Interventricular Septal Hematoma Detected by Transesophageal Echocardiography after Congenital Heart Surgery in an Infant: A Case Report

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Case report

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Abstract

Background

Interventricular septal hematoma is an extremely rare complication following congenital heart surgery. During cardiac surgery, interventricular septal hematomas can be detected only by intraoperative transesophageal echocardiography. Here, we report an interesting case of interventricular septal hematoma that was accidentally found in an infant following ventricular septal defect (VSD) closure.

Case presentation

Transesophageal echocardiography images were acquired from a 1-month-old boy after surgical repair of a large (6.5 mm) perimembranous outlet VSD with interventricular septal flattening. Surgical correction was performed with auto-pericardium and 7-0 Prolene sutures. The patient was successfully weaned from cardiopulmonary bypass, and transesophageal echocardiography showed no VSD leakage and good ventricular function. However, approximately 30 minutes later, two anechoic masses were found within the interventricular septum, which were suspected to be interventricular septal hematomas; the larger mass measured 1.51 x 1.48cm. The swollen interventricular septum showed decreased contractility and compressed both the right and left ventricles. However, there was no change in the size of hematomas or a significant hemodynamic instability for 30 minutes of observation. Therefore, expecting spontaneous resolution of the hematomas, the interventricular septum was not explored and the patient was removed from cardiopulmonary bypass. On postoperative day 4, follow-up transthoracic echocardiography revealed thrombi filling the hematomas. The patient was discharged on postoperative day 15 and followed-up with regular echocardiographic evaluations.

Conclusions

We describe a unique case of interventricular septal hematoma after VSD closure. Surgical manipulation of perimembranous VSD and injury of the septal perforating artery may contribute to development of an interventricular septal hematoma. In hemodynamically stable patients, conservative treatment and serial echocardiographic evaluation generally show gradual resolution of the hematoma. Pediatric cardiac anesthesiologists should be aware of this rare complication after VSD repair.

Background

A ventricular septal defect (VSD) is the most common congenital heart disease [1]. The reported incidence of complications after VSD repair is low; nonetheless, various complications such as heart block, chylothrax, wound infection, or seizures can still occur [2]. Interventricular septal hematoma is an extremely rare complication after congenital heart surgery and can be life-threatening [3, 4]. In adults, interventricular septal hematoma is associated with a high mortality rate of more than 80% [5]. In contrast, the reported survival rate of pediatric patients is higher than that of adults [3].

We report a case of in which interventricular septal hematomas were accidentally detected on transesophageal echocardiography (TEE) after surgical correction of VSD in an infant.

Case Presentation

A 1-month-old boy weighing 3.1 kg was admitted for the repair of a VSD and atrial septal defect (ASD). Preoperative transthoracic echocardiography revealed a huge (8 mm) perimembranous VSD with trabecular and outlet extensions, and a 2.5-mm secundum ASD. A bidirectional shunt was found through the VSD with interventricular septal flattening and right ventricular enlargement, attesting to severe pulmonary hypertension.

Surgical correction was performed with cardiopulmonary bypass (CPB). Throughout the surgery, monitoring was done using TEE. The VSD was closed with glutaraldehyde-fixed auto-pericardium and 7 – 0 Prolene sutures. The total CPB time was 118 min, and the patient was successfully weaned from cardiopulmonary bypass under inotropic support. Post-CPB TEE revealed no VSD leakage and good ventricular function with mild interventricular septal flattening.

However, approximately 40 minutes later, two anechoic masses were found within the interventricular septum (Fig. 1, Video 1). Low-velocity flow color Doppler echocardiography showed no communication between the ventricles and anechoic masses (Fig. 2, Video 2). The larger mass was 1.51 × 1.48cm, and interventricular septal hematomas were suspected (Fig. 3). The attending surgeon and pediatric cardiologist were immediately notified of these echocardiography findings. The swollen interventricular septum compressed both the right and left ventricles. As there was no hemodynamic instability and the sternum was already closed, the surgeon decide to observe the patient. The size of hematomas and vital signs did not show any change during 30 minutes of observation (Table 1). Therefore, expecting spontaneous resolution of the hematomas, a decision was made not to perform surgical exploration and incisional drainage. The patient was transferred to the intensive care unit (ICU), and no specific treatment for hematoma was provided.

