically. The caloric intake was high with patients on oral feeding than ones on nasogastric tube feeding where as Protein intake in patients with nasogastric tube feeding was high than those on oral feeding.

Conclusion: The caloric and protein intake in study subjects was below the recommended level both in nasogastric and oral feeding. A constant monitoring of nutritional status of post operative patients especially in post operative children is mandatory for optimal wound healing and survival of patient.

Keywords: Intensive Care (ITC), Optimum Caloric and protein intake, Food frequency questionnaire (FFQ), Nasogastric tube feeding, Oral feeding.

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INTRODUCTION

Post operative nutritional care plays a crucial role in wound healing specially in pediatric population1. Nutritional requirements in post operative pediatric patient do not differ quantitatively from normal subjects. The quantitative requirement of individual nutrients differ from normal values. Primary objective of nutritional study in surgical patient is to define quantity of these nutrients that is appropriate for these patients in post operative phase2. There is a consensus on the fact that early post-operative nutritional support benefits surgical patients by reducing septic morbidity, improving healing of wound and maintenance of immuno competence3. Treatment of surgical patient during last two centuries has been improved tremendously which has led to better survival, safety and scope of operative procedures. Growing understanding of the metabolic response of the body in injury and infection has developed in parallel with nutritional advances3. An important cause of morbidity and mortality in surgical setting is defective responses to nutritional deprivation. These responses when overlooked by the clinician results in more protracted and even jeopardize surgical convalescence4.

The many causes of growth failure in the cardiac infant population include delayed onset
of enteral feedings, increased metabolic stress of cardiac surgery, cyanosis, low cardiac output, increased energy expenditure from physiologic stress. For optimal rehabilitation and wound healing, the body needs to be in an anabolic state. The body requires extra nutrients to heal, so focusing on nutrition can mean the difference between bouncing back and a lengthy recovery. After surgery, drugs, fatigue, and complications can make eating unappealing. The mouth and throat can be soar or dry, medicines can make food taste metallic, and even sense of smell can be diminished. On average, a person can expect to lose 5 to 10 percent of total body weight after surgery. There is a need to infuse the body with calories and nutrition. Protein is needed to repair tissue, slow muscle catabolism and decrease the inflammatory phase. Post operative requirement for protein is 1.5 grams per kilogram of body weight. For elective surgery, where as the energy requirement for 1-6 yrs of age is 75-90 k/cal per kg of body weight and that for children from 7-12 yrs is 40-60 k/cal/kg of body weight the low end of the range is sufficient, for major surgery, the higher end of the spectrum is more appropriate.

Attention to nutrition response is especially important in pediatric surgical patients. Despite its importance, adequate nutrition delivery remains a challenge and enteral feeding problems remain poorly understood in this fragile infant population. This study was planned to find the gap in optimum caloric and protein requirements and the actual intake in post operative patients in Pediatric Cardiac ITC.

**MATERIAL AND METHODS**

A Retrospective observational study was conducted in Pediatric ITC of Armed Forces institute of Cardiology and National Institute of Heart Diseases between 1st Feb 2015 to 1st July 2015. Data was collected from hospital records and FFQ (food frequency questionnaire) The study population was divided into two groups. Children between 1 to 6 years of age and second between 7-12 years of age. The reason behind dividing study subjects in two groups was the fact that protein and energy requirement of children of age less than 6 years is different from those above 6 years of age. Optimal post operative energy and protein requirement of the patients was calculated for both the groups (1-6) years and (6-12) years were calculated. It was then compared with the actual protein and energy intake on first three post operative days.

All post operative patients in pediatric ITC had started oral/ N.G feed from 1st post operative day were included in the study where as those patients who did not survive till 3rd post operative day and patients with history of renal problems or metabolic illnesses.

Reference protein and caloric intake was calculated for each patient and actual caloric and protein intake was calculated for all the study subjects on 1st, 2nd and 3rd post operative day.

**RESULTS**

A retrospective chart review was conducted of daily protein and caloric intake in the cardiac intensive care unit of AFIC Rawalpindi. The study consisted of 102 patients between the age of 1-12 years with mean age of 6.5 years ± 5.6 years. Of 102 study subjects 38 were females where as 64 were male children. The study subjects were divided into 2 groups on basis of their age. The first group consisted of children between 1-6 yrs of age and in 2nd group consisted of children from 7-12 years.

Mean caloric intake on 1st, 2nd and 3rd post operative day was 353,438,570 k/ cals respectively recommended caloric intake of all the subjects were calculated the difference in the Mean caloric intake on 1st, 2nd and 3rd post operative day was found much less than the mean recommended caloric intake. The difference was statistically significant (p=0.001).

Mean caloric intake in children of group 1 (age 1-6 years) on day 1 was 283 k/ cals where as in group 2 (age 6-12) was 481 k/ cals on day 2 in group 1 mean caloric intake was 356 k/ cals and of group 2 was 569 k/ cals and the mean caloric
intake on day 3 for group 1 was 416 k/cals whereas that of group 2 was 702 k/cals. The difference in mean caloric intake in both the groups on all 3 days was statistically significant p=0.05 as shown in table-I.

Mean protein intake on 1st, 2nd and 3rd post operative day was 11, 11, 12 grams respectively. Recommended protein intake of all the subjects were calculated the difference in the Mean protein intake on 1st, 2nd and 3rd post operative day was less than the recommended protein intake but the difference was found statistically significant (p =0.04, 0.03 and 0.04 respectively) as shown in table-II.

Mean protein intake in children of group 1 (age 1-6 years) on day 1 was 12.4 gms where as in group 2 (age 6-12) was 9 gms on day 2 in group 1 mean protein intake was 12.4 gms and of group 2 was 9.9 gms and the mean protein intake on day 3 for group 1 was 12.1 gms whereas that of group 2 was 13.4 gms.The difference in the mean caloric intake between the 2 groups on 1st, 2nd and 3rd post operative day were statistically significant. The difference in the mean protein intake between 1st and 2nd groups on 1st, 2nd and 3rd post operative day were statistically not significant. Mean caloric intake of 32 patients who were on nasogastric feeding was 246,320 and 377 k/ cals where as mean caloric intake of patients on oral feeding was 402,490 and 581 respectively, as shown in fig. The difference in the caloric intake was statistically significant on all 3 post operative days where as caloric intake was high with patients on oral feeding than ones on nasogastric tube feeding. Protein intake in patients with naso gastric tube feeding was high than those on oral feeding but the difference was statistically significant on 1st post operative day.

**DISCUSSION**

A study was conducted to compare the protein and caloric intake and optimum requirement in postoperative patients in pediatric ITC as Feeding in post operative patients is an

<table>
<thead>
<tr>
<th>Group wise</th>
<th>Mean caloric intake in k/cals</th>
<th>Recommended caloric intake</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st post operative day</td>
<td>283</td>
<td>923</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>2nd post operative day</td>
<td>356</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd post operative day</td>
<td>416</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st post operative day</td>
<td>481</td>
<td>1390</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>2nd post operative day</td>
<td>569</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd post operative day</td>
<td>702</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group wise</th>
<th>Mean protein intake in gms</th>
<th>Recommended protein intake in take</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st post operative day</td>
<td>12.4</td>
<td>17</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>2nd post operative day</td>
<td>12.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd post operative day</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st post operative day</td>
<td>9</td>
<td>38</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>2nd post operative day</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd post operative day</td>
<td>13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Healthy children need regular nourishment, including energy (i.e. carbohydrates and fat), protein, vitamins, and minerals, for maintenance and growth. Nutrition therefore is essential for maintenance of physiologic homeostasis and growth. Hypermetabolic states lead to a depletion of body stores, with decreased immune competence and increased morbidity and mortality. Surgical patients need nourishment for optimal wound healing. When an organ is injured, the healing process involves the growth of new blood vessels. Since the cells lining the interior of blood vessels and blood cells themselves are important for developing new vasculature.

Modern nutritional support for the surgical patient comprises numerous stages, including assessment of nutritional status, nutritional requirements, and nutritional therapy. Nutritional assessment is performed utilizing the clinical history, clinical examination, anthropometry, and biochemical evaluation. These parameters are subject to error and are influenced by the rapid changes in body composition in the post-operative period. Critically ill children are at high risk of developing nutritional deficiencies due to imbalance between their energy expenditure and caloric intake. There is a correlation between the accuracy of estimated energy requirement and infection, mortality, and length of stay. Actual energy delivery to the postoperative cardiac surgery child in the pediatric intensive care unit can be further hindered by many procedural and patient barriers. The provision of appropriate caloric requirements may help clinicians correct the metabolic state and promote recovery and anabolism. Therefore, optimizing nutrition intake of the postoperative, cardiac surgical child requires a paradigm shift toward individualized nutrition prescription, in the context of a Pediatric intensive care unit-specific feeding algorithm. It has been documented that nutritional deficiency is associated with compromised immune defense, more infection, growth failure, longer hospital stay, and increased costs. Historically, energy needs were estimated using predictive equations with stress factor adjustments to address the changing metabolic state. The daily nutritional needs of healthy children are best met by a balanced oral diet. However, it is not always possible to meet the needs of pediatric surgical patients in this fashion. Postoperative nutritional therapy includes enteral and/or parenteral nutrition. Enteral feeding is the first choice for nutritional therapy. The daily nutritional needs of healthy children are best met by a balanced oral diet. If enteral feeding is not feasible only than parenteral nutrition is utilized. Among the few studies available that evaluated the influence of adequate protein and calories on postsurgical outcomes, a retrospective clinical practice improvement study by Neumayer et al. involved eight hospitals and 1007 patients undergoing operations. Sufficient nutrition support was defined as at least 60% of

**Figure: Caloric intake in patients on nasogastic versus oral feeding on 1, 2 and 3rd post-OP day.**
the patient's calorie and protein goals. After controlling for severity of illness, the authors found that early, sufficient nutrition support significantly reduced length of stay and hospitalization fees compared with those patients fed early but not sufficiently or fed sufficiently but not early. Others have made similar conclusions in regard to eternal nutrition\textsuperscript{15,16} suggesting that both the amount and timing of nutrition support intervention are important factors in improving clinical outcomes. Protein serves an important role in tissue maintenance, wound healing, and slowing endogenous protein catabolism, particularly after major surgery. Postoperative protein requirements typically range between 1.2 and 2 g/kg, with the lower end appropriate for patients after uncomplicated elective surgery and the higher end recommended after major surgery\textsuperscript{17}. Severe renal or hepatic dysfunction may require short-term protein restriction below this range, whereas large open wounds or burns can increase protein needs to >2 g/kg\textsuperscript{17}. Studies have demonstrated the feasibility of early eternal nutrition for babies with congenital cardiac malformations, postoperatively with mother's milk. Providing fortification in the form of a calorie dense expressed breast milk to these infants is tolerated and also benefits in better postoperative recovery with less chance of infection and ICU stay, thereby reducing the health-care burden to the individual and the system.

**CONCLUSION**

The results indicated that the postoperative caloric and protein intake in study subjects was suboptimal both in nasogastric and oral feeding. However protein intake was better in patients on nasogastric feeding than on oral feeding. On the other hand caloric intake was better on in patients on oral feeding. A constant monitoring of nutritional status of post operative patients is mandatory for optimal wound healing and survival of patient. We anticipate that this study may result in a better understanding of the caloric needs of neonates after cardiac surgery. Further prospective randomized controlled studies with bigger sample sizes are required to strengthen the evidence.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCE**

ABSTRACT

Objective: To evaluate the frequency of risk factors with respect to age and gender in patients presenting for Coronary Artery Bypass Graft Surgery at a tertiary care cardiac facility.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology from February 2016 to October 2016.

Material and Methods: One hundred and seventy two individuals were enrolled in the study through purposive convenience sampling. All adult males and females undergoing elective coronary artery bypass graft (CABG) aged 18 and above were included in the study after informed consent. A structured questionnaire regarding the risk profile of patients was designed to collect the data from the history given by patients and their biochemical and radiological reports.

Results: The frequencies of male and female genders are 128 (74.4%) and 44 (25.6%) respectively. The age varies from 27 yrs to 77 yrs with a mean age of 57.29 ±8.9. Maximum number of patients i.e. 73 (42.2%) lie within 56-65 years however we had a significant number of patients below the age of 55 years i.e. 67 (41.1%). Hypertension was the most common risk factor with 50 (28.9%) having stage II hypertension and 41 (23.7%) with Stage I hypertension. The second in line was diabetes with a frequency of 44 (25.4%). The prevalence of other risk factors like current smokers was 31 (17.9%), obesity 35 (20.2%), physical inactivity 92 (53.2%) with 112 (64.7%) having desk jobs and high salt and fat consumption 45 (26.0%) whereas the frequency of alcohol consumption was only 1 (0.6%). Among non modifiable risk factors 36 (20.8%) of the participants had a strong family history of coronary artery disease.

Conclusion: Our findings highlighted prevalence of CAD risk factors in younger age group. Modifiable risk factors like diabetes, hypertension, obesity and smoking need better control. Preventive screening programs and healthy lifestyle behaviors need to be emphasized upon in the Pakistani population.

Keywords: Coronary Artery disease, Coronary artery bypass graft (CABG), Risk factors.

INTRODUCTION

Coronary artery disease is the leading cause of death worldwide. An estimated 17.5 million people died from CVDs in 2012, representing 31% of all global deaths. Of these deaths, an estimated 7.4 million were due to coronary heart disease making it the most common public health problem which accounts for the greatest expenditure in most healthcare budgets. In developing countries, CVD accounts for 86% of the global burden of disease. There is a high prevalence of CAD risk factors in Pakistan with more than 30% of population over 45 years of age affected by the disease. There is no Pakistani study which cites prevalence of CAD except for one conducted in 1998. Although comparison of prevalence of CAD risk factors between South Asians and other countries has been conducted in 2007 showing higher frequency of risk factors in South Asians.

Increased prevalence of CAD in Pakistan has led to an increase in number of coronary artery bypass grafting (CABG). CABG surgery is recommended to improve survival in high-risk
patients based on evidence of prognostic benefit. It is also recommended to improve symptoms in patients with limiting angina despite medical therapy, or in whom medical therapy cannot be implemented because of contraindications or adverse effects to medications. Conventional risk factors for the development of CAD include hypertension, diabetes, sedentary lifestyle, low fruit and vegetables intake, and heavy alcohol intake. Risk factors for coronary artery disease are classified into modifiable and non-modifiable. Non-modifiable are age, family history and gender. Modifiable risk factors are high blood pressure, obesity, smoking, and a family history. These all have an adverse influence on prognosis in those with established disease, presumably through their effect on the progression of atherosclerotic disease processes. Since the risk factors are present in the cultural and economic conditions context so it is somewhat difficult to control.

Table I: Demographic features of the subjects (n=172).

<table>
<thead>
<tr>
<th>Variables</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>128 (74.4)</td>
</tr>
<tr>
<td>Female</td>
<td>44 (25.6)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>17 (99.4)</td>
</tr>
<tr>
<td>Single</td>
<td>1 (0.6)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Punjabi</td>
<td>91 (52.9)</td>
</tr>
<tr>
<td>Pathan</td>
<td>48 (27.9)</td>
</tr>
<tr>
<td>Sindhi</td>
<td>4 (2.3)</td>
</tr>
<tr>
<td>Others</td>
<td>29 (16.9)</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
</tr>
<tr>
<td>Armed forces</td>
<td>62 (36)</td>
</tr>
<tr>
<td>Govt. sector</td>
<td>12 (7)</td>
</tr>
<tr>
<td>Private</td>
<td>38 (22)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>60 (35)</td>
</tr>
</tbody>
</table>

Table II: Clinical characteristics of patients n=172.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Variables</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No. of lesions</td>
<td></td>
</tr>
<tr>
<td>Single vessel</td>
<td>3 (1.8)</td>
<td></td>
</tr>
<tr>
<td>Double vessel</td>
<td>30 (17.4)</td>
<td></td>
</tr>
<tr>
<td>Triple vessel</td>
<td>135 (78.5)</td>
<td></td>
</tr>
<tr>
<td>Multi vessel</td>
<td>4 (2.3)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Prior MI</td>
<td>69 (40.1)</td>
</tr>
<tr>
<td>3</td>
<td>Prior PCI</td>
<td>21 (12.2)</td>
</tr>
<tr>
<td>4</td>
<td>LV function</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>130 (75.6)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>37 (21.5)</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>5 (2.9)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Chest pain</td>
<td></td>
</tr>
<tr>
<td>CCS scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>24 (13.9)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>84 (48.8)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>27 (15.6)</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>14 (8.1)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dyspnea</td>
<td></td>
</tr>
<tr>
<td>NYHA scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>26 (15.1)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>59 (34.3)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>37 (21.5)</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>9 (5.2)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Palpitation</td>
<td>107 (62.2)</td>
</tr>
<tr>
<td>8</td>
<td>Sweating</td>
<td>101 (58.7)</td>
</tr>
<tr>
<td>9</td>
<td>Nausea/Vomiting</td>
<td>44 (25.6)</td>
</tr>
<tr>
<td>10</td>
<td>Fainting</td>
<td>63 (36.6)</td>
</tr>
</tbody>
</table>
them, but it is believed that there is a possibility to decrease mortality in at least 50% by controlling those risks\(^6\).

Differences have been observed in the prevalence of risk variables between Indians, Pakistanis and Bangladeshis and the various ethnic and religious groups within the subcontinent. Numerous studies have attempted to identify risk factors for patients undergoing CABG surgery; however the data for their frequency in patients in our population undergoing CABG is inadequate. This data will contribute to assess the strength of these risk factors in specific association with CABG. In addition, the knowledge of these risk factors would help in policymaking for its effective control in the community. Thus, risk assessment becomes quite important in the prevention and management of CAD.

**MATERIAL AND METHODS**

A descriptive cross sectional study was conducted at Armed Forces Institute of Cardiology & National Institute of Heart Disease from February 2016 to October 2016 after approval from institutional ethical review board. A total number of 173 individuals were enrolled in the study through purposive convenience sampling and informed consent was taken individually from all participants. All the adult males and females undergoing elective CABG, conducted at Armed Forces Institute of Cardiology & National Institute of Heart Disease from February 2016 to October 2016 after approval from institutional ethical review board. A total number of 173 individuals were enrolled in the study through purposive convenience sampling and informed consent was taken individually from all participants. All the adult males and females undergoing elective CABG,

<table>
<thead>
<tr>
<th>S. No</th>
<th>Risk Factors</th>
<th>Age (years)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;45</td>
<td>15 (11.7%)</td>
<td>36 (28.1%)</td>
</tr>
<tr>
<td></td>
<td>46-55</td>
<td>36 (28.1%)</td>
<td>25 (38.3%)</td>
</tr>
<tr>
<td></td>
<td>56-65</td>
<td>19 (13.4%)</td>
<td>5 (6.2%)</td>
</tr>
<tr>
<td></td>
<td>&gt;65</td>
<td>5 (3.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;45</td>
<td>5 (11.3%)</td>
<td>15 (34.0%)</td>
</tr>
<tr>
<td>2.</td>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>9 (12.16)</td>
<td>24 (32.43)</td>
</tr>
<tr>
<td></td>
<td>Pre hypertensive</td>
<td>2 (25)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Stage I</td>
<td>7 (17.5%)</td>
<td>12 (30%)</td>
</tr>
<tr>
<td></td>
<td>Stage II</td>
<td>2 (4%)</td>
<td>15 (30%)</td>
</tr>
<tr>
<td>3.</td>
<td>Diabetes mellitus</td>
<td>3 (6.28%)</td>
<td>12 (12.2%)</td>
</tr>
<tr>
<td>4.</td>
<td>Smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Active smoker</td>
<td>8 (25.8%)</td>
<td>7 (22.5%)</td>
</tr>
<tr>
<td></td>
<td>Ex-smoker</td>
<td>1 (2.9%)</td>
<td>10 (29.4%)</td>
</tr>
<tr>
<td>5.</td>
<td>Obesity(BMI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>7 (11.4%)</td>
<td>15 (24.5%)</td>
</tr>
<tr>
<td></td>
<td>Overweight</td>
<td>9 (11.8%)</td>
<td>25 (32.8%)</td>
</tr>
<tr>
<td></td>
<td>Obese</td>
<td>4 (11.4%)</td>
<td>11 (31.4%)</td>
</tr>
<tr>
<td>6.</td>
<td>Alcohol Intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td>Dietary Intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High lipid</td>
<td>5 (15.6%)</td>
<td>14 (43.7%)</td>
</tr>
<tr>
<td></td>
<td>High sugar</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>High salt</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Combined</td>
<td>8 (18.1%)</td>
<td>10 (22.7%)</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>7 (8.24%)</td>
<td>27 (31.7%)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>20 (11.6%)</td>
<td>51 (29.6%)</td>
</tr>
<tr>
<td>8.</td>
<td>Physical activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>8 (9.8%)</td>
<td>22 (27.1%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12 (13.1%)</td>
<td>27 (29.6%)</td>
</tr>
<tr>
<td>9.</td>
<td>Type of job</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Desk job</td>
<td>10 (9.0%)</td>
<td>34 (30.6%)</td>
</tr>
<tr>
<td></td>
<td>Ambulatory</td>
<td>10 (16.3%)</td>
<td>17 (27.8%)</td>
</tr>
<tr>
<td>10.</td>
<td>Family history of CAD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Death of either parent</td>
<td>5 (16.6%)</td>
<td>6 (20%)</td>
</tr>
<tr>
<td></td>
<td>CAD in close relatives</td>
<td>2 (6.25%)</td>
<td>8 (25%)</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>6 (16.2%)</td>
<td>11 (29.7%)</td>
</tr>
</tbody>
</table>
CABG + concomitant surgery and aged 18 and above were included in the study. Patients who underwent emergency CABG surgery were excluded from the study. A structured questionnaire was designed to collect the data from the history given by patients and their biochemical and radiological reports.

Sixty years or more at the time of presentation was considered as advanced age as described by the American Heart Association to be the first cutoff limit for CAD. Hypertension was defined as systolic pressure of more than 140mmHg and diastolic pressure of 90mmHg using WHO criteria. Hypertension was categorized into Normal (SBP 90-119mmHg and DBP 60-79mmHg), Pre-hypertensive(SBP 120-129mmHg and DBP 80-89mmHg), Stage I (SBP 130-139mmHg and DBP 90-99mmHg) and Stage II (SBP >140mmHg and DBP>100mmHg) as per the standard classification. Data on hypertension was taken through patient’s history and confirmed by patients documents.

Diabetics were defined as having a fasting blood glucose level >7.0 mmol/L on or on oral anti diabetic drugs or insulin therapy. Those who quit smoking a year ago were considered ex smokers while those who currently smoked or quit in less than a year were considered active smokers. Obesity was assessed by measuring Body Mass Index (BMI) as per following criteria:

- Height was measured via measuring tape and weight via weighing machine. Patients taking more than 5 drinks per week were considered alcoholic. Those patients who were not in habit of brisk walk for 30 minutes five days a week were labeled physically inactive. Nature of the job (desk job or ambulatory) was also investigated. History of regular intake (twice a week) of large amounts of meat, dairy products, trans fatty acids (oil and ghee) was considered unhealthy diet since exact measurements were not possible. CRP was measures via ELISA method. LVH was determined by measuring width of left ventricular wall on echocardiography. Carotid artery disease was assessed by viewing carotid Doppler ultrasonography.

Data were analyzed by using SPSS 22 version. Frequency tables for all the risk factors were made and occurrence of risk factors between different age groups was compared.

RESULTS

In the present study a total of 172 patients undergoing CABG surgery were included according to inclusion criteria, with a preponderance of male gender 128 (74.4%) as compared to females 44 (25.6%). Majority of our study population belonged to Punjab 91 (52.9%). The age varies from 27 yrs to 77 yrs with a mean age of 57.29 ± 8.9. The number of patients in the 56-65 years of age group was maximum 73 (42.2%) however we had a significant number of patients below the age of 55 years 67 (41.1%). Among all the modifiable risk factors hypertension was the most common risk factor.
coming for CABG surgery with 50 (28.9%) having stage II hypertension and 41 (23.7%) with Stage I hypertension. Fig-1 shows the prevalence of hypertension in various age groups. The second most common risk factor was diabetes with a frequency of 44 (25.4%). The prevalence of other risk factors like current smokers was 31 (17.9%), obesity 35 (20.2%), physical inactivity 92 (53.2%) with 112 (64.7%) having desk jobs and high salt and fat consumption 45 (26.0%) whereas the frequency of alcohol consumption was only 1 (0.6%) table I, II and III. Of all the non-modifiable risk factors 36 (20.8%) of the participants had a strong family history of coronary artery disease. Majority of the patients presented with triple vessel coronary artery disease 135 (78.5%) with a history of prior MI 69 (40.1%) and prior Primary percutaneous coronary intervention 21 (12.2%). Most of the patients had good LV function 130 (75.6%). 59 (34.3%) of the patients reported dyspnea NYHA class II and CCS II score of 84 (48.8%). Fig-2 depicts the frequency of various risk factors with respect to gender in our study population.

**DISCUSSION**

This study helped us to evaluate the prevalence of various risk factors for CAD leading to CABG surgery in our local population. During recent decades, Pakistan has undergone epidemiological transition from communicable to non-communicable diseases. Coronary heart disease (CHD), with myocardial infarction (MI) as its main manifestation, is a major cause of death in the country. There is a high prevalence of CAD risk factors in Pakistan with more than 30% of population over 45 years of age affected by the disease.$^9,10$

Among the non-modifiable risk factors age was an important entity as almost half of the patients 67 (41.1%) were below the age of 55 constituting young adults in our study. This finding is in line with the published literature$^{11-13}$ suggesting younger age group in South East Asian countries presenting for CABG surgery. Male gender is another important risk factor in our study 128 (74.4) with a male to female ratio of 2.9 reflecting male gender as a significant risk factor for CAD.

Among modifiable risk factors hypertension was the most frequent in our study and similar findings have been reported by Kulkarni et al depicting a prevalence of hypertension in Indian population.$^{14}$ This study shows the prevalence of diabetes as 44 (25.4%) coming for CABG surgery. This finding is in accordance with Hayashi et al that states that the elderly patients with type 2 diabetes mellitus (T2DM) have much higher risks of ischemic heart disease (IHD) and Cerebrovascular accident (CVA) compared to younger diabetic patients.$^{15,16}$

Active smoking was reported in 31 (17.9%) and there were 35 (20.2%) ex smokers in our study population. This finding is further validated by Abbas et al documenting higher
prevalence of smoking in male gender in Pakistani population.

The present study also highlights obesity as one of the important risk factors in patients presenting for CABG surgery. Various studies have stated that both increasing body mass index and waist circumference are associated with increased risk of developing coronary artery disease. Moreover, those with abdominal obesity had a higher risk of developing CAD in next 6 years as compared to those with generalized obesity. Dietary risk factors were reported from 45 (26.0%) of the patients, this is in line with various studies documenting a complex association between dyslipidemia and dietary factors predisposing to CAD.17,18 The risk of family history was found in 36 (20.8%) of the participants. Prashanth K et al found that positive family history of premature CAD was present in 32% of Indian population.19,20

CONCLUSION

Our findings highlight a high prevalence of CAD risk factors in patients undergoing CABG surgery affecting female gender predominantly. Modifiable risk factors like diabetes, hypertension and smoking and dietary intake need better control. Preventive screening programs and healthy life style behaviors need to be emphasized upon in the Pakistani population.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

OBJECTIVE: To determine and compare the frequency, clinical characteristics and outcomes of patients reporting in Emergency Department of AFIC & NIHD with typical and atypical chest pain.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Emergency Department of Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, from 1st December 2016 till 31st December 2016.

Material and Methods: All the patients presented with typical and atypical chest pain during our study time period were included in the study. A data collection tool was formulated by R & D Department to collect the relevant information.

Results: There were total 215 patients recruited with chest pain in emergency department during our study period. The mean age of the patients was 56.17 ±10.98 years. 130 (60.4%) patients had typical chest pain while 85 (39.5%) patients presented with atypical chest pain. Male patients were found to be more with typical chest pain 105 (80.7%). Clinical Characteristics and co-morbidities showed, diabetes in 58 (44.6%) patients of typical chest pain (p=0.01), 65 (50.0%) patients were hypertensive (p=0.88) and 36 (27.6%) had ischemic heart disease (p=0.02). Family history of cardiovascular disease was positive in 34 (26.1%) with p value=0.01. The most common diagnosis of typical chest patients were acute myocardial infarction 80 (37.9%) with statistically significant p value (p<0.01). Underlying causes for the majority of atypical chest pain patients 77 (90.5%) were gastric causes and anxiety related issues (p=0.01). About 25 (11.6%) patients under went primary PCI, injection streptokinase were administered to 15 (11.5%) patients, 16 (12.3%) patients were late for injection streptokinase, 15 (11.5%) patients were referred to OPD while 53 (40.7%) were admitted for further evaluation.

Conclusion: Patients with life threatening etiologies for chest pain may appear deceptively well, manifesting neither vital sign nor physical examination abnormalities. Emergency doctors must recognize and refer them for treatment and hospital admission.

Keywords: Atypical chest pain, Injection Streptokinase, Typical chest pain, Unstable Angina.

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INTRODUCTION

Chest pain comes in many varieties; patients present with a spectrum of signs and symptoms reflecting the many potential etiologies of chest pain. Diseases of the heart, aorta, lungs, esophagus, stomach, mediastinum, pleura and abdominal viscera may all cause chest discomfort. Chest pain can be the presenting complaint in a myriad of disorders ranging from life threats such as acute myocardial infarction (AMI) to mild self-limiting disorders such as muscle strain. Possible cardiac chest pain can be viewed as a continuum, ranging from acute myocardial infarction to simple short lived angina. Within this spectrum lie the acute coronary syndromes with critical cardiac ischemia and minimal myocardial damage.

Chest pain and symptoms consistent with myocardial ischemia are one of the most common reasons for emergency department evaluation, accounting for approximately 8% to 10% of the 119 million emergency department visits yearly around the world. Chest pain contributes approximately six million annual visits to
emergency departments in the United States, making chest pain the second most common complaint\textsuperscript{7-9}. In the United Kingdom 2\%–4\% of all new attendances at emergency departments present with chest pain\textsuperscript{10}. South Asian countries account for about quarter of world’s population and contribute the highest proportion of the burden of cardiovascular diseases\textsuperscript{11}. In Pakistan it is estimated that one in five middle aged adults may have underlying cardiovascular diseases\textsuperscript{3,12}. Prevalence of myocardial infarction is 11.2\%, more common in males 13.3\% than females 7.9\%\textsuperscript{13-14}.

The management of patients with chest pain is a common and challenging clinical problem. Although most of these patients do not have a life-threatening condition, the clinician must distinguish between those who require urgent management of a serious problem such as acute coronary syndrome (ACS) and those with more benign entities who do not require admission\textsuperscript{15}.

**Operational Definitions**

**Typical Chest Pain:** It is defined as chest pain that meets the three of the following characteristics; 1) Substernal chest discomfort of characteristic quality and duration, 2) Provoked by exertion or emotional stress, 3) Relieved by rest and/ or nitroglycerine\textsuperscript{7}.

**Atypical Chest Pain:** It is defined as chest pain or discomfort with two of the above characteristics\textsuperscript{7}.

