Interventricular septal hematoma associated with congenital heart surgery: A case report and literature review

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Interventricular septal hematoma (IVSH) is extremely rare, and most cases are reported to occur in pediatric patients as a complication after the repair of a ventricular septal defect (VSD). We present a case of a giant IVSH after patch closure of a perimembranous VSD and review of the relevant literature.

CLINICAL SUMMARY

A 3-month-old boy was admitted to the University of Tsukuba hospital with a diagnosis of VSD and severe pulmonary hypertension. The patient weighed 5.3 kg. Echocardiography revealed a large (6 mm) perimembranous trabecular VSD, which was surgically closed using cardiopulmonary bypass (CPB) and antegrade cardioplegia. A standard closure using a Dacron patch and a

continuous suture technique along the edge starting with a pledgeted horizontal mattress suture placed near the base of the medial papillary muscle was performed.

After VSD closure.

Central Message

Ten of 12 reported IVSH cases (83%) in the pediatric population were related to VSD closure, and 58% were conservatively treated. This rare but critical complication may result from an SPA injury.

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FIGURE 1. TEE showing changes in the interventricular septum hematoma over time. Longitudinal (*top*) and short-axis (*bottom*) views on postoperative day 1, month 1, and month 2. *Arrows* indicate hematoma. *POD*, Postoperative day; *IVSH*, interventricular septal hematoma; *LV*, left ventricle; *Ao*, aorta.

TABLE 1. Reported cases of interventricular septum hematoma associated with congenital heart defect corrective surgery

Reference	Year published	No. of patients	Age and gender	Diagnosis	Surgical procedure	Hemodynamic instability	Abnormal ECG findings	Surgical intervention for IVSH	Time for IVSH resolution	Outcomes
Drago and colleagues ¹	2005	1	4 mo, N/A	Perimembranous VSD	VSD patch closure	+	+	Incisional drainage on CPB	20 d	Discharged
Padalino and colleagues ²	2006	1	4 mo, female	Perimembranous VSD	VSD patch closure	—	+	Drainage with a 16-G needle	8 d	Discharged
Jensen and colleagues ³	2007	2	2 d, N/A	Malalignment VSD, interrupted aortic arch	VSD patch closure Arch reconstruction	—	—	—	A few months	Discharged
			3 mo, N/A	Perimembranous VSD	VSD patch closure	+	+	—	2 mo	Discharged
Zuhang and colleagues ⁴	2008	1	7 y, male	Perimembranous VSD	VSD patch closure	+	+	Incisional drainage on CPB	N/A	Died suddenly at 8 mo
Mart and colleagues ⁵	2011	1	3 mo, male	Perimembranous VSD	VSD patch closure	+	Data not shown	Incisional drainage on CPB	Data not shown	Discharged
Zhu and colleagues ⁶	2012	2	3 mo, male	Perimembranous VSD	VSD patch closure	+	+	Considered	N/A	Died before intervention
			7 mo, female	Tetralogy of Fallot	VSD patch closure RVOT reconstruction	+	+	—	3 mo	Discharged
Eyileten and colleagues ⁷	2013	1	10 mo, N/A	Perimembranous VSD	VSD patch closure	—	+	—	6 mo	Discharged
Suteu and colleagues ⁸	2016	1	21 d, N/A	Pulmonary valve stenosis	RVOT reconstruction	—	Data not shown	—	6 mo	Discharged
Bernasconi and colleagues ⁹	2016	1	14 d, male	TAPVR	TAPVR correction	+	Data not shown	—	11 d	Discharged
Present case		1	3 mo, male	Perimembranous VSD	VSD patch closure	—	—	—	2 mo	Discharged

ECG, Electrocardiography; IVSH, interventricular septal hematoma; N/A, not applicable; VSD, ventricular septum defect; CPB, cardiopulmonary bypass; AVB, atrioventricular block; JET, junctional ectopic tachycardia; VT, ventricular tachycardia; RVOT, right sventricular outflow tract; TAPVR, total anomalous of pulmonary venous return.

Upon weaning from CPB, transesophageal echocardiography (TEE) revealed an abnormal 18.1-mm thickening of the interventricular septum with an internal, mixed sonic mass, which was consistent with the findings of a giant IVSH. Ventricular septal motion was hypokinetic, and close TEE monitoring was maintained for approximately 30 minutes with the patient still on CPB. The IVSH did not enlarge, and no critical events such as lethal arrhythmia, septal perforation, or ventricular asynergy occurred. The hemodynamics were unexpectedly stable, except for sinus tachycardia. Both ventricular outflow tracts seemed slightly obstructed, but TEE detected no significant pressure gradients. The patient was taken off CPB and conservatively managed without an immediate surgical drainage.

The patient had several asthma attacks and airway obstruction episodes, and therefore needed careful respiratory management on mechanical ventilation until postoperative day 23. Serial transthoracic echocardiograms confirmed a significant reduction in the size of the IVSH

by this time. The patient was discharged 2 months after surgery when transthoracic echocardiograms showed complete resolution of the hematoma and normal thickness and normal motion of the interventricular septum (Figure 1).

DISCUSSION

IVSH occurs in adults after chest trauma, myocardial infarction, or various cardiac procedures. It is an extremely rare complication of congenital heart surgery; only 11 cases have been described since 2005.¹⁻⁹ Table 1 shows the demographics and clinical outcomes of 12 pediatric IVSH cases, including the present case. Patient age ranged from 2 days to 7 years, with 10 occurrences (83%)¹⁻⁷ requiring VSD closure, most of them being the perimembranous type. This suggests that surgical manipulation of the perimembranous ventricular septum contributes to the development of IVSH.

Seven patients^{1,3-6,9} were hemodynamically unstable after the development of IVSH, 3 of whom^{3,6,9} were conservatively treated without surgical intervention. Two

patients underwent incisional drainage of IVSH on CPB with good outcomes.^{1,5} One patient suddenly died of an unknown cause 8 months after incisional drainage⁴; the second patient collapsed and died immediately after the VSD patch closure without time for surgical intervention.³

Five patients, including ours, were hemodynamically stable; 4 patients were discharged without drainage.^{2,3,7,8} Seven patients (58%) were conservatively managed, and all of them survived. Although we recognize the importance of prompt management of IVSH, aggressive surgical intervention is evitable, especially when patients are hemodynamically stable. The time required for IVSH resolution varied with each case and widely ranged from 11 days to 6 months with conservative management.

The cause of IVSH is unclear, but it may be related to injury of the septal perforating artery (SPA).¹⁰ Anatomically, the first SPA crosses the lower border of the anterior limb of the septomarginal trabeculation and terminates at the base of the medial papillary muscle of the tricuspid valve.¹¹ Although the branches of the first SPA vary considerably in pattern and depth, Hosseinpour and colleagues¹² described that the areas surrounded by the outlet septum, the medial papillary muscle, and the margin of the VSD are generally devoid of the first SPA. The VSD patch sutures should be carefully placed on this “devoid area” to avoid possible SPA injury. Because the SPA supplies a critical portion of the interventricular conduction system, including the 2 main bundle branches and Purkinje arborization,¹³ IVSH may lead to not only ventricular dysfunction but also various types of lethal arrhythmias.⁴

CONCLUSIONS

Our case and the literature review highlight that IVSH in the pediatric population mostly occurs after VSD closure,

with underlying SPA injury as a possible cause. Although a timely management of IVSH is important, urgent surgical drainage is not required when hemodynamics are stable because all reported patients on conservative treatment survived.

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