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*Brief Report*

# Surgical management of postoperative ductal aneurysm: a case report

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**Abstract** We report the case of 24-year-old woman who presented with ductal aneurysm 7 years after a triple ligation of a patent ductus arteriosus. She underwent successful repair through median sternotomy and under moderate hypothermic circulatory arrest and selective cerebral perfusion.

Keywords: Postoperative ductal aneurysm; ligation of patent ductus arteriosus; selective cerebral perfusion; circulatory arrest; axillary artery cannulation

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## Case report

We report the case of 24-year-old woman, with a history of triple ligation of a patent ductus arteriosus 7 years before her admission for worsening dyspnoea and recurrent haemoptysis. A physical examination revealed a continuous systolo-diastolic murmur. A recent chest radiograph showed bilateral diffuse opacities (Fig 1a). Transthoracic echocardiography revealed a re-canalised ductal aneurysm with a restrictive left-to-right shunt (Fig 1b). Thoracic CT scan confirmed ductal aneurysm with partially calcified walls measuring 35 × 25 × 30 mm. The aneurysm was in communication with both the left pulmonary artery and the aorta via a 5 and 8-mm channel, respectively (Fig 1c).

The patient underwent urgent surgery. Femoral and right radial arterial lines were used for invasive blood pressure monitoring. The procedure was achieved through a full median sternotomy. Cannulation of the right axillary artery was achieved by using a 10-mm prosthetic graft, which was sewn to the artery in a terminolateral manner. The left ventricle was vented via the right superior pulmonary vein. The innominate vein, the aorta, as well as the origin of the supra-aortic branches were isolated and taped. During dissection, care was taken to stay away from the ductal aneurysm. At 25°C rectal temperature, the ascending aorta and the supra-aortic branches were cross-clamped, and antegrade, cold cardioplegia was provided; on the other hand, lower body circulatory arrest was initiated, and cerebral perfusion was maintained via the right axillary artery at the rate of 10 ml/kg/min with a mean pressure of 50 mmHg. Retrograde flow from the left carotid artery attested the permeability of the circle of Willis. Thereafter, the left side of the distal aortic arch was opened, and the sac of the aneurysm was entered (Fig 2). The communication between the aorta and the aneurysm was closed with a Dacron patch using 4–0 polypropylene sutures.

Upon completion of the circulatory arrest period, aortic de-airing was performed before full-flow cardiopulmonary bypass. During re-warming, the aortic haemostasis was checked, and the pulmonary artery was opened so as to complete exclusion of the aneurysm by closing its opening at the pulmonary end using another synthetic patch.

Cardiopulmonary bypass and aortic cross-clamping times were 150 and 80 minute, respectively. The circulatory arrest period was 40 minute.

The patient was extubated within the 4th post-operative hour. She experienced no neurological dysfunction. The subsequent course was uneventful. At her 6-month follow-up, she was doing well.

## Discussion

Ductal aneurysms are rare but life-threatening. It may be either spontaneous or acquired, occurring as a complication following surgical closure of a patent

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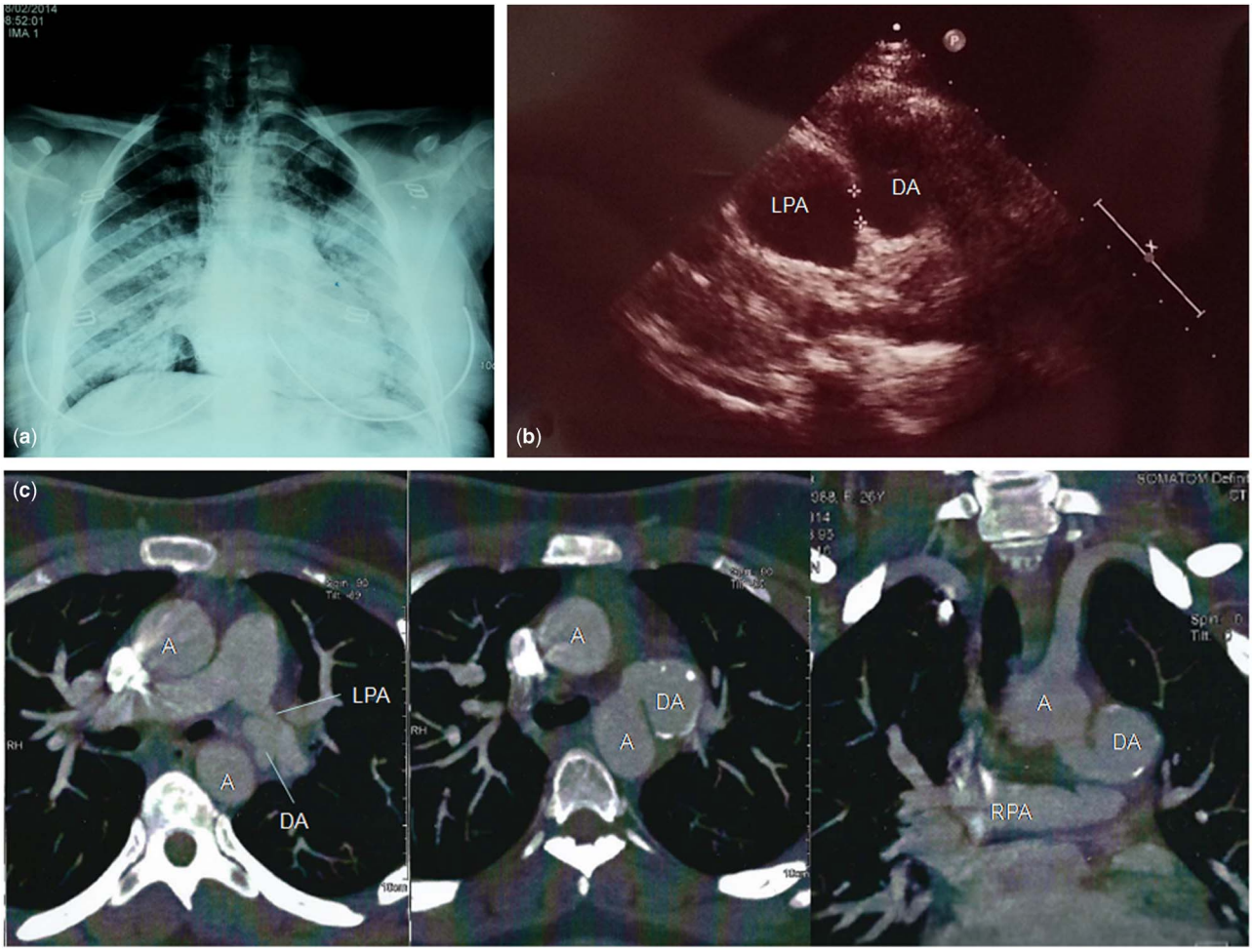