**Material and Methods**

It was a comparative cross-sectional study which was conducted at emergency department of AFIC & NIHD, Rawalpindi. Study was carried out from 1\textsuperscript{st} December till 31\textsuperscript{st} December, 2016. All the patients presenting in ER with typical and atypical chest pain were included in the study.

### Table-I: Comparison of demographic and clinical features of typical and atypical chest pain patients.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Typical Chest Pain (n=130)</th>
<th>Atypical Chest Pain (n=85)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>105 (80.7%)</td>
<td>61 (71.7%)</td>
<td>0.57</td>
</tr>
<tr>
<td>Female</td>
<td>25 (19.2%)</td>
<td>24 (28.2%)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 20 yrs</td>
<td>1 (0.7%)</td>
<td>2 (2.3%)</td>
<td></td>
</tr>
<tr>
<td>21-33 yrs</td>
<td>6 (4.6%)</td>
<td>7 (8.2%)</td>
<td></td>
</tr>
<tr>
<td>34-46 yrs</td>
<td>19 (14.6%)</td>
<td>13 (15.2%)</td>
<td>0.04</td>
</tr>
<tr>
<td>47-60 yrs</td>
<td>28 (21.5%)</td>
<td>31 (36.4%)</td>
<td></td>
</tr>
<tr>
<td>61-73 yrs</td>
<td>57 (43.5%)</td>
<td>26 (30.5%)</td>
<td></td>
</tr>
<tr>
<td>≥ 74 yrs</td>
<td>19 (14.6%)</td>
<td>6 (7.0%)</td>
<td></td>
</tr>
<tr>
<td><strong>Clinical Investigations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raised CK &amp; CKMB</td>
<td>117 (19.0%)</td>
<td>45 (52.9%)</td>
<td>0.78</td>
</tr>
<tr>
<td>Troponin I Positive</td>
<td>108 (83.0%)</td>
<td>32 (37.6%)</td>
<td>0.55</td>
</tr>
<tr>
<td><strong>ECG Changes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST Segment Elevation</td>
<td>64 (49.2%)</td>
<td>6 (7.0%)</td>
<td>0.93</td>
</tr>
<tr>
<td>ST Segment Depression</td>
<td>48 (36.9%)</td>
<td>9 (10.5%)</td>
<td></td>
</tr>
<tr>
<td>New Onset LBBB</td>
<td>11 (8.4%)</td>
<td>3 (3.5%)</td>
<td></td>
</tr>
<tr>
<td>Normal ECG</td>
<td>7 (5.3%)</td>
<td>67 (78.8%)</td>
<td></td>
</tr>
</tbody>
</table>
study. While patients presenting with the complaint of chest pain other than typical and atypical chest pain (palpitations, shortness of breath) and already diagnosed cases of myocardial infarction were excluded from the study.

Sampling Technique was convenient based purposive sampling. Data collection tool having different demographic and clinical variables related with chest pain, was used. Data were collected on daily basis in ER and was entered into the computer on the same day to maintain the quality. SPSS-21 was used to enter and analyze the data.

**RESULTS**

There were total 215 patients recruited with chest pain in emergency department during our study duration. The mean age of the patients was 56.17 ±10.98 years. Minimum age was 15 years while maximum age of the patients was 86 years. Out of 215 patients of chest pain, 130 (60.4%) patients had typical chest pain while 85 (39.5%) patients presented with atypical chest pain. Male patients were found to be more with typical chest pain 105 (80.7%) while females were 25 (19.2%) and this result was not statistically significant with p-value 0.57 as shown in table-I.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Typical Chest Pain(n=130)</th>
<th>Atypical Chest Pain(n=85)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Co-Morbid</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>58 (44.6%)</td>
<td>24 (28.2%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Hypertension</td>
<td>65 (50.0%)</td>
<td>42 (57.6%)</td>
<td>0.88</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>1 (0.7%)</td>
<td>3 (3.5%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>36 (27.6%)</td>
<td>7 (8.2%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Smoking</td>
<td>31 (23.8%)</td>
<td>17 (20.0%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Asthma/ COPD</td>
<td>10 (7.6%)</td>
<td>8 (9.4%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Inactive life style</td>
<td>13 (10.0%)</td>
<td>10 (11.7%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Family history of cardiovascular diseases</td>
<td>34 (26.1%)</td>
<td>31 (36.4%)</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Diagnosis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute MI</td>
<td>80 (61.5%)</td>
<td>5 (5.8%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Unstable angina</td>
<td>22 (16.9%)</td>
<td>1 (1.1%)</td>
<td>0.40</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>4 (3.0%)</td>
<td>2 (2.3%)</td>
<td>0.16</td>
</tr>
<tr>
<td>Gastric causes</td>
<td>4 (3.0%)</td>
<td>26 (30.5%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Aortic dissection</td>
<td>2 (1.5%)</td>
<td>-</td>
<td>1.20</td>
</tr>
<tr>
<td>Other causes</td>
<td>18 (13.8%)</td>
<td>51 (60.0%)</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary PCI done</td>
<td>23 (17.6%)</td>
<td>2 (2.3%)</td>
<td></td>
</tr>
<tr>
<td>Injection streptokinase given</td>
<td>15 (11.5%)</td>
<td>1 (1.1%)</td>
<td></td>
</tr>
<tr>
<td>Late for injection streptokinase</td>
<td>16 (12.3%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Admitted due to complications of MI</td>
<td>6 (4.6%)</td>
<td>-</td>
<td>0.01</td>
</tr>
<tr>
<td>Referred to OPD</td>
<td>15 (11.5%)</td>
<td>59 (81.1%)</td>
<td></td>
</tr>
<tr>
<td>Admitted for further evaluation</td>
<td>53 (40.7%)</td>
<td>13 (15.2%)</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>2 (1.5%)</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Clinical Characteristics and comorbidities showed, diabetes in 58 (44.6%) patients of typical chest pain (p=0.01), 65 (50.0%) patients were hypertensive with typical chest pain (p=0.88), 36 (27.6%) patients had ischemic heart disease (p=0.02), while 31 (23.8%) patients with typical chest pain had the history of smoking (p=0.01). Time since the start of chest pain is shown in figure. Family history of cardiovascular disease was positive in 34 (26.1%) typical chest pain patients with statistically significant p-value (p=0.01). The outcome of the patients with typical chest pain was, primary PCI done on 23 (17.6%) patients, injection streptokinase was administered to 15 (11.5%) patients, 16 (12.3%) patients were late for injection streptokinase, 15 (11.5%) patients were referred to OPD while 53 (40.7%) were admitted for further evaluation. Mortality of the patients was 1.5% as shown in table-II.

**DISCUSSION**

Chest pain is one of the few disease processes in which patients may initially appear to be well but in fact have an underlying life-threatening condition. Inadvertent discharge of patients with acute coronary syndrome has been associated with a short-term mortality of 2%. Identifying patients with chest pain who are at risk of adverse events is important not only to emergency department physicians but also to all physicians who evaluate such patients. Clinicians in the emergency department must focus on the immediate recognition and exclusion of life-threatening causes of the chest pain.

The present study helped us to understand various factors associated with the management of patients of chest pain in our local population. In this study the mean age of the patients was 56.17 ± 10.9 years with majority of the patients being above the age group 40 years. While in Western countries as well as in other Asian countries, majority of the patients presenting with chest pain in emergency departments, also belonged to the older age groups. One possible reason for the typical chest pain being common in older age groups, is the development of risk factors of cardiovascular diseases with advancing age.

Male patients were more in number and this result was in accordance with results of various national and international studies. Most common co-morbid found to be diabetes mellitus (44.6%), then hypertension (50.0%), positive family history (26.1%), smoking history (23.8%) and ischemic heart disease (27.6%). This is in agreement with the documented data from the developed and third world countries. Majority of the patients of typical chest pain were diagnosed with acute myocardial infarction 80 (61.5%) and unstable angina 22 (16.9%). Showing the very strong relation of typical chest pain with myocardial ischemia (p<0.01). Similar
findings have been reported in previous studies.10,13-15.

CONCLUSION
Patients with life threatening etiologies for chest pain may appear deceptively well, manifesting neither vital sign nor physical examination abnormalities. Emergency doctors must recognize those patients who may have acute myocardial infarction or unstable angina, and refer them for treatment and hospital admission. The consequences of not diagnosing, but discharging home, patients with significant cardiac pathology, may be serious. Not only may the patient be denied life-saving treatment for cardiac arrhythmias, but also the chance of benefiting from thrombolytic and anti-platelets therapy become less.

ACKNOWLEDGMENT
We would like to thank our data entry operators Miss Hina Shafique, Miss Nazma Latif, Mr. Uzair Babar and the whole staff of emergency department for their valuable cooperation in data collection and data entry.

CONFLICT OF INTEREST
This study has no conflict of interest to declare by any author.

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8. Hermann LK. Comparison of frequency of inducible myocardial ischemia in patients presenting to emergency department with typical versus atypical or nonanginal chest pain. Is J Cardiol 2010; 105:1567.
OUTCOMES OF CARDIOPULMONARY RESUSCITATION (CPR) IN EMERGENCY DEPARTMENT OF AFIC & NIHD. OUT-OF-HOSPITAL VERSUS WITNESSED-CARDIAC ARREST: A COMPARATIVE STUDY

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ABSTRACT

Objective: To compare the clinical characteristics and outcome of cardiopulmonary resuscitation (CPR) in patients with out-of-hospital cardiac arrest and witnessed-cardiac arrest in Emergency Department of AFIC & NIHD.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Emergency Department of Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, from 1st November 2016 till 31st January 2017.

Material and Methods: All the patients, presented with out-of-hospital cardiac arrest and witnessed-cardiac arrest, in emergency department during our study time period were included. Center of disease studies (CDC) registry for CPR was modified and modified/adapted as a data collection tool.

Results: A total number of 163 patients were recruited in our study, upon which CPR were performed in the emergency department. The mean age of the patients was 61.7±10.3 years. Mean duration of CPR was 32.1±2.3 minutes. Total number of CPR performed for witnessed cardiac arrest (in hospital) were 61(37.4%) while CPR performed upon the patients with out-of-hospital cardiac arrest were 102(62.5%). Reasons for CPR were found to be VT, VF, asystole, heart block, cardiac and respiratory arrest (p=0.03). The most common underlying disease was acute left ventricular failure (LVF), in 22(21.5%) patients, followed by dilated cardiomypathy (DCM) 19(18.6%) and acute myocardial infarction in 17(16.6%) patients (p=0.01). About 59(96.7%) patients revived out of 63 patients, who were given CPR after witnessed-cardiac arrest while 71(69.6%) patients revived out of 102 patients, who were given CPR after out-of-hospital cardiac arrest and the result was statistically significant (p=0.01).

Conclusion: Our study results yielded that witnessed-cardiac arrest patients have more survival as compared to out-of-hospital cardiac arrest patients.

Keywords: Asystole, Cardiopulmonary resuscitation, Out-of-hospital cardiac arrest, Witnessed-cardiac arrest.

INTRODUCTION

Cardiac arrest is defined as a clinical condition characterized by the simultaneous absence of pulse, breath and consciousness. There are four initial ECG rhythms of cardiac arrest: the Ventricular Fibrillation (VF), pulse less Ventricular Tachycardia (VT), PEA (Pulse less Electrical Activities) and Asystole1-2. The out-of-hospital cardiac arrest is often associated with an initial rhythm of VF/VT. In the hospital settings (witnessed-cardiac arrest), patients who suffer a cardiac arrest often have significant co-morbidities and then present more often rhythms such as PEA and Asystole3. In these cases it is important to set strategies to prevent the arrest. The main cause for the arrest is represented by coronary heart disease which is often the result of some chronic diseases such as hypertension, diabetes and hyperlipidemia4. The age at which cardiac arrest occurs more frequently is between 45 and 75 years, this is in relation to the increased incidence of cardiovascular disease in this period of life5,6. The male gender is mostly affected7. In fact, the World Health Organization (WHO) has estimated an incidence of 1.9 cases per thousand in men and 0.6 cases per thousand in women8.

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Email: dr.rehana.butt@gmail.com
Ischemic heart disease is the leading cause of death worldwide and the only cardiac arrest is responsible for about 60% of deaths from ischemic heart disease. Despite the achievements and advances in medicine that have led to a reduction in mortality from cardiovascular disease, cardiac arrest is still one of the most important health problems worldwide. A very important factor to improve survival is the time. It must take action as early as possible to get an increase in long-term survival and, above all, a satisfactory recovery of neurological function in those afflicted. In fact, for every minute that passes since the onset of the arrhythmia to the provision of electric shock, the

### Table: Comparison between CPR for witnessed-cardiac arrest patients and out-of-hospital cardiac arrest patients using Chi-square test

<table>
<thead>
<tr>
<th>Variables</th>
<th>CPR for Witnessed-Cardiac Arrest (n=61)</th>
<th>CPR for Out-of-Hospital Cardiac Arrest (n=102)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>36 (59.0%)</td>
<td>70 (68.6%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Female</td>
<td>25 (40.9%)</td>
<td>32 (31.3%)</td>
<td></td>
</tr>
<tr>
<td><strong>Reason for CPR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VT</td>
<td>3 (4.9%)</td>
<td>26 (25.4%)</td>
<td></td>
</tr>
<tr>
<td>VF</td>
<td>2 (3.2%)</td>
<td>15 (14.7%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Asystole</td>
<td>3 (4.9%)</td>
<td>32 (31.3%)</td>
<td></td>
</tr>
<tr>
<td>Other Reasons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac Arrest</td>
<td>-</td>
<td>6 (5.8%)</td>
<td></td>
</tr>
<tr>
<td>Respiratory Arrest</td>
<td>1 (1.6%)</td>
<td>2 (1.9%)</td>
<td></td>
</tr>
<tr>
<td>Heart Block</td>
<td>-</td>
<td>4 (3.9%)</td>
<td></td>
</tr>
<tr>
<td><strong>Underlying Diseases</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute LVF</td>
<td>-</td>
<td>22 (21.5%)</td>
<td>0.06</td>
</tr>
<tr>
<td>Acute MI</td>
<td>2 (3.2%)</td>
<td>17 (16.6%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Dilated Cardiomyopathy</td>
<td>3 (4.9%)</td>
<td>19 (18.6%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>TVCAD</td>
<td>-</td>
<td>11 (10.7%)</td>
<td>0.15</td>
</tr>
<tr>
<td>Septicemia</td>
<td>1 (1.6%)</td>
<td>3 (2.9%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Breast Carcinoma</td>
<td>-</td>
<td>2 (1.9%)</td>
<td>0.85</td>
</tr>
<tr>
<td>Pulmonary Embolism</td>
<td>-</td>
<td>3 (2.9%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Valvular Heart Disease</td>
<td>5 (8.1%)</td>
<td>-</td>
<td>1.34</td>
</tr>
<tr>
<td>COPD</td>
<td>-</td>
<td>7 (6.8%)</td>
<td>0.45</td>
</tr>
<tr>
<td>Infective Endocarditis</td>
<td>2 (3.2%)</td>
<td>1 (0.9%)</td>
<td>0.80</td>
</tr>
<tr>
<td><strong>Clinical Investigations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood Sugar Level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;67mg/ dl (Hypoglycemia)</td>
<td>8 (13.1%)</td>
<td>16 (15.6%)</td>
<td>0.03</td>
</tr>
<tr>
<td>&gt;67mg/ dl (Hyperglycemia)</td>
<td>23 (37.7%)</td>
<td>86 (84.3%)</td>
<td></td>
</tr>
<tr>
<td>Hypoxia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O2 Sat &lt;85%</td>
<td>19 (31.1%)</td>
<td>44 (43.1%)</td>
<td>0.45</td>
</tr>
<tr>
<td>O2 Sat &gt;85%</td>
<td>30 (49.1%)</td>
<td>58 (34.3%)</td>
<td></td>
</tr>
<tr>
<td><strong>ECG Changes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST Segment Elevation</td>
<td>1 (1.6%)</td>
<td>8 (7.8%)</td>
<td>0.02</td>
</tr>
<tr>
<td>ST Segment Depression</td>
<td>-</td>
<td>6 (5.8%)</td>
<td></td>
</tr>
<tr>
<td>Old Ischemic Changes</td>
<td>8 (13.1%)</td>
<td>32 (31.3%)</td>
<td></td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revived after CPR</td>
<td>59 (96.7%)</td>
<td>71 (69.6%)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
chances of successful resuscitation decreases by 7-10%12-14.

The incidence of out-of-hospital cardiac arrest and witnessed-cardiac arrests (in-hospital) assessed by emergency medical services (EMS) in the United States in 2013 was estimated to be 424,000 and 209,000, respectively10. Following a cardiac arrest, each minute without treatment decreases the likelihood of surviving without disability and survival rates depend greatly on where the cardiac arrest has occurred11. Decreasing the time between cardiac arrest onset and the first chest compression is critical. The likelihood of surviving decreases by 10% with every passing minute between collapse and return of spontaneous circulation12. Without defibrillation, mortality from VT, VF, or both increases by approximately 10% per minute9,12. The American Heart Association and European Society of Cardiology have published revised resuscitation guidelines in 2010, highlighting the importance of professional healthcare rescue teams performing multiple tasks during CPR such as establishing an airway or delivering advanced cardiac life support drugs5,13.

MATERIAL AND METHODS

A comparative cross sectional study was carried out in the Emergency Department of Armed Forces Institute of Cardiology and National Institute of Heart Diseases, Rawalpindi. Study population was the patients who presented in Emergency Department of AFIC & NIHD, with cardiopulmonary arrest. Study was completed over a period of three months, from 1st November, 2016 till 30th January, 2017. Purposive convenient sampling was used for the collection of data. Center of Disease Studies (CDC) registry for CPR was modified as data collection tool. SPSS version 21 was used for data entry and data analysis.

RESULTS

A total number of 163 patients were recruited in our study, upon which CPR were performed in the emergency department. The mean age of the patients was 61.7±10.3 years with minimum age of 5 years and maximum age of 94 years. Mean duration of CPR was 32.1±2.3 minutes. Total number of CPR performed for witnessed cardiac arrest (in hospital) were 61(37.4%) while CPR performed upon the patients with out-of-hospital cardiac arrest were 102(62.5%). In out-of-hospital cardiac arrest group, male patients were more in number 70(68.6%) as compared to female patients 32(31.3%) with statistically significant p-value(p=0.02). Reasons for CPR were found to be VT (ventricular tachycardia), VF (ventricular fibrillation), asystole, heart block, cardiac and respiratory arrest (p=0.03). The most common underlying disease was acute left ventricular failure (LVF), in 22(21.5%) patients, followed by dilated cardiomyopathy (DCM) 19(18.6%) and acute myocardial infarction in 17(16.6%) patients (p<0.01). Co-morbid of the patients were found to be diabetes, hypertension, ischemic heart disease, asthma and COPD (fig). Fifty nine (96.7%) patients revived out of 63 patients, who were given CPR after witnessed-cardiac arrest while 71(69.6%) patients revived out of 102 patients, who were given CPR after out-of-hospital cardiac arrest.
arrest and the result was statistically significant (p<0.01) as shown in the table.

**DISCUSSION**

Dealing patients with cardiopulmonary arrest in emergency department is a persistent challenge. The American Heart Association (AHA) and the European Resuscitation Council (ERC) state that cardiac arrest affects average one person in a thousand every year.\(^1\) The European Resuscitation Council in 2010 estimated that in Europe the cardiac arrest affects 500,000 people each year. According to the same estimates in Italy there are 60,000 new cases each year. The U.S. data is provided by the American Heart Association, in 2010, estimated that each year 785,000 Americans are victims of cardiac arrest.\(^2\) In our study out-of-hospital cardiac arrests were more in number as compared to witnessed-cardiac arrest and this was in consistent with the findings of previous literature.\(^3,7,11\) A systematic review including 67 peer-reviewed studies published from 1990 to 2008 concludes that the incidence of emergency medical service (EMS) attended out-of-hospital cardiac arrests in Europe is 86.4 per 100,000 inhabitants per year.\(^14\) Mean age of the patients in our study was 61.7±10.3 years with very wide range from 5 years to 94 years. Male gender was statistically significant (p=0.02). Ventricular tachycardia and asystole were the most common reasons for CPR (p=0.03). Factors positively associated with out-of-hospital cardiac arrests described in two systematic reviews were: older age, male gender, witnessed cardiac arrest and early start of cardiopulmonary resuscitation (CPR).\(^3,15\) Underlying causes, with which patients presented with cardiac arrest in our study were noted to be acute LVF, acute MI, Dilated cardiomyopathy, Triple vessel coronary artery disease (TVCAD), septicemia, breast carcinoma, pulmonary embolism, valvular heart diseases, COPD and infective endocarditis. In our study co-morbid diseases of the patients of out-of-hospital cardiac arrest were found to be diabetes (22.8%), hypertension (29.0%), ischemic heart disease (31.7%), and asthma/ COPD (4.9%). These findings were closely related with previous international studies.\(^9,15\) The most interesting finding of our study was the outcome of the patients. The revival after CPR in patients with witnessed-cardiac arrest was 96.7% while the revival of out-of-hospital cardiac arrest patients was 69.6%. This showed that time factor is very important for the survival of the patient. Out-of-hospital cardiac arrest is found to be one of the main causes of death in Europe\(^10\) and the value of early cardiopulmonary resuscitation (CPR) has been proven in many community-based studies.\(^11,14\)

**CONCLUSION**

Our study results yielded that witnessed-cardiac arrest patients have more survival as compared to out-of-hospital cardiac arrest patients.

Although breakthroughs in understanding and treating cardiac arrest are promising and the ability to deliver timely interventions and high-quality care is inconsistent; but cardiac arrest treatment is a community issue, requiring a wide range of people to be prepared to act, including bystanders, family members, first responders, emergency medical personnel, and health care providers.

**ACKNOWLEDGMENT**

We would like to thank our data entry operators Miss Hina Shafique, Miss Nazma Latif, Mr. Uzair Babar and the whole staff of emergency department for their valuable cooperation in data collection and data entry.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

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VISUAL QUANTIFICATION OF ADENOSINE STRESS INDUCED TC-99m MIAMI MYOCARDIAL PERFUSION SPECT IN LEFT BUNDLE BRANCH BLOCK AND IT’S COMPARISON WITH CORONARY ANGIOGRAPHY

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ABSTRACT

Objective: To determine the role of visual quantification of Tc-99m MIAMI myocardial perfusion SPECT in left bundle branch block as compared to coronary angiography findings.

Study Design: Prospective randomized controlled trial.

Place and Duration of Study: Department of Nuclear Medicine, Armed Forces Institute of Pathology and Armed Forces Institute of Cardiology/ National Institute of Heart Diseases; Rawalpindi: Pakistan from 1st Sep 2016 to 31st Jan 2017.

Material and Methods: Thirty six patients with complete left bundle branch block and coronary angiography done within past 4 months were included in our study. Patients were divided in three groups on the basis of coronary angiographic findings. Six patients (4 males and 2 females) have normal LAD on coronary angiography, 18 (11 males and 7 females) have less than 50% LAD disease and 12 (9 males and 3 females) have more than 50% LAD lesions. Gated and non-gated pharmacological stress with adenosine myocardial perfusion SPECT was carried out in 1-day rest-stress protocol.

Results: There was no significant difference in the baseline data among all these three groups. Mean left ventricular ejection fraction (LVEF) values were lower in moderate LAD Disease group as compared to other two groups (42 ± 12.4 vs 58 ± 9.2 and 60.6 ± 10.6), left ventricular end diastolic volume (LVEDV) and left ventricular end systolic volume (LVESV) were greater in moderate LAD disease group as compared to other groups. There was no significant difference in LVEF, LVEDV, and LVESV between Normal LAD patients and minor LAD disease group. In normal LAD group 2 patients have normal myocardial perfusion scan; while rest of the 4 exhibit mild to moderate intensity fixed perfusion defects involving distal anteroseptal and distal inferoseptal walls. In Minor coronary artery disease group 4 patients scans show minor intensity fixed perfusion defect in distal anteroseptal and distal inferoseptal areas while rest of the 14 patients studies demonstrate moderate intensity fixed perfusion defects involving distal halves of anteroseptal and inferoseptal walls. In moderate LAD disease group myocardial perfusion scan showed moderate reversible myocardial ischemia in 8 patients and 2 patients studies show moderate to severe fixed perfusion defects in anteroseptal wall and apex while rest of the two showed severe reversible myocardial ischemia in LAD territory. The coronary angiography in these 4 patients showed >80 coronary artery disease.

Conclusions: Visual quantification of myocardial perfusion scan images is not only simple and easy way of myocardial assessment in LBBB patients but its results are statistically significant when compared with coronary angiography. Mild to moderate fixed perfusion defects in anteroseptal wall should be taken as normal in LBBB cases. However, reversible and severe fixed perfusion defects on myocardial perfusion study in the presence of LBBB must be further investigated and treated accordingly.

Keywords: Adenosine, Fixed perfusion defect, Mild coronary artery disease, Myocardial perfusion, Reversible perfusion defect, Sestamib, Scintigraphy.

INTRODUCTION

Myocardial perfusion imaging (MPI) with adenosine stress is the standard worldwide method for assessment of myocardial perfusion and function in coronary artery disease (CAD). The detection of myocardial ischemia in patients with left bundle branch block (LBBB) remains a challenge.
Since LBBB may or may not accompanied with ischemic heart disease (IHD) and hypertension, diagnosis of CAD in LBBB patients is important. Exercise stress test is inconclusive in LBBB patients. MPI is being used as an alternative method of diagnosis in these cases. Despite utilizing pharmacologic stress with vasodilator agents many false positive results in LAD territory area have been reported. Coronary angiography could not be used as screening test in these patients because of its high cost and possible complications. Many MPI studies with pharmacologic stress have reported frequent anteroseptal defects with MPS in patients with LBBB in the absence of significant left anterior descending (LAD) coronary artery disease. Several mechanisms have been proposed to explain this false-positive phenomenon. Various interpretative methods and stress techniques have been evaluated in an attempt to improve the specificity of noninvasive studies for detecting LAD disease. A number of software packages for quantifying myocardial perfusion are commercially available. In this study we emphasize that the simple visual quantification and a define method of interpretation could be easily utilized for better results.

**MATERIAL AND METHODS**

Thirty Six patients with complete left bundle branch block and have coronary angiography done within past 4 months were included in our study. Patients with previous myocardial infarction and have any documented evidence of any cardiac problem after the coronary angiography were excluded. These patients were divided in three groups on the basis of coronary angiographic findings (table-I). Six patients (4 males and 2 females) have normal LAD on coronary angiography, 18 (11 males and 7 females) have less than 50% LAD disease and 12 (9 males and 3 females) have more than 50% LAD lesions. Gated and non-gated pharmacological stress with adenosine myocardial perfusion SPECT was carried out in 1-day rest-stress protocol. Post stress electrocardiographic-gated acquisition was performed and non-gated study was acquired for resting images.

**Adenosine Infusion and Study Acquisition Protocols**

Myocardial perfusion studies were acquired by using one-day rest and stress protocols (fig-1 a). Pharmacological stress study was acquired after the rest study. All the procedure was explained to the patients. Intravenous line was secured by using 22-gauge cannula with three way Y-connector attached. Patients were placed on coach in semi recumbent position by adjusting the back with essential gadgets attached. All baseline parameters like, heart rate, blood pressure, ECG were recorded on a designed sheet. Adenosine infusion was started at a rate of 140 mcg/ kg/ min for 6 minutes and radiotracer Tc-99m sestamibi 20-30 mCi was injected at mid-way of this infusion. ECG, blood pressure and heart rate were recorded at every 2 minute and continued till 4 minutes post infusion or till the cessation of any side effect. Any unwanted effect describes by the patient like, breathlessness, palpitations, flushing, nausea, headache, blurring of vision etc was also recorded. After the completion of stress, the patient was advised to take a glass of full cream milk or fatty diet.

The study was acquired on dual head gamma cameras, Symbia-E SPECT and Symbia T-6 SPECT/ CT SPECT equipped with high resolution general purpose parallel-hole collimator at 30-45 min post injection. The acquisition parameters were based on guidelines and recommendations published by the American Society of Nuclear Cardiology. A window of 20% centered on the 140-keV photo peak was used. The gated SPECT study was acquired using a non-circular orbit of 180°, starting at a 45° right anterior oblique angle and ending at a 45° left posterior oblique orientation. Acquisition was performed in a step-and-shoot mode, with a total of 32 projections of 40 seconds duration each.
Image Processing and Analysis

The tomographic images were processed by using Siemens Cardiology processing software. The Butterworth filter with a frequency cutoff of 0.40 cycles/pixel and an order of 6.0 for image reconstruction was utilized. The processed images were displayed and analyzed by using Corridor 4DM (Segami) v5.1, Cedars-Sinai quantitative perfusion SPECT (QPS4) and quantitative gated SPECT (QGS4.0). Polar plots of the left ventricle were created and divided into 20 segments. The tomographic slices were analyzed systematically in the short axis, vertical long axis and in the horizontal long axis. The visual analysis was performed systematically, dividing the heart into 9 regions: anterior, lateral, and inferior walls; septum, anteroseptal, anterolateral, inferolateral, and inferoseptal regions; and apex. These regions (except the apex) were further divided into basal, middle, and apical segments. The radiotracer uptake and diagnosis of reversible ischemia was based solely on qualitative visual analysis using a color scale. To be considered significant, a defect had to be confirmed in other tomographic cuts (short or long axis). The defects were described in relation to their extent and severity as small, medium, and large; mild moderate and severely reduced tracer uptake. Reversibility was classified as completely reversible, partially reversible, or nonreversible (fixed).

Statistical Analysis

All the collected data were presented as mean ± SD or frequency, when appropriate. Comparisons between group means were determined by utilizing unpaired Student t-test. All calculations were made with the help of software SPSS version 16. A p-value <0.05 was considered statistically significant.

RESULTS

The mean LVEF values were lower in moderate LAD Disease group as compared to other two groups (42 ±12.4 vs 58 ±9.2 and 60.6 ±10.6). LVEDV and LVESV were greater in the left ventricle were created and divided into 20 segments. The tomographic slices were analyzed systematically in the short axis, vertical long axis and in the horizontal long axis. The visual analysis was performed systematically, dividing the heart into 9 regions: anterior, lateral, and inferior walls; septum, anteroseptal, anterolateral, inferolateral, and inferoseptal regions; and apex. These regions (except the apex) were further divided into basal, middle, and apical segments. The radiotracer uptake and diagnosis of reversible ischemia was based solely on qualitative visual analysis using a color scale. To be considered significant, a defect had to be confirmed in other tomographic cuts (short or long axis). The defects were described in relation to their extent and severity as small, medium, and large; mild moderate and severely reduced tracer uptake. Reversibility was classified as completely reversible, partially reversible, or nonreversible (fixed).

Table-I: Characteristics of patient population.

