Retrospective analysis of 11 cases of primary cardiac valve tumors

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Abstract

Objective: To explore the clinical features and surgical treatment experience of primary cardiac valve tumor.
Methods: The present study retrospectively analyzed the clinical data of 11 patients with primary valvular tumors who underwent surgical treatment in our department from 1980 to 2016. Echocardiography of preoperative patients was indicated as a heart valve tumor. All patients underwent cardiopulmonary bypass surgery after endocardial angiography and positron emission tomography–computed tomography diagnosis, including four tumor resections–valvuloplasty and seven tumor resections–heart valve replacement. Pathological analysis was performed on all tumors. Postoperative cardiac ultrasound was followed up. Pathological analysis was performed on all tumors. All patients underwent postoperative ultrasound follow-up examination.
Results: Primary valvular tumors are rare, accounting for only 0.034% (11/32.728) of extracorporeal circulation surgery in our center. It accounts for 2.8% (11/399) of primary cardiac tumors in the same period. Pathological study indicated that there were 10 cases of benign tumor and 1 case of low-grade sarcoma. After 0.6–16 years of follow-up, the operation effect was satisfactory.
Conclusion: Most of these tumors are papillary fibroelastoma located on the mitral valve, and surgical operation is the best strategy for cardiac primary valve tumors. *(Anatol J Cardiol 2019; 21: 11-7)*
Keywords: primary cardiac valve tumor, extracorporeal circulation surgery, tumorectomy, valvuloplasty, valve replacement

Introduction

Less than 10% of primary cardiac tumors are cardiac valve tumors (1). The most common primary cardiac tumors are myxomas, which rarely grow in valve tissue, and papillary fibroelastomas are most common in the valvular endocardium (2, 3). Most studies on valve tumors are based on scattered cases. Heart-occupying valve tumors may cause hemodynamic disorders, vascular thrombosis, valve opening and closing disorders, arrhythmia, heart failure, and other cardiovascular complications. These seriously threaten human health. Thus far, the clinical manifestations and surgical guidelines for cardiac tumors have not been well defined. In theory, early tumor removal and valve function recovery are the best treatment schemes. However, since this tumor is not easily detected, when the patient seeks medical care, the valve tumor is usually in the middle and late stages. Since 1980, our department has completed the surgical treatment of 399 primary cardiac tumors, including surgical treatment of 11 primary heart valve tumors. The aim of the present study was to explore more comprehensive and standard diagnostic and treatment options to facilitate clinical practice through retrospective analysis of previous cases.

Methods

General information

Three hundred and ninety-nine patients with primary cardiac tumor who underwent surgical treatment in our cardiac surgery department between 1980 and December 2016 were retrospectively analyzed, including 7 males and 4 females with primary cardiac valve tumor (2.8%). Written informed consent was obtained from all patients. The study protocol was approved by the Medical Ethics Committee of the Second Affiliated Hospital of Chinese People's Liberation Army Medical University (XQYY-LUNLI-FJ001.02).

The mean age of the patients was 37.6±20.6 (range: 1–63) years, with a body weight of 8–69 (40.7±10.2) kg and a course

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Accepted Date: 31.08.2018 **Available Online Date:** 23.11.2018

DOI:10.14744/AnatolJCardiol.2018.40325

Anatol J Cardiol 2019; 21: 11-7
DOI:10.14744/AnatolJCardiol.2018.40325

Table 1. Clinical manifestations and auxiliary examination of primary cardiac valve tumors (cases)

Tumor location	Case no.	Clinical manifestation			Auxiliary examination findings		
		Systemic symptoms	Congestive cardiac insufficiency	Arterial embolism	Increased heart shadow	Arrhythmia	Hemodynamic disorders
Mitral valve	6	2	4	2	4	3	5
Aortic valve	3	1	2		1		1
Tricuspid valve	1		1				1
Pulmonary valve	1	1	1				1

of disease of 1–17 (6.7±2.4) months. Clinical manifestations included systemic symptoms of recurrent low fever, emaciation and fatigue, congestive cardiac insufficiency of palpitation, short of breath and decreased exercise tolerance, hemiplegia, and blurred vision due to cerebral infarction. On examination, findings included increased heart shadow on chest films (five cases) and arrhythmia on electrocardiograms (three cases). In addition, seven patients showed hemodynamic disorders according to cardiac ultrasound examinations: (1) right ventricular systolic peak pressure difference was >50 mm Hg and (2) moderate or severe mitral regurgitation or mean velocity was >130 cm (Table 1) (4).

