Cardiology in the Young

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Right ventricular dissection after arterial switch operation

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Brief Report

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Abstract

Herein we present the right ventricular dissection and describe its successful management after arterial switch operation in a full-term male neonate. There are no evidence-based recommendations for the management of this rare complication. Our management included veno-arterial extracorporeal membrane oxygenation placement and delayed surgical evacuation of the dissecting haematoma with beneficial outcomes.

Intramyocardial dissecting haematomas are a rare form of myocardial rupture induced by myocardial infarction, trauma, or heart surgery.[1,2] Pathological studies describe intramyocardial haematoma as muscle bundles separated by serpiginous haemorrhagic channels, caused by the rupture of intramyocardial vessels into interstitial space.[3] The mortality rate in patients with intramyocardial haematoma is up to 90%, especially among those with right ventricular dissection.[4]

A large dissecting intramyocardial haematoma as a nightmare complication following arterial switch operation has not been reported so far. There are no evidence-based recommendations for the management of this rare complication in either adult or in the paediatric population.

Hereby we present the right ventricular dissection and describe its successful management after arterial switch operation in a full-term male neonate.

Case report

A full-term, 3.8 kg male neonate, with transposition of the great arteries and intact ventricular septum, underwent elective arterial switch operation at the age of 10 days after performed Rashkind procedure. Intraoperative coronary anatomy was two coronary ostia and posterior looping course corresponding to Yacoub type D.

Following aortic cross-clamp release and spontaneous sinus rhythm restitution, a haematoma on the anterior surface of the right ventricle was noted. After uncomplicated weaning from cardiopulmonary bypass, the initially small subepicardial haematoma progressed in width covering the entire anterior surface of the right ventricle (Fig. 1, Supplementary Video S1). Surgical evacuation of the haematoma was estimated as a high-risk procedure, thus we opted for a conservative approach that included the administration of protamine, fresh frozen plasma, fibrinogen concentrate, thrombocytes, and factor VII in order to stabilise the coagulation cascade. Initially, the patient was stable with vasoactive support of 0.25 mcg/kg/min norepinephrine and 0.2 mcg/kg/min epinephrine and without an increase in lactate level. However, over the next two hours after the surgery, further progression of subepicardial haematoma in the depth of the myocardium up to the endocardium caused almost complete obliteration of the ventricular cavity (Fig. 2, Supplementary Video S2) and accompanying deterioration of right ventricular diastolic function. The patient became haemodynamically unstable with low arterial blood pressure, high oxygen demand (supported with FiO2 of 90% on the ventilator), persistent metabolic acidosis with lactate level rising to 12 mmol/L, and base excess of up to -17 mEq/L.

This prompted a significant escalation of inotropic support and placement of central veno-arterial extracorporeal membrane oxygenation two hours after surgery in the intensive care unit. Consecutive echocardiography examinations over the next six days revealed partial haematoma resorption and recovery of right ventricular function. On the seventh postoperative day, we opted to evacuate the residual haematoma through the small epicardial incision followed by successful weaning from extracorporeal membrane oxygenation. On the 54th postoperative day, the patient was discharged from the hospital. A four-month follow-up was uneventful.

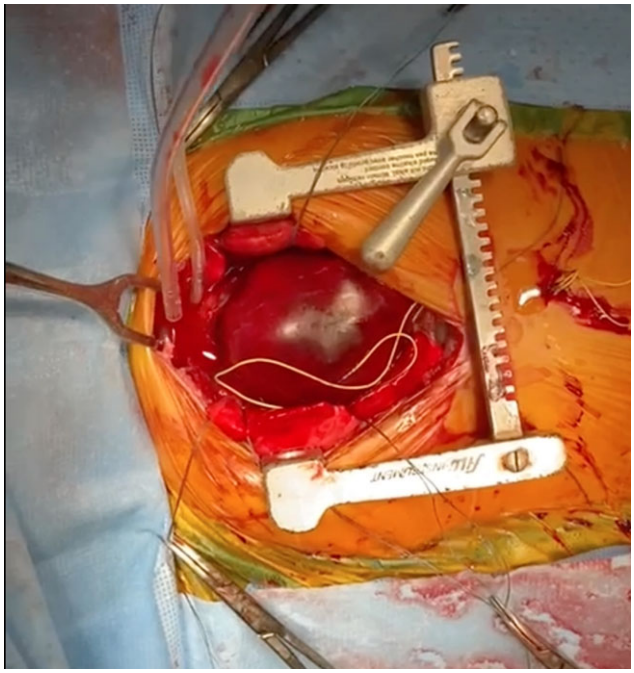

Figure 1. Intraoperative finding – dissecting hematoma covering the entire anterior surface of the right ventricle.