<table>
<thead>
<tr>
<th></th>
<th>Normal LAD</th>
<th>&lt; 50% LAD disease</th>
<th>&gt;50% LAD lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>45 ± 10.4</td>
<td>51 ± 8.3</td>
<td>54 ± 11.5</td>
</tr>
<tr>
<td>Gender (M:F)</td>
<td>4:2</td>
<td>11:7</td>
<td>9:3</td>
</tr>
<tr>
<td>LVEF (%)</td>
<td>60.6 ± 10.6</td>
<td>58 ± 9.2</td>
<td>42 ± 12.4</td>
</tr>
<tr>
<td>LVEDV (ml)</td>
<td>77 ± 12.6</td>
<td>84 ± 10.4</td>
<td>134 ± 13.4</td>
</tr>
<tr>
<td>LVESV (ml)</td>
<td>32 ± 9.8</td>
<td>35 ± 9.7</td>
<td>74 ± 13.2</td>
</tr>
</tbody>
</table>

Table-II: Coronary angiography vs myocardial perfusion scan findings.

<table>
<thead>
<tr>
<th>No of LBBB patients</th>
<th>Coronangi findings</th>
<th>MPI findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Normal LAD</td>
<td>Mild to Moderate FPD in AS wall</td>
</tr>
<tr>
<td>14</td>
<td>&lt;50% LAD disease</td>
<td>Moderate FPD in AS wall</td>
</tr>
<tr>
<td>4</td>
<td>&lt;50% LAD disease</td>
<td>Mild FPD in AS wall</td>
</tr>
<tr>
<td>8</td>
<td>50-80% LAD disease</td>
<td>Moderate RMI in LAD territory</td>
</tr>
<tr>
<td>2</td>
<td>&gt;80% LAD disease</td>
<td>Severe FPD</td>
</tr>
<tr>
<td>2</td>
<td>&gt;80% LAD disease</td>
<td>Severe RMI</td>
</tr>
</tbody>
</table>

Table-I: Characteristics of patient population.

Table-II: Coronary angiography vs myocardial perfusion scan findings.

Figure-1a: Resting first protocol.
other groups (table-I). There was no significant difference in LVEF, LVEDV, and LVESV between Normal LAD patients and minor LAD disease group.

**Myocardial Perfusion Scan Results**

In normal LAD group 2 patients (1 male and 1 female) have normal myocardial perfusion scan while rest of the 4 exhibit mild to moderate intensity fixed perfusion defects involving distal anteroseptal and distal inferoseptal walls (fig-1b). In Minor coronary artery disease group 4 patients scans show minor intensity fixed perfusion defect in distal anteroseptal and distal inferoseptal areas while rest of all the 14 patients studies demonstrate moderate intensity fixed perfusion defects involving distal halves of anteroseptal and inferoseptal walls. In moderate LAD disease group myocardial perfusion scan show moderate reversible myocardial ischemia in 8 patients and 2 patients studies exhibit moderate to severe fixed perfusion defects in anteroseptal wall and apex while rest of the two showed severe reversible myocardial ischemia in LAD territory (fig-2). The coronary angiography in these 4 patients showed >80 coronary artery disease (table-II).

**DISCUSSION**

In patients with LBBB, most the myocardial perfusion studies show false positive results which are wrongly interpreted as fixed or reversible perfusion defects in septal or anteroseptal region of left ventricular myocardium9. In that scenario further invasive tests or procedures are being performed for proper diagnosis and further treatment10-12. Many reported studies showed false positive interpretations leading invasive diagnostic procedures resulting prolonged morbidity and wastage of resources13,14. In most of the myocardial perfusion scan reports the intensity and extent of these defects are being mentioned as mild, moderate or severe. This quantification is done either visually or by utilization sophisticated software. In our study these fixed or reversible perfusion defects were compared/ correlated with conventional coronary angiography findings. Visual quantification of MPI images was assessed by two independent observers not knowing the coronary angiography results. The results showed that in cases of mild to moderate intensity fixed perfusion defects the coronary angiography showed normal results or mild CAD. In these patients no invasive intervention is required either. On the other hand, in cases of severe fixed perfusion defects or moderate or severe reversible myocardial perfusion defects the coronary angiography results showed >50% CAD.

In different reported studies many methods were utilized by the researcher for optimization of MPI results in LBBB. Among those reported studies analysis of Gated myocardial perfusion images and polar map presentations of end diastolic and end systolic images could give better clue of anteroseptal myocardial perfusion status15. Ali M et al in their study conclude that the patients with left bundle branch block showing moderate to severe reversible perfusion defects on dipyridamole thallium cardiac SPECT have high likelihood of coronary artery disease16. The presence of reversible perfusion defect may or may not alter the indices of mechanical dyssynchrony by phase analysis17. Left bundle branch block and ventricular pacing may induce typical artefacts that appear as perfusion defects in myocardial perfusion single photon emission
computed tomography. However, the long term prognosis and cardiac event remain same\(^8\).

On the basis of severity and extent of myocardial perfusion defect in LBBB the future cardiac event could also be predicted\(^9\)-\(^11\). In our study where the perfusion defects were severe the coronary angiography showed \(>80\%\) LAD lesion. In most of the nuclear cardiology departments gated studies are being acquired only for one set (either stress or rest) of images. In that scenario visual quantification give excellent results as a long term diagnostic and therapeutic solution for most of the LBBB patients. Quantification of regional radiotracer distribution in left ventricular myocardium could give better results but that need extra efforts, software and expertise which is not available in all of the nuclear cardiology departments in our setup. The visual quantification is not only easy but it also gives scientifically valid results as evident in our study. The prerequisites are essentially to be made for visual quantification like selection of patients and usage of pharmacological stress agents like adenosine or dipyridamole.

**CONCLUSION**

Visual quantification of myocardial perfusion scan images is not only simple and easy way of myocardial assessment in LBBB patients but its results are statistically significant when compared with coronary angiography. Mild to moderate fixed perfusion defects in anteroseptal wall should be taken as normal in LBBB cases. However, reversible and sever fixed perfusion defects on myocardial perfusion study even in the presence of LBBB must be further investigated and treated accordingly.

**ACKNOWLEDGMENT**

We acknowledge the work of all nuclear medicine department staff and stress testing technicians involved, without whom this project could not have been produced.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

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EFFICACY OF MAJOR AORTOPULMONARY COLLATERAL ARTERIES COILING IN PATIENTS OF TETRALOGY OF FALLOT

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Armed Forces Institute of Cardiology/ National Institute of Heart Diseases/ National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To establish the efficacy of free coils for occlusion of MAPCAs in pre operative and post operative patients of total correction.

Study Design: Retrospective analytical study.

Place and Duration of Study: Paediatric Cardiology unit, Armed Forces Institute of Cardiology/ National Institute of Heart Diseases Rawalpindi study was carried out from Jan 2015 to Jan 2017.

Material and Methods: A total no of 44 patients were enrolled in this retrospective study. In 40 patients had MAPCAs coiled in pre operative and 4 patients underwent MAPCAs coiling in postoperative period while having total correction of TOF. There vital signs, total PICU stay, inotropic support and ventilation time were monitored in Pediatric Intensive Cardiology Unit (AFIC/ NIHD).

Results: All the patients had successful occlusion of MAPCAs in post procedure time. There were n=28 male patients and n=16 female patients. All patients were cardiac catheterization done prior to total correction.

Cook’s free coils were used for occlusion under sedation and successful outcome documented in form of check angiogram.

Conclusion: Transcatheter coil occlusion of MAPCAs is effective and haemodynamically beneficial interventional therapy in patients of total correction for Tetralogy of Fallot.

Keywords: Cooks free coils, MAPCAs, Total correction.

INTRODUCTION

Tetralogy of Fallot is the most common cyanotic congenital cardiac defect. It is characterized by large malaligned Ventricular Septal Defect, right ventricular outflow tract obstruction, aortic override and right ventricular hypertrophy. It is treated by total correction at 1-2 years of age. There are certain anatomical associations with tetralogy of Fallot. Additional midmuscular VSD, anomalies of coronary arteries, PAPVR (Partial anomalous pulmonary venous return) and major aortopulmonary collateral arteries (MAPCAs)3. These MAPCAs develop due to persistence of primitive embryological connections in lung parenchyma which manifest due to persistent hypoxia. Persistent polycythemia and delay in total correction in TOF patient leading to growth of MAPCAs. MAPCAs are anatomically complex arteries and follow a tortuous course. Once established, they result in postoperative pulmonary edema after tetralogy repair. It leads to prolonged ICU stay, prolonged ventilation, post operative bleeding and poor patient outcome.

The major disease burden of congenital cardiac surgery remains TOF repair. The association of MAPCAs with post operative TOF repair has resulted in morbidity and mortality in a pediatric intensive care unit. With the advancement in pediatric cardiac interventions, coils are used to close MAPCAs in pre operative and post operative period following total correction of TOF 5. The use of Cooks detachable coils, Free coils, intravascular devices and vascular plugs has been reported previously. The aim of this study is to establish the efficacy and utility of free coils for the successful occlusion of MAPCAs in TOF patients in
congenital cardiac catheterization lab. It not only reduced the post operative ventilation time but also reduces ICU stay and postoperative inotropic support. With the average cost of coils being 5000-8000 Rupees, the timely intervention provides enormous social and economic benefits to patients.

MATERIAL AND METHODS

We conducted this study at AFIC/NIHD from 2015 to 2016. A total of 44 patients underwent coil occlusion of collateral arteries. There were 40 patients who had MAPCA coil before total correction and n=4 patients had MAPCA coiling after total correction. All the patients between were from 2-25 years of age. There were 28 male and 16 female patients (table). All the patients had cardiac catheterization prior to total correction. Mapcas were coiled under GA for patients below 12 years of age and LA for patients above 12 yrs of age. The Cook’s free coils used for the occlusion of MAPCAs in pre operative period were carried out in collaboration with cardiac anesthetist and with subsequent total correction on the same day. The occlusion of MAPCAs in post operative period was done in TOF repair patients having prolonged inotropic support or assisted ventilation. The outcome of these patients was documented in the form of reduced pulmonary artery pressures, pulmonary edema, decrease in inotropic supports in PICU and minimal residual flow in preoperative patients. Vital signs and oxygen saturation were monitored during procedure. During procedure, appropriate antibiotics were given and patients kept under observation for 24 hours.

RESULTS

There was no mortality related to procedure, multiple coils were used in 11 patients, 8 patients 3 coils,12 patients had 2 coils and 7 patients had single coil utilized. The right femoral artery was canulated with 5/ 6 F radial sheath, Judkin Right catheter used for selective angiogram and coiled implanted using 0.38 wire hard end and check angiogram done using non ionic contrast which revealed significant reduction in blood supply. 2 patients had residual leak, 4 patients had hypoxic spells, 1 patient developed chest pain and n=1 patient developed post procedure fever. There was no mortality reported. One patient 18 years of age who had total correction, and remained in PICU for 13 weeks after total correction and improved significantly after MAPCAs were coiled. Another patient 10 years of age, who had cardiac catheterization done 2 years before repair, remained in PICU on inotropes for one week and improved significantly after MAPCAs were coiled (fig 1& 2).

DISCUSSION

The utilization of transcatherter devices and coils for successful occlusion of residual shunts in postoperative patients of congenital cardiac defects has been documented in literature. The mayrid of shunts that includes residual VSD,
residual MAPCAs, residual PDA, ASD have been
dlosed in a cardiac interventional lab. These
shunts produce hemodynamic compromise on
the heart which leads to prolonged usage of
medicines and also results in impaired quality
of
life for children. The intravascular devices like
Gianturco coils, Cooks coils, vascular plugs, have
evolved over the years and developed into
patient friendly and biocompatible forms.

Collateral arteries have also been described
as persistent, abnormally dilated arteries that
connect the bronchial arteries to the pulmonary
circulation secondary to external factors such as
hypoxia, trauma or inflammation. Hypoxia, in
cases of decreased pulmonary blood flow as
encountered in cyanotic congenital heart
diseases. These vessels also developed in patients
of Pulmonary Atenesia with VSD, after Fontan
surgery and D-TGA. The utilization of free coils
has been reported in many collateral vessels and
BT shunt in cyanotic heart diseases which result
in residual hemodynamic overload.

As reported by Zhang et al in 2007 the
most of residual defects were closed after the
repair of the primary defects. In our study we
focused on Tetralogy of Fallot alone in pre
operative and post operative periods. The
dramatic improvement of patients was
established in terms of improved hemodynamic.
Li S et al reported that MAPCAs being a
significant factor in prolonged mechanical
ventilation times after total correction. According to Jean-Fracios, transcatheater
occlusion of MAPCAs using coils and plugs can
be carried out through arterial as well as venous
approach.

As mentioned by Kajiwara et al in 2013 the
primary focus of coil embolization was
established for treatment of pulmonary
atrioventricular malformations. Pulmonary AV
malformations being the major group of diseases
cause extracardiac right to left shunts and
leading to cyanosis. The successful implantation
for coils later shifted to other shunts as reported
by ugo viaro et al in 2008. Post operative residual
MAPCAs have resulted in congestive cardiac
failure after total correction.

The study conducted by Grifika et al in 2008
reported that occlusion coils can be beneficial for
closure of PDA and isolated collateral arteries as
well. Our study is directed towards supportive
role of coil embolization in collaboration with
congenital cardiac surgeon. TOF being the major
cyanotic congenital cardiac defect needs to be
surgically repair in all age groups and the
problems encountered of residual shunts can be
addressed in cardiac catheterization lab.

MAPCAs can also be ligated during cardiac
surgery but it takes longer time, results in blood

| Table: Demographics and basic clinical characteristics. |
|-----------------------------|---------|---------|-------------|--------------|
| Age (years)                | Height (cm) | Weight (kg) | Fluoroscopy Time (min) | Procedure Time (min) |
| Mean ±SD                  | 17.8 ±6.4  | 165 ±90   | 43.6 ±14.3         | 18.67 ±15.4 | 58.7 ±32.5 |
| Maximum value             | 25       | 134.6     | 59                 | 86           | 126        |
| Minimum value             | 2        | 26.9      | 10                 | 5            | 36         |

As reported by Grifika et al in 2008 the
most of residual defects were closed after the
repair of the primary defects. In our study we
focused on Tetralogy of Fallot alone in pre
operative and post operative periods. The
dramatic improvement of patients was
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Li S et al reported that MAPCAs being a
significant factor in prolonged mechanical
ventilation times after total correction. According to Jean-Fracios, transcatheater
occlusion of MAPCAs using coils and plugs can
be carried out through arterial as well as venous
approach.

As mentioned by Kajiwara et al in 2013 the
primary focus of coil embolization was

CONCLUSION

Transcatheter MAPCA coiling can be
successfully performed in TOF patients in pre
operative and post operative period. These
procedures can have a positive impact on patient
outcome; however, they should be performed
only by a pediatric interventional cardiologist
supported by a multi-disciplinary team.
CONFLICT OF INTEREST
This study has no conflict of interest to declare by any author.

REFERENCES
8. Nadeem S, Maadullah, Amjad M. Perioperative major aortopulmonary collateral arteries (MAPCAs) coiling in tetralogy of fallot patients undergoing for total correction. JCCR 2015; 6(3).
PROCEDURAL SUCCESS RATE OF CARDIAC RESYNCHRONIZATION THERAPY AND DEFIBRILLATOR IMPLANTATION IN HEART FAILURE PATIENTS

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ABSTRACT

Objective: To determine the success rate of cardiac resynchronization therapy and defibrillator implantation in heart failure patients.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: This study was conducted at AFIC-NIHD from 1st Jul 2014 to 31st Dec 2014.

Material and Methods: A total of 45 patients were included in the study that underwent CRT-D implantation. The procedural success was noted in the catheterization laboratory (cath lab) and in wards, where patients were managed after CRT-D implantation. Procedural success was based on three criteria: 1) class improvement in NYHA class, 2) ≥ 5 % improvement in ejection fraction (EF) and 3) conversion of Left bundle branch block (LBBB) into normal QRS complexes.

Results: Most of patients (33.0%) were between 57-62 years of age. 34 (75.6%) were males and 11 (24.4%) females. the mean age of the patients was 53.6 ± 7.8 years (range 35 - 67 years).

Pre-procedure mean EF was 24.71% and post procedure mean EF was 31.33%. Prior to procedure 33 (73.3%) patients were in NYHA Class III and 12 patients (26.7%) were in NYHA Class IV. 93.0% patients showed improvement in NYHA class. EF improved in 93.0% patients and 89.1% patients converted to normal QRS complexes after CRT-D implantation. The overall combined success rate was 93.0%.

Conclusion: The procedural success rate of CRT-D was high and should be offered to the patients with heart failure who are non responder to medical treatment whenever the facility is available.

Keywords: CRT-D (cardiac resynchronization therapy and defibrillator), Heart failure.

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INTRODUCTION

Heart failure (HF) has become a major disease burden in last two decades due to aging population, growing incidence of diabetes, hypertension, obesity, improved survival after Myocardial infarction (MI) and success in preventing sudden cardiac death1,2. Medical therapies, such as angiotensin converting enzyme (ACE) inhibitors, beta blockers, and spironolactone have markedly improved both symptom control and overall survival in patients with heart failure. Unfortunately, medical therapy is not completely effective in prevention or reversing the progression of HF2.

Simultaneous pacing of both ventricles (biventricular or BiV pacing) or of one ventricle in patients with bundle branch block, benefits some patients with Heart Failure. This approach is referred to as cardiac resynchronization therapy (CRT)3,9. It resynchronizes the contractions of the heart’s ventricles by sending tiny electrical impulses to the heart muscle, which in turn improves mechanical performance of heart, leading to improved systolic and diastolic left ventricular (LV) function9,11. Patients with advanced heart failure who are not benefited from optimal medical treatment are candidates for cardiac resynchronization therapy (CRT). This is achieved with a device, designed only for pacing or combined with an ICD (implantable Cardioverter defibrillator) called CRT-D (cardiac resynchronization therapy and defibrillator)9,10. CRT-D has the additional function to quickly
terminate an abnormally fast, life-threatening heart rhythm. CRT and CRT-D have become increasingly important therapeutic options for patients with moderate and severe heart failure with low EF. The success rate for CRT ranged from 88.0% to 92.0% in clinical trials. No similar study has been conducted in our setup so far.

The rationale of this study was to assess the success rate of CRT-D in our setup. This will help and guide us about advanced management of heart failure patients in our population who are refractory to optimal medical management.

**MATERIAL AND METHODS**

This descriptive study was conducted at AFIC/NIHD Rawalpindi for the duration of six months, from 1st Jul 2014 to 31st Dec 2014. A total of 45 patients of heart failure were included in the study on the basis of non-probability purposive sampling. Inclusion criteria were: Age limit 20-75 years, Heart failure of NYHA class II to IV, LVEF ≤ 35%, LBBB with QRS >120ms, Patients of both genders. Exclusion criteria included: Chronic non-cardiac condition in which life expectancy is less than 6 months, RBBB on ECG, Asymptomatic patients with reduced LVEF≤35%, Patients who were unwilling for CRT-D implantation. Success of the CRT-D was ascertained on the basis of 3 criteria:

- One class improvement in NYHA class of heart failure accessed clinically on 6th post CRT-D implantation day.
- Conversion of LBBB to normal QRS complexes determined on ECG immediately after CRT-D implantation.
- 5% or more improvement in EF measured by echocardiography on 6th post CRT-D implantation day.

A written informed consent was taken from all the patients enrolled in the study. Patients who presented with heart failure in the emergency department, their ECG was done immediately and promptly managed by resident cardiologist, then shifted towards where echocardiography was done to determine EF and ventricular dyssynchrony. Patients were
counseled about advantages and disadvantages of CRT-D, written informed consent for the procedure was obtained and patients were prepared for CRT-D implantation after arrangement of CRT-D device. The procedure was performed by the consultant cardiologist in catheterization laboratory. The correct implantation was ensured by the satisfactory positions of leads in RA, RV and CS, desired pacing, sensing thresholds and successful DC shock delivery on inducing ventricular tachycardia (VT).

**Data Analysis**

Data was analyzed in SPSS version 21. Mean and standard deviation were used for quantitative variables i.e. age, EF, and width of QRS complex while frequency and percentage was used for qualitative variables like gender and success rate. Effect modifiers like age, gender, NYHA class were controlled by stratification. Post stratification Wilcoxon Signed Ranks test was applied to determine the improvement in NYHA class, and the paired t-test was applied to determine the improvement in QRS width and EF. P-value was significant i.e. <0.05.

**RESULTS**

A total of 45 patients were included in the study, out of which 34 (75.6%) were male and 11 (24.4%) were female. The mean age of the patients was 53.60 ± 7.887 years (range 35-67 years) (fig-1).

Out of 45 patients 33 (73.3%) were in NYHA Class III and 12 patients (26.7%) were in NYHA Class IV. 40 (89.0%) patients showed conversion of LBBB into normal QRS complexes. Pre-procedure the mean QRS width was 132.22 msec and post-procedure the mean QRS width was 118.11 msec. The two other success criteria i.e. one class improvement in NYHA Class and ≥5% improvement in EF were each achieved in 42 (93.0%) patients (fig-2).

Pre-procedure mean EF was 24.71% and post-procedure mean EF was 31.33%. Overall successful response to CRT-D was seen in 42 (93%) patients (fig-3).

**DISCUSSION**

With advancing technologies and new methods of intervention, CRT-D has evolved as a great new development in the management of patients with heart failure, especially those refractory to optimal medical treatment. Recent trials are also favoring CRT-D over medical therapy because of the better outcome. There were not enough studies done in our country due to lack of centers and expertise capable of CRT-D implantation in heart failure patients.

This Retrospective study was carried out among 45 patients of symptomatic heart failure. Three success criteria in our study were: 1) the conversion of LBBB into normal QRS complexes, 2) improvement in EF by 5% or more 3) improvement in NYHA class by one. The first criteria i.e; conversion of LBBB into normal QRS complexes was met in 89.0% patients while other two criteria (improvement in EF by 5% or more and improvement in NYHA class by one) were achieved in 93.3% patients, proving the overall beneficial effects of CRT-D in heart failure patients. These findings were in agreement with CARE-HF, MIRACLE and COMPANION trial data which support the use of CRT-D in heart failure patients having LBBB with QRS duration ≥120 to 140 msec, NYHA class III or IV and EF ≤35 percent, to reduce symptoms, duration of hospitalizations and overall survival.6,13,14.

In the CARE-HF trial, there were 813 patients (mean age 67) with NYHA class III or IV HF (94 percent class III and 6 percent IV), an
LVEF ≤35 percent (mean 25%), and QRS prolongation (mean QRS duration 138 msec) who underwent CRT implantation. The benefits noted were improvement in EF up to 3.7% at 3 months. Our study was done on 45 patients, with mean age of 53.60 ± 7.887 years. Out of 45 patients 33 (73.3%) were in NYHA class III and 12 patients (26.7%) were in NYHA class IV. The mean QRS width was 132.22 msec, pre-procedure mean EF was 24.7% and post procedure mean EF was 31.33%. In our study, improvement in EF was 6.6%, which is more than that seen in CARE-HF trial. MADIT-CRT trial has proved that CRT-D is more beneficial as compared to ICD alone while our study only evaluated the performance of CRT-D.

CONCLUSION

The success rate of CRT-D implantation was found to be very high (93.0%) among patients with heart failure who have LBBB, EF ≤ 35 % and NYHA Class III or IV. Patients with heart failure especially those who were non responder to maximally optimized medical treatment benefitted with CRT-D device. So, CRT-D, whenever the facilities are available, should be offered to the patients of refractory heart failure and who are unfit for cardiac transplantation.

There is also need for future trials to compare the outcome of CRT-D with routine anti heart failure treatment.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

HYPOALBUMINEMIA IN CARDIAC SURGICAL PICU PATIENTS

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Armed Forces Institute of Cardiology/ National Institute of Heart Diseases/ National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objectives: The aim is to study frequency of hypoalbuminemia and examine factors associated with hypoalbuminemia in critically ill children.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, from Jan 2016 to Sep 2016.

Material and Methods: This prospective study measured the serum albumin concentration of 153 children admitted to Peds intensive care unit after congenital heart disease surgery. Data was collected from PICU registry included demographic profile (age, sex, and weight), clinical findings and postoperative complications. Data was entered and analyzed in IBM SPSS Statistics 22 (statistical package for social sciences).

Results: Mean albumin level was 31.8 mg/dl (Range 8-56 mg/dl). Patients with albumin more than 25 mg/dl were 132 (86%) and patients with albumin less than 25 mg/dl were 21 (14%). 13 (62%) patients with hypoalbuminemia were females. Average ICU stay of patients with hypoalbuminemia was 211 ± 458 hours. Average ventilation time of patients with hypoalbuminemia was 49 ± 103 hours.

Conclusion: Hypoalbuminemia is a prominent factor in post operative congenital heart disease patients. It is strongly correlated with the type of defect, cyanosis and it effects the post operative complications like ICU stay, ventilation duration and urine output of the patients.

Keywords: Hypoalbuminemia, ICU, Peds intensive care unit.

INTRODUCTION

Albumin is a highly water soluble protein, it constitutes up to two-third of total plasma protein and is responsible for the transport and binding of many molecules. Serum albumin has been extensively evaluated as a biomarker for predicting adverse outcomes and mortality in patients undergoing high risk surgery. Various studies have shown that low blood levels of albumin can indicate malnutrition and a poorer prognosis in terms of increased morbidity and mortality. Hypoalbuminemia was defined as an albumin level of less than 2.5 g/dL at any time during PICU stay. Hypoalbuminemia is a frequent and early biochemical derangement in critically ill-patients. Cardiac surgery and cardiopulmonary bypass (CPB) induced inflammatory response syndrome leads to endothelial dysfunction and edema secondary to capillary leak across all major organ systems all of which manifest in the immediate postoperative period. Besides dietary intake, nonnutritional factors such as chronic inflammation, recurrent infections, hepatic failure, renal dysfunction, altered gastrointestinal function, increased right sided heart pressures, dilution from fluid overload, and medications can influence serum albumin concentration. Such states are frequently encountered in patients with long standing cyanotic congenital heart disease (CCHD).

MATERIAL AND METHODS

This prospective study, conducted from January to September 2016, measured the serum albumin concentration of 153 children admitted to Peds intensive care unit after congenital heart disease surgery. The protocol of the study was approved by the hospital Institutional Ethical
Review Board Committee. It’s the unit’s policy to perform comprehensive metabolic profile including serum albumin level of all admitted patients at the time of admission in intensive care unit. Serum albumin concentration was measured from 0-6 hours post surgery. Hypoalbuminemia was defined as an albumin level of less than 2.5 g/dL at any time during PICU stay. Data was retrieved from PICU registry included demographic profile (age, sex and weight), clinical findings, postoperative mortality, length of ICU stay, ventilation time, GI complications, urine output, TLC levels, arrhythmias, cyanosis and major cardiac complications were evaluated.

The statistical analysis was carried out using SPSS software version 22 (IBM corporation, 2013) the normal distribution of allele frequency was tested with the Kolmogorov-Smirnov test. Data normality was assessed using histograms. The Pearson correlation coefficient test was performed to assess the association of different variables and albumin levels. The Student’s t-test and ANOVA were applied to evaluate the differences between mean parametric values. The Mann-Whitney U test was used for comparison of non-parametric values. Categorical variables were compared with chi-square test (chi-square or Fisher’s exact test when appropriate). A p-value of less than 0.05 was considered statistically significant.

Table 1: Relation of albumin levels with categorical variables.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variable</th>
<th>&gt;25 mg/dl (n=132)</th>
<th>&lt;25 mg/dl (n=21)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gender:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>90 (68%)</td>
<td>8 (38%)</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>41 (31%)</td>
<td>13 (62%)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Ethnicity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Punjabi</td>
<td>74 (56%)</td>
<td>17 (81%)</td>
<td>0.314</td>
</tr>
<tr>
<td></td>
<td>Pakhtun</td>
<td>39 (30%)</td>
<td>2 (9.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kashmiri</td>
<td>11 (8%)</td>
<td>2 (9.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hindko</td>
<td>1 (0.7%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>RACHS categoray</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 1</td>
<td>18 (14%)</td>
<td>2 (9.5%)</td>
<td>0.629</td>
</tr>
<tr>
<td></td>
<td>Class 2</td>
<td>106 (80%)</td>
<td>19 (90%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 3</td>
<td>6 (4.5%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 4</td>
<td>21 (15.5%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Primary procedure:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASD closure</td>
<td>17 (13%)</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BDG</td>
<td>7 (5.3%)</td>
<td>4 (19%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fontan- Primary</td>
<td>1 (0.7%)</td>
<td>2 (9.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modified BT shunt</td>
<td>7 (5.3%)</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PA Banding</td>
<td>4 (3%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PDA closure</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PPM placement</td>
<td>3 (2.2%)</td>
<td>1 (4.7%)</td>
<td>0.0850</td>
</tr>
<tr>
<td></td>
<td>Senning/ Mustard Procedure</td>
<td>2 (1.5%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sub Aortic Membrane</td>
<td>3 (2.2%)</td>
<td>2 (9.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TAPVR/PAVSD/AVSD Repair</td>
<td>11 (8.3%)</td>
<td>5 (24%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VSD</td>
<td>45 (34%)</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total correction</td>
<td>24 (18%)</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Valve replacement</td>
<td>6 (4.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>COA repair</td>
<td>21 (15.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Diagnosis:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VSD</td>
<td>4 (19%)</td>
<td>0</td>
<td>0.046</td>
</tr>
<tr>
<td></td>
<td>PDA</td>
<td>48 (36%)</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TGA</td>
<td>0</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOF</td>
<td>4 (3%)</td>
<td>8 (38%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COA</td>
<td>31 (23%)</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DORV</td>
<td>2 (1.5%)</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DORV</td>
<td>3 (2.2%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Cyanosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>69 (52%)</td>
<td>16 (76%)</td>
<td>0.033</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Major complication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CPR</td>
<td>2 (1.5%)</td>
<td>4 (19%)</td>
<td>0.548</td>
</tr>
<tr>
<td></td>
<td>Shift to OT</td>
<td>0</td>
<td>1 (4.7%)</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Fever</td>
<td>5 (%)</td>
<td>0</td>
<td>0.663</td>
</tr>
<tr>
<td>9.</td>
<td>Stool passed</td>
<td>59 (%)</td>
<td>7 (33.3%)</td>
<td>0.403</td>
</tr>
<tr>
<td>10.</td>
<td>Bradycardia</td>
<td>1 (0.7%)</td>
<td>1 (4.7%)</td>
<td>0.113</td>
</tr>
<tr>
<td></td>
<td>Tachycardia</td>
<td>28 (21%)</td>
<td>8 (38%)</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Reopening</td>
<td>1 (0.7%)</td>
<td>0</td>
<td>0.858</td>
</tr>
<tr>
<td>12.</td>
<td>Mortality</td>
<td>6 (4.5%)</td>
<td>3 (14%)</td>
<td>0.109</td>
</tr>
</tbody>
</table>
and statistical tests applied were Chi-square and T test for comparing various groups. Descriptive statistics was applied to calculate mean, standard deviation and percentages.

