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Management of Tetralogy of Fallot with Major Aortopulmonary Collateral Arteries: Presurgical Endovascular Coil Embolization Experience

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Abstract

Tetralogy of Fallot with major aortopulmonary collateral arteries is a complex and heterogenous condition varying degrees of severity, while MAPCA present in 20-25% with TOF and pulmonary atresia. Our institutional approach to this lesion emphasizes presurgical endovascular multiple coil embolization ofsignificant bilateral MAPCAs along with complete intracardiac repair in the same sitting. The presurgical endovascular coil embolization of all MAPCAs of more than 3mm and complete intracardiac repairwere done in the same sitting. The multiple Boston scientific pushable cols of diameters ranging. The presence of MAPCAs is a major determining factor in the prognosis and management of TOF The role of the cardiac radiologist is not only in reporting critical components regarding collateral arteries and underlying cardiac structural disease but also in the management of TOF with MAPCAs along with cardiac surgeons.

Keywords: Aortopulmonary collateral; Coil; Endovascular; Tetralogy of fallot.

INTRODUCTION

Tetralogy of Failat (TOF) with major aortopulmonary collateral arteries (MAPCAs) is a complex and hetergenous condition varying degrees of severity, while MAPCA present in 20-25% with TOF and pulmonary atresia. Our institutional approach to this lesion emphasizes presing endovascular multiple coll embolization of significant bilateral MAPCAs along with complete intracardiac repair in the same sitting.

Embryologic formation: Flowchart depicts the normal pulmonary vasculature development with regression of the segmental arteries as the pulmonary artery develops from the sixth branchial arch. PA pulmonary artery, PDA patent ductusarteriesus, RV right ventricle.[1,2] (Fig. 1 & 2)

MATERIAL & METHODS

A 14-years-old boy presented with symptoms of Dyspnoea on exertion, bluish discolouration, signs

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of cyanosis, and clubbing with oxygen saturation on room air 85-89%. Echocardiography and cardiac computerized tomography revealed-ventricular septal defect (VSD) of 18mm in size, overriding of the aorta, severe right ventricular outlet obstruction, multiple MAPCAs of 4-6 mm in sim, Diameters of main, right and left pulmonary arteries à 11mm, 8mm and 7.6 mm respectively, right and left coronaries to appear normal. (Fig. 3 & 4) The presurgical endovascular coil embolization of all MAPCAs of more than 3mm and complete intracardiac repair were done in the same sitting. The multiple Boston scientific pushable cols of diameters ranging from 2-6 mm were used through a trans femoral route under digital subtraction angiography. (Fig. 5 & 6) The complete intracardiac repair includes Dacron patch under moderate hypothermic cardiopulmonary bypass with cold blood cardioplegic arrest with topical cooling.

RESULTS

The cross-clamp and cardiopulmonary bypass times were 126 minutes and 178 minutes respectively. without any intracardiac blood flooding and complication. The patient was extubated within 6 hours of surgery and ICU stays were 6 days. At follow-up RVOT was found to be of good caliber with mild pulmonary valvular stenosis, no residual VSD, good LV systolic function and patient is on diuretics and beta blockers.

