Diagnosis and Observational Management of a Postoperative Interventricular Septal Hematoma in a Pediatric Patient

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INTRODUCTION

We present a case of a 1-month-old infant boy with complication of postoperative interventricular septal hematoma (IVSH) after cardiac surgical repair of a ventricular septal defect (VSD) and coarctation of the aorta. Our management of this unusual finding and a summary of other cases reported in the literature are also discussed.

CASE PRESENTATION

The infant was diagnosed prenatally with coarctation of aorta, which was confirmed after birth at 37 weeks of gestation with findings of mild transverse aortic arch hypoplasia and moderate narrowing of the distal arch. In addition there was a large perimembranous VSD partially obstructed by aneurysmal tricuspid valve tissue. He was followed closely by his primary pediatric cardiologist and then referred to our cardiac surgical center at 4 weeks of age for surgical repair of these defects. Preoperative echocardiography (both transthoracic, performed the day prior to surgery, and transesophageal imaging done day of surgery but prior to incision) also noted borderline left ventricular (LV) dilation with normal systolic function, normal appearance of the rest of the ventricular septum, and a patent foramen ovale.

Surgical repair was performed utilizing cardiopulmonary bypass and heparin anticoagulation. The VSD was approached through the tricuspid valve, and the defect was closed with two separate pledgetted sutures. With the use of low-flow cerebral perfusion, the aortic arch was opened from proximal to the descending thoracic aorta. The aortic arch was reconstructed with pulmonary homograft material, and full-flow cardiopulmonary bypass was resumed. The patent foramen ovale was also closed primarily with a single running suture. The patient was separated from cardiopulmonary bypass uneventfully on milrinone and nitroprusside infusions. Total cardiopulmonary bypass time was 82 minutes. Myocardial ischemic time was 34 minutes. Low-flow antegrade cerebral perfusion time was 22 minutes. Immediate postoperative transesophageal echocardiography (TEE) revealed a large interventricular septal mass within the apical/posterior ventricular septum. This was oval in shape with a homogenous echo-signal (distinctly different than the normal myocardium) and surrounded by an echogenic ring (Figures 1A and 1B, Videos 1 and 2). There was no LV outflow tract obstruction, and hematoma size remained stable by end of exam.

The infant was admitted to our pediatric cardiac intensive care unit in hemodynamically stable condition. Postoperative recovery was notable for respiratory failure requiring reintubation on postoperative day (POD) 2, but he was successfully extubated on POD 5. Transthoracic echocardiogram performed on POD 1 showed stable size of the IVSH; follow-up echocardiography on POD 6 and 9 showed smaller size of the IVSH, a small residual VSD, and low-normal LV systolic function. The patient was discharged home on POD 11 without electrocardiogram abnormalities. At interval follow-up at 7 weeks of age, he was clinically doing well with complete resolution of the IVSH, normal ventricular wall thicknesses, no residual VSD shunt, and normal systolic function by echocardiography (Figures 2A and 2B, Videos 3 and 4).

The patient continued to do well with longer term follow-up and at 7 months of age continued to have normal appearance of the interventricular septum and unchanged, normal systolic function (Videos 5 and 6).

DISCUSSION

IVSH is an overall rare phenomenon that has been reported in the clinical settings of acute myocardial infarction, chest wall trauma, aortic valve disease, and coronary artery bypass surgery.[1] More recently, cases have been reported in pediatric patients during cardiopulmonary bypass and surgical repair of several different congenital heart defects.[2-7] Yoneyama *et al.*[8] presented one case and reviewed similar pediatric case reports; other recent reports in addition to our case give a total of 16 cases reported thus far in the literature.[9-12]

The interventricular septum is a thick, muscular structure notably supplied by septal perforator branches of the posterior descending and left anterior descending coronary arteries. In nearly all reported cases, VSD patch closure was associated with development of IVSH (the one notable exception being a neonate who underwent repair of atrial septal defect and mixed total anomalous pulmonary venous connection[6]). Thus the bleeding likely originates from surgical trauma of a septal perforator branch, with bleeding (worsened by cardiopulmonary bypass anticoagulation) accumulating into a hematoma.[13]

In adult patients, IVSH formation is associated with hemodynamic or conduction system abnormalities such as atrioventricular block, outflow tract obstruction, and tamponade. In adult cases (especially in the setting of myocardial infarction), medical treatment or surgical intervention are variously reported.[1] In pediatric cases, a total of four patients were reported to have undergone intraoperative drainage of the IVSH; three patients underwent incisional drainage on cardiopulmonary bypass, and one patient underwent drainage with a 16-gauge needle.[8] Two of these patients requiring intervention on the IVSH later died (one 8 months after surgery and the other immediately after