On postoperative day (POD) 4, follow-up transthoracic echocardiography revealed thrombi filling the hematomas (Fig. 4, Video 3), with improvement in both ventricular functions. There was no significant hemodynamic instability during the ICU stay. Follow-up echocardiography on POD 14 revealed cystic lesions in the apical ventricular septum, and on POD 40, there was no lesion in the interventricular septum, indicating complete resolution of the hematomas.

Discussion And Conclusions

This case report describes a large interventricular septal hematoma that was newly detected using TEE after VSD repair in an infant. The patient was transferred to the ICU without surgical intervention, and follow-up echocardiography showed that all hematomas were absorbed without residual intramural lesions.

Most cases of interventricular septal hematomas, especially the perimembranous type as in our case, occur after VSD repair [4]. Surgical injury of the septal perforating artery during VSD closure is suggested to be a contributing factor for development of ventricular septal hemorrhage [4, 6]. From the superior interventricular artery, the septal perforating branch passes toward the base of the medial papillary muscle and outlet septum of the right ventricle (RV). In VSD, the septal perforating arteries are near the VSD margin [6]. The sutures for the VSD patch are recommended to be placed in the triangular area surrounded by the outlet septum, medial papillary muscle, and the VSD margin, as this area is free of major perforating arteries [4, 6].

Factors including surgical trauma can contribute to development of intramural hematomas [3]. High-perfusion pressure during cardioplegia and high preoperative RV pressure are other risk factors for myocardial hemorrhages [3, 7, 8]. Suteu et al. reported a case of spontaneous interventricular septal hematoma in an infant with pulmonary atresia with an intact ventricular septum, following RV outflow tract reconstruction [3]. The authors assume that severely increased RV pressure might lead to impaired RV perfusion, development of a myocardial lesion, and intramural hematoma after CPB weaning [3]. In our case, although the exact reason could not be elucidated, we consider that all specified factors could be possible causes of the interventricular hematoma after VSD closure.

A large myocardial hematoma could be associated with decreased ventricular function, myocardial ischemia, or conduction abnormalities, leading to lethal arrhythmias [4, 9, 10]. Some cases of intraventricular septal hematoma showed hemodynamic instability, such as tachycardia with hypotension [4, 11]. Prompt surgical drainage may be required under CPB [10]. However, some patients with interventricular septal hematoma also had stable hemodynamics, and no surgical treatment was required [4] as in our case. Some clinicians used antithrombotic agents for conservative therapy [11].

During congenital heart surgery, interventricular septal hematoma can be detected only by intraoperative TEE. Although most similar cases were detected immediately after CPB, our case was detected 30 minutes after weaning from CPB. Therefore, pediatric cardiac anesthesiologists should perform vigilant monitoring using TEE, which can facilitate the early detection of complications following congenital heart surgery [9, 12].

Regular follow-up echocardiography is recommended to confirm complete resolution of hematomas or to detect delayed complications including newly developed aneurysms, myocardial infarction, arrhythmia, or myocardial rupture. Yamazawa et al. recommended follow-up by echocardiography every 2–3 months within 6 months after the detection of an interventricular septal hematoma [11].

In conclusion, the present case suggests that interventricular septal hematoma can occur after VSD closure, although its incidence is very low. Continuous TEE monitoring during anesthesia is essential to detect this rare complication immediately after congenital heart surgery. Close follow-up using echocardiography is recommended for several weeks to monitor absorption of the hematoma.

Abbreviations

ASD: atrial septal defect; CPB: cardiopulmonary bypass; ICU: intensive care unit; POD: postoperative day; RV: right ventricle; TEE: transesophageal echocardiography; VSD: ventricular septal defect

Declarations

Ethics approval and consent to participate

Institutional Review Board approval and informed consent was waived.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editors-in-Chief of this journal

Availability of data and materials

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Competing interests

There is no competing interests.