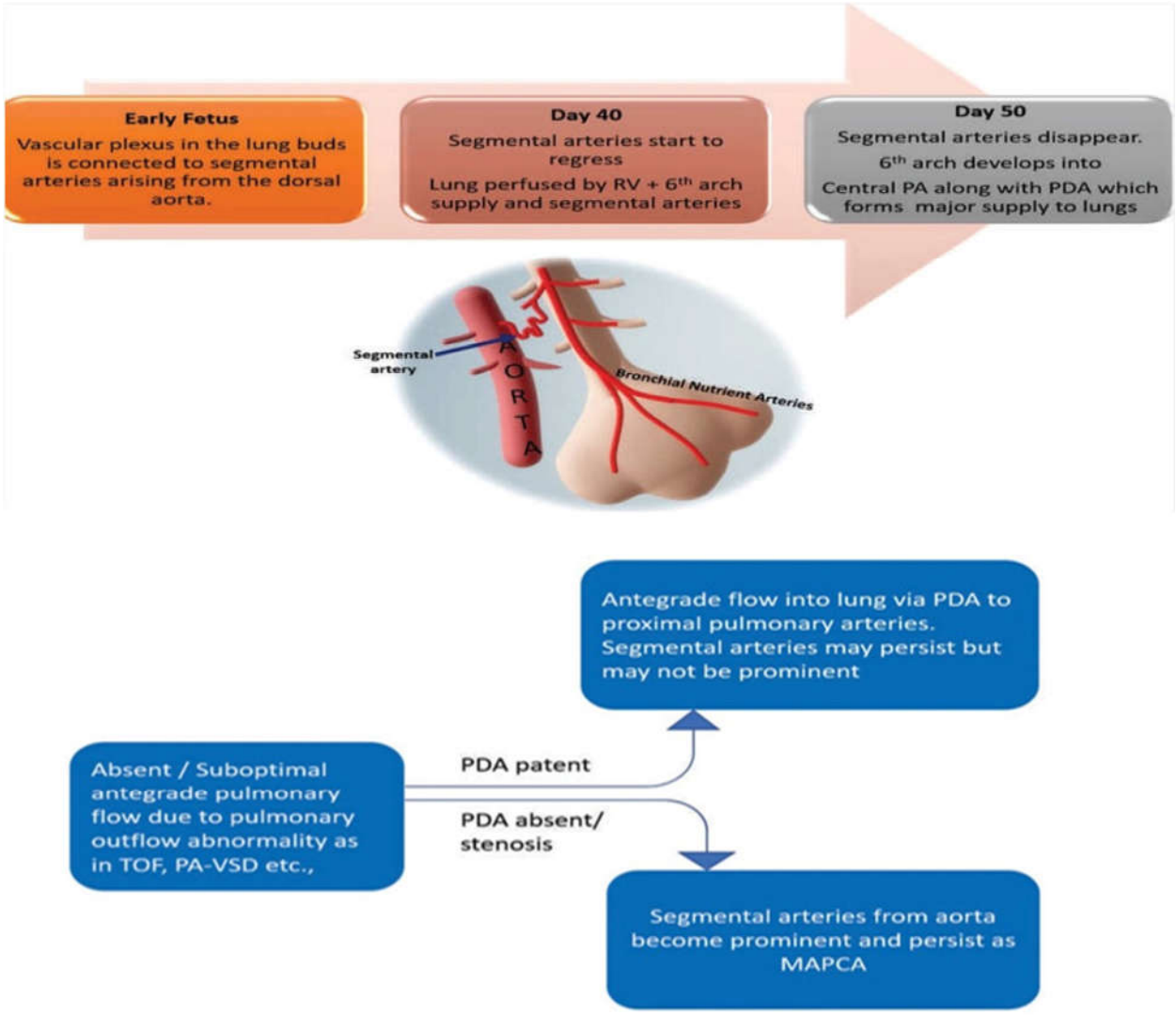

Fig. 1: Flowchart shows the development of collateral vessels with regard to the formation of ductus arteriosus. MAPCAS = Major Aortopulmonary Collateral Arteries, PA-VSD = Pulmonary Atresia with Ventricular Septal Defect, PDA = Patent Ductusarteriosus, TOF = Tetralogy of Fallot.

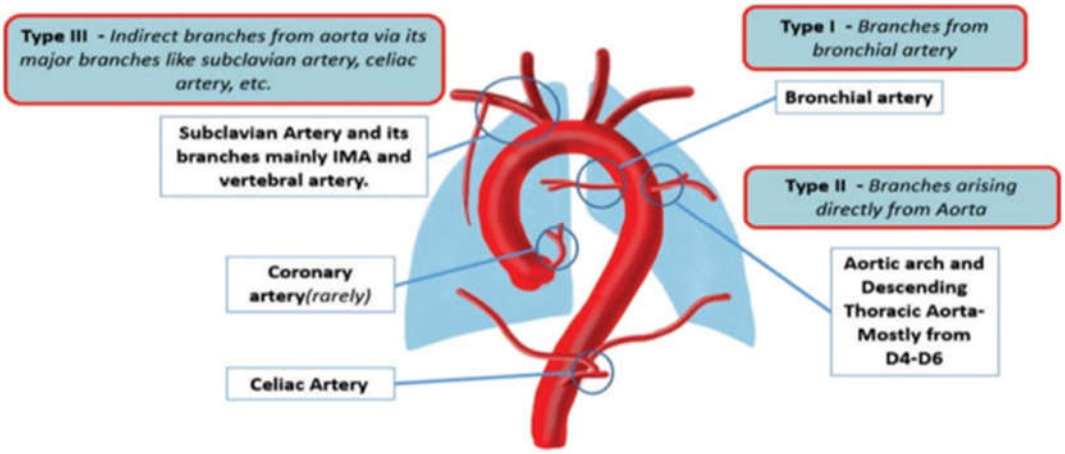

Fig. 2: Diagram representing the common sites of major aortopulmonary collateral arteries origin and classification. D4-D6 = Dorsal Vertebrae 4 to 6, IMA = Internal Mammary Artery.