**Figure 1.**
*(**a**) Chest X ray showing bilateral diffuse opacities. (**b**) Supra-sternal view showing the communication between the ductal aneurysm and the left pulmonary artery. (**c**) CT scan slides showing ductal aneurysm with its connection to the aorta and the left pulmonary artery. A = aorta; DA = ductal aneurysm; LPA = left pulmonary artery; RPA = right pulmonary artery.*

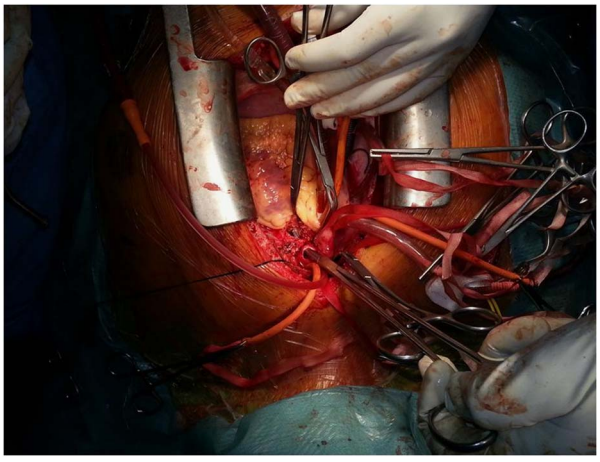

**Figure 2.**
*Operative view showing the re-canalised ductal aneurysm.*

duct arteriosus.[1] Postoperative forms are frequently met after ligation of patent ductus arteriosus in older children and adolescents and are nearly always associated with re-establishment of the shunt.[1–3] It has been suggested that aneurysm formation is mainly due to dilatation of a duct distal to a stenosing, but not completely obliterated, aortic end ligature, or residual diverticulum exposed to systemic pressure when ligature is placed at some distance from the aorta.[1]

Postoperative ductal aneurysm may occur at variable time intervals after the initial surgery varying from a few months to a few years. In our case, ductal aneurysm manifested after 7 years, which is one of the longest reported intervals in non-septic condition.[2]

The natural history of ductal aneurysm is poor. Complications arising from a ductal aneurysm include compression and erosion into adjacent structures, thromboembolism, infection, and free rupture.

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Erosion of these aneurysms may result in fistula formation into the bronchial tree or trachea, resulting in life-threatening haemoptysis.[1] This clinical presentation requires emergent surgical intervention, as was the case in our patient.[4]

Postoperative ductal aneurysms can be approached through left posterolateral thoracotomy either with or without cardiopulmonary bypass.[2–4] Thoracotomy may provide optimal exposure of the diseased part of the aorta with the possibility of its replacement by a prosthetic graft, particularly in adult patients. Such approaches, however, involve a perfect control of the proximal and distal aorta, and obviously an extensive dissection and liberation of all chest adhesions. Therefore, they carry a high risk of spinal cord ischaemia as well as uncontrolled haemorrhage. Indeed, both Varma et al[3] and Valiathan et al[5] reported separately to have attempted this approach in three cases with 100% operative mortality. They recommend the use of median sternotomy as well as deep hypothermic circulatory arrest to treat postoperative ductal aneurysm and to prevent haemorrhagic events. The main drawback of the sternotomy approach is the limited access to the descending aorta and hilum; however, in our case, a more accurate study of the relationship of the ductal aneurysm showed that it involves the concavity of the aortic arch – just beneath the origin of the left subclavian artery – rather than the descending aorta.

Although time is the main limiting factor in deep hypothermic circulatory arrest, we opted for sternotomy, moderate hypothermic circulatory arrest, and selective cerebral perfusion with the aim to exclude ductal aneurysm. Indeed, this technique is currently the prevalent strategy during many aortic arch surgeries. As the brain is the most susceptible organ to ischaemia, selective antegrade cerebral perfusion allows a better cerebral protection and safe prolongation of the duration of circulatory arrest. It also suppresses all the drawbacks of profound hypothermia, such as prolonged cardiopulmonary bypass times and adverse effects in multiple organ systems including endothelial dysfunction, coagulopathy, and renal failure.[6] Even though the supra-aortic branches were isolated, we preferred axillary artery cannulation to obtain optimal exposure of the aortic arch with no cumbersome cannula or additional incisions; moreover, many authors[7] have demonstrated that cannulating a graft sewn to the right axillary artery resulted in a lower incidence of neurological dysfunction in comparison with other sites of arterial cannulation.

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## Conflicts of Interest

None.

## Ethical Standards

The case report was written according to ethical standards.

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