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Authors' contributions

LJH and JYE gathered all patient data and prepared the original version of the manuscript. KJT provided supervision about the manuscript preparation and proof read the manuscript for English errors. All authors read and approved the final manuscript.

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Not applicable

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Tables

Table 1 not available with this version.

Figures

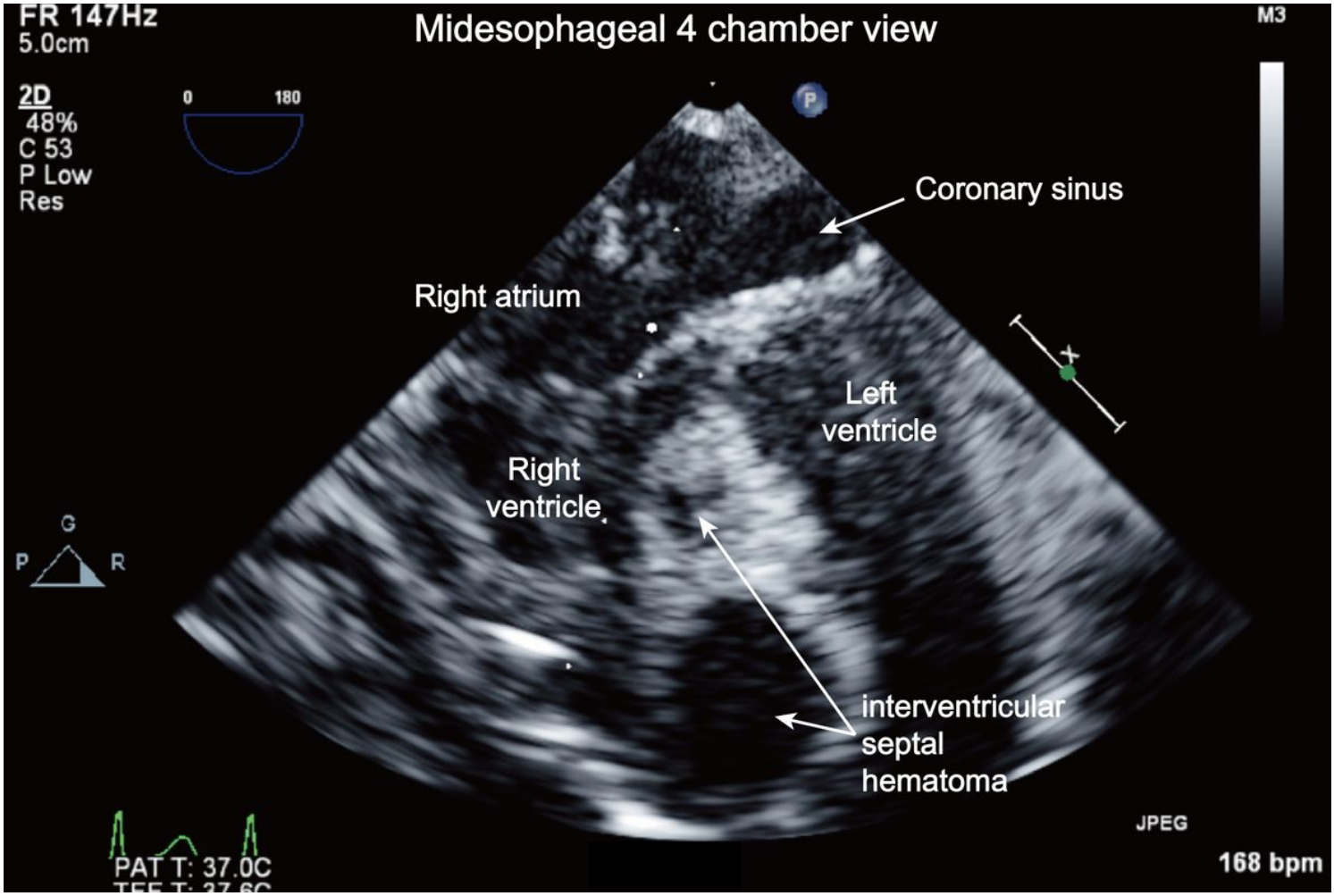

Figure 1

Identification of the anechoic interventricular septal hematomas using the midesophageal 4- chamber view.