Fig. 3: CT image shows dilated MAPCAs

DISCUSSION

With the development of medical technology and computed tomography imaging technology, cardiac surgeon gradually has advanced understanding about the MAPCAS, and their treatment has become an important part of intracardiac correction of TOF.[3,4] The disadvantages of ligation of MAPCAs are surgical field s relatively fixed, creates big wounds, easily damages surrounding tissue, and consumes time. Transcatheter occlusion, which preferably solves the disadvantages of ligating, is becoming a common method for treating collaterals in recent years.[5] The occlusion can be performed before, during, or after operation. Most research on the management of MAPCAS before surgical correction of TOF; however, occlusion of MAPCAs before surgical correction could lead to a further decrease in arterial oxygen saturation, and the patient needed surgical correction immediately after transcatheter closure of MAPCAS.

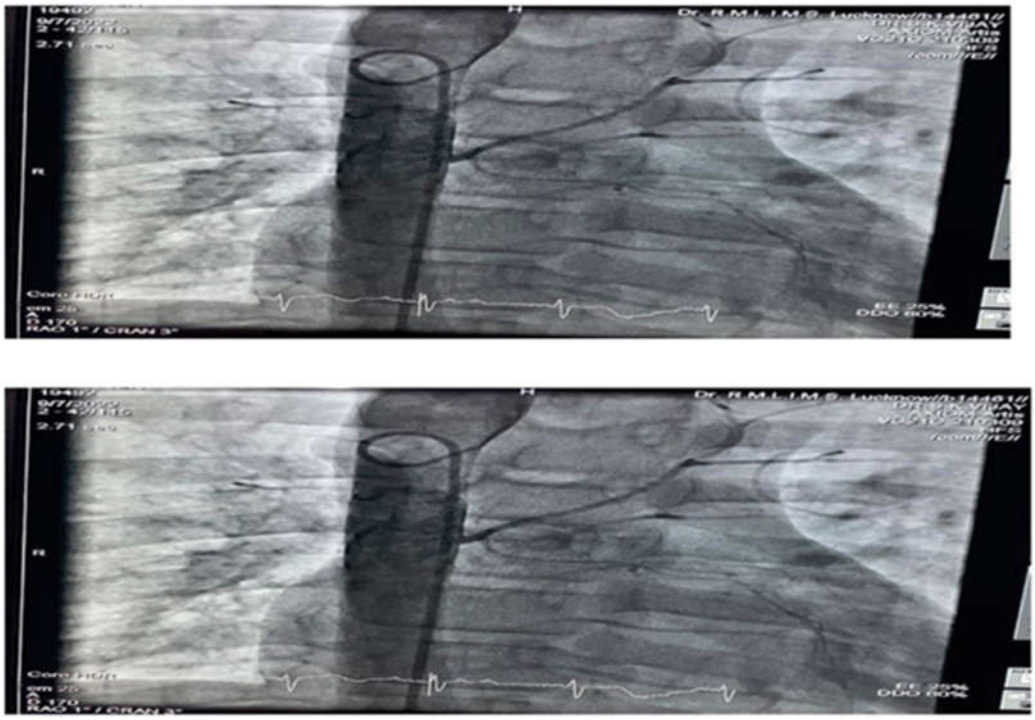

Fig. 4: Descending thoracic aortic angiography image shows the MAPCAS.