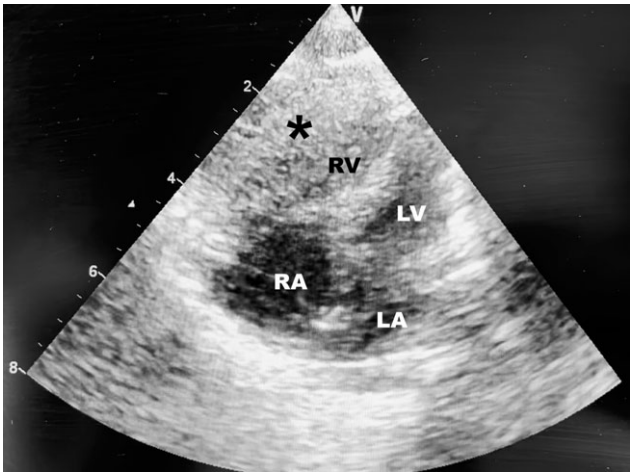

Figure 2. Echocardiography shows a hyperechoic mass (dissecting hematoma – black asterisk) compressing the cavity of the right ventricle. RV = right ventricle; RA = right atrium; LA = left atrium; LV = left ventricle.

Discussion

The majority of reported intramyocardial dissecting haematomas were associated with myocardial infarction in adult patients.[2,4,5] In our patient, this complication was probably iatrogenic, caused by the compression of the right ventricle by the sternal retractor during atrial septum closure.

When the bleeding within the myocardium occurs due to trauma or infarction, the blood accumulates between myocardial fibres making haemorrhagic channels and may progress deeper along spiral myocardial fibres.[6,7] The connective tissue sheats between the muscle bundles could determine the blood pathway through the myocardium.[1,7] The blood forced through the original small tear produces dissection along the connective tissue planes, resulting in neocavitation and intramyocardial haematoma formation.[1,7] In our case, initial subepicardial bleeding caused by blunt trauma of the right ventricular free wall progressed from a subepicardial haematoma in the depth of the myocardium longways helical muscle bundles and became a large intramyocardial haematoma contained between the endocardium and epicardium of the anterior wall of the right ventricle. Despite optimisation of the coagulation cascade after weaning from cardiopulmonary bypass, the amount of blood accumulated in the myocardial wall was sufficient to change the normal architecture of the right ventricular free wall towards the spherical shape of the wall, causing almost complete obliteration of the right ventricular cavity, accompanying venous congestion and low cardiac output syndrome. Therefore, the patient was placed on extracorporeal membrane oxygenation to decompress the right ventricle, halt further progression of the haematoma and maintain cardiac output. We believe surgical evacuation should be avoided before coagulation stabilisation, haematoma organisation, and ventricular function recovery to prevent intractable bleeding owing to the ominous serpiginous pattern of intramyocardial haemorrhagic channels.

Extracorporeal membrane oxygenation support with delayed surgical evacuation of the dissecting haematoma was a good therapeutic approach for our patient, resulting in complete recovery and discharge from hospital. Important to note is that our case does not represent the intramyocardial dissecting haematoma as a complication related to the transposition of the great arteries or arterial switch operation, but our experience in the treatment of this iatrogenic complication, which is not reported yet in the neonatal population of patients who underwent open heart surgery. Albeit there are no guidelines regarding this problem, especially in the paediatric population, our strategy resulted in a beneficial outcome and may be a good example of how to manage this rare complication.

Right ventricular dissecting haematoma in newborns after open heart surgery is rare but life-threatening and requires an individual approach, careful deliberation of the surgical intervention, and assessment of the risk-benefit ratio. The management includes vigilant follow-up of haematoma dimensions, thorough coagulation management, and a decrease in intracavitary pressure to avoid further progression of haematoma and subsequent myocardial injury. The treatment algorithm and prognosis of the dissecting intramyocardial haematoma, especially in paediatric and neonatal populations, remain unknown and it is crucial to report cases on this topic to accumulate knowledge and experience in the treatment of such a catastrophic scenario.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S1047951123002998

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Competing interests. None.

Ethical standard. This research does not involve human or animal experimentation.

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