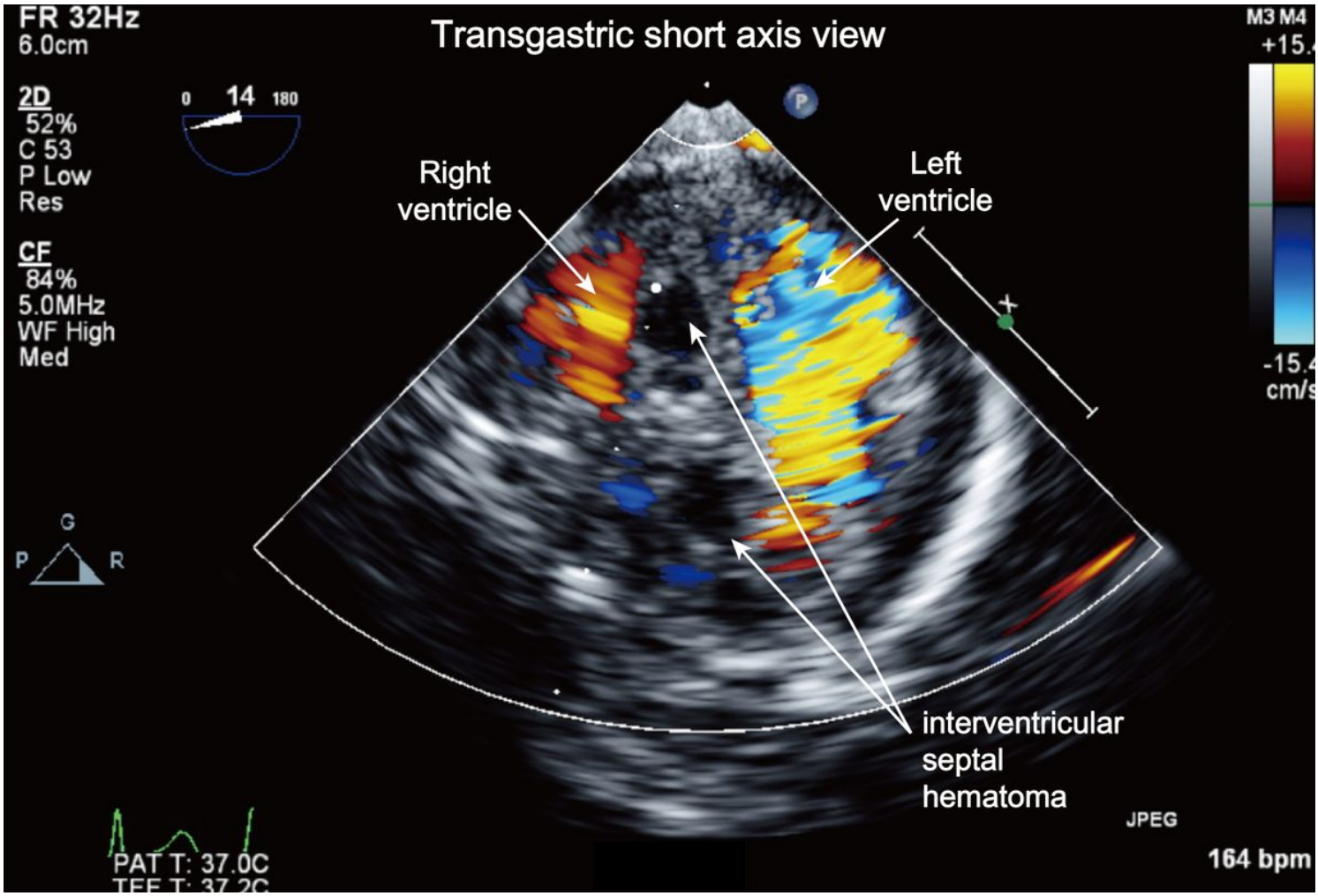

Figure 2

Assessing the connection between the interventricular septal hematomas and the coronary artery using color Doppler images with low Nyquist velocity limits in the transgastric short-axis view.