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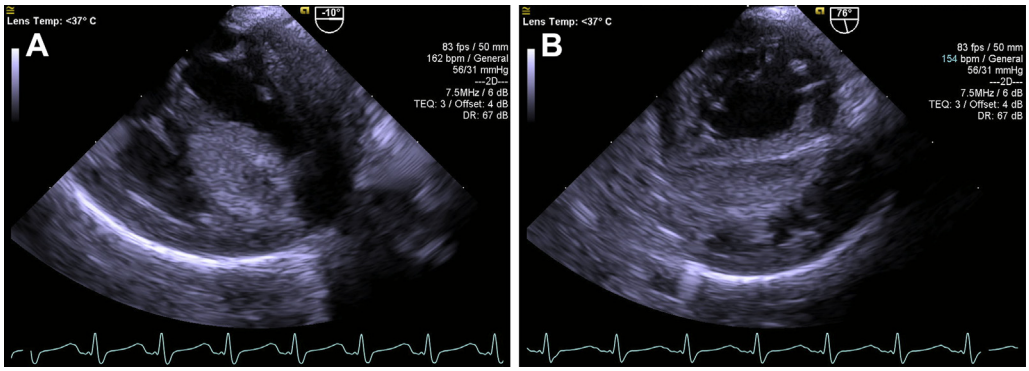

Figure 1 **(A)** Midesophageal four-chamber image of the left and right ventricles, interventricular septum, and large, oval septal hematoma, which measured 9 mm in diameter. **(B)** Midesophageal modified short-axis view of the left and right ventricles and the IVSH.

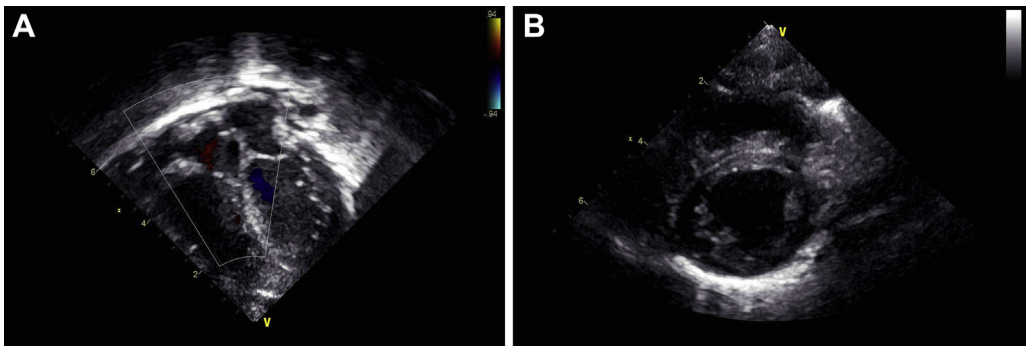

Figure 2 **(A)** Transthoracic apical four-chamber view (with color Doppler overlay) of the left and right ventricles and normal interventricular septum with resolution of the septal hematoma mass. **(B)** Transthoracic parasternal short-axis view of the left and right ventricles, normal interventricular septum, and resolved septal hematoma.

surgical repair). All other patients survived with gradual resolution of the IVSH by echocardiography in most cases. The great majority (75%) of patients were conservatively managed with typical postoperative care and observation and did well overall.

Our patient showed no signs of hemodynamic instability, and the IVSH by echocardiography had normalized by 3 weeks after surgery. In a majority of pediatric cases of IVSH (as with our patient), typical postoperative care and expectant observation were associated with good prognosis. Most cases of IVSH were immediately identified on postoperative TEE, performed prior to sternal closure (as was our case). Furthermore, we routinely obtain preoperative TEE images, which demonstrated a normal ventricular septum in our patient, in stark contrast to the IVSH found on postoperative TEE images. The IVSH was also readily visible in standard parasternal, apical, and subcostal images in our patient. This emphasizes the importance of awareness for this rare but significant abnormality not only for pediatric cardiothoracic surgeons and pediatric cardiologists but also for sonographers and pediatric intensivists.

CONCLUSION

We present a case of an infant with IVSH, a rare postoperative complication in congenital heart surgical cases. This was readily visualized both by transthoracic and TEE. Regardless of timing or method of diagnosis, most cases of IVSH are associated with overall good outcomes with observation and typical postoperative care. Postoperative echocardiography assessment should evaluate for resolution or increase of the IVSH as well as outflow tract obstruction and ventricular dysfunction. Close follow-up with electrocardiography and echocardiography of the ventricular function, septum, and conduction system is recommended.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.case.2018.04.001.

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