**RESULTS**

Mean age of patients with hypoalbuminemia was 81 ± 113 months, height 97 ± 36 centimeters and weight 18 ± 19.9 kg. Mean albumin levels was 31.8 mg/dl (Range 8-56 mg/ dl) (table-I). Patients with albumin more than 25 mg/ dl were 132 (86%) and patients with albumin less than 25 mg/ dl were 21 (14%). Ninety four (62%) patients with hypoalbuminemia were females. 8 (38%) patients with hypoalbuminemia were diagnosed with TOF and 4 (19%) with VSD. 16 (76%) hypoalbuminemic patients were cyanotic. Most of the hypoalbuminemic patients fall in class 2 of RACHS category (Risk adjustment for congenital heart surgery) i.e. 137 (90%). Average ICU stay of patients with hypoalbuminemia was 211 ± 458 hours (Range: 16-2160 hours) and patients with normal albumin levels stayed in ICU for average 64 hours (Range: 8-665 hours). Average ventilation time of patients with hypoalbuminemia was 49 ± 103 hours (Range: 3-365 hours). Average urine output of patients with hypoalbuminemia was 8538 ml (Range: 1 ml-35155 ml ) and patients with normal albumin levels average urine output was 2478 ml (Range: 1 ml-19095 ml). Mean postoperative TLC levels of hypoalbuminemic patients were 15.95 ± 7.8 (table-II).

**Table-II**: Relation of albumin levels with continuous variables.

<table>
<thead>
<tr>
<th>Continuous variables</th>
<th>Serum Albumin (0-6 hrs)</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Months</td>
<td>&lt;= 25</td>
<td>81.38</td>
<td>113.087</td>
<td>0.537</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>70.13</td>
<td>70.483</td>
<td></td>
</tr>
<tr>
<td>Height in Centimeters</td>
<td>&lt;= 25</td>
<td>97.52</td>
<td>36.731</td>
<td>0.651</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>101.02</td>
<td>32.097</td>
<td></td>
</tr>
<tr>
<td>Weight in Kilograms</td>
<td>&lt;= 25</td>
<td>18.22</td>
<td>19.968</td>
<td>0.998</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>18.21</td>
<td>16.361</td>
<td></td>
</tr>
<tr>
<td>CPB Time in minutes</td>
<td>&lt;= 25</td>
<td>67.29</td>
<td>62.844</td>
<td>0.446</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>76.13</td>
<td>46.443</td>
<td></td>
</tr>
<tr>
<td>X-Clamp time in minutes</td>
<td>&lt;= 25</td>
<td>55.05</td>
<td>76.740</td>
<td>0.785</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>58.77</td>
<td>52.729</td>
<td></td>
</tr>
<tr>
<td>Total ICU stay in hours</td>
<td>&lt;= 25</td>
<td>211.38</td>
<td>458.076</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>64.33</td>
<td>79.501</td>
<td></td>
</tr>
<tr>
<td>Total ventilation time in hours</td>
<td>&lt;= 25</td>
<td>49.29</td>
<td>103.428</td>
<td>0.084</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>23.83</td>
<td>53.105</td>
<td></td>
</tr>
<tr>
<td>Urine Output - ml (0-6 hrs)</td>
<td>&lt;= 25</td>
<td>8538.29</td>
<td>11050.745</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>2478.83</td>
<td>3243.342</td>
<td></td>
</tr>
<tr>
<td>PD Drainage - ml (0-6 hrs)</td>
<td>&lt;= 25</td>
<td>4208.29</td>
<td>6441.715</td>
<td>0.768</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>2942.02</td>
<td>10996.137</td>
<td></td>
</tr>
<tr>
<td>Fluid Balance - Negative / Positive (0-6 hrs)</td>
<td>&lt;= 25</td>
<td>14244.50</td>
<td>47780.819</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>1377.98</td>
<td>3240.811</td>
<td></td>
</tr>
<tr>
<td>Post op TLC</td>
<td>&lt;= 25</td>
<td>15.95</td>
<td>7.80</td>
<td>0.744</td>
</tr>
<tr>
<td></td>
<td>26+</td>
<td>18.1</td>
<td>31.09</td>
<td></td>
</tr>
</tbody>
</table>

with hypoalbuminemia were diagnosed with TOF and 4 (19%) with VSD. 16 (76%) hypoalbuminemic patients were cyanotic. Most of the hypoalbuminemic patients fall in class 2 of RACHS category (Risk adjustment for congenital heart surgery) i.e. 137 (90%). Average ICU stay of patients with hypoalbuminemia was 211 ± 458 hours (Range: 16-2160 hours) and patients with normal albumin levels stayed in ICU for average 64 hours (Range: 8-665 hours). Average ventilation time of patients with hypoalbuminemia was 49 ± 103 hours (Range: 3-365 hours). Average urine output of patients with hypoalbuminemia was 8538 ml (Range: 1 ml-35155 ml ) and patients with normal albumin levels average urine output was 2478 ml (Range: 1 ml-19095 ml). Mean postoperative TLC levels of hypoalbuminemic patients were 15.95 ± 7.8 (table-II).

**DISCUSSION**

Hypoalbuminemia is common amongst children who have heart disease and can affect the outcome of cardiac surgery. We found
hypoaalbuminemia in about one-seventh of the total patients.

Davari et al. observed a significant decrease in serum albumin concentration, especially in the male and cyanotic patients, which was related to the severity of metabolic responses. In our study hypoaalbuminemia was observed more in females and cyanotic patients.

Murray et al. established that serum albumin level was associated with longer ICU and hospital stay in sick patients. Furthermore in the adult trauma population, patients with a lower serum albumin level (<2.6 g/dL) were found to have significantly longer ICU and hospital lengths of stay, prolonged ventilatory support and greater mortality when matched for age and injury severity. In our study, hypoaalbuminemic patients had prolonged PICU stay, high incidence of respiratory failure requiring mechanical ventilator and prolonged ventilatory support.

Albumin concentration at 48 hours after surgery had a positive correlation with the duration of cardiopulmonary bypass establishing the role of the extracorporeal circuit in systemic inflammatory response activation and causation of endothelial cell injury. The patients exposed to longer durations of CPB progressively developed lower serum albumin levels 48 hours after the surgery. In our study there was no relation found in cardiopulmonary bypass duration and X clamp time with hypoaalbuminemia.

Fluid balance is also influenced by hypoaalbuminemia in the severely ill patient due to inflammation, vasodilatation or increased vascular permeability, increased nonspecific catabolism, malnutrition or liver dysfunction leading to reprioritization of synthesis, or increased protein loss. Increased vascular permeability encountered in sepsis leads to loss of albumin in the interstitial space, thereby reducing vascular oncotic pressure and contributing to the altered fluid compartmental distribution and slow vascular refilling.

According to our findings patients having hypoaalbuminemia have comparatively higher urine output than normal patients.

**CONCLUSION**

Hypoaalbuminemia is the prominent factor in post operative congenital heart disease patients. It is strongly correlated with the type of defect, cyanosis and it effects the post operative complications like ICU stay, ventilation duration and urine output of the patients.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCE**

CORRELATION OF RISK FACTORS ASSOCIATED WITH POST OPERATIVE DELIRIUM IN CARDIAC SURGICAL INTENSIVE CARE UNIT

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Armed Forces Institute of Cardiology/ National Institute of Heart Disease/ National University of Medical Sciences (NUMS) Rawalpindi, Pakistan

ABSTRACT

Objective: The objective of the present study is to determine the frequency of delirium and the associated factors in patients undergoing open heart surgery.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology and National Institute of Heart Disease, from October 2016 to December 2016.

Materials and Methods: A descriptive cross sectional study was conducted on 328 patients, who underwent elective open heart surgery at intensive care unit of AFIC/ NIHD, over 3 months spanning from October to December 2016. The patients who underwent elective coronary artery bypass graft (CABG) surgery during the specified study period are included in inclusion criteria and age of over 18 years. While patients with the history of psychiatric illness were excluded. Samplings were performed by non-probability consecutive sampling technique. Patients were assessed for delirium by using the DSM IV Criteria for diagnosis of Delirium. Chi-square statistics and Pearson correlation were used as a test of significance.

Results: The frequency of immediate post surgical delirium was found to be 5.0%. The patients mean age was found to be 55 (±14) and most frequent age group was >50 years i.e. 200 (61.0%) while number of patients in <50 years were 128 (39.0%). Among these patients, 245 (72.0%) were male and 95 (28.0%) were females. Of these patients, 246 (72.0%) had coronary artery bypass graft (CABG) and 60 (18.0%) underwent valve replacement. Risk factors such as age, ventilator time, intra-aortic balloon pump, intensive care unit stay, need for ionotropes, arrhythmias, number of reopen procedure and mortality were positively correlated with delirium (p-value <0.05).

Conclusion: Diagnosis of delirium is of greatest value; therefore, further studies are essential to clarify the risk factors because controlling them will help prevent delirium.

Keywords: Arrhythmia, Delirium, DSM, IABP, POD, PACU.

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INTRODUCTION

According to the diagnostic and statistical manual of mental disorders-IV-text revision (DSM-IV-TR), delirium is a cognitive and consciousness disorder which develops over a short period and has certain features such as decreased level of consciousness, attention disorders (e.g. loss of concentration and memory), orientation disorder, rapid onset (a few hours to a few days), short duration, and prominent fluctuation. The main characteristic of delirium is inattention. It can also be termed intensive care unit or ICU delirium. Delirium is categorized as either hyperactive or hypoactive. Hyperactive delirium puts the patient at greater risk of self-extubation, of accidental removal of life saving/ invasive catheters, and of worsening patient ventilator synchrony. On the other hand, hypoactive delirium can result in a quiet but neglected patient given the decreased motion (hypoactive delirium suggests a worse prognosis). Any delirium that occurs after surgery may be called “postoperative delirium,” it may also be termed as ICU delirium. Delirium in ICU patients in the postoperative period from cardiac surgery varies from 8.4% to 41.7%.
Delirium in ICU patients postoperatively has shown to increase ICU mortality, increase length of ICU stay, and increase ICU costs. In patients who are post cardiac surgery, delirium can increase postoperative complications such as respiratory insufficiency, sternum instability, and need for reoperation of the sternum.

CAM ICU (Confusion Assessment Method of the ICU) is most commonly used to evaluate the prevalence of delirium, though many studies will also use the DSM IV Criteria for Delirium. In our study we will use the DSM IV Criteria for diagnosis of Delirium. The American Psychiatric Association’s Diagnostic and Statistical Manual 4th Edition (DSMIV) Criteria for Delirium:

Disturbance of consciousness (reduced clarity of awareness of the environment) with reduced ability to focus, sustain, or shift attention.

A change in cognition or the development of a perceptual disturbance that is not better accounted for by a pre-existing, established, or evolving dementia.

The disturbance developed over a short period of time (usually hours to days) and tends to fluctuate during the course of the day.

There is evidence from the history, physical examination or laboratory findings that the disturbance is caused by the direct psychological consequences of a general medical condition.

MATERIAL AND METHODS

This was a descriptive crosssectional study conducted on 328 patients, whom underwent elective open heart surgery at intensive care unit of AFIC/NIHD, over 3 months spanning from October to December 2016. The patients who underwent elective coronary artery bypass graft (CABG) surgery during the specified study period are included in inclusion criteria and age of over 18 years. While patients with the history of psychiatric illness were excluded. Samplings were performed by non-probability consecutive sampling technique. Selection of patients was done by Armed forces nursing staff that were trained and informed about the inclusion and exclusion criteria. Patients were assessed for delirium by using the DSM IV Criteria for diagnosis of Delirium, American Psychiatric Association’s Diagnostic and Statistical Manual 4th Edition (DSMIV) Criteria for Delirium. A checklist of post-surgical factors and demographic information was completed for each patient. Approval from Institutional ethical review board was taken before proceeding. Due to ethical considerations, any patient with symptoms of delirium was reported to the head of the ward for treatment.

We used descriptive statistics (percentage, mean, median, and mode) to describe the variables related to the patient’s variables and the frequency of delirium was using chi-square for continuous variables. Correlation of risk factors for delirium was determined using Pearson correlation. SPSS version 22 was used for statistical analysis and p<0.05 is considered statistically significant.

RESULTS

The frequency of immediate post surgical delirium was found to be 5.0%. The patients mean age was found to be 55 (53±14) and most frequent age group was >50 years i.e. 200(61.0%) while number of patients in <50 years were 128(39.0%). Among these patients, 245(72.0%) were Male and 95(28.0%) were females. Of these patients, 246 (72.0%) had coronary artery bypass graft (CABG) and 60 (18.0%) underwent valve replacement. Demographics of patients are shown in table-I.
In this study, a few things were taken into consideration such as age, ventilator time, intra-aortic balloon pump, intensive care unit stay, cardiopulmonary bypass time, need for inotropes, arrhythmias that require intervention care, number of reoperation procedure and mortality were positively correlated with delirium (p-value <0.05) (table I).

**DISCUSSION**

According to the findings of the present study, frequency of delirium was found to be 16 (5.0%) after the surgery. Different studies have reported the incidence of delirium to be 46.0%, 32.0%, 16.0% and 10.0% which is comparable with the frequency of delirium observed in our study is 16(5.0%). These differences may be a sign of the variation in sample size, study duration, delirium assessment tools, study environments, and timing of evaluations. In another study, most common cited risk factors were found to be older age, sepsis, co-morbidity, and heavy alcohol. In this study, age was found to be significantly linked with frequency of delirium with p=0.03 and its similar with another study in which older age is considered a highly significant risk factor for delirium due to a reduced synthesis of cerebral neurotransmitters. Fluctuations in the neurotransmitter levels lead to damage in neurotransmission, resulting in increased weakness to delirium in older patients.

Our findings have shown that patients who developed delirium were intubated for a longer time as compared to those who were not intubated. Furthermore, the relationship between ventilator time and delirium was established statistically significant (p=0.01). Long term intubation, which affects the cerebral function, may be the result of poor physical conditions, respiratory failure, or overuse of muscle relaxants and anesthetics. Hypoxia during surgery may be linked with cerebral ischemia and development of cognitive disorders. Findings of this study, in which the average intubation time was 11 hours and 25 minutes, support those of previous studies. For example, an earlier study suggests that intubation more than 24 hours is directly correlated to the development of delirium.

Most patients in our study followed a natural route after surgery and did not require re-surgery (93.0%). On the other hand, those who were indicated for re-surgery during the first 24 hours had higher incidences of delirium and the difference was statistically significant (p=0.05). This is in consistent with findings of a previous study on delirium after cardiac surgery.

In another study, a mortality rate of 15.8% at 6-month follow-up was observed and post operative delirium (POD) was an independent risk factor for mortality as well as other observed risk factors namely congestive heart disease, severity of disease scores (higher SAPS II and APACHE II) and longer length of stay at the post anesthesia care unit (PACU) and in the hospital. It is in accordance with mortality rate of our study i.e. 24 (7.0%).

In our study, prolong length of ICU stay is found to be significant factor of delirium with (p-value=0.01) and it is comparable with other studies. Delirium in ICU patients postoperatively has shown to increase ICU mortality, increase length of stay, and increase ICU costs.

**CONCLUSION**

In this study, age, ventilator time, intra-aortic balloon pump, intensive care unit stay, cardiopulmonary bypass time, need for inotropes, arrhythmias that require intervention...
care, number of reopen procedures and mortality (p<0.05).

In patients with high risk of developing delirium, it may not be promising to prevent it, but its early recognition can be beneficial. Thus, risk factors found in this study can be considered by means of systematic observations of the patients' behavior. This ensures that patients can be treated efficiently and the postoperative morbidity and mortality can thereby be reduced.

ACKNOWLEDGEMENT

I would like to take this opportunity to express my gratitude to director Research and Development, Dr Farrah Pervaiz for providing valuable assistance and encouragement and a special thanks to Mr. Shahzaib Arshad and Miss Nazima Latif (KPO’s) for their support in data collection.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

FREQUENCY OF EARLY LEFT VENTRICULAR THROMBUS IN PATIENTS PRESENTING WITH VARIOUS TYPES OF ACUTE ST ELEVATION MYOCARDIAL INFARCTION USING ECHOCARDIOGRAPHY AS A MEASURING TOOL

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ABSTRACT

Objectives: To determine frequency of left ventricular thrombus (LVT) in acute ST elevation myocardial infarction (STEMI) and to find out the correlation of risk factors with development of left ventricular thrombus.

Study Design: Hospital-based observational cross sectional study.

Place and Duration of Study: AFIC/ NIHD Rawalpindi, from Nov 2016 to Feb 2017.

Material and Methods: One hundred and fifty consecutive patients presented with first episode of acute STEMI were included. Patients with previous history of myocardial infarction, valvular heart disease, dilated Cardiomyopathy and mural thrombus were excluded. 2-D echocardiography was performed after 24 hours, 48 hours and 72 hours of admission. Descriptive and inferential statistical analysis was performed using SPSS version 23.0.

Results: Mean age of patients was 59.84 ±11.16 years. Thrombus was seen in 35 (23.3%) patients out of which 21 (60%) were males and 14 (40%) were females. Left ventricular thrombus occurred in 8 (22.8%) after 24 hours and 27 (77.2%) patients after 72 hours. LV thrombus was seen in 20 (57.1%) patients whose EF was less than 30% while it occurred in 10 (28.5%) patients having EF 30-45% and 5 (14.2%) patients with EF >45%. Among risk factor LV thrombus was seen in 17 (48.5%) diabetic patients, 4 (11.4%) patients had hypertension and 14 (40%) were those who had both diabetes and hypertension.

Conclusion: LVT is important complication of acute myocardial infarction. If diagnosed and anticoagulated earlier, risk of complications and its potential to embolise can be minimized.

Keywords: Left ventricular thrombus (LVT), ST elevation myocardial infarction (STEMI), Two dimensional echocardiography (2D Echo).

INTRODUCTION

Acute myocardial infarction (AMI) is the leading cause of death all over the world and also among the most important reason for morbidity in hospitalized patients. The most important initiating event in the development of AMI is coronary artery plaque fissuring or rupture that leads to the exposure of underlying subendothelial matrix to formed elements of blood. That further leads to cascade of events resulting in activation of platelets and thrombin generation leading to formation of thrombus. The development of occlusive thrombus within the lumen of coronary artery in the absence of collateral blood vessels most often results in the development of acute ST-segment elevation myocardial infarction (STEMI). Left ventricular mural thrombus is a well-recognized complication of acute myocardial infarction. In subjects dying of infarction, its overall incidence at postmortem is reported to be 30-40%.

The pathophysiologic mechanism for LV thrombus formation can be explained by so called “Virchow’s triad” that is commonly found in patients suffering from AMI. The three components of this triad are stasis of blood, endocardial injury or dysfunction and a hypercoagulable state.

The likelihood of LV thrombus developing after an acute MI depends on the location as well...
on the size of infarct. LV thrombus is most often seen in patients with large anterior ST-elevation infarctions (STEMI) with antero-apical aneurysm formation\textsuperscript{5}. One study has found increased age as a risk factor for LV thrombus\textsuperscript{6}.

The clinical significance of left ventricular thrombi lies on their potential risk of systemic embolization\textsuperscript{7}. In fact, left ventricular embolism after myocardial infarction resulting in stroke, bowel, and limb ischemia has been reported in literature\textsuperscript{8} In survivors of myocardial infarction with an LV mural thrombus, systemic embolization occurs in about 10\%\textsuperscript{9}.

Factors that increase the risk of embolization are mobility, protrusion into the LV cavity and central echo-lucency of the clot\textsuperscript{4}. The wall motion abnormalities, poor ejection fraction and mitral regurgitation have been linked with left ventricular thrombus formation. It has been seen that patients having low ejection fraction were more likely to develop left ventricular thrombus\textsuperscript{10}. Another study done by glazier et al also supports the above finding\textsuperscript{11}. Transthoracic echocardiography (TTE) is the most commonly used imaging modality to make a diagnosis of LV thrombus and has a sensitivity of 90%-95\% and specificity of 85%-90\%. In recent years, timely therapy during the acute phase of AMI, such as anticoagulation, thrombolytic, and primary percutaneous coronary intervention (PPCI), has reduced the incidence of LVT\textsuperscript{12}.

This study is being done to highlight the magnitude of left ventricular thrombus in patients having acute ST elevation myocardial infarction\textsuperscript{13,14}. The results will be helpful in assessing importance of diagnosis of this complication at early stage and will also guide in developing strategies regarding treatment in the post infarct patients, because significant frequency of left ventricular thrombus warrant early diagnosis and management of dangerous, yet silent complication of myocardial infarction.

\textbf{MATERIAL AND METHODS}

This study was carried out in Armed Forces Institute of Cardiology & National Institute of Heart Diseases from November 2016 to February 2017. Approval was taken from institutions ethical and review committee prior to data collection. 150 consecutive patients presenting with first episode of acute STEMI were included. Patients with previous history of myocardial infarction, valvular heart disease, dilated Cardiomyopathy and mural thrombus were

<table>
<thead>
<tr>
<th>Gender</th>
<th>Left Ventricular Thrombus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
</tr>
<tr>
<td>Male</td>
<td>21 (22.8%)</td>
</tr>
<tr>
<td>Female</td>
<td>14 (24.1%)</td>
</tr>
</tbody>
</table>

\textbf{Table-II: Demographic and clinical characteristics of patients presenting with STEMI.}

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Visible Thrombus</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 hours n=4</td>
<td>48 hours n=13</td>
</tr>
<tr>
<td>Left Ventricular EF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 30%</td>
<td>-</td>
<td>2 (15.3%)</td>
</tr>
<tr>
<td>31 - 45%</td>
<td>1 (25.0%)</td>
<td>3 (23.0%)</td>
</tr>
<tr>
<td>&gt; 45%</td>
<td>3 (75.0%)</td>
<td>8 (61.5%)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anterior wall MI</td>
<td>-</td>
<td>5 (22.7%)</td>
</tr>
<tr>
<td>Inferior wall MI</td>
<td>1 (25.2%)</td>
<td>8 (36.3%)</td>
</tr>
<tr>
<td>Inferoposterior wall MI</td>
<td>1 (36.3%)</td>
<td>4 (18.1%)</td>
</tr>
<tr>
<td>Anteroinferior wall MI</td>
<td>2 (36.3%)</td>
<td>5 (22.7%)</td>
</tr>
<tr>
<td>Late for streptokinase</td>
<td>-</td>
<td>3 (23.0%)</td>
</tr>
</tbody>
</table>
excluded. 2-D echocardiography was performed at 24 hours, 48 hours and 72 hours after admission. Basic demographics and clinical data were collected on specified data collection forms. Basic Descriptive and inferential statistical analysis was performed using SPSS version 23.0.

RESULTS

Mean age of patients was 59.84 ± 11.16 years, males were more in number 92 (61%) as compared to females 58 (39%). 58 (12%) patients were found to be diabetic while 40 (29%) were hypertensive. Anterior, inferior, infero-posterior and antero-inferior wall myocardial infarction was seen in 76 (50.67%), 46 (30.67%), 17 (11.33%) and 11 (7.33%) patients respectively. Primary percutaneous intervention was done in 60 (41.3%) patients while 48 (30.8%) were given streptokinase, 42 (41.5%) patients were late for thrombolysis. Mean ejection fraction on 2D echo was 45.77 ± 7.34%. Thrombus was seen in 35 (23.3%) patients out of which 21 (60%) were males and 14 (40%) were females as shown in table-I. (11.4%) left ventricular thrombus occurred after 24 hours, 13 (37.1%) after 48 hours and 18 (51.4%) after 72 hours. LV thrombus was seen in 20 patients whose EF were less than 30% while it occurred in 10 patients having EF 30-45% and 5 in patients with EF >45% as shown in table-II & fig. Among risk factor LV thrombus figure was seen in 17 diabetic patients, 4 patients having hypertension and 14 patients have both diabetes and hypertension.

DISCUSSION

Formation of Left ventricular thrombus is a serious complication after acute ST elevation myocardial infarction. Incidence of early LV thrombus is around 20-60% as reported in different studies. Left ventricle thrombus (LVT) occurs much more frequently (98%) in anterior infarcts as compared to infaracts present at other areas of myocardium (2%) and in larger infarcts as compared to smaller one15,16. Higher mortality has been reported in patients with left ventricular thrombi after infarction, especially when these develop within the first 48 h after infarction17. The incidence of LVMT may be significant without the treatment and may be reduced with the proper management18. Transthoracic echocardiography remains the imaging modality of choice. Many researchers agree that although thrombolytic therapy does not prevent LVT formation but has significantly reduced the incidence of embolization.

Our study showed that early left ventricular thrombus occurred in 35 patients out of 150 (23.33%). Rathi and his colleagues found that 17.8% of the patient of all MI groups developed LVThrombus which is close to our study19. Among the different types of myocardial infarction, the incidence of left ventricular thrombus was highest in anterior myocardial infarction 76 (50.67%) and 74 (49.33%) was seen in other myocardial infarctions. The mechanism of LVT after AMI is still not clear and it is thought to occur due to abnormalities of coagulation cascade and injury to myocardium20. An extensive area of myocardial injury stimulates a large quantity of fibrin, erythrocytes, and platelets to adhere to the exposed collagen, which impels a coagulation cascade and results in the formation of a thrombus. In our study, the percentage of extensive anterior wall myocardial infarction was much higher than that of other infarction locations among the LVT patients, possibly because extensive myocardial injury is related to a larger explosion of coagulation, which induces a greater amount of platelet adhesion. Additionally, severe regional wall motion abnormalities are usually accompanied by an extensive myocardial infarction, which
results in a higher incidence of LVT. In our study, Left ventricular thrombus was more common in males as compared to females. Regarding the occurrence of thrombus it was mostly seen in 72 hours as compared to 24 hours. LV clot were mostly seen in apical position which is comparable to Salehi et al who also found most left ventricular thrombi in apical position in their study.21

This study also took into account two major risk factors i.e. diabetes and hypertension. In our study there were 30 (20.0%) hypertensive patients, out of which 4 (1.3%) had left ventricular thrombus. Out of 50 diabetic patients 17 (34%) developed left ventricular thrombus. This showed that LV thrombus was more common in diabetic patients. Patients managed with streptokinase and PPCI were also included in the study and it was seen that LV thrombus occurred more commonly in those who were late for thrombolysis as compared to those who underwent revascularization. This fact is supported by the Kambery et al study which concluded that in patients in whom PCI was administered as the primary therapy, the frequency of LVT was 5.6% in anterior M1 while in the non PCI group the frequency was as high as 44.4%22.

In our findings, who had low EF i.e. EF less than 30% LV thrombus were more as compared to those having EF more than 45%. Previous studies have also indicated LVEF ≤40% as an independent risk factor of LV thrombus.23

CONCLUSION

Left ventricular thrombus is a common finding in patients of acute ST elevation myocardial infarction (STEMI).

It commonly occurs after 72 hours, in anterior wall myocardial infarction and in those who present late for thrombolysis so echocardiography should be done routinely to rule out this complication.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

21. Salehi NF, Hutchinson MC. Early detection of left ventricular mural thrombi after acute Q wave myocardial infarction using III In Oxine Labeled autologous platelets. Nuclear Medicine Communications 1990; 105-64.
OUTCOME OF SEPSIS IN POST OPERATIVE ADULT PATIENTS OF CARDIAC SURGICAL INTENSIVE CARE UNIT

Rehana Javaid, Syed Muzaffar Hassan, Imran Bashir, Safdar Ali Khan, Irie Pervez, Safdar Abbas, Maha Bhatti, Maham Zahid, Hafa Khalil, Razia Javaid

Armed Forces Institute of Cardiology/ National Institute of Heart Diseases/ National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To determine the frequency of sepsis and to evaluate the morbidity and mortality of patients subjected to cardiac surgery that developed sepsis during the in-hospital postoperative period.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology, Intensive Care Unit of Rawalpindi, from Oct 2016 to Dec 2016.

Material and Methods: Three hundred and twenty eight patients were included who underwent elective open heart surgery at intensive care unit of AFIC/NIHD. All the patients who were above 18 years of age and underwent elective coronary artery bypass graft (CABG) surgery during the specified study period were included. Patients with any infection and with infective endocarditis were excluded. Non-probability consecutive sampling technique was used.

Results: The frequency of immediate post surgical sepsis was found to be 55(17.0%). The mean age of patients was found to be 55 (53±14) years. Among these patients, 29(9.0%) were males and 26(8.0%) were females. 38 (12.0%) had coronary artery bypass graft (CABG) and 17 (5.0%) underwent valve replacement. Mean ICU stay was found to be 14.5 ±10.1 days in males & 17.3 ±12.4 days in females, surgical site infection rate 8 (2.3%), cardiac support 19 (34.5%), likewise mechanical cardiac support in males 10 (18.0%) and in females 2 (4.0%), mean mechanical ventilation time was found to be (5.1±1.3 hours), post-op acute renal failure in males 6 (11.0%) and 1(2.0%) in females. Mortality in males was found to be 5 (9.0%) and in females it was 6(11.0%). Haemoculture results of septic population showed that 15 patients were positive and of which 11 (73.0%) mainly comprised of the acinetobacter species.

Conclusion: Sepsis that occurs in the cardiac surgery post-operative period significantly contributes to patients’ high morbidity and mortality. Moreover, further studies are essential to simplify the proper diagnosis, and risk factors that will help prevent sepsis.

Keywords: Cardiac surgery, Postoperative period, Sepsis.

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INTRODUCTION

Sepsis, a syndrome of physiologic, pathologic, and bio-chemical abnormalities caused by infection, is a main public health concern, accounting for more than $20 billion (5.2%) of total US hospital costs in 2011. Sepsis is linked with high rates of morbidity and mortality, responsible for as much as one of every two to three in-hospital deaths. Particularly, the mortality rates of sepsis amplified during the last decade, which is in contrast to the declining rates of all other major causes of death in the US. Sepsis after cardiac surgery has been prescribed as a low-prevalence infectious complication with terrible results. Patients who develop sepsis, regardless of the infectious focus present with high morbidity and mortality, which show a discrepancy from 17% to 65%. Finding the incidence of sepsis is of great concern to both clinicians and public health officials, in order to calculate the load of the disease. However, assessment of sepsis incidence is difficult, as it depends on the definition of sepsis, the method used to evaluate the condition, and the
underlying population. Until 1992, no consensus existed on the terminology used to describe the presence and severity of sepsis, impairing comparison of studies on sepsis incidence and therapy outcomes. This issue was addressed by The American College of Chest Physicians/Society of Critical Care Medicine (ACCP/SCCM) Consensus Conference in 1991, with the purpose to create a set of criteria for identifying and assessing the severity of sepsis. The consensus proposal incorporated an introduction of the systemic inflammatory response syndrome (SIRS) criteria for early identification of sepsis, defining sepsis as 2 SIRS criteria in patients with known or suspected infection, and severe sepsis as sepsis associated with organ dysfunction, hypoperfusion, or hypotension. However, repeatedly criticised for being too sensitive and of questionable prognostic value, these easily applied “Bone criteria” remained the clinical standard in many hospital guidelines even after the introduction of internationally agreed-upon, but more comprehensive, criteria. A 2001 task force, identifying boundaries with these definitions, extended the list of diagnostic criteria but did not suggest alternatives because of the lack of underneath evidence, and PIRO criteria was introduced. It was Recognized to reexamine the current definitions, the European Society of Intensive Care Medicine and the Society of Critical Care Medicine convened a task force of 19 critical care, infectious disease, surgical, and pulmonary specialists in January 2014. In 2016 the definition of sepsis was rationalized to categorize sepsis as a life-threatening organ dysfunction caused by a dysregulated host response to infection (by The Third International Consensus Definitions for Sepsis and Septic Shock).