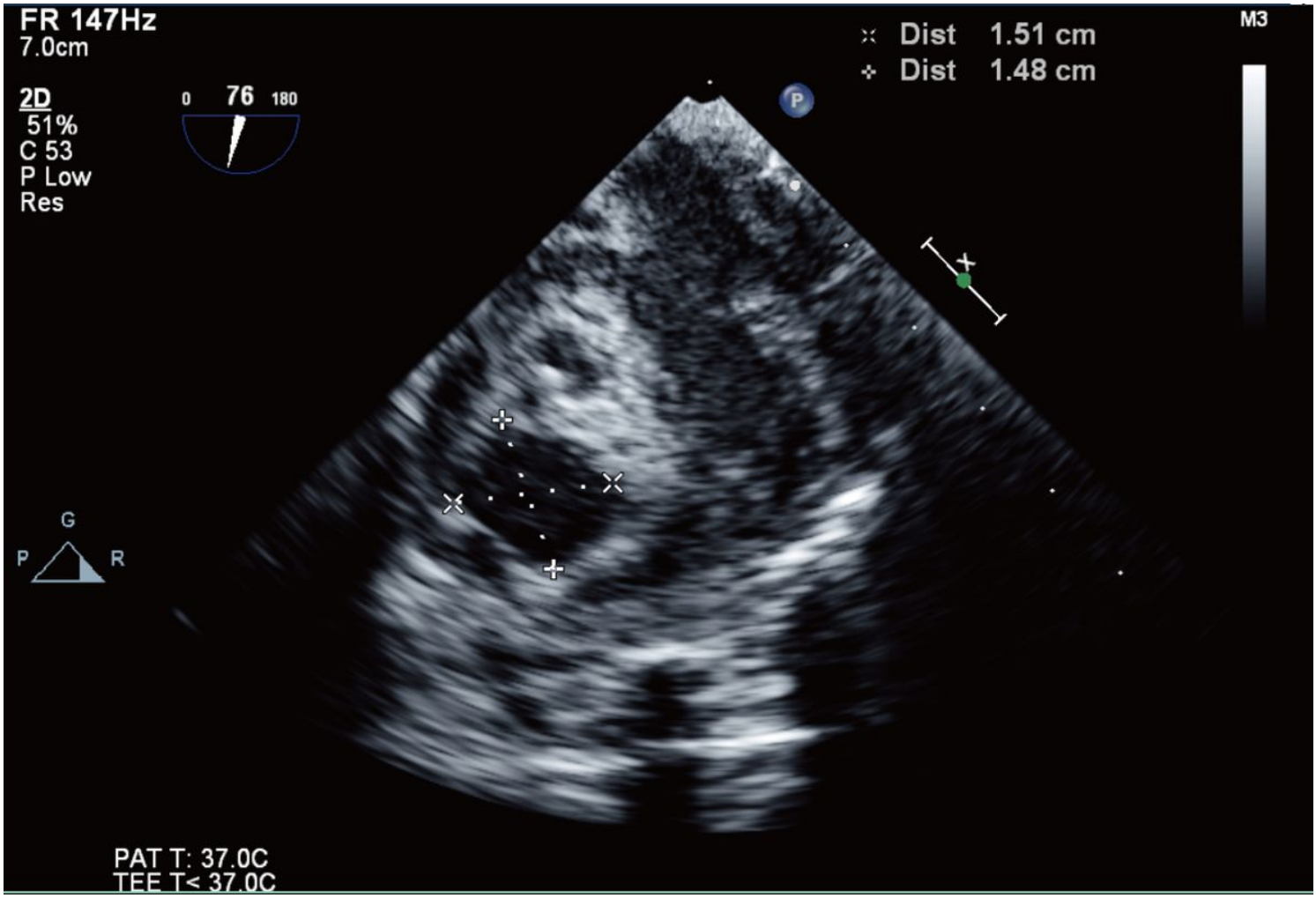

Figure 3

The larger interventricular septal hematoma measuring 1.51 × 1.48 cm.

