Blood cysts of the heart are rare benign tumors, usually involving the cardiac valves. They are found mainly in the first month of life and in children; and are rarely seen in adults. Here, we report a case of a blood cyst on the subvalvular apparatus of the mitral valve, which was incidentally discovered during chest computed tomography in a 47-year-old man. To the best of our knowledge, this is the first reported case of blood cyst of the heart in an adult in Korea.

**KEY WORDS:** Blood cyst · Mitral valve · Adult.
between the anterior leaflet of the mitral valve and anterolateral papillary muscle. The mass showed intermediate signal intensity (SI) on T1 weighted image and high SI on T2 weighted image. The mass showed no definite contrast enhancement after contrast infusion (Fig. 2).

During surgery, the cyst was seen attached to the chordal structures of the anterior mitral leaflet and tip of the anterolateral papillary muscle. The cystic mass was round to oval shaped, measured 1.5 cm in diameter, purple in color and the cyst wall was translucent enough to show its dark blue content. The outer surface was smooth and glistening (Fig. 3A). The cystic mass was successfully resected and a mitral valvuloplasty with neo-
chordae formation and using Carpentier-Edwards Physio annulo-plasty ring was performed (Fig. 3B). The cyst cavity was filled with old blood and serosanguineous fluid and showed a small yellowish calcified body in the cyst wall (Fig. 3C).

Microscopically, the unilocular cyst wall was composed of a dense layer of connective tissue with internal flat lining cells. Underneath the lining cells, a blood-filled cystic cavity surrounded by a myxoid stroma was found (Fig. 3D). Immunostaining using standard avidin-biotin-peroxidase complex methods with antibodies against pancytokeratin and cluster of differentiation 31 (CD31) was done. The flat lining cells were stained with antibody CD31 (Fig. 3E). CD31 is highly expressed on endothelial cells and are concentrated at the junctions between them. The results were consistent with endothelial cells lining the blood cyst. The patient had an uneventful recovery from the operation and has been maintained on anticoagulation therapy for 1 month and after 1 month, anticoagulation therapy was discontinued. He has been maintained on aspirin 100 mg. The patient has had no symptoms or recurrent intracardiac masses for the 8 month since the excision.

**DISCUSSION**

Intracardiac blood cysts are usually asymptomatic, small and congenital. They are mainly seen during autopsy in fetuses and infants under the age of 6 months. The cysts regress spontaneously in most patients and are consequently rare in adults.\(^3\) Elsässer\(^7\) first reported a blood-filled cyst of the heart valve in 1844. Since then, similar cyst growth has been reported and potential complications include valve dysfunction, left ventricular outflow tract obstruction, and embolic stroke have been documented.\(^3\)\(^5\)

Several hypotheses have been proposed to explain the development of blood cysts.\(^3\)\(^8\)\(^9\) The first is that blood cysts are formed during valve development as a result of blood being pressed and trapped in crevices that are later sealed off. This hypothesis could be a plausible explanation for cysts in infants. The second hypothesis is that blood cysts are the result of hematoma formation in the subvalvular region secondary to the occlusion of small vascular branches of end arteries due to inflammation, vagal stimulation, anoxia, or hemorrhagic events. The third hypothesis involves possible heteroplastic changes in the tissue that comes from primitive pericardial mesothelium. The fourth and fifth hypotheses are that these blood cysts simply represent ectatic or dilated blood vessels in the valve or that they represent angiofibromas. However, there is still no consensus regarding the development of blood cysts.
Paşaoğlu et al. suggested surgical removal of a cardiac blood cyst at the time of diagnosis even if the patient is asymptomatic. On the other hand, Dencker et al. suggested that a conservative approach in asymptomatic patient with minor cyst, and surgical resection should be considered if symptoms exist or if the cysts lead to any cardiac dysfunction.

We report our incidentally discovered blood cyst. Although our patient was asymptomatic and the cyst did not interfere with the cardiac function, our patient wanted surgical resection of the cardiac mass to rule out primary cardiac malignancy and to prevent possible complications.

Blood cysts are rarely reported, so there is no consensus or guidelines for the optimal management of asymptomatic cases. According to some case reports, depending on which area of the heart is affected, blood cysts may result in a variety of clinical phenomena, including embolism, valvular dysfunction and heart block. Therefore surgical resection should be considered in patients with symptoms or valvular dysfunction and resection is also suggested to rule out malignancy.

REFERENCES

1. Zimmerman KG, Paplanus SH, Dong S, Nagle RB. Congenital blood cysts of the heart valves. Hum Pathol 1983;14:699-703.
2. Gallucci V, Stritoni P, Pasoli G, Thiene G. Giant blood cyst of tricuspid valve. Successful excision in an infant. Br Heart J 1976;38:990-2.
3. Basso C, Valente M, Poletti A, Casarotto D, Thiene G. Surgical pathology of primary cardiac and pericardial tumors. Eur J Cardiothorac Surg 1997;12:730-7; discussion 737-8.
4. Dencker M, Jexmark T, Hansen F, Tylén P, Roijer A, Lührs C. Bileaflet blood cysts on the mitral valve in an adult. J Am Soc Echocardiogr 2009;22:1085-8.
5. Minato H, Manabe T, Masaki H, Kawahara Y. Blood cyst of the pulmonary valve in an adult: report of a case and review of the literature. Hum Pathol 1997;28:252-5.
6. Nowicki M, Misterski M, Malinska A, Perek B, Ostalska-Nowicka D, Jemielity M, Wirkiewicz W, Zabel M. Endothelial integrity of radial artery grafts harvested by minimally invasive surgery--immunohistochemical studies of CD31 and endothelial nitric oxide synthase expressions: a randomized controlled trial. Eur J Cardiothorac Surg 2011;39:471-7.
7. Elsässer C. Bericht über die ereignisse in der gebäranstalt des Catherinen-Hospital in Jahre 1844. Med Correspondenzblatt 1844;14:297.
8. Xie SW, Lu OL, Picard MH. Blood cyst of the mitral valve: detection by transthoracic and transesophageal echocardiography. J Am Soc Echocardiogr 1992;5:547-50.
9. Kuvin J, Saha P, Rastegar H, Solomon RN, Pandian N, Denofrio D. Blood cyst of the mitral valve apparatus in a woman with a history of orthotopic liver transplantation. J Am Soc Echocardiogr 2004;17:480-2.
10. Paşaoğlu I, Doğan R, Demircin M, Bozer AY. Blood cyst of the pulmonary valve causing pulmonic valve stenosis. Am J Cardiol 1993;72:493-4.
11. López-Pardo F, López-Haldón J, Granado-Sánchez C, Rodríguez-Puras MJ, Martínez-Martínez A. A heart inside the heart: blood cyst of mitral valve. Echocardiography 2008;25:928-30.