Body mass index ≥40 kg/m², haemodialysis in the preoperative period, pre-op cardiogenic shock, age ≥80 years, pre-op treatment with immunosuppressive agents, diabetes mellitus, mechanical circulatory support, 3 or more revascularized vessels are the most important predictors of infections in postoperative period.

Our study was conducted according to latest definition by the Third International Consensus Definitions for Sepsis and Septic Shock 2016, in which sepsis is defined as “a life-threatening organ dysfunction caused by a dysregulated host response to infection”.

For clinical investigation, organ dysfunction can be represented by an increase in the Sequential (Sepsis-related) Organ Failure Assessment (SOFA) score of 2 points or more, which is associated with an in-hospital mortality greater than 10%.

Table I: Demographics and basic clinical information.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sepsis Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, [n (%)]</td>
<td></td>
</tr>
<tr>
<td>Male = 245 (72.0%)</td>
<td>55 (17.0%)</td>
</tr>
<tr>
<td>Female = 95 (28.0%)</td>
<td></td>
</tr>
<tr>
<td>Hypertension, n (%)</td>
<td></td>
</tr>
<tr>
<td>153 (45.0%)</td>
<td>30 (9.0%)</td>
</tr>
<tr>
<td>Diabetes mellitus, n (%)</td>
<td></td>
</tr>
<tr>
<td>92 (27.0%)</td>
<td>19 (6.0%)</td>
</tr>
<tr>
<td>Type of surgery, n (%)</td>
<td></td>
</tr>
<tr>
<td>CABG = 246 (72.0%)</td>
<td>38 (12.0%)</td>
</tr>
<tr>
<td>Valve = 60 (18.0%)</td>
<td>17 (5.0%)</td>
</tr>
</tbody>
</table>

Identification of sepsis, defining sepsis as 2 SIRS criteria in patients with known or suspected infection, and severe sepsis as sepsis associated with organ dysfunction, hypoperfusion, or hypotension. However, repeatedly criticised for being too sensitive and of questionable prognostic value, these easily applied “Bone criteria” remained the clinical standard in many hospital guidelines even after the introduction of internationally agreed-upon, but more comprehensive, criteria. A 2001 task force, identifying boundaries with these definitions, extended the list of diagnostic criteria but did not suggest alternatives because of the lack of underneath evidence, and PIRO criteria was introduced. It was Recognized to reexamine the current definitions, the European Society of Intensive Care Medicine and the Society of Critical Care Medicine convened a task force of 19 critical care, infectious disease, surgical, and pulmonary specialists in January 2014. In 2016 the definition of sepsis was rationalized to categorize sepsis as a life-threatening organ dysfunction caused by a dysregulated host response to infection (by The Third International Consensus Definitions for Sepsis and Septic Shock).

Our study was conducted according to latest definition by the Third International Consensus Definitions for Sepsis and Septic Shock 2016, in which sepsis is defined as “a life-threatening organ dysfunction caused by a dysregulated host response to infection”.

For clinical investigation, organ dysfunction can be represented by an increase in the Sequential (Sepsis-related) Organ Failure Assessment (SOFA) score of 2 points or more, which is associated with an in-hospital mortality greater than 10%.

**Material and Methods**

From October 2016 to December 2016, 328 adult patients who underwent cardiac surgery were included in this study. Prophylactic antibiotic therapy was given according to the
protocol of our hospital, from the induction of anesthesia up to ICU stay. Selection of patients was done by Armed Forces Nursing staff that were trained and informed about the inclusion and exclusion criteria. Sepsis in the postoperative period was defined as confirmation of infection linked with two or more criteria of systemic inflammatory response syndrome: body temperature >38°C or <36°C, leukocytes >12,000 cells/mm³, positive blood cultures, and respiratory rate >20/min, heart rate >100/min. According to new definition of sepsis, Organ dysfunction can be recognized as an acute change in total SOFA score>2 points consequent to the infection. The baseline SOFA score are supposed to be zero in patients not known to have preexisting organ dysfunction. A SOFA score<2 reflects an overall mortality risk of about 10% in a general hospital population with assumed infection. In our study, after diagnosis of sepsis, identified septic patients were analysed using descriptive statistical tests i.e. chi square and t-test. The assessed characteristics of the patients with sepsis were: age, gender, number of days spent in the ICU, surgical site infection rate, cardiac support, mechanical cardiac support, mechanical ventilation time, positive haemocultures, post-op acute renal failure and mortality.

**RESULTS**

There were 328 cardiac surgery patients subjected to cardiac surgery during the study period, 246 (75%) had CABG and 62 (18%) underwent valve surgeries. Among these patients, 245 (72.0%) were males and 93 (28.0%) were females. Demographics of patients are shown in table I. 

Fifty five (17%) developed sepsis during the in-hospital post-op period. There was a predominance of male patients with sepsis during the post-op period when compared to female patients (69% vs. 31%); the patients’ mean age was 55 (53±13) years. Mean ICU stay was found to be 14.5 ±10.1 days in males & 17.3 ±12.4 days in females, surgical site infection rate 8 (2.3%), cardiac support 19 (34.5%), likewise mechanical cardiac support in males 10 (18.0%) and in females 2 (4.0%), mean mechanical

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**Table II: Septic patients in cardio surgical icu with demographics and clinical findings.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Males n=29 (9.0%)</th>
<th>Females n=25 (8.0%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean±SD)</td>
<td>55 (51±15)</td>
<td>60 (58±8)</td>
</tr>
<tr>
<td>ICU stay (mean)</td>
<td>14.5 ±10.1 days</td>
<td>17.3 ±12.4 days</td>
</tr>
<tr>
<td>Cardiac support n(%)</td>
<td>10 (18.0%)</td>
<td>9 (16.0%)</td>
</tr>
<tr>
<td>Mechanical cardiac support n(%)</td>
<td>10 (18.0%)</td>
<td>2 (4.0%)</td>
</tr>
<tr>
<td>Mechanical ventilation time (median)</td>
<td>5 hours</td>
<td>5 hours</td>
</tr>
<tr>
<td>CRRT n(%)</td>
<td>6 (11.0%)</td>
<td>1 (2.0%)</td>
</tr>
<tr>
<td>Surgical site infection rate (SSI) n(%)</td>
<td>6 (11.0%)</td>
<td>2 (4.0%)</td>
</tr>
<tr>
<td>Mortality n(%)</td>
<td>5 (9.0%)</td>
<td>6 (11.0%)</td>
</tr>
</tbody>
</table>

**Table III: Isolated microorganisms from haemocultures of septic patients.**

<table>
<thead>
<tr>
<th>Isolated Microorganism</th>
<th>Number of patients with positive haemoculture (expressed as a percentage of total septic patients) (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acinetobacter spp.</td>
<td>11 (73.0%)</td>
</tr>
<tr>
<td>Klebsiella pneumoniae</td>
<td>2 (13.0%)</td>
</tr>
<tr>
<td>E.coli</td>
<td>1 (7.0%)</td>
</tr>
<tr>
<td>Burkholderia cepacia</td>
<td>1 (7.0%)</td>
</tr>
</tbody>
</table>
ventilation time was found to be (5.1±1.3 hours), post-op acute renal failure in males 6 (11.0%) and 1(2.0%) in females. Mortality in males was found to be 5 (9.0%) and in females it was 6(11.0%). Haemocultures results of septic population showed that 15 patients were positive and of which 11 (73.0%) mainly comprised of the acinetobacter species (table-II).

Isolated microorganisms from haemocultures of septic patients are shown in table-III. All of them received antibiotic therapy according to antibiogram. Of all 55 septic patients 11 (3.3%) of them died during ICU stay. No Methicillin Resistant Staphylococcus Aureus (MRSA) was found.

**DISCUSSION**

The prevalence of infectious complications after cardiac surgery is up to 3.5% of patients. Cardiac surgery postoperative infections increase the morbidity and mortality, hospital cost and ICU stay duration and it is similar with finding of our study i.e.frequency of sepsis in our study was 55 (17.0%).

Cardiac dysfunction is an important component of multiorgan failure that is caused by severe sepsis. Regarding multi organ failure, continuous renal replacement therapy (CRRT) was performed on 7 (2%) patients. Patients with known organ failure disease who then become septic appear to have increased mortality. Overall mortality calculated in our study was 24 (7%). In which 11 (20.0%) were from sepsis group. These findings argue for the critical importance of early identification and aggressive response to sepsis in cardiac patients, given that they appear to be at increased risk for complications. In another study, the sepsis associated mortality is 27% but exceeds 50% in cases of septic shock.

Frequency of sepsis in our study was 55 (17.0%), which is associated with hospital cost and occurrence of sepsis. Toumpoulis et al. studied 3,720 patients submitted to cardiac surgery, with the objective of identifying risk factors for sepsis and endocarditis. The prevalence of sepsis in the post-op period was 1.2%; however, the in-hospital mortality was >70% and there was an increase in cost and time of hospitalization associated with the pace of sepsis.

The Surviving Sepsis guidelines additionally stress the importance of initiating antibiotics within an hour of identification of septic shock, with empiric therapy targeted to the suspected site of infection and responsible organisms, and then working to obtain infection source control as quickly as possible. Overall surgical site infection rate during study time period was found to be 8 (2.3%). Out of this, 6 (62%) patients were from sepsis group and it was in accordance with the present study.

Results of a study reported by Stoeckle et al., conclude that relative frequency of bloodstream infections is found be more than 4 times higher in diabetic than in non-diabetic general inpatients. Diabetic population of our study was 19 (35.0%). This finding was similar with previous literature.

According to the third international consensus definitions for sepsis and septic shock, the sequential onset of complications, that is, the occurrence of adverse events after the onset of sepsis, proposed that the patients with this disease are more vulnerable and thus present such high rates of complications. This lends to belief that the patient with sepsis has a higher chance of presenting with acute renal failure, heart failure. An added challenge is that infection is seldom confirmed microbiologically when treatment is started; even when micro-biological tests are completed, culture-positive “sepsis” is observed in only 30% to 40%of cases. This is similar in the present study, only 15 microorganisms were isolated which are mentioned in table-III.

In spite of its low prevalence, sepsis that occurs in the cardiac surgery post-operative period significantly contributes to patients’ high morbidity and mortality. Therefore, the current recommendations for the treatment of severe
Sepsis represent a strategy that is potentially capable of improving the outcome of such patients and need to be evaluated concerning the sepsis that occurs after cardiac surgery.

**CONCLUSION**

Sepsis has always been a rare complication in the postoperative period of cardiac surgery. However, when observed, the result is catastrophic: 7% of the patients who presented such complication died during the hospitalization phase. Cardiac surgery, in most cases, is a clean surgery with a low rate of infectious complications; however, when these do happen, they contribute to patients’ unfavorable outcome. The therapeutic measures suggested by the international guidelines for the treatment of sepsis must be functional to patients that present with sepsis after cardiac surgery, as they are potentially proficient of reducing morbidity and mortality.

**Limitation of the Study**

The study was conducted at single center with relatively small sample size. A multicenter study with larger sample size is needed.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**


13. UCLA Medical Center. Sepsis Nurse Driven Protocol [Internet]. 2013 [cited 2015 Sep].
EFFECT OF DURATION OF VENTILATION AND UNDERLYING ETIOLOGY ON THE OUTCOME OF PATIENTS RECEIVING VENTILATORY SUPPORT IN CORONARY CARE UNIT

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Armed Forces Institute of Cardiology/ National Institute of Heart Diseases/ National University of Medical Sciences (NUMS) Rawalpindi Pakistan,*Rawalpindi Medical College Rawalpindi Pakistan, **Khayber Teaching Hospital Peshawar Pakistan

ABSTRACT

Objective: To determine the frequency of patients undergoing ventilatory support in coronary care unit of AFIC & NIHD, Rawalpindi and to assess the association between duration of stay and etiology with outcome of the patients.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Coronary Care unit (CCU-1) of Armed Forces Institute of Cardiology & National Institute of Heart Diseases Rawalpindi, from 1st Jan 2016 till 31st Dec 2016.

Material and Methods: All the patients who underwent ventilatory support in coronary care unit during our study period were included using consecutive sampling. Data collection tool comprising different demographic and clinical variables related to ventilatory support was used.

Results: There were 118 patients who underwent ventilatory support in coronary care unit-1 during our study period. The mean age of the patients was 61.2±4.8 years. Male patients were more in number 73(61.9%). The most frequent etiology with which patients underwent ventilation was acute left ventricular failure (LVF) due to myocardial infarction 59(50.2%), followed by arrhythmias. 69(58.5%) patients were on ventilation for less than 3 days while 49(41.5%) patients had duration of ventilatory support more than 3 days. Patients with acute left ventricular failure 35(29.7%) had high mortality (p<0.01), followed by patients 12(10.2%) with arrhythmias (p=0.46) then DCM 11(9.3%). Association between ventilation time and outcome of the patients exhibited that patients who were on ventilation for less than 3 days had higher survival (36(30.5%) vs 33(28.0%) p=0.02) as compared to patients with ventilatory support for more than 3 days (34(28.8%) vs 15(12.7) p=0.02).

Conclusion: Our study results yielded that underlying etiologies, co-morbidities and duration of ventilation stay affect significantly on the outcome of the patients on ventilation in coronary care unit.

Keywords: Arrhythmias, Left ventricular failure, Myocardial infarction, Ventilatory support.

INTRODUCTION

The role of the coronary care units (CCU) have evolved markedly from a purely an observational unit dedicated to the monitoring and prompt resuscitation of patients with myocardial infarction, to a unit treating an increasingly aging population with complex cardiac conditions and concomitant non-cardiac comorbidities1,2. Patients admitted to the coronary care units present with a variety of conditions, including complicated myocardial infarction, acute heart failure, arrhythmias, and complications of adult congenital heart disease3. Advances in early coronary intervention are reflected in decreasing rates of patients admitted with ST elevation myocardial infarction to the coronary care unit2. However, there is an increase in the prevalence of non-cardiac critical illness, such as respiratory failure, sepsis, and acute kidney injury4. This new paradigm has led to an increase in the number of patients requiring ventilation and with a longer duration of this therapy during their CCU stays5. A deep understanding of respiratory physiology and the interactions between the cardiovascular and respiratory systems is essential for managing...
patients requiring ventilation in the coronary care unit. Congestive cardiac failure, pulmonary edema and severe cardiogenic shock are common indications for ventilatory support in the coronary care unit. The choice of ventilation modes should be tailored to the specific patient’s condition, ensuring effective ventilation, reducing the work of breathing and minimizing adverse hemodynamic effects. Discontinuation of mechanical ventilation should be considered as soon as the cardiac pathology that prompted the initiation of respiratory support, is stabilized.

### Table-I: Showing descriptive statistics of the patients.

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;40 years</td>
<td>26(22.0%)</td>
</tr>
<tr>
<td>≥40 years</td>
<td>92(78.0%)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>73 (61.9%)</td>
</tr>
<tr>
<td>Female</td>
<td>45 (38.1%)</td>
</tr>
<tr>
<td><strong>Etiology</strong></td>
<td></td>
</tr>
<tr>
<td>Acute Left Ventricular Failure due to Myocardial Infarction</td>
<td>59 (50.0%)</td>
</tr>
<tr>
<td>Pulmonary Edema due to Mitral Stenosis/ Mitral Regurgitation</td>
<td>15 (12.7%)</td>
</tr>
<tr>
<td>Respiratory (COPD + Pneumonia)</td>
<td></td>
</tr>
<tr>
<td>Arrhythmias (Recurrent VT/ VF and fast AF)</td>
<td>8 (6.8%)</td>
</tr>
<tr>
<td>Dilated Cardiomyopathy with acute Decompensation</td>
<td>20 (16.9%)</td>
</tr>
<tr>
<td></td>
<td>16 (13.6%)</td>
</tr>
<tr>
<td><strong>Ventilation time in days</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;3 days</td>
<td>69 (58.5%)</td>
</tr>
<tr>
<td>≥3 days</td>
<td>49 (41.5%)</td>
</tr>
<tr>
<td><strong>LVEF(Left Ventricular Ejection Fraction)</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;40%</td>
<td>78 (66.1%)</td>
</tr>
<tr>
<td>≥40%</td>
<td>40 (84.7%)</td>
</tr>
<tr>
<td><strong>Length of Hospital Stay</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;7 days</td>
<td>50 (42.4%)</td>
</tr>
<tr>
<td>≥7 days</td>
<td>68 (57.6%)</td>
</tr>
<tr>
<td><strong>CPR Done before putting on Ventilation</strong></td>
<td>35 (29.7%)</td>
</tr>
<tr>
<td><strong>Raised Serum Urea/ Creatinine</strong></td>
<td>26 (22.0%)</td>
</tr>
<tr>
<td><strong>Increased TLC (Total Leukocyte Count)</strong></td>
<td>15 (12.7%)</td>
</tr>
</tbody>
</table>

### Table-II: Association between duration of ventilation and underlying etiology with outcome.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Underlying Etiology</strong></td>
<td>Death</td>
</tr>
<tr>
<td>Acute Left Ventricular Failure due to Myocardial Infarction</td>
<td>35(29.7%)</td>
</tr>
<tr>
<td>Pulmonary Edema due to Mitral Stenosis/ Mitral Regurgitation</td>
<td>7(5.9%)</td>
</tr>
<tr>
<td>Respiratory Disorders (COPD, Pneumonia)</td>
<td>2(1.7%)</td>
</tr>
<tr>
<td>Arrhythmias (Recurrent VT/ VF, Fast AF)</td>
<td>12(10.2%)</td>
</tr>
<tr>
<td>Dilated Cardiomyopathy with acute Decompensation</td>
<td>11(9.3%)</td>
</tr>
<tr>
<td><strong>Ventilation time in days</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;3 days</td>
<td>33(28.0%)</td>
</tr>
<tr>
<td>≥3 days</td>
<td>34(28.8%)</td>
</tr>
</tbody>
</table>
Most patients undergoing mechanical ventilation in coronary care unit can be quickly removed provided the condition responsible for establishing the ventilation has been treated or stabilized. The unnecessary prolongation of this process can result in increased hospital costs and complications associated with it. It is well established that 5% to 30% of patients undergoing ventilation are difficult to wean mainly because of underlying severe coronary artery disease complicated by myocardial infarction, previous pulmonary diseases, prolonged mechanical ventilation times, multiple organ dysfunctions and debilitating neurological diseases. The effects of ventilation in patients with ischemic heart disease are complex and depend upon a number of variables especially the patient’s volume status, the role of right and left ventricles, after loads, lung functional status and chest and abdominal compliance. These patients require special precautions for ventilatory, nutritional, haemodynamic and inotropic support. Many of these patients have ventricular dysfunction, pulmonary congestion, haemodynamic instability, myocardial ischemia or use of vasoactive drugs all of which can contribute to the weaning failure and prolonged dependence on ventilator. The weaning process can significantly stress the cardiovascular system and cardiac failure is a common cause of failure avoiding complications related to prolonged mechanical ventilation.

Outcome of the patients on ventilatory support is multi-factorial in origin. The outcome of cardiac patients receiving ventilation in coronary care unit for particular indications has been studied, but the association of duration of ventilatory support and underlying etiology with outcome has not been studied very often.

**MATERIAL AND METHODS**

A comparative cross-sectional study was conducted at Coronary Care Unit (CCU-1) of Armed Forces Institute of Cardiology & National Institute of Heart Diseases, Rawalpindi. Study was carried out from 1st January 2016 till 31st December 2016. All the patients who underwent ventilatory support in coronary care unit during our study period were included using consecutive sampling. Data collection tool having different demographic and clinical variables related with ventilatory support was used. Data was collected on daily basis in CCU-1 and was entered into the computer on the same day to maintain the quality. SPSS-22 was used to enter and analyze the data.

**RESULTS**

There were 118 patients who underwent ventilatory support in coronary care unit-1 during our study time period. The mean age of the patients was 61.2±4.8 years. Greater number of patients were above 40 years of age 92(78.0%). Male patients were more in number i.e 73(61.9%) as compared to females i.e 45(38.1%). The most

![Figure: Showing co-morbid diseases of patients.](image-url)
frequent etiology for ventilation was acute left ventricular failure (LVF) due to myocardial infarction 59 (50.2%), followed by arrhythmias which included recurrent ventricular tachycardia (VT)/ventricular fibrillations (VF) and fast atrial fibrillations 20 (16.9%)(table-I).

Out of all the patients, 69(58.5%) patients were on ventilation for less than 3 days while 49(41.5%) patients had duration of ventilatory support more than 3 days. Majority of patients had left ventricular ejection fraction (LVEF) less than 40%, 78(66.1%). Cardiopulmonary resuscitation (CPR) was performed on 35(29.7%) patients before putting them on ventilation. Comorbid diseases of the patients (figure).

Chi-square test was applied to find out the association between ventilation time and underlying etiology with the outcome of the patients. Results showed that patients with acute left ventricular failure had highest mortality (35(29.7%) vs 24(20.3%) p<0.01), followed by patients with arrhythmias (12(10.2%) vs 8(6.8%) p=0.46) then DCM (11(9.3%) vs 5(4.2%) p=0.03). Association between ventilation time and outcome exhibited that patients who were on ventilation for less than 3 days had higher survival (36(30.5%) vs 33(28.0%) p=0.02) while patients with ventilatory support of more than 3 days had higher mortality (34(28.8%) vs 15(12.7) p=0.02)(table-II).

**DISCUSSION**

Patients admitted to the coronary care unit have increased complexity in terms of cardiac conditions and non-cardiac comorbidities and as a consequence, require specialized care. Recent studies showed that almost one third to one half of patients admitted to these units require mechanical ventilation at some point during hospitalization. In our study, majority of patients were above 40 years of age 92(78.0%) with the mean age of 61.2±4.8 years. The most frequent underlying etiology with which, patients underwent ventilation was acute left ventricular failure due to myocardial infarction, followed by arrhythmias that included recurrent VT/VF and fast AF, then dilated cardiomyopathy with acute decompensation, pulmonary edema due to mitral stenosis/mitral regurgitation and respiratory disorders. An observational study by Katz and colleagues performed in a coronary care unit at Duke University Hospital also showed the similar underlying etiologies with which patients underwent ventilation. Majority of our patients had left ventricular ejection fraction (LVEF) less than 40% owing to acute left ventricular failure as the most common etiology of the patients. CPR was performed for 35(29.7%) patients before putting them on ventilation. 26(22%) patients had raised serum urea/creatinine levels and 15(12.7%) patients had increased total leukocyte count. The results were similar with the previous literature. Interesting finding of our study was the association between ventilation time and underlying etiologies with the outcome of the patients. Patients with acute left ventricular failure had highest mortality 29.7%, followed by patients with arrhythmias 10.2% and DCM 9.3%. Association with days on ventilation time and outcome of the patients exhibited that patients who were on ventilation for less than 3 days had high survival 36(30.5%) while patients with ventilatory support for more than 3 days expired more 34(28.8%) and the result was statistically significant with p-value 0.02. A longitudinal study by Tanios et al performed in 1989-2009, demonstrated that patients with prolonged ventilation time (>96 hours) had higher mortality as compared to patients with shorter duration of ventilation. Our results were also in accordance with other previous studies.

**CONCLUSION**

Our study results exhibited that underlying etiologies, co-morbidities and duration of ventilation stay affect significantly on the outcome of the patients on ventilation in coronary care unit. Particular attention towards adverse outcome predictors, reduction of coronary ischaemia, co-morbid, control of infection and use of standardized weaning protocol can improve the survival of the patients.
ACKNOWLEDGMENT

We acknowledge the cooperation of whole CCU-1 staff and specially Dr. Fiaza Noor resident Internal Medicine, without whom the project could not have been completed.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

A COMPARATIVE STUDY OF CYANOTIC & ACYANOTIC PATIENT’S OUTCOMES IN A POSTOPERATIVE INTENSIVE CARE UNIT AT AFIC/NIHD

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Armed Forces Institute of Cardiology/ National Institute of Heart Disease/ National University of Medical Sciences (NUMS)
Rawalpindi, Pakistan

ABSTRACT

Objective: To compare the outcome of cyanotic and acyanotic patients undergone congenital cardiac surgery.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: Paeds cardiac surgical intensive care unit of AFIC/ NIHD, Rawalpindi, from Jan to Sep 2016.

Methodology: This Retrospective cross sectional study was conducted at AFIC/ NIHD, from Jan 2016 to Sep 2016. A total of 431 patients were monitored from the time they entered the Paediatric Cardiology Intensive Care Unit till their final discharge SPSS version 22 was used for statistical analysis and p<0.05 was considered statistically significant.

Results: A total of 431 patients were enrolled in this study, out of which 209 (48.5%) were cyanotics and 222 (51.5%) were acyanotic cases. The complications in cyanotic patients 30 (57.7%) were more as compared to acyanotic cases 22 (42.3%) p-value <0.001. Cyanotic CHD had a higher mortality rate than acyanotic lesions (p<0.04). Cardiac procedure, mortality, longer mechanical ventilation, ICU stay, rhythm problem, and post op O2 saturation were associated with cyanosis and the differences were highly significant.

Conclusion: In our setting, cyanotic young infants had more complications than acyanotic lesions. Cyanotic patients had longer ICU stay and Prolonged mechanical ventilation and increased risk of mortality.

Keywords: A cyanotic, Congenital heart disease, Cyanotic.

INTRODUCTION

Recent improvements in facilities in paediatric intensive care units (ICUs) have increased the survival rates among children suffering from congenital heart diseases (CHD), including those suffering from the more complex conditions1. The patient’s course after a successful heart surgery depends on such diverse factors as the severity of the CHD, age and condition of the patient before surgery, events in the operating room, and the quality of postoperative care2. Ideal post-operative care following either corrective or palliative operations requires a thorough understanding and systemic evaluation of the underlying anatomic defect, the pathophysiology of pre-operative state, the anesthetic regime used during surgery, the cardiopulmonary bypass (CPB), and the details of operative procedures3. The post-operative myocardium that has been exposed to the effects of CPB, aortic cross clamping, deep hypothermia, or myocardial ischaemic damage may be incapable of increasing stroke volume to confront an acute increase in after-load following surgical procedures. This is especially true if myocardial performance is weakened by ventriculotomy as required for repair of a variety of CHDs3. Complete correction of the intracardiac defect and adequate intraoperative myocardial protection generally result in good cardiac function after the operation. Children who undergo an uncomplicated cardiac surgery, with good intraoperative care should need little post-operative management for a smooth recovery4.

In developing countries, several other factors affect the outcome of the paediatric cardiac surgery. Some of these factors depend on
the condition of the patients or their parents such as, high incidence of malnutrition in children5,6, financial constraint of the parents, lack of awareness about signs and symptoms of heart disease and late presentation of the cases5. There are other factors related to limitations in healthcare facilities of these countries, such as

<table>
<thead>
<tr>
<th>Table-I: Comparison of cyanotic &amp; acyanotic patients.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variables</strong></td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>RACHS Category</strong></td>
</tr>
<tr>
<td>class-1</td>
</tr>
<tr>
<td>class-2</td>
</tr>
<tr>
<td>class-3</td>
</tr>
<tr>
<td>class-4</td>
</tr>
<tr>
<td><strong>Disease</strong></td>
</tr>
<tr>
<td>VSD</td>
</tr>
<tr>
<td>PDA</td>
</tr>
<tr>
<td>PS (Pulmonary Stenosis)</td>
</tr>
<tr>
<td>TGA</td>
</tr>
<tr>
<td>TOF</td>
</tr>
<tr>
<td>TAPVR/ PAPVR</td>
</tr>
<tr>
<td>COA</td>
</tr>
<tr>
<td>AVSD/ AVCD/ CAVSD/ PVSD</td>
</tr>
<tr>
<td>ASD</td>
</tr>
<tr>
<td>AR/ MR/ AVR/ MVR</td>
</tr>
<tr>
<td>Single ventricle anomaly</td>
</tr>
<tr>
<td><strong>Procedure</strong></td>
</tr>
<tr>
<td>CoA</td>
</tr>
<tr>
<td>ASD Closure</td>
</tr>
<tr>
<td>Arterial switch operation</td>
</tr>
<tr>
<td>AVSD repair</td>
</tr>
<tr>
<td>BDG</td>
</tr>
<tr>
<td>Fontan</td>
</tr>
<tr>
<td>BT Shunt</td>
</tr>
<tr>
<td>PA Banding</td>
</tr>
<tr>
<td>PDA Closure</td>
</tr>
<tr>
<td>PPM placement</td>
</tr>
<tr>
<td>Rastelli</td>
</tr>
<tr>
<td>Senning/ mustard procedure</td>
</tr>
<tr>
<td>PAPVR/ TAPVR</td>
</tr>
<tr>
<td>Total correction</td>
</tr>
<tr>
<td>VSD closure</td>
</tr>
<tr>
<td>Valve replacement</td>
</tr>
<tr>
<td>PA plasty (MPA/ RPA/ LPA)</td>
</tr>
<tr>
<td>Kawashima</td>
</tr>
<tr>
<td><strong>Type of surgery</strong></td>
</tr>
<tr>
<td>Open</td>
</tr>
<tr>
<td>Close</td>
</tr>
<tr>
<td><strong>Mortality (13) 3%</strong></td>
</tr>
<tr>
<td>Sinus rhythm</td>
</tr>
<tr>
<td>Sinus Tachy</td>
</tr>
<tr>
<td>Sinus Brady</td>
</tr>
<tr>
<td>Pacing</td>
</tr>
<tr>
<td>Irregular rhythm</td>
</tr>
<tr>
<td>Major complications</td>
</tr>
<tr>
<td>CPR</td>
</tr>
<tr>
<td>Reopening in OT</td>
</tr>
<tr>
<td>Bradycardia</td>
</tr>
<tr>
<td>Tachycardia</td>
</tr>
<tr>
<td>Redo surgery</td>
</tr>
</tbody>
</table>

awareness about signs and symptoms of heart limited human and material resources for
corrective heart surgery in early neonatal period and young infants, inadequate facilities for paediatric cardiac anesthesia, non-existence of pediatric cardiac surgery anesthesiologist, insufficiently trained staff in pediatric cardiology ICU (PICU), poor health infrastructure and referral systems. Pakistan is a developing country with a relatively well-established healthcare system. However, there are still insufficient facilities for corrective cardiac surgery in neonates and specialists for cardiac surgery anesthesia. In review of the literature no local reference was found on the study subject. The current study was undertaken to determine the frequency of complications, the rate of mortality and morbidity of cyanotic/ Acyanotic patients and its associated factors in children with CHD who underwent cardiac surgery and were hospitalized in the PICU.

METHODOLOGY

The retrospective observational study was conducted at AFIC/ NIHD, from Jan 2016 to Sep 2016. A total of 431 patients were monitored from the time they entered the Paediatric Cardiology Intensive Care Unit till their final discharge.

