Ventricular Septal Defect

17

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Abstract

Ventricular septal defects (VSD) was a common congenital cardiac abnormality with defects in the interventricular septum results in a hemodynamic communication between the right and left ventricles. It is considered the most common congenital cardiac disease diagnosed in children and the second most common in adults. It accounts for approximately 40% of congenital heart disease. Clinical presentation varies depending on the defect size and degree of the shunt. The diagnosis can be accomplished by echocardiography or CTA with ECG-gating with direct visualization of the septal defect. Surgical and transcatheter closure of the defect were commonly used, while defect closure in patients with raised pulmonary vascular resistance can result in substantial morbidity and mortality.

17.1 Case of VSD

17.1.1 History

- Four-months-old male infant cough for several days and systolic murmur was heard over the left sternal border during physical examination.
- X-ray and CT examination were suggested to observe cardiac structure.

Physical Examination

- Blood pressure: 90/60 mmHg; Breathing rate: 30/min
- Heart rate: 155 bpm without arrhythmia
- 3/6 grade systolic murmur heard on the left border of sternum.

Laboratory

Serum myocardial enzyme spectrum showed negative results.

17.1.2 Imaging Examination

X-ray Images

CT Images

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17.1.3 Imaging Findings and Diagnosis

The X-ray image demonstrates prominent pulmonary vasculature (active congestion) without pleural effusions or convincing consolidation and cardiomegaly with prominence of the main pulmonary trunk.

CT images demonstrate subarterial ventricular septal defect. Enlarged left ventricle and dilated pulmonary trunk was shown (Figs. 17.1 and 17.2).

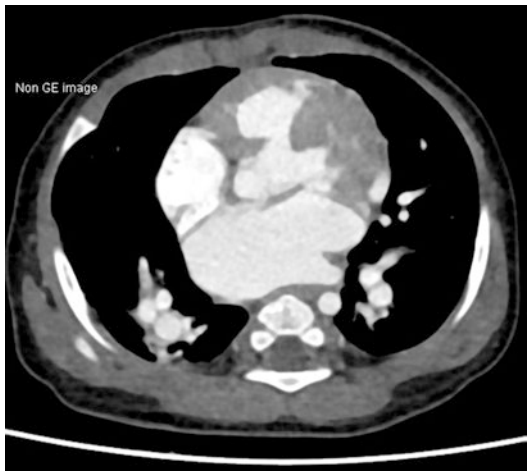

Fig. 17.1 Axial image showed ventricular septal defect

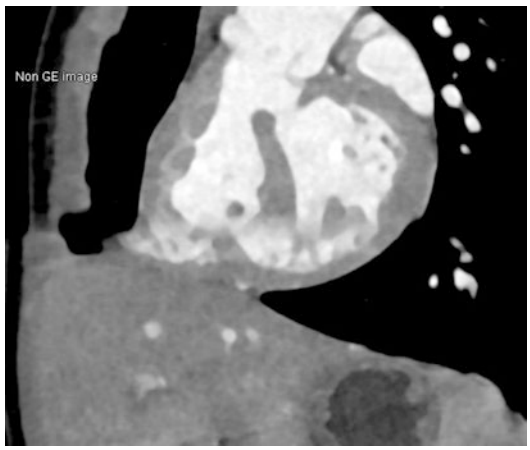

Fig. 17.2 Reconstructed image showed ventricular septal defect

17.1.4 Management

- Surgical closure of VSD
- Out-patient follow-up observations

17.2 Discussion

VSD is one of the most common congenital heart malformations, accounting for up to 40% of all congenital heart anomalies. The frequency of this defect varies with age since many tiny muscular defects reported by highly sensitive color Doppler echocardiography shortly disappear during the first year of life [1].

VSD is classified into three types according to defect location: perimembranous, infundibular, and muscular VSD. The clinical consequences of a VSD is related to the amount and direction of interventricular shunting. The size of the defect and relative resistances of pulmonary vascular beds determine the amount of interventricular amount. Neonatus with VSD might experiences minimal left-to-right shunting due to high pulmonary vascular resistance, while the shunting rises and the patient develops symptoms as pulmonary vascular resistance falls. Excessive pulmonary blood flow will result in increased pulmonary vascular resistance, the amount of interventricular left-to-right shunting could decrease and eventually lead to right-to-left shunting causing cyanosis and Eisenmenger's syndrome.

Typical X-ray image shows prominent pulmonary vasculature and enlarged heart, especially the enlargement of the left ventricle. CT images show the defect directly and contrast agents connect between the left and right ventricles [2]. Left and right ventricles and left atrium are enlarged. Dilated pulmonary artery can also be seen to reflect pulmonary hypertension.

Patch closure of a ventricular septal defect through sternotomy was commonly used in the past 50 years. Transcatheter techniques for closure of ventricular septal defects have been developed in the few decades. Surgical closure in patients developed pulmonary hypertension can result in substantial morbidity and mortality due

to right ventricular failure caused by increased pulmonary blood flow and right ventricle pressure. Supportive treatment is appropriate for individuals with Eisenmenger's syndrome.

17.3 Current Technical Status and Applications of CT

CT is an important imaging modality in the evaluation of congenital heart disease with three-dimensional reconstruction and rapid prototyping technology of multislice spiral computed tomography angiography (CTA). CT also requires no sedation and has shorter scan duration. CT can also provide detailed information of extracardiac abnormalities [3].

CT images show direct visualization of the defect with a high sensitivity and specificity. Size measurements can be comprehensively obtained with short diameter, normalized area, and relative area, which is hardly obtained by two-dimensional echocardiography. Patients with VSD might combine with other congenital heart disease requiring additional imaging evaluation beyond echocardiography [4]. CT images are able to simultaneously assess associated anomalies with high spatial and temporal resolution beyond the echocardiographic window.

17.4 Key Points

- Ventricular septal defect accounts for up to 40% of all congenital cardiac anomalies.
- The chest radiograph can be normal with a small VSD. Larger VSDs showed prominent pulmonary vasculature and enlarged heart, especially the enlargement of left ventricle in X-ray image.
- CT images show the defect directly. Left and right ventricles and left atrium are enlarged, features of pulmonary arterial hypertension, pulmonary edema, pleural effusion.

References

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