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EFFECT OF DURATION OF VENTILATION AND UNDERLYING ETIOLOGY ON THE OUTCOME OF PATIENTS RECEIVING VENTILATORY SUPPORT IN CORONARY CARE UNIT

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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 Jan2016 till 31st Dec2016.

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 toventilatory support was used.

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. 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 comorbidities[1,2]. 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 disease[3]. Advances in early coronary intervention are reflected in decreasing rates of patients admitted with ST elevation myocardial infarction to the coronary care unit[2]. However, there is an increase in the prevalence of non-cardiac critical illness, such as respiratory failure, sepsis, and acute kidney injury[4]. 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 stays[5]. A deep understanding of respiratory physiology and the interactions between the cardiovascular and respiratory systems is essential for managing

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patients requiring ventilation in the coronary care unit[1,6].Congestive cardiac failure, pulmonary edema and severe cardiogenic shock are common indications for ventilatory support in the coronary care unit[3,7].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[8].Discontinuation of mechanical ventilation should be considered as soon as the cardiac pathology that prompted the initiation of respiratory support, is stabilized[6].

Table-I: Showing descriptive statistics of the patients.

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

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

Variables	Outcome		*p*-value
Underlying Etiology	**Death**	**Survived**	
Acute Left Ventricular Failure due to Myocardial Infarction	35(29.7%)	24(20.3%)	< 0.01
Pulmonary Edema due to Mitral Stenosis / Mitral Regurgitation	7(5.9%)	8(6.8%)	0.27
Respiratory Disorders (COPD, Pneumonia)	2(1.7%)	6(5.1%)	0.04
Arrhythmias (Recurrent VT / VF, Fast AF)	12(10.2%)	8(6.8%)	0.46
Dilated Cardiomyopathy with acute Decompensation	11(9.3%)	5(4.2%)	0.03
Ventilation time in days			
< 3 days	33(28.0%)	36(30.5%)	0.02
≥ 3 days	34(28.8%)	15(12.7%)	

Most patients undergoing mechanical ventilation in coronary care unit can be quickly removed provided the condition responsible for establishing the ventilation has been treatedor stabilized[9]. The unnecessary prolongation of this process can result in increased hospital costs and complications associated with it[10]. 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[11]. 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[8]. 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[12]. The weaning process can significantly stress the cardiovascular system and cardiac failure is a common cause of failure to wean[13]. The identification of patients more likely for failure to wean and prompt preemptive intervention is crucial for successful weaning and avoiding complications related to prolonged mechanical ventilation[1,14].

Outcome of the patients on ventilatory support is multi-factorial in origin. The outcome of cardiac patients receivingventilation 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

Acomparative cross-sectional study was conducted atCoronary 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 usingconsecutivesampling. Data collection tool having different demographic and clinical variables related with ventilatorysupport 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

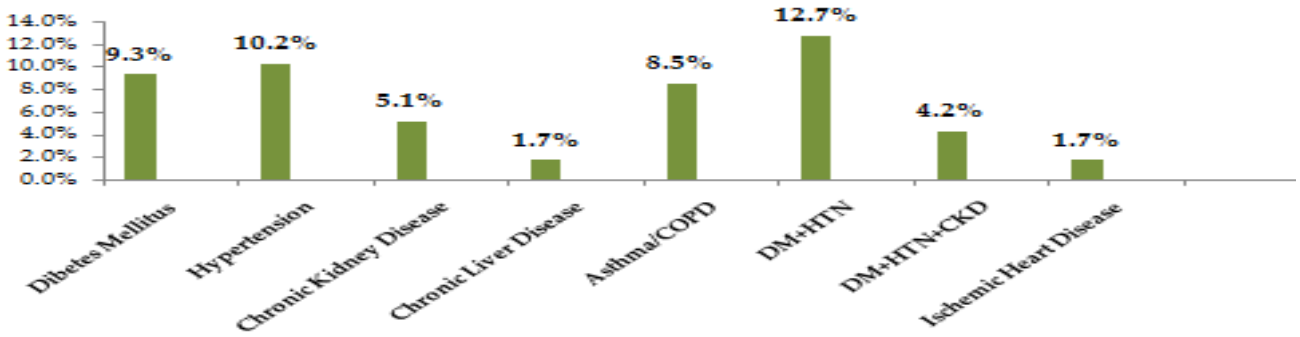

Figure: Showing co-morbid diseases of patients.

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. Co-morbid 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 outcomeexhibited 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[5].Recent studies showed that almost one third to one half of patients admitted to these units require mechanical ventilation at some point during hospitalization[11,14]. 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[13] 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 litrature[5,8,10].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 patientswith 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 etal[11] 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[6,12,15].

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-morbids, control of infection and use of standardized weaning protocol can improve the survival of the patients.

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CONFLICT OF INTEREST

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

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