Evolution of Interventricular Septal Hematoma: Echocardiographic Diagnosis

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INTRODUCTION

Interventricular septal hematoma (IVSH) is a rare complication that has been described after several types of surgical procedures including patch closure of a ventricular septal defect (VSD),2 percutaneous coronary artery intervention,2 and internal mammary artery grafting to the left anterior descending coronary artery.3 Often IVSH causes hemodynamic compromise and is associated with significant morbidity and mortality.4 Commonly reported complications of IVSH include myocardial rupture, ventricular dysfunction, ventricular outflow tract obstruction, and abscess formation. The hematoma leading to coronary cameral fistula has been previously reported after stent placement in a coronary artery.2 We present a unique case of IVSH after closure of a VSD with development of a coronary fistulous communication associated with decompression of the hematoma into the right ventricle (RV) cavity and a favorable clinical outcome.

CASE PRESENTATION

A 5-month-old, 3.8 kg male was born at 34 weeks of gestation with a large perimembranous VSD diagnosed on an echocardiogram performed at 10 days of life for evaluation of heart murmur and tachypnea. The patient had symptoms of heart failure evidenced by failure to thrive requiring hospitalization and nasogastric tube feeding. His weight, height, and body mass index were less than the first percentile for age and gender, and he had only gained 6 g per day despite feeding on 30 Kilocalorie per ounce formula with medium chain triglycerides oil. On physical examination, there was mild tachypnea, a grade 2 holosystolic murmur heard with maximum intensity at the left lower sternal border, wide splitting of the second heart sound, and right ventricular systolic function (Video 1). After chest closure in the operating room, there was systemic hypotension with suspected cardiac tamponade. Transthoracic echocardiogram (TTE) demonstrated an underfilled/compressed RV with severe systolic dysfunction, moderate left ventricular systolic dysfunction, and a hypokinetic, echo-bright ventricular septum with a small hypoechoic space suggestive of IVSH measuring 0.75 × 0.15 cm (Figure 2A, Video 2). Surgical exploration revealed a mild-moderate thrombus in the pericardial space. Hemodynamics improved immediately after reopening the sternum. Despite the lack of significant hematoma in the pericardium, reopening of the sternum led to decompression and better filling of RV resulting in improved cardiac output. Systolic and presumed diastolic dysfunction after two runs of cardiopulmonary bypass and IVSH caused the clinical decompensation. Epicardial echocardiogram showed thick interventricular septum and small hypoechoic space (Video 3). Four hours after leaving the operating room, the patient decompensated with a hypotensive arrest requiring resuscitation. On postoperative day (POD) 1, the IVSH increased in size (1.1 × 0.35 cm) and developed a fistulous connection into the RV, and biventricular systolic function was moderately depressed (Figure 2B, Videos 4 and 5). On POD 2, the fistulous connection was noted from the left anterior descending artery to the IVSH with diastolic flow, and it ultimately drained into the RV cavity during systole (Figure 2C and 3, Videos 6-8). There was improvement in TR and biventricular systolic function (mildly decreased; Videos 6-8). The patient had had 2:1 atrial flutter on POD 0 and accelerated junctional rhythm requiring AAI pacing. By POD 3, arrhythmias had resolved, the patient was weaned off low-dose epinephrine, the patient was hemodynamically stable with normal biventricular systolic function, and delayed sternal closure was performed (Video 9). The IVSH decreased in size (0.6 × 0.2 cm) by POD 18 (Videos 10-12). The patient was discharged home on POD 20. Three months after the surgery, the echocardiogram demonstrated complete resolution of IVSH with normal biventricular systolic function and trivial TR (Videos 13 and 14).

DISCUSSION

We present the echocardiographic features of a postoperative IVSH related to patch closure of a VSD that developed a fistulous connection to the RV cavity and subsequently resolved. There is currently a lack of consensus on the etiology and management of IVSH. The literature is limited to a few case reports and one case series of 12 patients. In the adult literature, IVSH has been described after myocardial infarction, percutaneous coronary artery intervention, coronary artery bypass graft procedures, or trauma. In the pediatric literature, IVSH has been reported following procedures such as isolated VSD closure, VSD closure along with repair of interrupted aortic arch, coarctation of aorta, transposition of great arteries, and repair of tetralogy of Fallot as well as after relief of pulmonary atresia/critical pulmonary

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Figure 1  Preoperative TTE demonstrating a large perimembranous VSD with left atrial dilation. (A) Parasternal long-axis view showing the perimembranous VSD; (B) parasternal short-axis view demonstrating the VSD in 2D and color with left to right shunt; (C) apical five-chamber view shows the perimembranous VSD. LA, Left atrium; LV, left ventricle.

Figure 2  Sequence of echocardiographic changes in IVSH. (A) IVSH detected on parasternal short axis view on POD 0; (B) increase in the size of the IVSH noted on parasternal long-axis view on POD 1; (C) development of fistulous connection between the IVSH and the RV shown in apical five-chamber view on POD 2. LV, Left ventricle.

Figure 3  Pulse-wave Doppler tracing of fistula from the IVSH demonstrating systolic flow into the RV.
mean time for resolution of the IVSH is reported to be variable at 20 ± 185 days. In one case series, 75% of pediatric patients had recovery of ventricular function. In our patient, the unique course of development of fistulous drainage between the IVSH and RV cavity resulted in decompression of the hematoma and likely contributed to spontaneous and early recovery. To our knowledge, this is the first report describing this sequence of echocardiographic changes in the evolution of postoperative IVSH with the development of a fistulous connection between the IVSH and the RV cavity and resolution of the IVSH. We highlight the utility of echocardiography in diagnosis and serial monitoring to evaluate the progress of IVSH.

CONCLUSION

Although rare, IVSH is a serious complication after surgical repair of VSD that is often overlooked in both adult and pediatric cases. Early recognition of this phenomenon is important as it is associated with high morbidity and mortality. Complications such as ventricular dysfunction, myocardial rupture, abscess formation, right or left ventricular outflow tract obstruction, and cardiac tamponade should be ruled out. In our patient, IVSH was associated with severe low cardiac output state, hypotensive arrest, and arrhythmia. During follow-up assessment, the IVSH fistulized to the right ventricular cavity leading to decompression and spontaneous recovery of biventricular systolic function, which led to a good clinical outcome. Recognition of this unusual phenomenon avoided an invasive procedure to drain the IVSH. Serial 2D echocardiography with color Doppler is useful in recognition of this sequence of changes.

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SUPPLEMENTARY DATA

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