Diagnosis of cardiac blood cyst by echocardiography in 8 cases

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Abstract

Objective: To explore the characteristics of intra-cardiac blood cysts to provide a reference for accurate diagnosis and prognosis. Methods: In this study, 8 cases of cardiac blood cysts were analyzed retrospectively from January 2006 to March 2020, and the clinical symptoms, echocardiography, operation and prognosis were analyzed. Results: All clinical symptoms were not typical and cysts were isolated. The cysts were attached to the anterior leaflet of the mitral valve (n=4), posterior papillary muscle and chordae of mitral valve (n=1), septal leaflet of the tricuspid valve (n=2), or the tricuspid valve orifice and tricuspid anterior annulus (n=1). Echocardiography revealed the cysts were small and balloon-like. They had high tension wall, the wall was thin and smooth. Calcification could be seen on the cyst wall. The inside was none echogenicity area and the cyst moved and swung with the valve or chordae. Of the 8 patients, 1 had no hemodynamic effects and did not need surgery. The other 7 cases were confirmed by surgery and pathology for the cardiac blood cysts. 3 subjects underwent simple cystectomy alone. 1 with infectious endocarditis and mitral valve vegetation, and the other one caused the left ventricular outflow tract obstruction. 2 subjects had a history of mitral valve abnormality with mechanical mitral valve replacement. Conclusions: Cardiac blood cysts are rare and benign heart condition in adults. They can be diagnosed by echocardiography to guide intervention.

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Abstract: Objective To explore the characteristics of intra-cardiac blood cysts to provide a reference for accurate diagnosis and prognosis. **Methods** In this study, 8 cases of cardiac blood cysts were analyzed retrospectively from January 2006 to March 2020, and the clinical symptoms, echocardiography, operation and prognosis were analyzed. **Results** All clinical symptoms were not typical and cysts were isolated. The cysts were attached to the anterior leaflet of the mitral valve (n=4), posterior papillary muscle and chordae of mitral valve (n=1), septal leaflet of the tricuspid valve (n=2), or the tricuspid valve orifice and tricuspid anterior annulus (n=1). Echocardiography revealed the cysts were small and balloon-like. They had high tension wall, the wall was thin and smooth. Calcification could be seen on the cyst wall. The inside was none echogenicity area and the cyst moved and swung with the valve or chordae. Of the 8 patients, 1 had no hemodynamic effects and did not need surgery. The other 7 cases were confirmed by surgery and pathology for the cardiac blood cysts. 3 subjects underwent simple cystectomy alone. 1 with infectious endocarditis and mitral valve vegetation, and the other one caused the left ventricular outflow tract obstruction. 2 subjects had a history of mitral valve abnormality with mechanical mitral valve replacement.**Conclusions** Cardiac blood cysts are rare and benign heart condition in adults. They can be diagnosed by echocardiography to guide intervention.

Cardiac blood-filled cyst is also named cardiac blood cyst for short. It is a rare primary benign tumor in the heart. It was firstly reported by Professor Elasser in 1844 and most commonly observed in children, especially in neonates, with the age increasing cyst rupture and rarely found in adults. It can occur in most parts of the heart and causes different hemodynamic effects. In this study, we retrospectively reviewed 8 cases of cardiac blood cyst and describe the clinical features, echocardiographic characteristics, surgical procedures and prognosis.

Materials and Methods

Patients

The study population consisted of 8 patients with a pathology confirmed diagnosis of cardiac blood cyst from January 2006 to March 2020. There were 5 male and 3 female patients with ages ranging from 24 to 58 years (median age 45 years).

Echocardiographic Equipment and Study Protocols

Transthoracic echocardiography was performed on all patients with use of the Vivid 7 system (GE-Vingmed Ultrasound AS, Horten, Norway), iE33 ultrasound system (Philips Medical Systems, Bothell, WA). Transesophageal echocardiography was performed with the use of iE33 ultrasound system (Philips Medical Systems, Bothell, WA). All patients were examined by routine 2-dimensional echocardiography. Color Doppler imaging was used to assess the occurrence of perforation and evaluate the function of the atrioventricular or semilunar valves.