All patients admitted to the paediatric cardiology ward, first undergo a thorough evaluation and upon diagnosis, if required, are referred to the cardiac surgeon. After surgery, they are admitted to PICU for post-op management. Upon discharge from the PICU, they return to the paediatric cardiology ward for complete recovery prior to final discharge from the hospital. During the period of this observational study, from Jan 2016 to Sep 2016, 431 patients underwent operation at the department. Patients above 18 year of age were excluded. All the patients undergoing congenital cardiac surgery were included. Each case was enrolled only once. The study was approved by the Ethical Review Board of the institution. All our patients had CHD. All the patients had a complete medical record containing demographic characteristics, past and present medical history, physical examination, diagnostic evaluation, and operation notes. The monitoring devices to be used in the PICU were placed in the operating room, usually with the help of the anaesthesiologist. The PICU care was provided by a team of trained ICU nurses, paediatric cardiologists, anaesthesiologists, cardiac surgeons, and in some cases by necessary paediatric subspecialists. The cardiac surgeons were responsible for the patient's course of care, including interactions with the other services. The post-operative course of each patient from entering the PICU until being discharged from it was carefully monitored and the following data was collected: age, gender, type of cardiac malformation, type of cardiac surgery, history of previous cardiac surgery, if applicable, pump time, cross-clamp time, intubation time, ICU-stay time, type of complication, and outcome.

Categorical data were expressed as frequencies and percentage and tested with chi square test or Fisher’s exact test. Quantitative variables were expressed as mean ± standard deviation (SD) and analysed with student’s t-tests. T-test and chi-square tests were used to determine the outcome of cyanotic & acyanotic patients. The data was analysed using the SPSS version-22, and p<0.05 was considered statistically significant.

RESULTS

A total of 431 patients, out of which 209 (48.5%) were cyanotics and 222 (51.5%) were acyanotic cases. Of the 209 cyanotic patients, 138 (66%) were male and 71 (34%) were female. The average age of the patients was 5.38 ± 4.36 years, ranging from few days to 16 years. The median age of the group was 3 years. Acyanotic heart lesions consisted of 14 (6.3%) different types of left-to-right shunts; 6 (2.7%) valvular disease; 4 (1.8%) coarctation of aorta, 5 (2.25%) patent ductus arteriosus (PDA). Cyanotic heart lesions consisted of 53 (25.4%) tetralogy of Fallot; 9 (4.3%) different combinations of transposition of great arteries (TGA); and 76 (36.3%) VSD. Of the total, 378 (88.3%) patients underwent open heart surgery. Most patients (n=427; 99%) experienced
their first cardiac surgery and for 4 (1%) cases, this was their second heart operation. For cyanotic patients aortic cross-clamp time was with a mean of 51.8 ± 44.1 minutes and CPB or pump time was 82.03 ± 42.7 minutes. While in acyanotic patients cross clamp time was 56.02 ± 48.8 minutes and CPB time was 83.7 ± 48.1 minutes. Mean ICU stay time for cyanotics was 4.2 ± 4 days and for acyanotics it was 2.5 ± 2.4 days.

Most of the patients had a smooth and uncomplicated course in ICU and were discharged from the PICU and subsequently from the hospital, while 52 (12%) experienced some kind of complication. Of the 52 complicated cases, 13 (3%) died, and the remaining 418 (97%) cases recovered and were discharged from PICU and the hospital. The complications in cyanotic patients 30 (57.7%) were more as compared to acyanotic cases 22(42.3%) p-value=0.001. Cyanotic CHD had a higher mortality rate than acyanotic lesions (p=0.04). As mentioned in table- I & II cardiac procedure, mortality, longer mechanical ventilation, ICU stay, rhythm problem, and post op O2 saturation were associated with cyanosis and the differences were significant (p=0.007, p=0.03, p=0.004, p=0.04, p=0.05, p=0.009) respectively.

Table-II: Comparison of cyanotic & acyanotic patients with Mean ± SD.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Presence of Cyanosis</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Months</td>
<td>Acyanotic</td>
<td>76.50</td>
<td>75.412</td>
<td>0.108</td>
</tr>
<tr>
<td></td>
<td>Cyanotic</td>
<td>64.64</td>
<td>76.369</td>
<td></td>
</tr>
<tr>
<td>Height in Centimeters</td>
<td>Acyanotic</td>
<td>100.84</td>
<td>32.927</td>
<td>0.223</td>
</tr>
<tr>
<td></td>
<td>Cyanotic</td>
<td>97.00</td>
<td>32.220</td>
<td></td>
</tr>
<tr>
<td>Weight in Kilograms</td>
<td>Acyanotic</td>
<td>18.15</td>
<td>15.544</td>
<td>0.407</td>
</tr>
<tr>
<td></td>
<td>Cyanotic</td>
<td>16.89</td>
<td>16.199</td>
<td></td>
</tr>
<tr>
<td>CPB Time in minutes</td>
<td>Acyanotic</td>
<td>83.70</td>
<td>48.072</td>
<td>0.811</td>
</tr>
<tr>
<td></td>
<td>Cyanotic</td>
<td>82.03</td>
<td>42.7</td>
<td></td>
</tr>
<tr>
<td>X-Clamp time in minutes</td>
<td>Acyanotic</td>
<td>56.20</td>
<td>48.842</td>
<td>0.365</td>
</tr>
<tr>
<td></td>
<td>Cyanotic</td>
<td>51.81</td>
<td>44.115</td>
<td></td>
</tr>
<tr>
<td>Total ICU stay in days</td>
<td>Acyanotic</td>
<td>2.5</td>
<td>2.4</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td>Cyanotic</td>
<td>4.2</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Total ventilation time in hours</td>
<td>Acyanotic</td>
<td>18.51</td>
<td>31.192</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>Cyanotic</td>
<td>35.81</td>
<td>79.905</td>
<td></td>
</tr>
<tr>
<td>O2 Saturation % (0-6 hrs)</td>
<td>Acyanotic</td>
<td>67.19</td>
<td>27.791</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>Cyanotic</td>
<td>111.56</td>
<td>136.537</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Cyanotic heart diseases are usually complex lesions which require difficult surgical techniques and longer operation time for correction. The technique difficulty, the case complexity, and the surgery duration have been reported to be associated with higher mortality and morbidity in previous reports. In the present study, mortality was higher in cyanotic patients than acyanotic and it was a significant finding. According to a study mortality in neonatal period is higher than that in infancy and childhood, while in another study the number of cyanotic CHD were about half of the acyanotic lesions, but mortality in cyanotic patients was significantly more than that of acyanotic cases. In our study critically ill cyanotic children suffering from complex heart lesions usually had more complications (p=0.001). Congenital heart disease patients usually suffer from severe metabolic acidosis and tissue hypoxaemia which predispose them to complications and death. The standard management for such patients is quick and safe transfer to a well-equipped, specialised ward and effective treatment by corrective surgeries. The majority of our cyanotic newborns and young infants suffered from various combinations of TGA. We did not find significant differences
between open and closed heart surgeries, while there was a significant difference between simple and complex procedures. Higher mortality and morbidity such as central nervous system (CNS) problems in redo operation were reported in previous studies. Our findings suggest a significant difference between outcome of first operation, and of second (redo) operation. Intraoperative support techniques, including CPB, can precipitate a complex systemic inflammatory response that impairs the function of multiple organs and results in more haemodynamic instability and early morbidity in newborns, more so than in infants and children. In several previous reports, prolonged CPB and aortic cross clamp times were cited as risk factors for major postoperative complications and increased mortality. In this study, no significant relation was found with cross clamp time and CPB time. Longer mechanical ventilation is usually associated with longer ICU stay and both are associated with higher mortality. A study showed that the longer intubation time and shorter ICU stay were associated with higher mortality. While in another study 10 of the 25 deaths occurred in young infants with complex cyanotic heart lesion who were in shock and/ or were intubated before operation. They died due to low cardiac output state within the first several hours after surgery. Their short ICU stay was due to their poor condition in the early postoperative period. The complication rate in our patients was 12% (52), and 13 of the 52 complications resulted in death (p<0.001). The overall mortality rate was 3% (13). In large pediatric cardiac centers of North America, post-operative mortality after complete repair of CHD in neonates was <5%. One study looked at 184 consecutive CHD patients with a median age of 9 months (range, 10-165 months); 11 (5.9%) patients who required reintubation died. In another study, 200 newborns younger than 45 days underwent cardiac surgery requiring CPB. The whole series mortality was 19% and fell to 14% within 5 years of experience. In other study, the major complications which resulted in death were in young cyanotic infants with complex heart lesions who were affected by cardiovascular or CNS problems. Patients with CNS problem had longer duration of mechanical ventilation and ICU stay. The frequency of vaso-occlusive stroke in children with CHD undergoing cardiac surgery is reported to vary from 0.5 to 10% in different studies. Hypoperfusion, long CPB, redo operation, complex anomaly, and metabolic acidosis were reported as risk factors for stroke. The same risk factors have been reported for fatal arrhythmias after CHD surgery. We had arrhythmias in our study group (p<0.05). We did not find a significant difference between open and closed heart surgery. However, complications in complex procedures were significantly higher. This study was conducted in a single tertiary cardiac surgery unit with limited number of cases. A multi-central study, with a larger cohort of patients is recommended.

CONCLUSION

In our setting, cyanotic young infants had more complications than acyanotic lesions. Cyanotic patients had longer ICU stay and Prolonged mechanical ventilation and increased risk of mortality.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES


COMPARISON OF THE EFFECT OF LACTATE LEVELS DURING CARDIOPULMONARY BYPASS ON PATIENT OUTCOME

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Rawalpindi, Pakistan, *Combined Military Hospital (Army Cardiac Center) Lahore/ National University of Medical Sciences (NUMS)
Pakistan

ABSTRACT

Objective: To compare the effect of high and normal lactate levels during cardiopulmonary bypass (CPB) on post-operative outcome.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Army Cardiac Center, Lahore from 1st Nov 2015 to 30th Jun 2016.

Material and Methods: Ninety eight consecutive patients undergoing coronary artery bypass grafting (CABG) on CPB were divided in two groups according to lactate levels at the time of re-warming on CPB, group A with lactate <4mmol/ L and group B with lactate >4mmol/ L. Outcome was measured in the post-operative intensive care unit (ICU) in terms of duration of ventilation; need for re-ventilation, increase in inotropic support and / or IABP; and ICU length of stay (LOS).

Results: About 59.18% patients had hyperlactatemia during CPB. There was no statistically significant difference in the pre-operative characteristics of the patients in two groups. Mean duration of ventilation in group A was longer (3.54 ± 2.76 hours) compared to group B (4.09 ± 2.96 hours) with a higher frequency of need of re-ventilation in group B (p<0.01); need of increase in inotropic support (p=0.01); and need of intra-aortic balloon pump in the post-operative ICU (p<0.01). There was no statistically significant difference in the duration of post-operative inotropic support (p=0.14) and ICU length of stay (p=0.08). The mortality was significantly higher in the group with high lactate during CPB (3.45% vs Nil).

Conclusion: High lactate levels during CPB can lead to post-operative complications including hemodynamic compromise and longer duration of ventilation.

Keywords: Cardiopulmonary bypass, Intensive care units, Lactate, Ventilation.

INTRODUCTION

Since its inception more than 5 decades ago, cardiopulmonary bypass (CPB) remains an important component of cardiac surgery. Despite large number of coronary revascularization surgeries being performed “off pump”, CPB is still required in valvular repair and replacement surgeries and repairs of congenital heart disease. There is almost always some degree of hypoperfusion of the tissues during CPB resulting in lactic acidosis. The hypoperfusion is caused by constriction of pre-capillary arteriolar sphincters, edema, decreased lymphatic drainage, loss of pulsatile flow, “sludging” in the capillaries due to hypothermia, altered deformability of red blood cells (RBCs) and microaggregation and adhesion of white cells, platelets, and fibrin onto the endothelium.

A rising trend in serum lactate level is seen from baseline to the time of institution of CPB and 30-45 minutes into the CPB. The lactate levels tend to progressively decline at the time of rewarming and after termination of CPB, however, persistent higher lactate levels are sometimes observed in some patients, that lead to post-operative complications including increased ventilation time and inotropic support requirement. Post-CPB serum lactate levels >4mmol/ L at the time of ICU admission has been labeled as a biomarker to identify early postoperative morbidity and mortality in cardiac transplant patients. Similarly, lactate levels of 4 mmol/ L or higher during adult cardiac surgery...
has been associated with higher morbidity & mortality\(^5\). No studies have so far documented correlation between blood lactate level elevations during CPB, and use of inotropic support during weaning from CPB. There has been no study for such correlation in our population.

This study was conducted to compare the effect of different levels of serum lactate during CPB on patient’s outcome; determine the causative factors of high lactate levels and to suggest the measures to keep lactate levels within acceptable limits during CPB.

**MATERIAL AND METHODS**

This comparative cross-sectional study was conducted in the department of cardiac anesthesia and intensive care at the Army Cardiac Center, Lahore from 1\(^{st}\) November 2015 to 30\(^{th}\) June 2016. After approval from the hospital ethics committee, 98 consecutive patients coming for coronary artery bypass grafting (CABG) on CPB were selected. Patients of either genders; between the age of 25 and 65 years; presenting with 2 or 3 vessels disease; and undergoing on-pump CABG were included in the study. Emergency surgeries; CABG with valve surgeries; patients with left ventricular ejection fraction (LVEF) <35% patients with pre-existing renal disease (creatinine clearance <40ml/ min); or patients with pre-operative intra-aortic balloon pump (IABP) were excluded from the study. All patients received induction and maintenance of anesthesia as per standard protocol and ventilation was turned off on commencement of CPB. Anesthesia was maintained during CPB with propofol infusion at 25mcg/ Kg/ min. The target mean arterial pressure (MAP) was set to 65-75mmHg and achieved with intermittent boluses of phenylephrine where necessary.

Arterial blood gases (ABGs) were monitored throughout the surgery and serum lactate levels were measured at the time of rewarming, before coming off bypass. Patients were divided into two groups; lactate 4 mmol/L in Group A and lactate >4 mmol/ L in Group B. Patient’s outcome was measured in the post-operative intensive care unit (ICU) in terms of duration of ventilation (in hours); need for re-ventilation, increase in inotropic support and / or IABP; and ICU length of stay (LOS) in hours.

Independent sample t-test was used to compare the numerical data in the two groups while chi square test was used to compare the categorical data. Patient’s hemoglobin (Hb) during CPB; and total CPB time were also noted in both groups and Pearson’s correlation of these variables was calculated with lactate levels.

**RESULTS**

Out of 98 patients 58 (59.18%) had lactate levels of 4 mmol/L or higher at the time of rewarming during CPB. There was no statistically significant difference between the patient’s demographics including age (p-value 0.99); pre-operative left ventricular ejection fraction (p-value 0.80); pre-operative hemoglobin (p-value 0.48); or pre-operative serum creatinine (p-value 0.08) between the two groups. The mean CPB time was 127.98 ± 53.6 minutes in group A while 115.71 ± 29.3 minutes in group B (p-value 0.22) (table-I).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group A (n=40)</th>
<th>Group B (n=58)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient's Age (in years)</td>
<td>54.08 ±9.8</td>
<td>54.05 ±11.2</td>
<td>0.99</td>
</tr>
<tr>
<td>Pre-op LVEF (%)</td>
<td>54.00 ±9.9</td>
<td>53.48 ±9.8</td>
<td>0.80</td>
</tr>
<tr>
<td>Pre-op Haemoglobin (g/ dL)</td>
<td>11.22 ±1.8</td>
<td>11.495 ±1.7</td>
<td>0.48</td>
</tr>
<tr>
<td>Pre-op Serum Creatinine (mg/ dL)</td>
<td>0.99 ±0.3</td>
<td>0.8997 ±0.2</td>
<td>0.08</td>
</tr>
<tr>
<td>Total Bypass (CPB) Time (in mins)</td>
<td>115.7 ±29.3</td>
<td>127.9 ±53.6</td>
<td>0.22</td>
</tr>
<tr>
<td>Cross-Clamp Time (in mins)</td>
<td>70.5 ±18.8</td>
<td>81.28 ±44.5</td>
<td>0.18</td>
</tr>
</tbody>
</table>
There was a weak negative correlation between lactate level and hemoglobin \((r=0.120; p=0.36)\) and total CPB time \((r=0.12; p=0.22)\). In the post-operative outcome, there was a significant difference in the serum lactate levels on arrival in ICU in both groups \((p=0.01)\). There was a statistically significant difference in the mean duration of ventilation between group A \((3.54 \pm 2.76\) hours) compared to group B \((4.09 \pm 2.96\) hours) (table-II). There was a higher incidence of need of re-ventilation in group B \((p<0.01)\); need of increase in inotropic support \((p=0.01)\); and need of intra-aortic balloon pump in the post-operative ICU \((p<0.01)\) (table-III).

However, there was no statistically significant difference in the duration of post-operative inotropic support \((p=0.14)\) and ICU length of stay \((p=0.08)\) (table-II). The mortality was significantly higher in the group with high lactate during CPB \((3.45\% \text{ vs nil})\) (table-II).

**DISCUSSION**

High lactate levels have been recognized as a marker of circulatory insufficiency, due to any reason, and the severity of hyperlactatemia (HL) has been associated with increased morbidity and mortality in different clinical conditions. Metabolic acidosis due to HL is a considerable complication of the CPB occurring in 10% to 20% of cases and remains a source of worry for the cardiac anesthesiologists due to the associated morbidity and mortality. The frequency of HL was significantly high in our patients \((59.1\%)\) compared to the quoted studies. Demers et al found the incidence of HL (peak lactate levels 4 mmol/ L or more) in 18% of the patients leading to higher post-operative hemodynamic instability \((29.5\% \text{ vs } 10.9\%)\) and higher mortality \((11.0\% \text{ vs } 1.4\%)^{5,6,14}.

This HL has been attributed to tissue hypoxia caused by haemodilution and impaired oxygen delivery. Ranucci et al have described the post-operative ICU \((p<0.01)\) (table-III).

**Table-II: Comparison of post-operative parameters.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group A (n=40)</th>
<th>Group B (n=58)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Lactate on ICU arrival (mmol/L)</td>
<td>4.73 ± 2.9</td>
<td>6.07 ± 2.5</td>
<td>0.01</td>
</tr>
<tr>
<td>Mean Post-op Ventilation Duration (in hours)</td>
<td>3.54 ± 2.76</td>
<td>4.09 ± 2.96</td>
<td>0.03</td>
</tr>
<tr>
<td>Mean Post-op Inotropes Duration (in hours)</td>
<td>6.79 ± 9.8</td>
<td>192.8 ± 958.8</td>
<td>0.14</td>
</tr>
<tr>
<td>Mean Post-op ICU Stay Duration (in hours)</td>
<td>41.3 ± 23.69</td>
<td>63.47 ± 91.9</td>
<td>0.08</td>
</tr>
</tbody>
</table>

**Table-III: Comparison of post-operative course.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group A (n=40)</th>
<th>Group B (n=58)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients requiring re-ventilation</td>
<td>Nil</td>
<td>4</td>
<td>0.01</td>
</tr>
<tr>
<td>Number of patients requiring increase in inotropes</td>
<td>10</td>
<td>40</td>
<td>0.01</td>
</tr>
<tr>
<td>Number of patients requiring IABP in ICU</td>
<td>Nil</td>
<td>2</td>
<td>0.01</td>
</tr>
</tbody>
</table>
period and immediately post-CPB period (p<0.01) in patients with NYHA Class-IV. These values, however, were not significantly different in all classes at 24 and 48 hours after surgery. Other significant predictors of HL identified by Svenmarker et al have been patients’ age, complexity of surgery, need of blood transfusion during CPB, acid base level, emergency surgeries, pre-operative diabetes, vasoactive intervention, venous-blood-return to the heart-lung machine and renal function. We found a weak negative correlation between lactate levels and haemoglobin during CPB as well as CPB duration, however, Shinde et al, we found significant difference in patient’s pre-operative dyspnea symptoms (NYHA class) and incidence of HL (p-value <0.01).

There is a controversy whether or not using Lactated Ringer’s solution for pump priming can contribute to development of metabolic acidosis. At one hand it has been shown that infusion of Ringer’s lactate does not affect the accuracy of lactate measurement and some studies show development of metabolic alkalosis due to metabolism of lactate to bicarbonate and the lactate act as a base and cannot cause acidosis. Himpe et al compared the acid-base difference in two groups of patient who received lactated and non-lactated solution for CPB-prime. Hyperchloaraemic metabolic acidosis was seen at the end of CPB in Group II (lactated prime), as evidenced by the negative base excess (median=2.90 mEq litre) and slightly increased chloride levels (median=108 mEq litre). We used only lactated Ringer’s solution for pump priming in all our patients and hence could not find the correlation of prime solution with HL.

Shinde et al used lactate levels >4 mmol/ L as HL and they found these patients required prolonged inotropic and ventilatory support in the post-operative ICU. Similarly, Svenmarker et al have described patients with HL requiring longer intensive care and postoperative ventilatory support, but the threshold for HL was set to equal 2 mmol/ L. In their study they found more complications like renal dysfunction, infections, respiratory and circulatory disorders in patients of HL during CPB with a higher hospital mortality (13.3% vs 2.2%). We used the threshold of 4 mmol/ L of lactate level during rewarming period as marker of HL and we found that the patients who had higher lactate level during CPB had significantly longer duration of post-operative ventilation (median=3.00 vs ± 3.50 hours). Similarly, more patients required re-ventilation, increase in inotropic support and intra-aortic balloon pump in the post-operative period. Likewise, the mortality in HL group was higher (3.45% vs nil). However, we found no significant difference in the duration of post-operative inotropic support or ICU length of stay.

**CONCLUSION**

High lactate levels during CPB can lead to post-operative complications including hemodynamic compromise and longer duration of ventilation. Short CPB duration and optimal hemoglobin can reduce incidence of hyperlactatemia.

**Limitation of the Study**

The study was conducted at single center with relatively small sample size. A multicenter study with larger sample size is needed.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

5. Demers P, Elkouri S, Martineau R, Couturier A, Cartier R: Outcome with high blood lactate levels during cardiopulmonary


**ABSTRACT**

**Objective:** This study evaluates the effect of preserving pulmonary valve in total correction repair for Tetrology of Fallot in terms of early clinical outcomes.

**Study Design:** Retrospective observational study.

**Place and Duration of Study:** Armed Forces Institute of Cardiology and National Institute of Heart Disease, from Oct 2016 to Jan 2017.

**Material and Methods:** All 15 cases of classic Tetrology of Fallot (TOF) undergoing total correction by a single operator were studied for early post operative outcomes. A total of 15 patients with classic TOF were included in this study. There were 10 (66.7%) males and 5 (33.3%) females. The age ranged from 2-15 years with a mean age of 6.73 ±4.2 years. Total correction for tetrology of Fallot was done through primary repair securing the integrity of the pulmonary valve. Two of the patients (13.32%) had repair through mono cusp valve made from native pericardium while 2 (13.32%) had Donah patch to main pulmonary artery and right ventricular outflow tract. Six of all patients (39.69%) had normal pulmonary valve while 5 patients (33.30%) had open pulmonary valvotomy.

**Results:** One patient (6.66%) died due to sepsis after having pulmonary valvotomy and MAPCA coiling in total correction procedure. Bilateral pleural effusion was reported in 4 (26.64%) and 2 patients (13.32%) had ascites. Superficial wound infection occurred in 4 (26.64%) of the patients.

**Conclusion:** Pulmonary valve securing approach is a significant factor for total correction complete repair for tetrology of Fallot.

**Keywords:** Congenital cyanotic, Pulmonary valve, Repair, Tetrology of fallot.

INTRODUCTION

Tetrology of Fallot (TOF) is one of the most common variant of congenital cyanotic heart disease. TOF is characterized by a large ventricular septal defect (VSD), right ventricular hypertrophy, right ventricular outflow obstruction (RVOT) and an overriding aorta. The first successful repair of TOF was conducted in 1954 in a little boy by Lillehei and associates\(^1\). Although there has been a decrease in surgical mortality associated with the repair in the recent decade, postoperative complications such as residual ventricular septal defect, incompetence of the left atrioventricular (AV) valve, residual right ventricular outflow tract obstruction, and pulmonary regurgitation do occur and sometimes require reoperation\(^2,3\).

The best TOF repair should be appropriate for children of all ages, and should provide good relief of right ventricular outflow tract obstruction (RVOTO) to avert development of right ventricular hypertrophy. There should be complete atrial and ventricular septation, with prevention of ventriculotomy and circulatory arrest. Preservation of pulmonary valve (PV) and tricuspid valve (TV) function and biventricular contractility would also be considered elementary, along with minimal early mortality and morbidity. In the present era, in which the immediate outcome of TOF repair is good employing various surgical strategies, the goal of

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treatment should include the averting of long-term complications and a decreased possibility of early and late reoperations. A good neuro-developmental and functional status and quality of life could complete the expectations.

The principal aim of our study was to evaluate the transatrial and transventricular approaches for the primary repair of TOF by securing pulmonary valve in young children and evaluating their short term outcomes in a tertiary care cardiac health facility.

**MATERIAL AND METHODS**

The study was conducted from October 2016 to January 2017. This study was approved by the Institutional Ethical Review Board of AFIC/ NIHD. For this study, patients with classic TOF but without important complicated features were selected. Such patients were considered to be those who underwent repair without using a valved extracardiac conduit or an orthotopically inserted pulmonary valve substitute. All patients were diagnosed by echocardiography. Cardiac catheterization and angiography was done in which infundibular and pulmunary valvular stenosis was evaluated along with peri-membranousventricular septal defect (PMVSD). The other variables included transpulmonary gradient, size of pulmonary valve, VSD type and LV size suitable for biventricular repair. The McGoon ratio was calculated. Patients with a McGoon ratio of <1.2 were excluded. Infants and neonates were also excluded from the study.

Patients undergoing a two-stage operation and the abnormal coronary artery course (double-left anterior descending branches, preventing a transventricular approach to repair TOF) were also excluded.

Complete repair was done with the technique of transatrial, transventricular approach VSD closure in 12 (80%) of cases while in 3 (20%) cases transventricular approach was done.

**Table: Demographic and clinical characteristics.**

<table>
<thead>
<tr>
<th>S No.</th>
<th>Variables</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Age (Mean ±SD)</td>
<td>6.73 ± 4.2</td>
</tr>
<tr>
<td>2.</td>
<td>Gender N (%)</td>
<td>Male 10(66.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female 5(33.3%)</td>
</tr>
<tr>
<td>3.</td>
<td>Weight (Mean ±SD)</td>
<td>14.6 ±11.27</td>
</tr>
<tr>
<td>4.</td>
<td>Cyanotic spell history (Mean ±SD)</td>
<td>13 (86.6%)</td>
</tr>
<tr>
<td>5.</td>
<td>Pre op RV-PA mean gradient (mmHg) (Mean ±SD)</td>
<td>79.33 ±10.2</td>
</tr>
<tr>
<td>6.</td>
<td>NYHA III-IV N (%)</td>
<td>9 (60%)</td>
</tr>
<tr>
<td>7.</td>
<td>McGoon ratio (Mean ±SD)</td>
<td>1.61 ± 0.29</td>
</tr>
<tr>
<td>8.</td>
<td>Arrhythmias</td>
<td>2 (13.3%)</td>
</tr>
<tr>
<td>9.</td>
<td>MAPCA coiling</td>
<td>1 (6.7%)</td>
</tr>
<tr>
<td>10.</td>
<td>Previous BT shunt</td>
<td>1 (6.7%)</td>
</tr>
<tr>
<td>11.</td>
<td>Pulmonary valve status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>6 (40%)</td>
</tr>
<tr>
<td></td>
<td>Stenosis</td>
<td>9 (60%)</td>
</tr>
<tr>
<td>12.</td>
<td>Operative Technique</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two patch</td>
<td>2 (13.3%)</td>
</tr>
<tr>
<td></td>
<td>Pulmonary valvotomy</td>
<td>5 (33.3%)</td>
</tr>
<tr>
<td></td>
<td>Monocusp patch</td>
<td>2 (13.3%)</td>
</tr>
<tr>
<td></td>
<td>ROVOTO patch</td>
<td>1 (6.7%)</td>
</tr>
<tr>
<td></td>
<td>Infundibulectomy</td>
<td>5 (33.3%)</td>
</tr>
<tr>
<td>13.</td>
<td>Bypass time (min) (Mean ±SD)</td>
<td>103.8 ± 30.6</td>
</tr>
<tr>
<td>14.</td>
<td>Cross clamp time (min) (Mean ±SD)</td>
<td>71.08 ± 31.3</td>
</tr>
</tbody>
</table>
Open pulmonary valvotomy was done in 5 (33.3%) cases while pulmonary valve was normal in 6 (40.0%) of the patients. Monocusp valve designed from normal pericardium was applied in pulmonary valve stenosis when pulmonary valve size was not adequate for age and weight despite valvotomy. When main pulmonary artery was fibrotic two patch technique was done for right ventriculotomy and main pulmonary artery.

All complete repairs were performed after standard median sternotomy using a cardiopulmonary bypass with moderate systemic hypothermia (25-28°C). The patent ductus arteriosus was repaired before cross-clamping the ascending aorta to prevent lung perfusion. Antegrade cold blood cardioplegia was used for myocardial protection.

The transatrial & transventricular surgical approach was used. Visualization of the VSD was usually adequate through the tricuspid valve and was even easier after division and resection of the obstructing muscle bundles. If visualization of the VSD through the transatrial route was not adequate, a longitudinal incision was made in the right ventricular outflow, a few millimeters away from the pulmonary valve. The obstructing muscles in the RVOT were excised until the VSD could be detected clearly. Synthetic patch (Bard Sauvage filamentous knitted polyester fabric patch) was cut to the appropriate size, usually equal to the diameter of the mid ascending aorta. It was then sutured to the right side of the septum with an interrupted suture technique, with 5-0 Prolene suture on pledgets. In the region of the bundle of His, it was safer to place the sutures in the base of the tricuspid valve leaflet. Particularly in case of a very thin tissue, extra pledgeted sutures were used.

In case of a proximal narrowing in one of the individual pulmonary arteries, the incision was continued across the stenotic part. When making the incision through the pulmonary valvular annulus, an attempt at cusp preservation by making the incision through the commisure of the cusp was done. A monocusp constructed of autologus pericardium was used in these cases to preserve the function of the pulmonic valve. To assess the adequacy of the RVOT, Hegar’s dilators were introduced through RVOT to assess adequacy based on normalized sizes according to the body surface area. RV/ LV pressure ratio was measured by direct RV puncture to rule out any significant residual outflow tract obstruction. For a postrepair ratio of <0.7, the RVOT appeared to be reconstructed adequately. Pulmonary annulus was enlarged by a glutaraldehyde-treated autologous pericardial patch when necessary. Transesophageal echocardiography was used to evaluate the surgical result immediately.

The major aorto-pulmonary collateral arteries were evaluated by the doctor and coil embolization was performed. The patients in the study were observed during their postoperative stay in the ICU and the post operative ward.

**RESULTS**

A total no 15 patients were included in this study. There were 10 (66.7%) males and 5 (33.3%)
females (table). The age ranges from 2-15 years with a mean age of 6.73 ± 4.2. There was a history of cyanotic spell in 13 (86.6%) of the patients. Nine patients (60.0%) had dyspnea NYHA class III-IV. Mean McGoon ratio was 1.61 ± 0.29 (fig-1).

