Open Access

Original Article

Pak Armed Forces Med J 2017; 67 (Suppl-2): S190-93

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

Hajira Akbar, Maadullah, Nadeem Sadiq, Amjad Mehmood, Kaleem Ahmad, Mehboob Sultan

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 hameodynamically beneficial interventional therapy in patients of total correction for Tetralogy of Fallot.

Keywords: Cooks free coils, MAPCA s, Total correction.

INTRODUCTION

Tetrallogy of Fallot is the most common cyanotic congenital cardiac defect. It is characterized by large malalligned 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[1]. There are certain anatomical associations with tetra logy of Fallot. Additional midmusculer VSD, anomalies of coronary arteries, PAPVR (Partial anomalous pulmonary venous return) and major aortopulmonary collateral arteries (MAPCAs)[2]. 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[3]. MAPCAs are anatomically complex arteries and follow a tortuous course. Once established, they result in postoperative pulmonary edema after tetra logy repair. It leads to prolonged ICU stay, prolonged ventilation, post operative bleeding and poor patient outcome[4].

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[2]. 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

Correspondence: Dr Hajira Akbar, Armed Forces Institute of Cardiology / NIHD, Rawalpindi, Pakistan

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[6].

MATREIAL 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 coiling 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 utlized. 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).

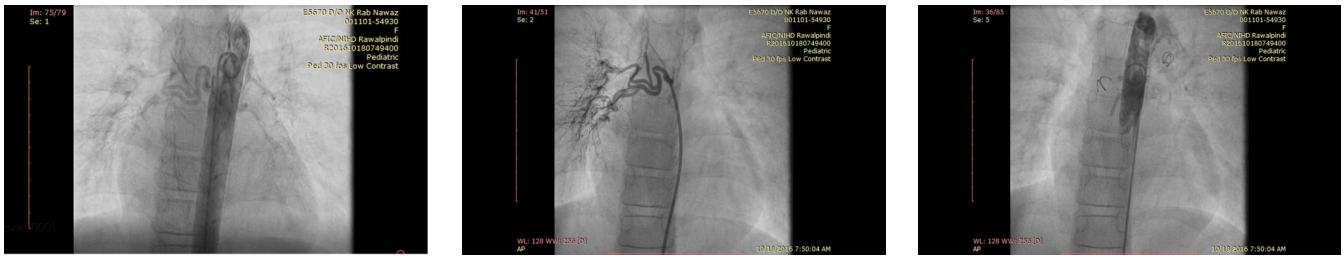

Figure-1: Showing pre-op images.

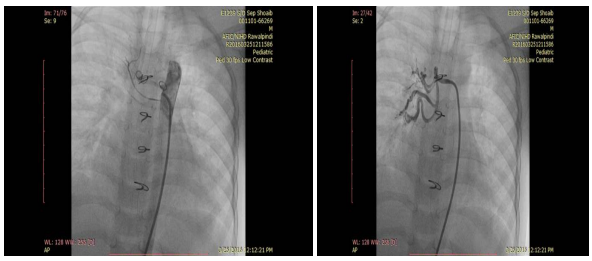

Figure-2: Showing post-op images.

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[7]. The mayrid of shunts that includes residual VSD,

residual MAPCAs, residual PDA, ASD have been closed 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 Atresia with VSD, after Fontan surgery and D-TGA[4]. The utilization of free coils has been reported in many collateral vessels and BT shunt in cyanotic heart diseases[8] which result in residual hemodynamic overload.

As reported by Zhang Z et al in 20107 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 times14 after total correction. According to Jean-Fracios[9,10]. transcatheter 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[1] the primary focus of coil embolization was established for treatment of pulmonary atrioVentricular malformations. Pulmonary AV malformations being the major group of diseases causing extrcardiac 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[4]. Post operative residual MAPCAs have resulted in congestive cardiac failure after total correction[11,12].

The study conducted by Grifika et al in 2008[3] 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[13 14].

MAPCAs can also be ligated during cardiac surgery but it takes longer time, results in blood loss and at times these vessels cannot be visualized in operating table. If the total correction is carried out in less than 2 year of age, significant MAPCAs do not develop and the need to embolize these vessels does not arise. According to Parag et al[10], large arotopulmonary collateral (APC) can be closed through transvenous route as well when transtarterial route is challenging.

Table: Demographics and basic clinical characteristics.

	Age (years)	Height (cm)	Weight (kg)	Flouroscopy 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

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

1. Kajiwara K1, Urashima M2.Venous sac embolization of pulmonary arteriovenous malformation: safety and effectiveness at midterm follow up. Acta Radiol 2014; 55(9): 1093-8.
2. Cil BE1, Erdogan C, Akmangit I, Cekirge S. Use of the TriSpan coil to facilitate the transcatheter occlusion of pulmonary arteriovenous malformation. Cardiovascular Intervent Radiol 2004; 27(6): 655-8.
3. Grifka RG1, Fenrich AL, Tapio JB. Transcatheter closure of patent ductus arteriosus and aorto-pulmonary vessels using non-ferromagnetic Inconel MReye embolization coils. Catheter Cardiovasc Interv 2008; 72(5): 691-5.
4. Liava'a M1, Brizard CP, Konstantinov IE, Robertson T. Pulmonary atresia, ventricular septal defect, and major aortopulmonary collaterals: neonatal pulmonary artery rehabilitation without unifocalization. Ann Thorac Surg 2012; 93(1): 185-91.
5. Ugo Vairo, Luigi Ballerini, Duccio di Carlo. Coil embolization of aortopulmonary collateral arteries as an emergency in infants and children: J AM Coll Cardiol 1989; 13(1): 100-8:
6. Perry B, Radtake W, fellows KE, Keane JE, Lock JE. Coil embolization to occlude aortopulmonary collateral vessels and shunts in patients with congenital heart disease. JACCR 1989; 13(1): 100-08.
7. Xin Z, Guan X, Za B, Zhang Z, Xie ZW. Interventional catheterization management for patients with postoperative residual cardiovascular malformations 2010; 38(4): 326-9.
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).
9. Piéchaud JF. Closing down: transcatheter closure of intracardiac defects and vessel embolisation. Heart 2004; 90(12): 1505-10.
10. Parag W, Barwad, Gulati GS. Transvenous closure of large aortopulmonary collateral. Ann Pediatr Cardiol 2014; 7(1): 34–36.
11. Tang L1, Zhou SH. Transcatheter occlusion of multiple aortopulmonary collateral arteries for post-operative heart failure in a patient with tetralogy of Fallot using the Amplatzer vascular plug and a detachable coil. Chin Med J (Engl) 2011; 124(6): 951-3.
12. Inamura S1, Sakurai Y, Kawada S. Improvement of heart failure after intracardiac operation for tetralogy of Fallot by transcatheter embolization of major aortopulmonary collateral arteries]. Kyobu Geka 1990; 43(3): 219-21.
13. Liu YL1, Shen XD, Li SJ, Wan X, Yan J. An integral approach for cyanotic congenital heart disease with major aortopulmonary collateral arteries. Zhonghua Yi Xue Za Zhi 2006; 86(4): 228-31.
14. Li S1, Zhang Y1, Li S2, Wang X1, Zhang R1. Risk Factors Associated with Prolonged Mechanical Ventilation after Corrective Surgery for Tetralogy of Fallot. Congenit Heart Dis 2015; 10(3): 254-62.