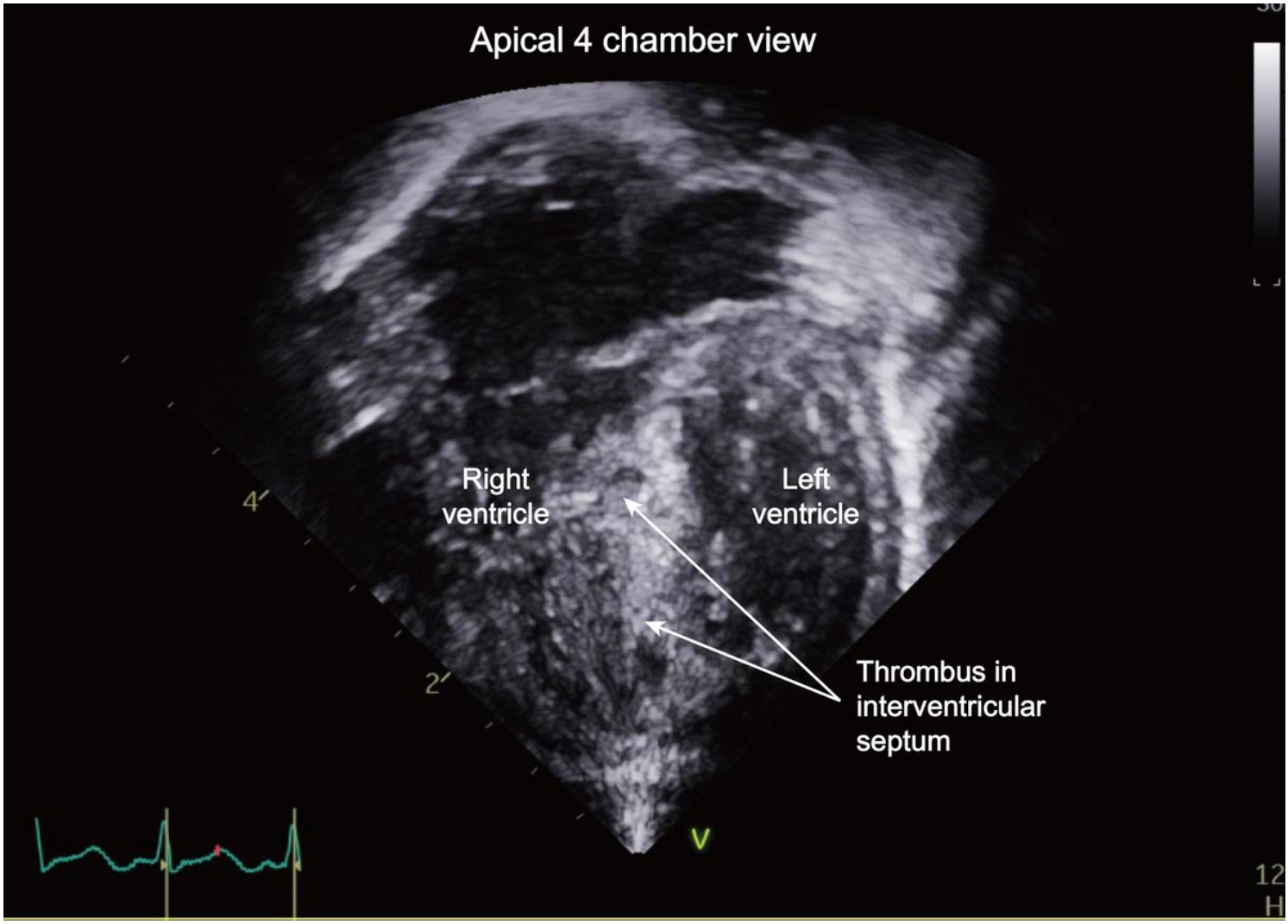

Figure 4

Follow-up transthoracic echocardiography showing a decrease in the size of the anechoic interventricular septal hematomas with thrombi filling the hematomas in the apical 4-chamber view.

Supplementary Files

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- Consentformfromparent.pdf
- Video1.mp4
- Video2.mp4
- video3.avi