Methods of Analysis

The clinical features, echocardiographic characteristics, surgical procedures, and outcomes were retrospectively analyzed in all patients with blood cyst. All echocardiographic images were reviewed and confirmed by 2 experienced readers who were blind to clinical or surgical data. Analysis of each lesion's characteristics was focused on site, appearance, size, pulsatility, and communication with other cardiac chambers.

Results

General Clinical Presentations

Of 8 patients with cardiac blood cyst, 5 were admitted to the author's hospital due to chest distress, palpitation, and chest uncomfortable; 3 cases were transferred to the author's hospital from other healthcare providers due to occupying lesions of the heart. None of these patients had a history of operation or a history of trauma. 1 case had tumor plop,2 cases had a systolic murmur and other physical examination were negative. The blood carcinoembryonic antigen was slightly increased in 1 case, the remaining 7 patients' blood tests were normal.

Echocardiographic Characteristics of cardiac blood cyst

All cases were single and 7 of them were less than 25mm in maximal diameter. In these patients, transthoracic echocardiography revealed a single balloon-like small cyst. The cyst had high tension, the wall was thin and smooth, and calcification could be seen on the wall of the cyst (fig.1). 4 of the cases were attached to the ventricular surface of the anterior mitral leaflet and 1 was attached to the posteromedial papillary muscles and chordae tendineae of the mitral valve. Of these 5 cases, 3 were located in the left ventricular outflow tract (fig.2), of which only 1 resulted in mild obstruction of the LVOT (the maximum flow velocity was 236cm/s, and the pressure gradient was 22mmHg). 2 were attached to the septal leaflet of the tricuspid valve. The other one was located on the tricuspid orifice and connected to the anterior tricuspid valve annulus. The echocardiographic characteristics in this case are atypical. The cyst was 54×31mm and attaches to the atrial surface of the anterior tricuspid valve annulus. Severance and many hyperechogenic masses with various sizes could be seen in the cyst. The wall of the cyst is intact and the shape is regular. With the swing of the cardiac cycle, the diastole reaches tricuspid valve orifice, and the systolic return into the right atrium, resulting in the stenosis of the tricuspid valve.

Surgical Treatment and Follow-Up

Of the 8 cases, 1 patient was not submitted to surgery due to the lack of clinical symptoms and discharged home with follow up. 3 cases only performed cystectomy because of no combined deformity. 1 case had infective endocarditis of mitral valve, 1 case had extensive adhesion of mitral valve and left ventricular outflow tract obstruction, and all these 2 cases underwent mitral valve replacement.1 case had a ventricular septal defect and secundum atrial septal defect, 1 case had endocardial cushion defect and these 2 cases underwent cystectomy and congenital heart disease correction. These 7 cases of operation were confirmed by pathology. All the patients had good prognosis, no recurrence occurred after the operation.

Discussion

Cardiac blood cyst is a rare benign primary tumor of the heart. It was first reported by Professor Elsasse [1] in 1844. This disease has a high incidence in infancy, especially in the neonatal. It was reported that in 38 random autopsies of fetuses and infants 2 years of age or younger were examined. Blood cysts were found in 18 cases (47%) in which ages ranged from 26 weeks of gestation to 11 months [2] .

The pathogenesis of blood cyst is not clear, and there are several hypotheses, Zimmerman reported that light microscopic examination of serially sectioned paraffin-embedded tissue and plastic-embedded tissue and scanning electron microscopic examination revealed connections between the cyst lumens and ventricles via small endothelium-lined channels. The cyst structure suggested formation from ventricular endothelial infoldings in the valve leaflet base, which bulged into the atrium because of the pressure gradient present during valve closure [2] . Takeda investigated retrospectively the morphologic aspects of blood cysts of the atrioventricular valve in eight Beagle dogs and clarified the morphogenesis of the lesions. Formation of blood cyst is divided into four basic stages: first, the blood vessels only slight expansion, cannot be detected; then, blood vessels of moderate or significant expansion and contains a large number of red blood cells, changes in this stage can be observed; and the blood flows into the cystic lesions, lesions of degeneration and necrosis. In the connective tissue around the cyst or dense fibrous tissue; finally, lesions formed in metaplasia [3] .

Blood cyst can occur in the normal heart, but also can occur in the lesion of the heart or heart invasive surgery, such as ischemic heart disease, atrial fibrillation, atrial septal defect, ventricular septal defect, transcatheter aortic valve replacement [4] and so on. The clinical symptoms of the patient are atypical.

