

An interarterial course of the left coronary artery: Pulmonary artery translocation procedure

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Received: June 15, 2020 Accepted: September 14, 2020 Published online: November 06, 2020

ABSTRACT

Congenital anomalies of the coronary arteries are rare congenital cardiac pathologies, representing 0.3 to 1.6% of congenital cardiac anomalies and are often associated with the cause of sudden death in the young individuals. Coronary artery anomalies consist of a wide range of abnormalities, including anomalous origin, anomalous course or both. In this report, we present a pediatric case of anomalous origin of the left main coronary artery from the right cusp with an interarterial course between the aorta and pulmonary artery.

Keywords: Coronary vessel anomalies, operative, sudden cardiac arrest, surgical procedures.

Congenital coronary artery anomalies are rarely seen. They can be divided into subgroups based on anomalous origin, course, size, and numbers.^[1] The term of the course of anomalous coronary artery refers to the fact that the coronary artery originates from another coronary sinus and runs along an alternative course to reach its region. The incidence of interarterial course of the left coronary artery is estimated at about 1.3% of coronary anomalies and is the most feared situation.^[1,2] An aberrant left coronary artery with an interarterial course is a complex and malignant variant of coronary artery anomalies.

In this article, we present a pediatric case with anomalous origin and course of the left coronary artery, in which surgical correction with lateral translocation of the pulmonary trunk to the left pulmonary artery (PA) was performed successfully.

CASE REPORT

A 13-year-old male patient was referred to our department with chest pain. His medical history revealed that the chest pain was exacerbated by exercise and disappeared with rest. On physical examination, the vital signs were normal. Blood tests, electrocardiography, and chest X-ray findings were normal. The left coronary artery was unable to be visualized by transthoracic echocardiography in its

usual location. Therefore, computed tomography (CT) examination was decided. Contrast-enhanced CT revealed that the left main coronary artery (LMCA) originated from the right coronary sinus (Figure 1). The right coronary sinus had only one ostium in the aortic sinus and the LMCA separated from the right coronary artery and was running posteriorly between the aorta and PAs (Figure 2). After the artery reached the posterior via the interarterial course, it divided into the left anterior descending artery and circumflex artery. The right coronary artery was originating from the aorta into the atrioventricular groove as usual. The patient's condition was discussed with pediatric cardiology and surgery was decided as the most optimal treatment option. A written informed consent was obtained from each parent.

During surgery, the mediastinum was approached via median sternotomy. The pericardium was incised and an aorto-bicaval cannulation was performed. Cardiopulmonary bypass was initiated and antegrade blood cardioplegia was infused for diastolic arrest.

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Citation:

Işık O, Mercan İ, Demircan T, Akyüz M. An interarterial course of the left coronary artery: Pulmonary artery translocation procedure. *Cardiovasc Surg Int* 2020;7(3):178-181.

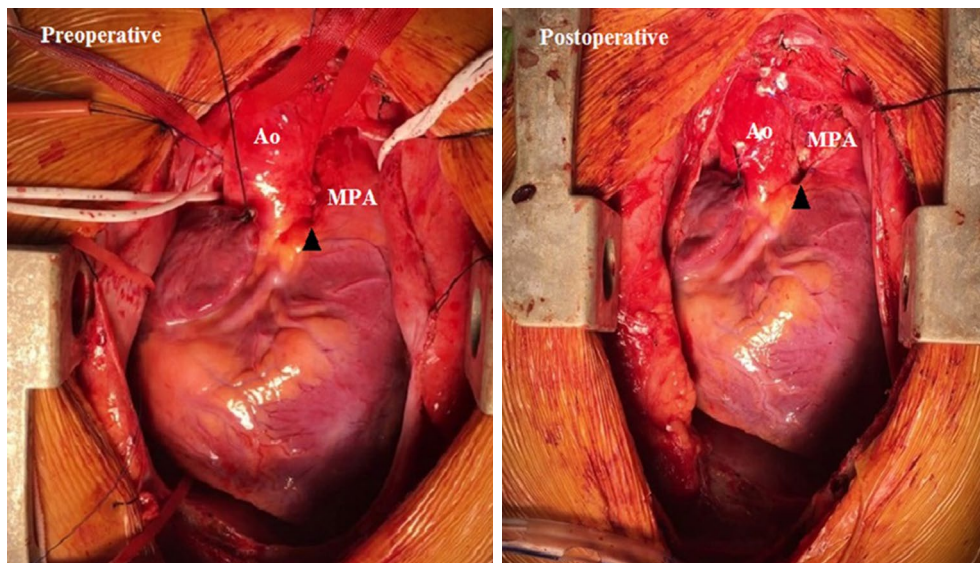


Figure 1. Three-dimensional computed tomography images. An anomalous origin of left main coronary artery arising from right cusp in a malignant configuration and course between aorta and pulmonary trunk.

Ao: Aorta; MPA: Main pulmonary artery.