The tetrology of fallot surgery was done through primary repair securing the integrity of the pulmonary valve. 2 (13.32%) of the patients had repair through mono cusp valve made from native pericardium while 2 (13.32%) patients had Donhl patch to main pulmonary artery and Rt ventricular outflow tract. 6 (40.0%) of all patients had normal Pulmonary valve while 5 (33.30%) patients had open pulmonary valvotomy. One patient (6.66%) died due to septicemia after lung collapse and hemoptasis. Bilateral pleural effusion were reported in 4 patients (26.6%) and 2 patients (13.32%) developed as cities postoperatively. Superficial wound infection occurred in 4 (26.6%) of the patients. In the postoperative phase all the patients were on ionotropic supports of Milrinone and Dopamine. Mean postoperative transpulmonary gradient was 25mmHg (fig-2).

**DISCUSSION**

Tetrology of fallot is a well recognized congenital heart disease and involves the combination of ventricular septal defect, overriding aorta, right ventricular hypertrophy and pulmonary stenosis. TOF has been known to exist for more than 100 years. The operative correction of TOF has been performed for more than 40 years. Over the last decade despite improvement in the outcomes of surgical repair, certain issues remain under debate such as the optimal timing of surgery and the use of transatrial or a transventricular approach for the closure of VSD.

Right ventricular dysfunction is a significant cause of morbidity and mortality after surgical correction of tetrology of Fallot. Preservation of the right ventricular function by avoiding a right ventriculotomy and preserving function of the pulmonic valve helps in reducing postoperative outcomes. Seliem etal demonstrated that among patients who underwent TOF repair before six months of age both right ventricular wall thickness and right ventricular hemodynamic function decreases significantly. The total repair of TOF with transatrial transventricular approach for patients more than six months of age have mortality of 0-2%. The group of the Great Ormond street documented that a total of 124 patients with transannular patch were significantly associated with RV and LV dysfunction. The two patches above and below the annulus are preferable to a single patch crossing the annulus. This is according to the recommendations of the North Western university group, avoidance of a transannular patch (TAP) with the preservation of the pulmonary valve. The preservation of pulmonary valve in case of complete AVSD/ TOF has excellent long term results.

The present study documents the survival and clinical outcomes of 15 patients who underwent transatrial transventricular approach.
for the repair of TOF with the preservation of pulmonary valve. The two patch technique and monocusp patch and pulmonary valvotomy have shown equivocal results. The morbidity in our study is attributed to local factors with only one case of mortality due to septicaemia.

**Limitation of the study**

This study had some limitations inherent to a single centre study. Due to small sample size, no comprehensive statistical analysis and inference could be drawn.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

EFFECTS OF LOW VOLUME VENTILATION DURING CARDIOPULMONARY BYPASS ON POSTOPERATIVE PULMONARY OUTCOME AFTER CORONARY ARTERY BYPASS GRAFTING

Mehwish Naseer, Rashad Siddiqi, Aqeel Hussain, Imama Tehniet, Imran Bashir
Army Cardiac Centre, Lahore/ National University of Medical Sciences (NUMS), Pakistan

ABSTRACT

Objective: To study the effects of low volume ventilation during cardiopulmonary bypass on postoperative pulmonary outcomes after coronary artery bypass grafting.

Study Design: Randomized controlled trial.

Place and Duration of Study: Army cardiac Centre CMH Lahore for duration of 6 months from April to September 2016.

Material and Methods: After taking approval by the hospital ethics committee which written informed consent, was taken by 100 consecutive patients of either sex, undergoing CABG on CPB, were randomly divided into two groups. Patients in Group I received continuous low volume ventilation (2mL/Kg) throughout the CPB period, whereas ventilation was switched off and disconnected in patients of Group II. Frequency of post-operative respiratory complications, duration of mechanical ventilation after surgery and intensive care unit (ICU) length of stay (LOS) were noted in both groups.

Results: Whereas the demographics of both groups were almost the same, patients in Group I had a significantly longer post-operative mechanical ventilation time (4.68 vs 2.8 hrs) with p-value (p=0.031); longer ICU LOS (1.84 vs 1.28 days, p=0.016) and more requirement of oxygen (O2) therapy (p=0.01); and had significant difference in post-operative pulmonary complications.

Conclusions: Our study reports that continued low tidal volume ventilation during CPB improved post-bypass oxygenation and lung mechanics.

Keywords: Coronary artery bypass, Intensive Care Unit, Pulmonary complications, Ventilation.

INTRODUCTION

Cardiopulmonary bypass (CPB) by serving four basic functions of respiration, circulation, temperature regulation and provision of bloodless field, not only facilitates the surgery on a non-beating heart, but also causes diversion from normal physiology resulting in many problems during early postoperative period. After coronary artery bypass grafting (CABG), an often-considered risk factor is pulmonary outcome well known for post operativemorbidity and mortality ranging from the mild to the most severe (i.e. acute respiratory distress syndrome [ARDS]).

In literature an association was observed between diagnosis of poor pulmonary outcome or low forced expiratory volume in 1 second (FEV1) and post CABG morbidity and mortality. These outcomes are of more consideration, once the treatment cost, hospitalization stay, intensive care and mechanical ventilation were taken into account.

The etiology is multifactorial after open-heart surgery and based upon the mutual effect of cardiopulmonary bypass (CPB), anesthesia and surgical trauma. CPB in particular is known to activate the inflammatory process, resulting in increased pulmonary capillary permeability. Even midline sternotomy causes significant reductions in lung volumes and capacities resulting in atelectasis and poor arterial oxygenation.
During CPB a wide range of ventilatory strategies have been attempted that include continuous positive airway pressure (CPAP) with pressures of 5-15 cmH2O, high frequency low tidal volume ventilation (100 breaths/min), inspired oxygen concentrations of 21% to 100% and bilateral extracorporeal circulation to oxygenate the blood while on bypass. Although some small and transient benefits for CPAP with 10 cmH2O have been demonstrated, no convincing evidence of clinical benefits from any of the ventilatory strategies have thus far emerged. Among them low volume ventilation has gained particular interest. We therefore conducted this study to evaluate the effects of low volume ventilation during bypass period on postoperative pulmonary outcome in patients undergoing CABG.

MATERIAL AND METHODS

This Randomized clinical trial was conducted at Army Cardiac Centre, Lahore for duration of 6 months from 1 Apr to 30 Sep 2016. After approval of the hospital ethics committee and obtaining written informed consent of the patients, a total of 100 consecutive patients of either sex, in the age group of 18 to 70 years, undergoing CABG were selected for this study. They were randomized in two groups I and II, using draw method. Patients with any pre-existing respiratory disorders like asthma, chronic obstructive pulmonary disease (COPD); known allergies; patients falling under American society of anesthesiologists (ASA) class III or more; patients with poor left ventricular function (LVEF <30%); and patients with renal impairment (elevated serum creatinine >2 mg/ml) were excluded from the study. All patients received similar protocol for induction (using morphine 0.2 mg/kg and propfol 2 mg/Kg) and maintenance of anaesthesia (with isoflurane 1.2%).

Patients in Group I were ventilated throughout the CPB duration using 2 ml/kg tidal volume at a respiratory rate of 15/min with FiO2 of 0.5 and positive end-expiratory pressure (PEEP) of 3 cmH2O. Whereas Patients in Group II received no ventilation during CPB and the breathing circuit was disconnected. Patients who had difficulty in coming off bypass and required intra-aortic balloon pump in the immediate post-CPB period were dropped from the study.

Postoperatively all patients were shifted to intensive care unit (ICU) intubated and were put on mechanical ventilation with synchronized intermittent mandatory ventilation (SIMV) mode using 8 ml/Kg tidal volume, 0.5 FiO2 and PEEP of 5 cmH2O. The decision of weaning from ventilation and extubation was made according to standard protocols including adequate oxygenation, hemodynamic stability and no bleeding.

Data was entered on separate proforma for each patient including his/her age, weight, co-morbidities, and smoking history. PaO2 was measured at the time of shifting to ICU and then post-extubation. From these values PaO2/FiO2 was calculated. FiO2 was kept constant and same for all patients of both groups after termination of CPB, while shifting to ICU till time of extubation i.e. 0.5. A portable chest x-ray antero-posterior (AP) view was done in every patient on the 1st postoperative day to rule out and record any evidence of lung collapse, consolidation or pleural effusion. Any episode of post-operative hypoxia (PaO2 < 80 mmHg on inhaled oxygen) requiring high concentration oxygen through re-breathing mask or non-invasive ventilation (Duo PAP) was also noted. Also ICU ventilation time (in hours ± SD), re-ventilation and ICU length of stay (in days ± SD) was recorded for all patients in both groups. Collected data was analyzed by using SPSS version 20.

RESULTS

Results were available for all 100 patients. The male female ratio was different in both groups (2.13:1 in group 1 vs 11.5:1 in group II demographics of the patients in two groups incidence of hypertension & similarly 22 (44.0%)
in group I & 18 (36.0%) in group II 34(68.0%) in group I & 28 (56.0%) in group II (p=0.21, p=0.41. There was no significant difference in the demographics of the patients in the two groups. ventilation time (p=0.02); longer ICU LOS (p<0.01) and more requirement of oxygen (O2) therapy (p<0.01). There was no significant difference in post-operative pulmonary complications in terms of pleural effusions but patients in Group II had significantly higher incidence of post-operative consolidation and collapse and 3 out of 50 patients had to be re-ventilated due to persistent hypoxemia compared to none in Group I (table-III).

**DISCUSSION**

During cardiopulmonary bypass venous return is diverted from heart through right atrium or vena cava cannulation. The aortic

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**Table-I: Demographics of groups I and II (100 patients).**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group I (n=50)</th>
<th>Group II (n=50)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td>57 ± 12.2</td>
<td>57.0 ± 12.5</td>
<td>0.97</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>46(92.0%)</td>
<td>4(8.0%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>16(32.0%)</td>
<td>46(92.0%)</td>
<td></td>
</tr>
<tr>
<td>Weight (in Kgs)</td>
<td>65.21 ± 7.7</td>
<td>72.7 ± 20.81</td>
<td>0.01</td>
</tr>
<tr>
<td>Height (in Ft)</td>
<td>5.48 ± 0.30</td>
<td>5.46 ± 0.28</td>
<td>0.73</td>
</tr>
</tbody>
</table>

**Table-II: Co-morbid observed in both groups.**

<table>
<thead>
<tr>
<th>Co-morbid</th>
<th>Group I (n=50)</th>
<th>Group II (n=50)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>Yes</td>
<td>34(68.0%)</td>
<td>28(56.0%)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Yes</td>
<td>22(44.0%)</td>
<td>18(36.0%)</td>
</tr>
<tr>
<td>Smoking</td>
<td>Yes</td>
<td>12(24.0%)</td>
<td>24(48.0%)</td>
</tr>
</tbody>
</table>

**Table-III: Comparison of Outcome in both Groups.**

<table>
<thead>
<tr>
<th>Outcome variable</th>
<th>Group I (n=50)</th>
<th>Group II (n=50)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPB time (in minutes)</td>
<td>119.21 ± 54.21</td>
<td>123.71 ± 55.72</td>
<td>0.68</td>
</tr>
<tr>
<td>PaO2/FiO2 on arrival in ICU</td>
<td>304.01 ± 10.21</td>
<td>299.11 ± 10.05</td>
<td>0.01</td>
</tr>
<tr>
<td>Post-extubation PaO2/FiO2</td>
<td>298.21 ± 15.61</td>
<td>290.51 ± 20.17</td>
<td>0.03</td>
</tr>
<tr>
<td>ICU ventilation time (in hours)</td>
<td>2.8 ± 1.06</td>
<td>4.6 ± 4.11</td>
<td>0.01</td>
</tr>
<tr>
<td>ICU length of stay (in days)</td>
<td>1.28 ± 0.54</td>
<td>1.84 ± 0.98</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Incidence of Post-operative Pulmonary Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Group I (n=50)</th>
<th>Group II (n=50)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collapse</td>
<td>Yes</td>
<td>2 (4.0%)</td>
<td>8(16.0%)</td>
</tr>
<tr>
<td>Consolidation</td>
<td>Yes</td>
<td>Nil</td>
<td>10 (20.0%)</td>
</tr>
<tr>
<td>Pleural Effusion</td>
<td>Yes</td>
<td>6 (12.0%)</td>
<td>8 (16.0%)</td>
</tr>
<tr>
<td>Requirement of Duo PAP</td>
<td>Yes</td>
<td>4 (8.0%)</td>
<td>8 (16.0%)</td>
</tr>
<tr>
<td>Need of High Conc O2</td>
<td>Yes</td>
<td>Nil</td>
<td>10 (20.0%)</td>
</tr>
<tr>
<td>Re-ventilation</td>
<td>Yes</td>
<td>Nil</td>
<td>3 (6.0%)</td>
</tr>
</tbody>
</table>
outflow is provided through aortic cannula applied distal to cross clamp so circulation to heart and lung is totally bypassed\(^1\). The blood supply to lungs occur through bronchial artery which is subjected to vasoconstriction in the absence of ventilation and can lead to ischemic injury to lungs\(^13\)-\(^16\). Ischemic reperfusion injury is also initiated after restoration of blood supply\(^17\).

Postoperatively, it is reported that there is reduction of 30-50% in FEV1 and FVC among adults with coronary bypass procedures\(^17\). Among the many strategies studied continuous ventilation during CPB is least studied methodology because of the concerns of interference with surgical field\(^18\).

Sandeep et al conducted prospective study including 45 patients divided in two groups based on receiving low volume ventilation or not and concluded improvement in oxygenation and inspiratory capacity after low volume ventilation during CPB\(^1\). A randomized controlled trial of 100 patients by Aamir et al. concluded that there is improved PaO2/ FiO2 ratio, decreased A-a O2 gradient and incidence of atelectasis in patients who received low tidal volume ventilation during CPB\(^3\). Muzaffar et al conducted prospective randomized study on 100 patients undergoing elective CABG and concluded that there is significantly decreased incidence of atelectasis (0.08) and NIV requirement (0.07) among the patients receiving low tidal volume ventilation, however the incidence of postoperative lung complications was found to be equivocal\(^18\).

It is also found in published studies that ventilation with low tidal volume (3ml/ kg) without PEEP per CPB could not significantly change pulmonary vascular resistance index (PVRI), mean pulmonary artery pressure (MPAP), pulmonary complications, PaO2/ FiO2 ratio and total length of stay\(^12\)-\(^14\). A retrospective case control study conducted at Miami in 2009-2013 on 274 patients concluded that continued ventilation and pulmonary perfusion during CPB is not associated with improved postoperative outcomes\(^19\).

We designed this study to evaluate the effect of low volume ventilation during bypass period on prospective pulmonary outcome in patients undergoing coronary artery bypass grafting. The earlier statement was based on the concept that continued ventilation on CPB could lead to reduction in postoperative pulmonary complications. To avoid interference with surgical field we kept tidal volume low (TV=2ml/ kg). The postoperative lung functions were predicted by the measurements of PaO2, need of oxygen supplementation and extubation time and ICU stay. We reported significant oxygenation improvement and less postoperative pulmonary complications in patients receiving low volume ventilation in our study. One of the reasons for this reduction may be postoperative PEEP application and exclusion of all patients with respiratory diseases. Also it can be due to less number of patients who smoke in group which received ventilation during Cardiopulmonary bypass.

Our study reported significant decrease in the incidence of lung collapse and consolidation when low volume ventilation applied during Cardiopulmonary bypass.

There was significant improvement in PaO2/ FiO2 ratio with significantly decreased requirement of high concentration oxygen mask, less ICU ventilation time and shorter hospital stay for the ventilated group. The extubation time was significantly shorter in our findings for the ventilated group. This is similar to the study result by Lindsay et al. and Salama et al\(^20\).

Indeed we found significant association between the continued low tidal volume ventilation on CPB and its effects on postoperative pulmonary outcomes.

**CONCLUSION**

Our study reports that continued low tidal volume ventilation during CPB improved postoperative pulmonary outcome.
CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES


AORTIC ROOT REPLACEMENT: CLASSICAL BENTALL VERSUS COPELAND’S MODIFICATION
Muhammad Aamir Khan, Dawood Kamal Mehsud, Tahseen Ahmed, Muhammad Waseem
Armed Forces Institute of Cardiology/ National Institute of Heart Diseases/ National University of Medical Sciences (NUMS) Rawalpindi, Pakistan

ABSTRACT

Objective: To compare the aortic root replacement with composite aortic valve graft and to analyze these techniques.

Study Design: Retrospective observational.

Place and Duration of Study: Armed Forces Institute of Cardiology and National Institute of Heart Diseases (AFIC/ NIHD) Rawalpindi, between 2007 to 2016.

Material and Methods: Study was conducted at Armed Forces Institute of Cardiology and National Institute of Heart Diseases (AFIC/ NIHD) Rawalpindi between 2007-2016, 59 patients underwent Aortic root replacement with composite aortic valved graft. Initial 28 patients underwent the Classical Bentall Procedure and in the last 31 patients Copeland’s modification of Bentall procedure was employed.

Results: Mean age was 39.80 ± 14.24 and male to female ratio was 3:1. 13.6% patients had Marfan syndrome, 15.3% patients underwent concomitant Mitral Valve replacement. Statistically significant difference was observed between Classical and modified Bentall procedure in Cross Clamp Time (p=0.02), Total Inotrope Duration (p=0.01), Total Chest Drainage (p=0.04), Total Red Cell Concentrate (RCC) Transfused (p=0.01), Re-opening Rate (p=0.01) and Mortality (p=0.01).

Conclusion: Copeland’s Modification of Bentall Procedure provides superior post-operative outcome as compared to the Classical Bentall procedure.

Keywords: Aortic root replacement, Ascending aortic aneurysms, Bentall procedure, Composite valved grafts, Copeland’s modification.

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INTRODUCTION

Bentall and De Bono pioneered the replacement of aortic root with a Composite Valved Graft (CVG) in 1968, and since then the procedure has been widely used for variety of pathologies of the aortic valve, sinuses of Valsalva and ascending aorta. The major complications like post operative bleeding and pseudo aneurysm formation with the classical Bentall procedure lead to various modifications of the procedure. All the modifications in classical procedure aimed to reduce the risk of suture line bleeding and its sequel.

At Armed Forces Institute of Cardiology and NIHD Rawalpindi the classical and modified procedures were in practice but more recently the Copeland modification has been adopted. We share our experience of early post-operative outcome of this procedure.

MATERIAL AND METHODS

From Cardiac Surgery Database of Armed Forces Institute of Cardiology and NIHD Rawalpindi consecutive patients admitted from January 2007 to December 2016, for Aortic Root Replacement with composite aortic valved graft. 59 patients were entered into the present study through purposive convenience sampling. All the patients with ascending aortic aneurysm and who needed aortic root replacement were included in the study. All the emergency operations were excluded.

Between January 2007 till December 2011, Classical Bentall was in fashion at AFIC-NIHD Rawalpindi, and total 28 patients were operated during this time. Three patients had emergency
procedures for acute aortic dissection and were excluded from the study. From January 2012 till December 2016, the Copeland’s modification of Bentall procedure was adopted, and 31 consecutive patients were included in the study excluding patients undergoing emergency procedure. In both the groups, patients with concomitant Mitral Valve replacement were also included. All patients underwent first-time procedure except one patient with Prosthetic Aortic Valve Endocarditis.

**Operative Procedure**

Cardiopulmonary bypass was established using high ascending aortic cannulation and 2-stage right atrial cannulation. Bicaval cannulation was used where indicated. In classical technique cardiac arrest was achieved by fibrillation followed by ante grade cardioplegia directly in coronary ostia. From January 2012 we used the modified technique and used both ante grade and retrograde cardioplegia. Cardiac venting was done through right upper pulmonary vein. After opening the aorta, the coronary buttons were excised with 5 mm collar of the aortic wall around the Ostia.

<table>
<thead>
<tr>
<th>Table I: Baseline patient characteristics.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
</tr>
<tr>
<td>Patient Age</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Body Mass Index</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Body Surface Area</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table II: Disease characteristics.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Main pathology</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Left ventricular ejection fraction</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Marfan syndrome</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Shortness of breath</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Angina score</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Concomitant procedure</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Classical Bentall: The aortic wall was left intact till last for wrapping around the composite valved graft. Proximally the sewing ring of the aortic valve was sutured to the aortic annulus with interrupted non-absorbable suture. Two circular defects in the composite graft were fashioned for the right and left coronary arteries using ophthalmic cautery. The aortic tissue surrounding the coronary Ostia were directly sutured to these openings in the composite graft with 5/0 polypropylene in continuous fashion.

**Table III: Comparison of classical and modified bentall procedure—quantitative data.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Type of Bentall Procedure</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass Time (min)</td>
<td>Classical (n=28)</td>
<td>156.80</td>
<td>44.615</td>
<td>0.266</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>205.60</td>
<td>73.791</td>
<td></td>
</tr>
<tr>
<td>Cross Clamp Time (min)</td>
<td>Classical (n=28)</td>
<td>111.20</td>
<td>29.559</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>150.10</td>
<td>62.637</td>
<td></td>
</tr>
<tr>
<td>Maximum Inotropic Score</td>
<td>Classical (n=28)</td>
<td>20.800</td>
<td>14.5407</td>
<td>0.089</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>17.300</td>
<td>9.5690</td>
<td></td>
</tr>
<tr>
<td>Total Inotrope Duration (Hrs)</td>
<td>Classical (n=28)</td>
<td>127.90</td>
<td>204.829</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>44.90</td>
<td>10.203</td>
<td></td>
</tr>
<tr>
<td>Duration of Ventilation (Hrs)</td>
<td>Classical (n=28)</td>
<td>51.15</td>
<td>159.703</td>
<td>0.165</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>8.80</td>
<td>3.120</td>
<td></td>
</tr>
<tr>
<td>Total ICU stay (Hrs)</td>
<td>Classical (n=28)</td>
<td>120.15</td>
<td>219.611</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>39.50</td>
<td>30.519</td>
<td></td>
</tr>
<tr>
<td>Total days stayed in hospital</td>
<td>Classical (n=28)</td>
<td>13.21</td>
<td>5.147</td>
<td>0.403</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>11.67</td>
<td>1.871</td>
<td></td>
</tr>
<tr>
<td>Total Chest Drainage (ml)</td>
<td>Classical (n=28)</td>
<td>1256.00</td>
<td>512.470</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>619.00</td>
<td>205.775</td>
<td></td>
</tr>
<tr>
<td>Total RCC Transfused (ml)</td>
<td>Classical (n=28)</td>
<td>1212.50</td>
<td>638.228</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>315.00</td>
<td>303.727</td>
<td></td>
</tr>
</tbody>
</table>

**Table IV: Comparison of classical and modified bentall procedure—descriptive data.**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Type of Bentall Procedure</th>
<th>Percentage</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysrhythmias</td>
<td>Classical (n=28)</td>
<td>35.7 (n=10)</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>25.8 (n=9)</td>
<td></td>
</tr>
<tr>
<td>Re-opening rate</td>
<td>Classical (n=28)</td>
<td>21.4 (n=6)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>3.2 (n=1)</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>Classical (n=28)</td>
<td>25 (n=7)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>Copeland (n=31)</td>
<td>9.7 (n=3)</td>
<td></td>
</tr>
</tbody>
</table>
Copeland's Modification of Bentall: The diseased aortic wall was removed leaving behind a 3-4 mm cuff of aortic wall proximally above the valve commissures (figure). Distally aorta was transected 2-3 cm proximal to the innominate artery. Proximally the sewing ring of the aortic valve was sutured to the aortic annulus with interrupted non-absorbable suture by passing the sutures through the lower flange of the sewing ring. Then 3/0 polypropylene suture was used in running fashion between the cut edge of the proximal aorta and the upper flange of the sewing ring. The coronary buttons were anastomosed to the openings in the composite graft. The graft length was sized and distal anastomosis was done between the graft and distal aorta. Fibrin Glue was sprayed on all the suture lines 5 minutes before removing the aortic cross clamp in both the groups. De-airing and decannulation were done in standard fashion in both the groups.

The Outcome

The patients were observed for postoperative outcome till discharge from hospital. The major outcomes were mortality, ventilation time, Inotrope score, major bleeding, ICU and hospital stay.

Data analysis was carried out using SPSS 18. Quantitative data was described as mean ± standard deviation whereas qualitative data was described as frequencies and proportions. Various differences between the two groups were compared using students t-test for quantitative data and chi square test for frequencies and proportions, assuming a p-value of <0.05 as significant.

RESULTS

The baseline patient characteristics of both the groups are shown in table-I. The disease characteristics are shown in table-II. Operative details, Post operative outcome and comparison between the Classical and Modified Bentall Procedures are shown in table-III and IV.

Mean age was 39.80 ± 14.24 with male to female ratio of 3:1. Overall mortality was 16.95%.

Statistically significant difference was observed between Classical and Modified Bentall procedure in Cross Clamp Time, Total Inotrope Duration, Total Chest Drainage, Total Red Cell Concentrate (RCC) Transfused, Re-opening Rate and Mortality.

DISCUSSION

Since its introduction in 1968, CVG for replacement of the aortic valve and ascending aorta has led to increased life expectancy for patients with Marfan syndrome (MFS). CVG is also indicated in non-MFS annulo-aortic ectasia, ascending aortic aneurysms with concomitant aortic valve disease including mega-aorta syndromes, patients undergoing repair of type A aortic dissection and certain cases of complex endocarditis. It may be an isolated procedure or combined with other aortic procedures such as arch replacement, Coronary Artery Bypass Grafting or with Mitral Valve Replacement.

A major weakness in the replacement of the aortic valve and ascending aorta with CVG is bleeding from the proximal suture line. In the Classical Bentall technique, formation of pseudoaneurysms at sites of tissue to conduit anastomosis, has been a troublesome late complication of this technique. Such a complication has been attributed to undue
tension developing at the suture line of the side-to-side coronary anastomosis in large aneurysms, or by blood accumulation inside the aortic wrap\(^8\). This has in turn led some surgeons\(^9\) to construction of an aorto-right atrial shunt decompression but procedure has been attributed to increased morbidity due to fistula formation.

Various modifications in the classical procedure have been made over time to deal with these complications. Dusko Nezic et al adopted ‘a collar technique’ to improve hemostasis around coronary buttons and proximal anastomosis\(^10\). Proximal aorta wall 1cm beyond the coronary anastomosis is left intact. It is then wrapped and anastomosed around the coronary and proximal anastomosis to secure the potential bleeding sites. The author however did not provide a comparison with the classical procedure. Copeland et al\(^5\) abandoned the wrap technique and adopted an uncovered graft technique. Proximally the aorta is transected a few millimeters above the valve commissures and distally 2 to 3 cm proximal to the innominate artery. Horizontal mattress sutures are placed in an aorta to ventricle orientation circumferentially through the aortic valve annulus. These sutures (2-0 ethylene terephthalate-with Dacron pledget) are then passed closely through the lower flange of the aortic prosthesis sewing ring. After sutures are tied down, the lower edge of the prosthesis lies in an intra-annular position. Then a running 3-0 polypropylene suture is used between the cut edge of the proximal aorta and the upper flange of the prosthetic valve (fig). The coronary buttons are anastomosed in the standard fashion keeping them uncovered. Copeland used this technique in 5 patients without giving any comparison with the classical technique.

Till end 2011 we had been using the Classical Technique. Since then surgical paradigm at our centre shifted in the favor of Copeland’s modification as a standard technique. Though a small study population, yet a statistically significant difference was observed in the Cross Clamp Time, Total Inotrope Duration, Total Chest Drainage, Total RCC Transfused, Re-opening Rate and Mortality between the two procedures; supporting the paradigm that a water tight proximal suture line is better achieved with Copeland’s modification and makes the corner stone of the overall superior outcome. Though not significant but the Copeland’s modification had a relatively low inotropic score, shorter duration of ventilation and shorter ICU stay.

Eight patients (13.5%) had concomitant Mitral Valve disease and underwent mitral Valve replacement in addition to Bentall. All the patients did well post operatively without any significant complication. One patient presented with Prosthetic Aortic Valve Endocarditis. Per operatively the ascending aorta was involved in the disease process having abscesses and sinuses. The aortic wall was fragile and necessitated root replacement. The previous prosthesis was explanted, ascending aorta removed and Composite Aortic Valved Graft was used. The patient died due to excessive bleeding from the suture line postoperatively. This patient was not included in the study, and all patients with emergency root replacements for aortic dissections to remove any bias.

The study has its limitations. The patient population is small. Also we could not provide long term results with this procedure. We recommend a study with larger patient population, studying the outcome at 06 and 12 months post operatively.

**CONCLUSION**

Copeland’s modification of the Bentall Procedure provides more hemostatic proximal suture line which results in less post operative bleeding thus less transfusion requirement improving the overall early post-operative outcome.

The procedure is easy to reproduce and expected to avoid the post-operative pseudo-aneurysm formation which was one of the major long term sequels of the classical technique. A long term follow up is required to compare both the procedures for such complications.
CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

A REVIEW OF RISK FACTORS FOR PRIMARY PREVENTION OF CARDIOVASCULAR DISEASES IN PAKISTAN

Kaleem Uddin Aziz
Armed Forces Institute of Cardiology/ National Institute of Heart Diseases/ National University of Medical Sciences (NUMS)
Rawalpindi, Pakistan

ABSTRACT

The feasibility of instituting primary prevention of cardiovascular diseases in Pakistan was explored. For this purpose the reports of Metroville Health study (MHS) were reviewed in light of the experience of developed countries. The MHS showed that it is possible to implement risk factor modification study in lower middle class urban community in Pakistan. Diet was significantly modified; awareness of risk factor was enhanced. Mild reduction in serum cholesterol was achieved in over one year of intervention. After 5 years of intervention the awareness regarding cardiovascular diseases and the effect of risk factors on the genesis of heart diseases remained high. The current smokers' prevalence decreased significantly and serum cholesterol showed decrease, though not statistically significant. Physical activities improved, Blood pressure showed no change and BMI was increased in the intervention group. The non adherence increased after 5 years. It is concluded that it is possible to implement risk factor modification in a lower middle class community in Pakistan. For sustained intervention to impact mortality and morbidities the community needs to remain engaged which can be achieved by establishing a community center.

Keywords: Community intervention, Community health delivery, Primary prevention, Risk factors.

INTRODUCTION

In the developed world primary prevention by risk factors modification at the community level has shown modest success in the short term1-7. But for North Karelia study, the long term results in other studies are unknown1-3. The feasibility of modification of risk factors in the developing countries is largely undetermined. The recent WHO data shows that the epidemiologic transition from communicable to non-communicable diseases is occurring at a fast rate in the developing world4-6. In the developed world non-communicable diseases have replaced the communicable diseases7-9. This transition in developing world is occurring when communicable diseases are still prevalent. The large part of deaths due to cardiovascular disease are occurring in the developing countries while in developed countries the death rates due to cardiovascular diseases are falling10.

This review was done to find out of primary prevention by risk factor modification is feasible at the community level in Pakistan. There is no doubt that there is an urgent need of primary prevention of cardiovascular diseases in Pakistan. The high cost of secondary prevention is prohibitive for large population of Pakistan.

Metroville health study (MHS), conducted during the 1995-2000 is the only risk factor modification study undertaken in a lower middle class urban Pakistani community11-13.

METHODOLOGY

The published and unpublished reports of MHS (14-21) and similar community studies in the developed countries1-4 were reviewed. National level and targeted risk factor modification studies were excluded.