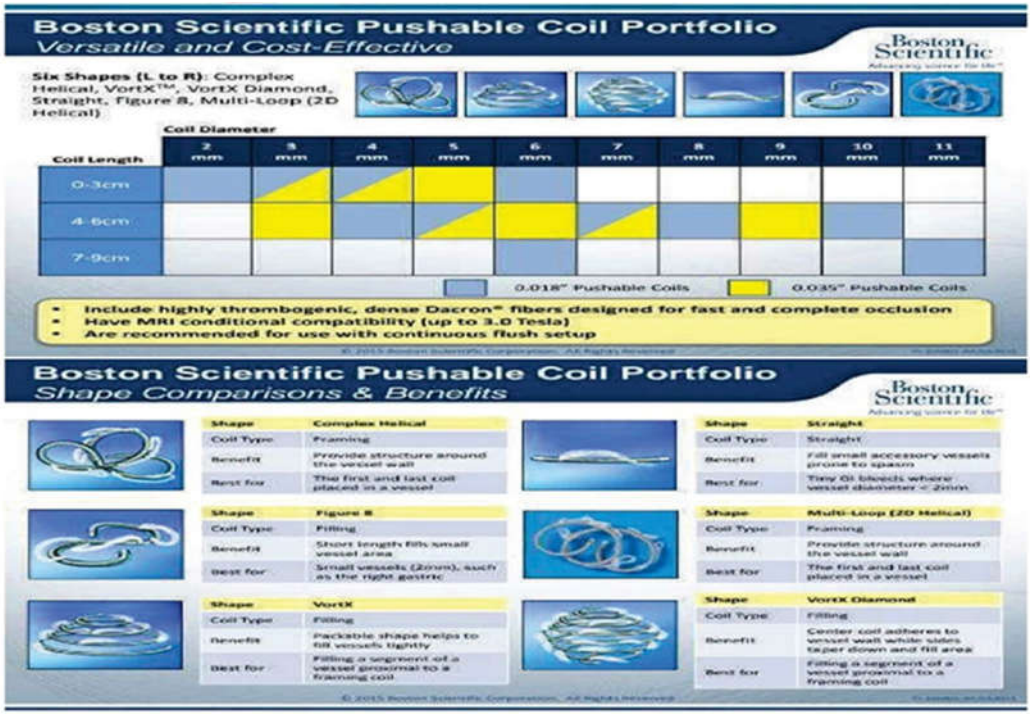

Fig. 5: Boston coils of different shapes and sizes (***Source:*** https://www.bostonscientific.com/content/dam/bostonscientific/pi/product-catalog/2023-EMEA-PI-Product-Catalogue-Eluvia-Ranger-Update%282%29.pdf)

CONCLUSION

The presence of MAPCAs is a major determining factor in the prognosis and management of TOF The role of the cardiac radiologist is not only in reporting critical components regarding collateral arteries and underlying cardiac structural disease but also in the management of TOF with MAPCAs along with cardiac surgeons.

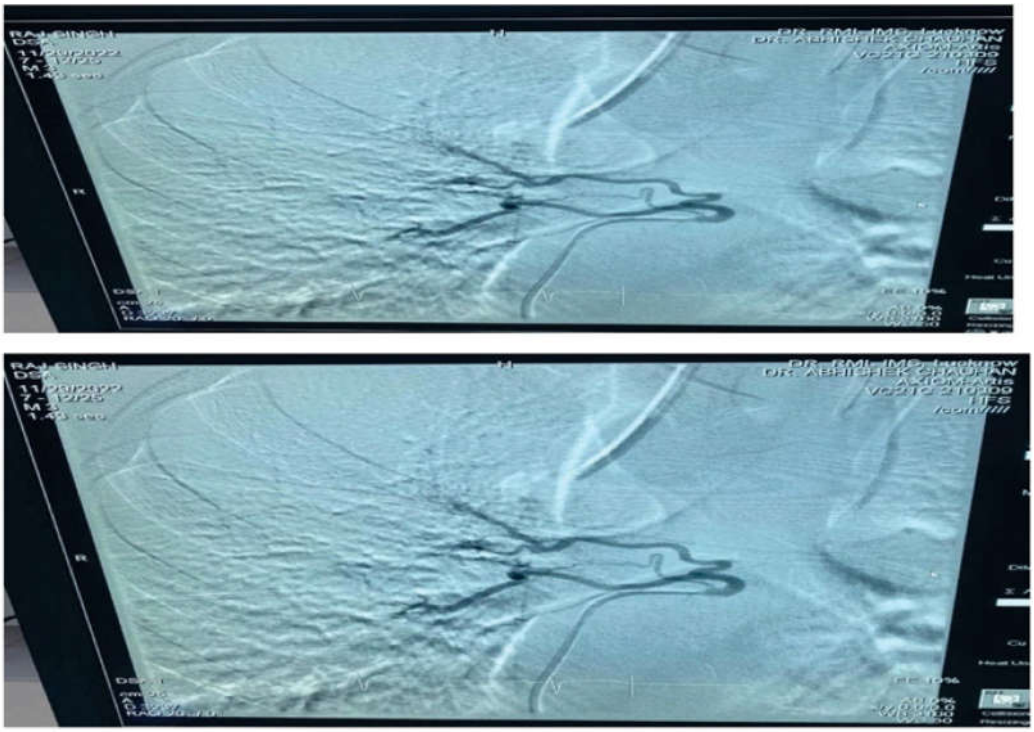

Fig. 6: Coils in aortopulmonary Collaterals

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