Following diastolic arrest, the interarterial segment between the aortic root and main PA was dissected

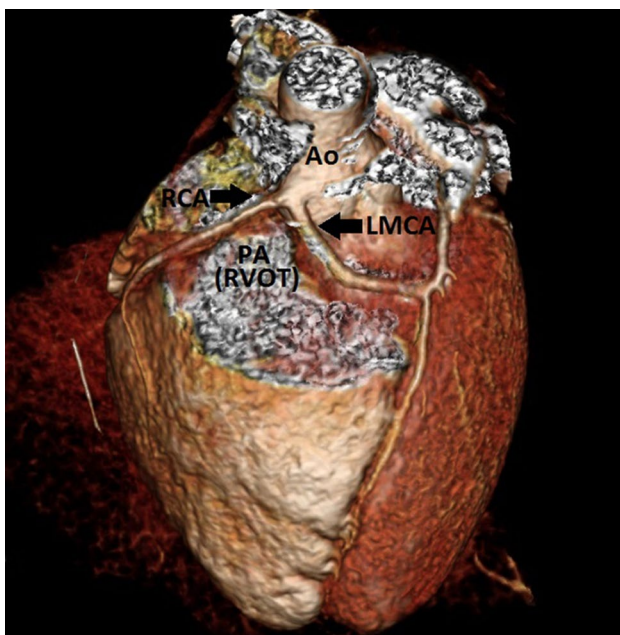


Figure 2. Intraoperative view. Division of main pulmonary artery with reanastomosis to left pulmonary artery. Note the increased distance between pulmonary artery and aorta (black arrows).

Ao: Aorta; LMCA: Left main coronary artery; PA: Pulmonary artery; RVOT: Right ventricular outflow tract; RCA: Right coronary artery.

out carefully to avoid damage to the coronary artery and branches. The main PA was transected prior to pulmonary bifurcation. The gap at the pulmonary confluence was repaired using a pericardial patch. An incision was made on the left PA and the main PA was anastomosed to this incision. Following completion of the anastomosis, the space between aorta and PA increased (Figure 2). The cross-clamp time was 35 min. Total bypass time was 55 min. Following decannulation, the chest was closed in a routine fashion. The patient underwent successful surgical ventricular septal defect closure and reimplantation of the main PA to the left PA. Postoperative echocardiography demonstrated normal flow to the left PA. The patient recovered gradually without any complication. On the fifth postoperative day, he was eventually discharged.

DISCUSSION

Coronary artery anomalies are a rare group of congenital disease with an anomalous origin and course of the native coronary artery.^[3,4] This course may be prepulmonic, subpulmonic, retroaortic, retrocardiac, or interarterial.^[2] All courses with the exception of interarterial are considered benign. An interarterial course can lead to sudden cardiac arrest. Sudden cardiac death due to this anatomical entity is the

leading second cause of mortality in young competitive athletes on the playing field.^[4-6]

The true incidence of this anomaly remains unknown due to the fact sudden cardiac arrest often represents as the initial symptom.^[4] Early presymptomatic diagnosis presents as a serious challenge. This issue is the major drawback of the diagnosis before a cardiac event.^[2] However, the minority of patients may refer to a consultant about non-specific chest pain, syncope, and arrhythmia.

An understanding of the anatomy of the coronary artery is required for optimal imaging. Transthoracic echocardiography is a non-invasive, effective, and first-line diagnostic tool.^[3] However, echocardiography is operator-dependent, and image quality can vary depending on the operator's experience and the patient's acoustic window. On routine echocardiographic exam, certain markers of the anomaly may be present. These include a fail to see the coronary ostium in a routine fashion, unusual coronary ostia, and coronary artery images at unexpected areas. In these cases, further evaluation is needed. Although some cardiologists can diagnose the abnormal coronary pattern, it is not recommended to plan surgery solely based on with this examination.^[3] In case of echocardiographic diagnosis or suspected existence, further evaluation is needed. Computed tomography angiography is the most appropriate imaging study for this indication which is considered as Class 1 indication.^[4]

Surgical indication is in accordance with the most accepted expert consensus on surgical treatment.^[4] The optimal management and surgical decision making for patients with coronary artery anomaly depend on multiple factors such type of coronary artery anomaly, age, and symptoms.^[6] The key factor in the surgical procedure selection is detailed anomalous coronary artery anatomy. The important points on coronary artery anatomy include aortic sinuses and coronary ostia, intramural course, and acute angles.^[5] Patients with LMCA and interarterial course should be treated surgically, even if there are no symptoms.^[4] In our case, the coronary artery anatomy was negative for intramural course and acute angulations.

Although the most optimal surgical approach is still controversial, current surgical options include unroofing procedure, button detachment and reattachment procedure, coronary artery bypass grafting, and PA translocation.^[4-6] Surgical planning should be performed based on the coronary artery

anatomy. In our case, no intramural anatomy was observed and, therefore, the unroofing procedure was unnecessary. Additionally, there was no left main coronary ostium and, thus, the coronary button detachment and reattachment procedure was abandoned. There was another unfavorable option; coronary artery bypass grafting.^[4,6] The reason why the bypass procedure is not favorable is the competitive flow due to anastomosis, iatrogenic injury to non-atherosclerotic, and stenosis-free artery via anastomosis.^[5,6] The last procedure was PA translocation,^[5] as it was thought to be the most appropriate option for our patient depending on his coronary artery anatomy. The PA lateral translocation procedure widens the gap between PA and aorta. Coronary artery compression is relieved via this maneuver. In our case, the surgical team decided performing PA lateral translocation procedure as the most optimal treatment option.

In conclusion, favorable surgical outcomes can be achieved with the appropriate method of surgical treatment of anomalies of the left coronary artery. As in our case, the lateral translocation procedure allows an anatomical reconstruction and is technically feasible as an effective surgical approach for patients with a suitable anatomy.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

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