Metroville Health Study

The study was a household based study conducted in 1995 to 2000 period. It was a
randomized controlled intervention study targeting all the risk factors for modification in a low middle class urban community (LMCUC), situated in the environs of Karachi. The study showed that risk factors were significantly prevalent in the community as well as other LMCUC of Karachi\textsuperscript{14-17}. Even in children the risk factors are significantly prevalent\textsuperscript{18} and obesity is increasing at an accelerated rate\textsuperscript{19}. The study targeted all of the risk factors, diet modification involved, direct interaction with the household cooks and smoking and sedentary life styles through health camps, one to one interviews and structured lectures to the community leaders. Awareness regarding cardiovascular diseases risk factors and their role in the genesis of stroke diabetes and heart attack was increased at above activities. In the short term awareness was enhanced and significant reduction in the consumption of saturated fats and substitution of saturated with unsaturated oils and reduction of salt in the diet in the intervention group. Risk factors such as blood Pressure, Body Mass Index (BMI) or blood sugar showed no change but serum cholesterol in intervention group showed decrease, which however was not significant\textsuperscript{13}.

**RESULTS**

After five years of intervention and continued contact with households, 44.2 percent of the original 398 households completed the final screen, which showed significant awareness of risk factors. The awareness of healthy food was tangible and the role of saturated oils and organic

**Table-I: Changes in risk factors from baseline to screen 111.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Control Mean ± S.D</th>
<th>Intervention Mean ± S.D</th>
<th>Difference</th>
<th>% Difference</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>Baseline</td>
<td>23.7 ± 5.4</td>
<td>24.4 ± 7.5</td>
<td>0.7</td>
<td>2.95</td>
</tr>
<tr>
<td></td>
<td>Re-Screen</td>
<td>25.9 ± 4.9</td>
<td>27.4 ± 7.5</td>
<td>1.5</td>
<td>5.79</td>
</tr>
<tr>
<td>Systolic Blood Pressure (mmHg)</td>
<td>Baseline</td>
<td>118.7 ± 17.8</td>
<td>118.3 ± 16.0</td>
<td>0.4</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>Re-Screen</td>
<td>124.2 ± 18.4</td>
<td>127.0 ± 19.0</td>
<td>2.8</td>
<td>2.25</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mmHg)</td>
<td>Baseline</td>
<td>79.0 ± 11.3</td>
<td>77.1 ± 11.1</td>
<td>1.9</td>
<td>2.40</td>
</tr>
<tr>
<td></td>
<td>Re-Screen</td>
<td>82.0 ± 12.3</td>
<td>82.2 ± 12.5</td>
<td>0.2</td>
<td>0.24</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dl)</td>
<td>Baseline</td>
<td>174.3 ± 43.3</td>
<td>166.6 ± 40.9</td>
<td>7.7</td>
<td>4.41</td>
</tr>
<tr>
<td></td>
<td>Re-Screen</td>
<td>182.2 ± 42.6</td>
<td>174.9 ± 39.7</td>
<td>7.3</td>
<td>4.00</td>
</tr>
</tbody>
</table>

No significant change was observed in blood pressure and cholesterol p>0.05*  

**Table-II: Exercise evaluation in men and women in screen 111 compared to Base line.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Men Baseline Times mean</th>
<th>Women Times mean</th>
<th>Women Baseline Screen 3 Times mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run/ swim/ exercise/m</td>
<td>76</td>
<td>5.3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>41</td>
<td>2.1</td>
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<tr>
<td>Play hockey, football/m</td>
<td>54</td>
<td>1.2</td>
<td>-</td>
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<tr>
<td></td>
<td>11.7</td>
<td>3.4</td>
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<tr>
<td>Play Games/ ;m</td>
<td>51</td>
<td>0.21</td>
<td>-</td>
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<tr>
<td></td>
<td>12.9</td>
<td>0.0</td>
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<tr>
<td>Flight of stairs/ d</td>
<td>92</td>
<td>11</td>
<td>-</td>
</tr>
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<td></td>
<td>94</td>
<td>14</td>
<td></td>
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<tr>
<td>Shopping trips/ w</td>
<td>92</td>
<td>5.2</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>87</td>
<td>4.4</td>
<td></td>
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</tbody>
</table>

Abbreviations m = monthly, d = daily, w = weekly*
fats in genesis of heart disease was high (fig-1) and significant decrease in current smokers in intervention group (fig-2) and some reduction of serum cholesterol. The BMI increased and resulted in higher prevalence of hypertension in women (fig-3). Serum cholesterol showed decrease, which was not significant (table-I). The physical activities at the end of 5 years of study did not improve but by enlarge population in both groups remained sedentary the main activities were walking stairs and weekly trips for shopping (table-II). Compared to base line, the heart attack or stroke did not change, the overall hypertension prevalence remained same as at baseline however in women the rate increased. In spite of sustained efforts a community center in the community could not be established.

**DISCUSSION**

MHS was a landmark study, which demonstrated that the primary intervention can be implemented in a LMCUC with limited education, low middle class economy and without health delivery infrastructure. It showed adherence levels increased to more than half of the participants.

In spite of efforts to establish a community center in the community this could not be accomplished. In communities where health delivery systems are not in place, continued engagement with community is intermittent or absent for long periods. The community centers were Institutes responsible for the community manned by residents and community social workers would serve educating the community and provide primary care. Constant engagement is essential for developing the will to change. In MHS the will to change was inculcated by explaining the reason of high mortality due to heart attack and stroke was the high prevalence of risk factors such as hypertension obesity and cooking food with Ghee. After multiple meetings with elders and religious leaders, lectures and health camps we were able to access the household cooks. MHS made serious unsuccessful effort to establish a community center which could have been used for sustained intervention and interaction with the community. The community centers run by the community would have been so useful.

The phenomenon of non-adherence has been noted in lower income communities even in the developed countries. MHS showed 60 percent non-adherence, the reason was lack of sustained interaction with the community. In order to solve this problem the studies undertaken in the poor

![Figure-1(A): Knowledge about Heart attack in Adults (≥18 years) in base line control and intervention and screen 111 control and intervention groups. Figure-1(B): Knowledge about Heart attack in Adults (≥18 years) in controls and intervention](image-url)
communities developed coalitions from among the poor communities in the state of Missouri in USA, who were willing to change. These coalitions determined their own priorities of intervention, successful outcome was shown in coalition of the willing compared to controls those who were not willing for interventions thus obviating the risk of non adherence.

The imperative of unplanned urbanization haunts Pakistan so that lower middle class slums surrounded by affluent communities and a unhealthy economic balance between rich employers and household workers provided by urban slums, have created an economic balance

Cultural practices and beliefs have profound influence on the will to change. The MHS showed that fate was attributed to heart and not to what they ate, smoked and physical inactivity. Women culturally are confined to home, a major cause of physical inactivity as MHS has shown. The

![Figure-2(A): Smoking profile in Men at base line (blue) and screen 3 control (red) and intervention (Grey). The smoking rate though decreased in screen 3 intervention group compared to control was not significant, p<0.07. Figure-2(B): Tobacco use in women at base line and screen 3 control and intervention groups.](image-url)

![Figure-3(A): Morbidities in men Base line (blue) and control (red) and intervention group (green) screen111. Hypertension rates were significantly higher in screen 3 intervention and control groups compared to the base line rates p<0.001. Figure-3 (B): Morbidities in women at base line and screen 3 control and intervention, no significant difference was observed in scree3 control and intervention groups as compared to the baseline p = 0.144.](image-url)

Figure-3(B): Morbidities in women at base line and screen 3 control and intervention, no significant difference was observed in screen3 control and intervention groups as compared to the baseline p = 0.144.

people in Pakistan traditionally think that disease management is pills and concept that diseases
can be prevented is not in psyche. Most however do believe as in Unani medicine which teaches that certain foods are cold (thandi) and certain hot that causes disease. One could use such a lexicon to define foods associated with CVD. One needs to find how a conviction that risk factor modification shall prevent heart attack and other CVD can be inculcated within the cultural lexicon.

Poverty did impact MHS and made prevention difficult to achieve. A study was conducted in poor communities of Birmingham Alabama USA, housing state, a low income and targeted physical activities. There was no significant improvement in physical activities and considerable difficulties in obtaining participation.

Japanese and Chinese food is mostly rice based with soya sauce and sea food while Mediterranean food is based on olive oil and herbs, both these cultures had low prevalence of coronary heart disease till recently when wheat and fast food was introduced with significant increase in coronary heart diseases. The food in Pakistan and India is based on saturated fat lentils rice and wheat and high salt content resulting in high prevalence of risk factors and coronary heart disease. The food industry is in infancy, thus open choices determine what people like. Puppet shows dramatizing that diet is responsible for heart attack and stroke and hypertension may affect food choices.

CONCLUSION

MHS was a pivotal study and showed the method of interaction with the community even the households. Its model of interaction with the community is as valid today as when it was applied. The households, elders and religious leaders were interacted with so that diet could be successfully modified. For the sustained risk factor reduction 5-10 year period is required and for significant reduction in mortality and morbidities as long as 20 year period is required (Karelia). In spite of the difficulties, which are a part and parcel of LMVUC in Pakistan, we believe that the prerequisite of sustained effort by the community can be ensured by physical presence in the community. The pivotal role of a permanent establishment of a community center is emphasized where education regarding healthy diet, risk factor modification and lifestyle changes can be taught. The sustained long term interaction with the community would build the will of the community to change.

ACKNOWLEDGEMENT

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CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES


Pacemaker Related Complications

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Abstract
Implanting pacemakers is associated with some complications which are not very common. A 60 years old female got PPM implanted two years ago. She was admitted many times with infection at pocket site. She had no co-morbidities. Antibiotics, drainage of infected material even change of site on same and opposite side of hemithorax did not help. Finally, direct implantation of electrodes to heart surface through small mini sternotomy and placing PPM in rectus sheath worked. Lower ministernotomy proved to be a safe and valuable option for placing PPM, once other options fail.

Keywords: ASD, CRP, Infected pockets, PPM.

Case Report
A 60 years old female 2 years back reported to E/R with dizziness, altered sensorium. She was hypertensive, bradycardiac and diaphoretic. She was admitted to hospital and a Permanent Pacemaker (PPM) was implanted. She was presented with fever, infection, and skin erosion of pocket site and was admitted twice for infection at pocket site. She had no co-morbid. Implantation site was changed to other side of chest after repeated infections. Repeated infections occurred on other side of chest as well. Total four attempts for P.M insertion was done two times on right side and two times on the left side of the chest. Finally, decision of exploration was and PPM was planned to remove due to repeated subcutaneous and sub pectoral infections.

TPM attempted under fluoroscopy through subclavian vein but wires couldn’t be crossed as vein was thrombosed and procedure abandoned. At last, open implantation of PPM was planned deep to abdominal muscles.

Clinically patient was pale and had decreased appetite and was extremely low mood due to multiple attempts for PPM implantation. Psychologist called for psychotherapy/ counseling of the patient. Necessary pre-operative investigations were carried out. In surgery, lower midline mini Sternotomy was carried out and pericardiectomy was performed. PPM leads stitched to RV epicardium and secured. Pocket for pacemaker was created deep to rectus abdominis sheath and PPM was placed. Sternum closed with 2 wires after placing mediastinal drain.

Patient received in I.C.U. with minimum dobutamine support. She was vitally stable and her blood gases and lab investigation was within normal limits (WNL).

On the 1st post op day she was shifted to HDU. She remained well and stable in HDU. Her inotropic support was tapered off. She was encouraged for oral intake and physical activity. Her family interaction was increased. Her incision site was healthy and her condition was improving and she was shifted to ward on 4th post op day.

She remained there for 3 days and was observed for infection. She was discharged from hospital on 7th POD.

After two weeks she came for follow up in OPD. Her surgery site was healed and PPM was working properly. And she was in better health.

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DISCUSSION

Pacemaker complications associated with the implantation procedure are not uncommon. Pacemaker complications can be divided into acute (immediate) or chronic according to implantation time (or date); lead or pocket complications according to the site of complication; and implantation or system failures. The frequency of complications varies between 10% and 59% for the procedures.

Skin erosion is caused by the underlying pacemaker generator has been reported several times as a complication of pacemaker implants (Kiviniemi et al., 1999)\(^1\). This is the most common late complication of pacemaker implantation and its incidence has been estimated around 0.8% (Harcombe et al., 1998)\(^2\). Factors predisposing skin erosion are the tissue fragility in old-age patients, the presence of a thin subcutaneous fat layer and abrasive action exerted on the skin from external agents. Other common causes of skin erosion are possible infections of the site and if pacemaker erosion is not caused by infection it can be successfully managed by ipsilateral re-implantation, i.e., revision and this is a financially advantageous solution\(^3\). If true erosion occurs, the system is considered contaminated and current opinion favors removal of the generator and leads to the clean site (Shapiro et al., 2004; Giuseppe et al., 2009)\(^3,4\). It is crucial to identify early signs of erosion before the hardware breaks the skin. If the skin is intact, surgical revision of the pocket is often all that is needed to protect the hardware from contamination and infections\(^5\). Very rarely, all above options fail, as in our case. This can be dealt with the help of minimal invasive surgery. Ministernotomy is very safe and viable option with excellent results.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

A CASE OF UNUSUAL SYSTEMIC AND PULMONARY VENOUS DRAINAGE

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ABSTRACT

Variation in systemic and pulmonary vein anomalies anatomic pattern and clinical presentation can present a diagnostic dilemma which can have significant implications on its course and outcome. This highlights the significance of its early recognition and accurate diagnosis with the help of various imaging modalities including transcatheter angiography for planning timely referral and appropriate intervention. We present a unique case of both systemic and pulmonary venous anomaly in a single patient.

INTRODUCTION

Systemic venous anomalies have a wide spectrum from asymptomatic anatomic variation to complex abnormalities leading to cyanosis or complicating surgical repair of congenital heart disease (CHD). Clinically significant abnormalities of systemic veins are rare in situs solitus or inversus (non isomorphic) but exceed 90% in situs ambiguous (isomorphic). Total anomalous pulmonary venous drainage (TAPVR) is a rare condition and makes 1-2% of all congenital heart lesions. TAPVR association with lesion like common AV canal, conotruncal anomalies, and systemic venous anomalies, mitral and pulmonary atresia characterize its association with heterotaxy patients. To our knowledge no case of both systemic and pulmonary veins anomalies to this extent in single patient so far been reported.

CASE REPORT

We present a case of one year old boy who was referred from a peripheral hospital for cardiac assessment to rule out CHD because of h/o increase work of breathing since birth and intermittent cyanosis specially on crying. Child also had h/o recurrent respiratory tract infections since birth although born full term with weight within normal centiles had so far shown poor weight. On examination he was weighing <2SD for age and sex, saturating 88% in air, well perfused, but tachypneic with mild S/C recession, had clear chest, 2/6 systolic murmur at LSE and no hepatomegaly.

Echocardiogram revealed situs ambiguous, levocardia, interrupted inferior vena cava (IVC), dilated coronary sinus with left superior vena cava (LSVC), all pulmonary veins draining via an ascending vein to right superior vena cava (RSVC), dilated RA + RV and Rt to Lt shunting across unrestricted ASD.

Cardiac angiogram was planned to delineate the extent of pulmonary and systemic venous anomalies which confirmed drainage of all four pulmonary veins in a common confluence and then draining in RSVC via ascending vein on left side in RSVC.

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side (fig-1), it showed bilateral infra-hepatic IVC (fig-2). Lt sided IVC was found draining in hepatic sinusoids on Rt side and ultimately draining in right atrium (RA) via hepatic veins, Rt sided IVC was draining in RSVC via Ayzgous continuation (fig-3). LSVc was draining in coronary sinus coming in RA (fig-3).

**DISCUSSION**

Combination of pulmonary and systemic venous anomalies in heterotaxic or isomeric patient is not an uncommon feature but presence of full blown pulmonary and systemic venous anomalies in a single patient is extremely rare. Although interrupted IVC is characteristic of LAI and bilateral Superior vena cava (SVC) along with partial anomalous venous drainage (PAPVR) is common in these patients, incidence of TAPVR is rare. In contrast our patient has both. Incidence of LSVC in two large autopsy series was approximately 0.3%6,7. Persistent LSVc to coronary sinus result in normal return of systemic venous blood to RA but this anomaly may have significant clinical implications for patients with associated cardiac malformation1. In one series incidence of interrupted SVC was 86% in patients of visceral heterotaxy2. Interrupted IVC with azgyous continuation usually does not result in physiologic abnormality and clinical manifestation but can complicate cardiac catheterization, interventional procedures like radiofrequency catheter ablation and surgical procedures like bidirectional Glenn operation (BDG) and Fontan. Bilateral nature of four of five venous systems that contribute to formation of IVC can explain the presence of bilateral IVC in supra and infra hepatic region. Bilateral infra hepatic IVC in isolation can occur in association with either normal or abnormal visceral situs without any hemodynamic disturbance as reported by several before8. Although existence of unpaired segment of IVC (hepatic segment) does not permit the formation of truly complete bilateral IVC but in presence of absent ductus venous it is possible to have two venous channels mimicking bilateral IVC8.

**CONCLUSION**

Presence of all pulmonary and systemic venous anomalies is a rare combination even in heterotaxic patient and can lead to significant clinical morbidity. Early and accurate diagnosis can help in careful surgical planning timely to reduce morbidity and mortality in these complex patients.

**CONFLICT OF INTEREST**

This study has no conflict of interest to declare by any author.

**REFERENCES**

TRIPLE VESSEL CORONARY ARTERY DISEASE WITH VENTRICULAR SEPTAL RUPTURE

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INTRODUCTION

Ventricular septal rupture (VSR) is a rare but devastating complication after acute myocardial infarction that generally produces progressive circulatory failure and rapid deterioration. The differential diagnosis of postinfarction cardiogenic shock should exclude free ventricular wall rupture and rupture of the papillary muscles. Prompt diagnosis followed by surgical repair with perioperative circulatory support is often life-saving.

CASE REPORT

A 58 year old man was admitted on 17th Nov 2016 with 5 days history of chest pain. He was smoker, diabetic, hypertensive. ECG was suggestive of left anterior wall myocardial infarction which was late for streptokinase. He was admitted in critical care unit. His 2D Echo showed EF 30%, apical LV akinesia and VSR of 10 mm size with left to right shunt. Angiography showed critical disease of proximal to mid LAD and RCA with moderate disease in left circumflex system. He was optimized on vasodilators, diuretics and anti coagulated with heparin infusion for a weak before surgical intervention. On 30th Nov, patient underwent coronary artery bypass grafting and closure of VSR. Before anaesthesia induction intra aortic balloon pump was inserted for myocardial protection (fig-).

MATERIAL AND METHODS

After sternotomy and pericardectomy hemopericardium found suggestive of leakage of blood subacute free wall rupture near apex which was sealed by it and apical clot was still present in cavity. Left long saphenous vein harvested for grafting. After aortic and bicaval cannulation cardiopulmonary bypass was established. Myocardial protection by cold antegrade cardioplegia for Grafting (SVG to LAD & PDA of RCA). Left ventricle (infarctectomy) opened lateral to LAD (aneurysm). Multiple VSR from mid to distal septum found (1 moderate sized and 2 small sized) repaired with Gortex patch and Left ventricle closed with 4/0 20 mm prolene plegeted interrupted sutures with bilateral gortex patch. Raw surfaces from the lysis of adhesions were profusely bleeding, pericardial cavity washed with warm saline and cell saver machine was on standby for use in case of uncontrolled bleeding. Haemostasis secured. Drains and pacing wires placed. Chest closed and patient shifted to ICU with circulatory support of nor adrenaline and Adrenaline at 0.2 mcg/ kg/ min. Gradually the supports were tapered off patient was weaned off from IABP and ventilator. Patient had smooth recovery and was discharged after 1 week of his surgery.

DISCUSSION

The septal blood supply comes from branches of the left anterior descending coronary artery, the posterior descending branch of the right coronary artery1. After successful repair, survival and quality of life are excellent, even in
patients older than 70 years. Operative mortality is directly related to the interval between myocardial infarction (MI) and surgical repair. With the use of an early operative approach, most studies show an overall mortality of less than 25%. Sudden death is rare, and intractable heart failure can also occur. Other causes of death include cerebral embolism. Most patients who survive the hospital period have good functional status.

To avoid the high morbidity and mortality associated with this disorder, patients should undergo emergency surgical treatment. Postinfarction VSR is recognized as a surgical emergency. The addition of CABG has helped improve long-term survival. Developments in myocardial protection, improved surgical techniques, better perioperative mechanical and pharmacologic support helped lower mortality.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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TRANSCATHETER STENTING OF SEVERE COARCTATION OF AORTA - TECHNIQUE TO PRESERVE FLOW TO LEFT SUBCLAVIAN ARTERY

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INTRODUCTION

Coarctation of aorta is a common cardiac anomaly with reported incidence of about 4-8% of overall congenital heart defects1,2. Isolated coarctation of aorta has varied clinical presentations depending upon its severity and age of presentation. Neonatal or infantile form is usually most serious and causes congestive cardiac failure & impairment of left ventricular functions and mandates immediate intervention. In adolescent and adults, coarctation presents with systemic hypertension with radio-femoral pulse delay and stenting of coarctation is now accepted modality of treatment even in native coarctation, and def analysis in post-operative recoarctation. One of the challenges in coarctation stenting, particularly in covered stents, is to preserve flow to left subclavian artery as its usually originates very close to coarctation segment. We are reporting a case of young boy who underwent stenting of severe coarctation with a maneuver to keep left Subclavian artery flow unobstructed.

CASE REPORT

A 13-year-old boy presented first time to us with system hypertension. He was normally grown up with presenting complaints of headache and exertional dyspnea. However, there was no history of fits, limb weakness, eye symptoms or renal symptom. His physical examination revealed radio-femoral delay & systemic hypertension with right upper limb blood pressure of 190/110 mmHg and in in lower limb of 90/50 mmHg along with grade 3/6 ejection systolic murmur over left sternal border. His 12 lead ECG showed signs of left ventricular hypertrophy. His 2D transthoracic echo showed marked left ventricular hypertrophy with good systolic function along with severe juxta-ductal coarctation of aorta very close to origin of left Subclavian artery with peak instantaneous gradient of 120 mmHg. Otherwise his aortic valve was trifoliate and there were no atrial or ventricular septal defect or patent ductus arteriosus. He underwent CT Angiography to better delineate the anatomy and CT confirmed the diagnosis of severe coarctation just distal to origin of left Subclavian artery.(as shown in fig-1 and fig-2). Family was counseled about the problem and was advised stenting of coarctation.

On the day of procedure, he was kept nil by mouth for six hours. Under sedation & local anesthesia, right femoral artery was entered with 6F sheath. Coarc segment was crossed with 6F MPA catheter and Aortogram done with pigtail 6F which showed tight coarctation just distal to left Subclavian artery. 39mm covered CP Stent (Numed) mounted on 14mm x40mm VACS-III balloon & upper 40% of stent was manually uncovered to allow flow to left Subclavian artery.

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Stent & balloon assembly passed through 12F cooks Mullins sheath and positioned across the coarctation segment. After confirming optimal position, Stent was deployed with VACS-III balloon at 8 Atm pressure. Post procedural Aortogram showed well dilated coarc segment and preserved flow to left Subclavian artery. Peak to peak pressure gradient reduced from 95 mm Hg to 16 mm Hg.

He made very good recovery after the procedure. He had absence of distal pulse in right lower limb for about four hours and was treated with intravenous heparin infusion as per our institution protocol. He was kept in for observation for 48hrs and was discharged on oral Propranolol. At follow up after two weeks his echo showed well placed coarctation stent (as shown in fig-3) with residual PG of 15 mmHg and pulsatile flow abdominal aorta and preserve flow in left Subclavian artery.

**DISCUSSION**

Morgagni first described coarctation in 1770 and its presentation depends upon age, site & severity of narrowing. Juxta ductal coarctation is the common site of narrowing and results in upper limb hypertension and discrepancy in upper & lower limb pulses. One old study documented mean age of death without intervention of 34 years in 465 cases who survived infancy. There is still some controversies recording best therapeutic occupation for coarctation. Modality of treatment depends upon age & mode of presentation as well as center expertise. Treatment options include surgical repair, balloon angioplasty or stenting of coarctation segment. In our institution, surgical repair is reserved for small children and neonates with severe coarctation. In older children (age >8 years & weight >25 Kgs), we usually prefer stenting of COA. Per current guidelines, peak-to-peak gradient ≥20 mmHg across coarctation or when there is significant anatomic evidence of narrowing on imaging with extensive collateral flow are indication of intervention.

Surgical management is usually reserved for native coarctation whereas ballooning is usually reserved for severe neonatal coarctation with impaired LV dysfunctions as a rescue measure. Stenting is first line of treatment for recurrent coarctation and growing role even in native coarctation in adults or grown up children with weight more than 25 Kgs. Bare metal CP stents can be used but carries the risk of dissection of aortic wall and may need immediate placement of covered stent. Two main complications associated with surgery or angioplasties are recurrent coarctation and aneurysm formation. Covered stents are more frequently used to avoid or treat these complications. Use of covered CP stent is defiantly safe but one must be very careful not to obstruct to flow to head and neck vessels. Zhang et al recently reported higher number of complications in group where left subclavian artery was obstructed by covered stent including stoke and claudication of left upper limb. In our case, coarctation segment was very close to origin of left subclavian artery and to achieve best optimal result, stent had to be deployed proximal to left subclavian artery to across the Coarctation segment to descending aorta. As we were using covered CP stent so the
main challenge was to preserve the flow to left subclavian artery. The only viable option in this case scenario was to partially but very precisely remove the cover of covered CP shunt to allow dilatation of coarctation segment in covered stent but allow flow to left subclavian artery through the upper uncover part of stent. We achieved the optimal results by uncovering about upper 40% of stent cover. Other studies including Zhang et al have strongly recommended about preserving the flow to left subclavian artery to avoid significant complications. We didn’t fully dilate the stent to prevent vessel wall damage and we plan to re-dilate the stent within one year to full adult size. This case reports highlight the importance to innovation in interventional cardiology to achieve optimum results.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

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It is policy of the Pakistan Armed Forces Medical Journal (PAFMJ) to publish articles pertaining to different fields of medical sciences providing sufficient contribution to medical knowledge. The journal is presently being published bimonthly. The articles may include new experimental methods of medical importance; new results obtained experimentally; new interpretation of existing results or data pertaining to clinical problems; or epidemiological work giving substantial scientific information pertaining to medical sciences.

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When reporting experiments on human subjects, authors should indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on
human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. If doubt exists whether the research was conducted in accordance with the Helsinki Declaration, the authors must explain the rationale for their approach, and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study. When reporting experiments on animals, authors should be asked to indicate whether the institutional and national guide for the care and use of laboratory animals was followed.

In case of any study involving clinical trial, taking of informed consent of patients is mandatory. Whenever editorial committee of PAFMJ feels necessary, the research paper will be referred to the ethical committee of the center for Research in Experimental and Applied Medicine (CREAM) based at Army Medical College, for its evaluation and approval.

**EDITORIAL OFFICE**

The editorial office has been established at Army Medical College, Rawalpindi, Pakistan.

**EDITORIAL ADVISORY BOARD**

The editorial advisory board will be as per following appointments.

- Surgeon General/DGMS (IS), Pak Army, Chairman
- Chief Editor PAFMJ/Principal, Army Medical College, Member
- Director General Medicine, Member
- Director General Surgery, Member
- Commandant AFPGMI, Rwp, Member
- Deputy Surgeon General/DGMS (IS), Member
- DGMS (Navy), Member
- DGMS (Air), Member

A meeting of editorial advisory board is held as often as required to give approval/decision on matters forwarded by editor pertaining to any change in the existing policy, appointment/deletion of any member of the editorial board and any other point.

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The members of the editorial board are appointed keeping in view their professional competence (advisers) in different fields of medical sciences. The aim is to have members having wide experience in different fields of medical sciences. In addition to senior specialists from Armed Forces, senior professionals from civil sector as well as from foreign countries will be co-opted with approval of the editorial advisory board.

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An editorial committee consisting of chief editor, editor(s), joint editor, assistant editor(s) and the editorial secretaries meet at least once a month to expedite the business of the journal.

The editorial committee follows the guidelines provided by International Committee of medical Journal editors in “Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication” which can be downloaded from http://www.icmje.org/

**PUBLICATION TIMELINES**

Timelines for print and online publications are as under:-

<table>
<thead>
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<th>Issue</th>
<th>Month</th>
<th>Date</th>
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<tr>
<td>1</td>
<td>Jan, Feb</td>
<td>28th Feb</td>
</tr>
<tr>
<td>2</td>
<td>Mar, April</td>
<td>30th April</td>
</tr>
<tr>
<td>3</td>
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<td>6</td>
<td>Nov, Dec</td>
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GUIDELINES FOR AUTHORS

Articles and all editorial correspondence should be sent to Editor, PAFMJ C/O Army Medical College, AbidMajeed Road, Rawalpindi.

EDITORIAL

Each editorial is written by one member of the editorial board as solicited by the editor. The editorial is scientific review on one or two of the current topics pertaining to medical sciences (preference is given to subjects pertaining to Army health problems).

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Original Paper

Manuscript must be accompanied by a certificate signed by author and all coauthors that they have seen and approved the final version of the manuscript and they have not submitted the manuscript to any other journal. All manuscript should be typed in double spacing on A-4 paper (8.25” x 11.70” = 21.0 cms x 29.70 cms) white bond paper with one inch (2.5 cms) margin on both sides. The article submitted should not exceed 2500 words (excluding references and abstract) with maximum 18-25 references and 3-5 figures or tables. If prepared on a word processor/computer, a properly protected, CD should be sent with the manuscript. Each manuscript should include:

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2. Structured Abstract:
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   Patients and Methods
   Results
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**Discussion:** This should emphasize present findings & the variations or similarities with other work done in the field by other workers. Detailed data should not be repeated in the discussion again. Emphasize the new and important aspects of the study and the conclusions that follow from them. It must be mentioned whether the hypothesis mentioned in the article is true, false or no conclusions can be derived.

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**Authors contributions:** Authorship credit should be based on: 1) Substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) drafting the article or revising it critically for important intellectual content; and 3) final approval of the version to be published. 4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Authors should meet conditions 1, 2, 3 and 4. (For details of authorship criteria kindly consult ICMJE guidelines)

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**Journals:** Standard journal article. (List all authors when six or less; when seven or more, list only first six and add et al)


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**5. Proof Reading:** Final version of manuscript is sent to corresponding author for proof reading before publication to avoid any mistakes. Corrections should be conveyed clearly & Editor informed by e-mail.

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Reference to GHQ letter no. 3543/242/DMS-5(b)-R3O1S dated 09 Oct 2014, the processing fee of Rs. 1000/- is to be paid at the time of submission of the article through pay order/demand draft/crossed cheque payable in the favour of PAFMJ-AMC OR PAFMJ account. In case of out station cheque please include Rs. 348/- (Rupees three hundred forty eight) as bank charges. It is further
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<thead>
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<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submission charges</td>
<td>Rs 1000.00</td>
</tr>
<tr>
<td>Publication charges</td>
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</tr>
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</tr>
</thead>
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</table>

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<table>
<thead>
<tr>
<th>Fixed Position</th>
<th>Price (Pak Rs)</th>
</tr>
</thead>
<tbody>
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