Most of them are diagnosed by echocardiography. The rupture of the blood cyst may cause chest pain, embolism, heart failure, systemic anaphylaxis and the like. Blood cyst was mostly single and multiple rare, can occur in any part of the heart, the most common is in heart valve and chordae, especially occurred in the ventricular surface of the anterior mitral valve or related chorda. In 6 cases of this group, 5 cases occurred in the ventricular surface of the anterior mitral valve or related chorda, the same results as other researchers. On the other hand, blood cysts in the aortic valve, pulmonary valve, atrium, and ventricle have also been reported [4-7] .

The typical characteristics of cardiac blood cyst in echocardiography is a cystic mass, a single balloon-like small cyst. The cyst has high tension, the wall is thin and smooth, which calcification can be seen on it. According to the location difference, it can cause different hemodynamic effects. (In some case, it could be a) larger cyst attached to the leaflet, can cause valve regurgitation or blood flow obstruction and stenosis. Cyst located in the outflow tract can cause outflow obstruction. Transthoracic echocardiography may miss blood cyst less than 5mm.Transesophageal echocardiography is sensitive to small cyst.

Small blood cyst which causes no hemodynamic effects do not require any treatment and just requires regularly followed up. Some may rupture and disappear spontaneously. When hemodynamic changes were caused, surgical resection may need. Complete resection can do when the cyst is small or less adhesion with the surrounding tissue and postoperative effect is good with no recurrence; A excision operation with valve replacement is needed when the cyst is large or widely adhesion with valve, chordae or surrounding tissue and it is impossible to excise the cyst with a complete valve structure kept.

Conclusions

The cardiac blood cyst is a rare benign primary tumor of the heart. The difference in location can cause different hemodynamic effects. Small blood cyst which causes no hemodynamic effects do not require any treatment and only requires regularly followed up. When the hemodynamic changes are caused, the operation can be performed and the prognosis is good. Transthoracic and transesophageal echocardiography can increase the diagnostic accuracy and transesophageal echocardiography is sensitive to small cyst less than 5mm. To manage the echocardiography characteristics of the cardiac blood cyst, it is helpful by doing early detection, diagnosis, and clinical treatment.

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Figure legends

FIGURE 1 .Transthoracic echocardiography demonstrating cardiac blood cyst. **A** . The apical four-chamber view shows that a size of 19 x 19mm cyst attached to the left ventricular posterior papillary muscle and anterior mitral valve, the cyst wall is smooth with visible echogenic calcification. **B.** Cyst slightly blocked the left ventricular outflow tract. **C** and **D.** The apical two-chamber view shows that the cyst was attached to the papillary muscle and anterior mitral leaflet. LA=left atrium; RA=right atrium; LV=left ventricle; RV=right ventricle; APM= anterior papillary muscle; PPM=posterior papillary muscle.

FIGURE 2 . Transesophageal echocardiography and intraoperative of the blood cyst. **A.** A balloon-like cyst sizes of 28×29mm attached to the anterior mitral leaflet located in the left ventricle (*). **B.** Cyst led to the mild left ventricular outflow tract obstruction and turbulence of blood flow in systolic. **C.** A cyst mass (arrow) was seen in the left ventricle during operation, 40×30mm in size. The cyst attached to the anterior mitral leaflet, the base was in the posterior papillary muscle, and multiple chordae attached to the cyst. **D.** Surgical excises of the cyst and the wall rupture, it contained brown fluid which is old blood. LA=left atrium; RA=right atrium; LV=left ventricle; AO= aorta.

TABLE I Summary of cardiac blood cyst cases.

Case	Gender	Age
1	M	30
2	M	45
3	F	57
4	M	58
5	M	57
6	F	24
7	M	49
8	F	29

TABLE I Summary of cardiac blood cyst cases.

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M=male; F=female; MV=mitral valve; AL= anterior leaflet; TV=tricuspid valve; SL=septal leaflet; LVOT=left ventricular outflow tract; TR=tricuspid regurgitation; SBE=subacute bacterial endocarditis; ASD= Atrial septal defect; VSD=ventricular septal defect; PECD= partial endocardial cushion defect; MVR= mitral valve replacement; TVP= mitral valve repair.