Surgical methods

All patients were given combined intravenous anesthesia and endotracheal intubation. Surgical approach was applied through incision at the center of the chest with routine cardiopulmonary. Cardiopulmonary bypass at mild hypothermia was selected with a cardiopulmonary bypass time of 58–196 (85.2±23.7) min and an aortic cross-clamp time under cardiopulmonary bypass of 28–125 (53.1±19.4) min.

Myocardial protection strategy: Of the patients, one received intermittent cold blood cardioplegia, seven received cold crystalloid cardioplegia, and three had beating heart at mild hypothermia. The operation steps included tumor removal and valve treatment: (1) remove tumors: removing as much tumor tissue as possible to avoid tumor recurrence; for surgery involved coronary arteries, vena cava, and other important structures, apply multiple surgical treatments and (2) recover valve function: performing valvuloplasty as much as possible. For small tumors, valvuloplasty was applied. In valvuloplasty, a catheter is passed through the artery and pushed close to the heart valve; valvuloplasty can be an effective alternative to valve replacement surgery. This was performed under X-ray guidance to avoid injury to other structures. For tumors involving valve severely, valve replacement was applied, and posterior chordae tendineae was maintained as much as possible. Valve replacement was performed in open heart replacement surgery, minimally invasive replacement surgery, and

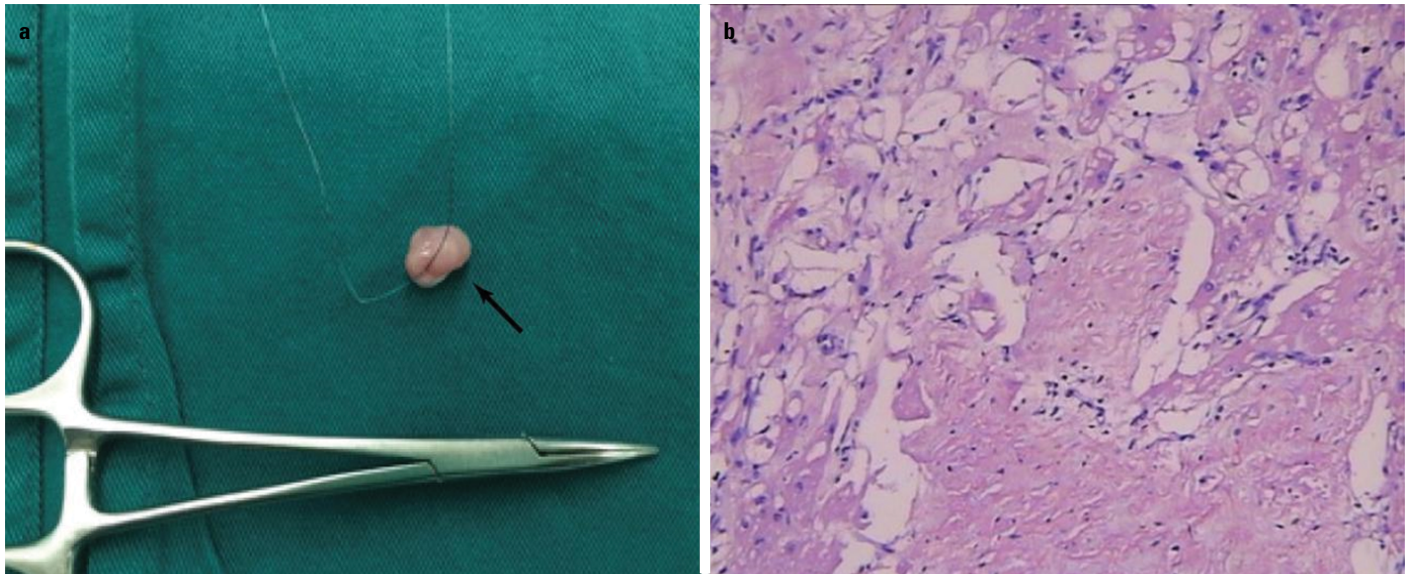

Figure 1. A representative data of primary cardiac valve tumor (case 4).
(a) A light red elliptical neoplasm resected at anterior mitral valve (approx. 1.0×0.8×0.4 cm^3).
(b) Hematoxylin and eosin staining of rhabdomyoma (100×). The tumor is composed of polygonal muscle cells mixed with spindle-shaped cells–spider web formed

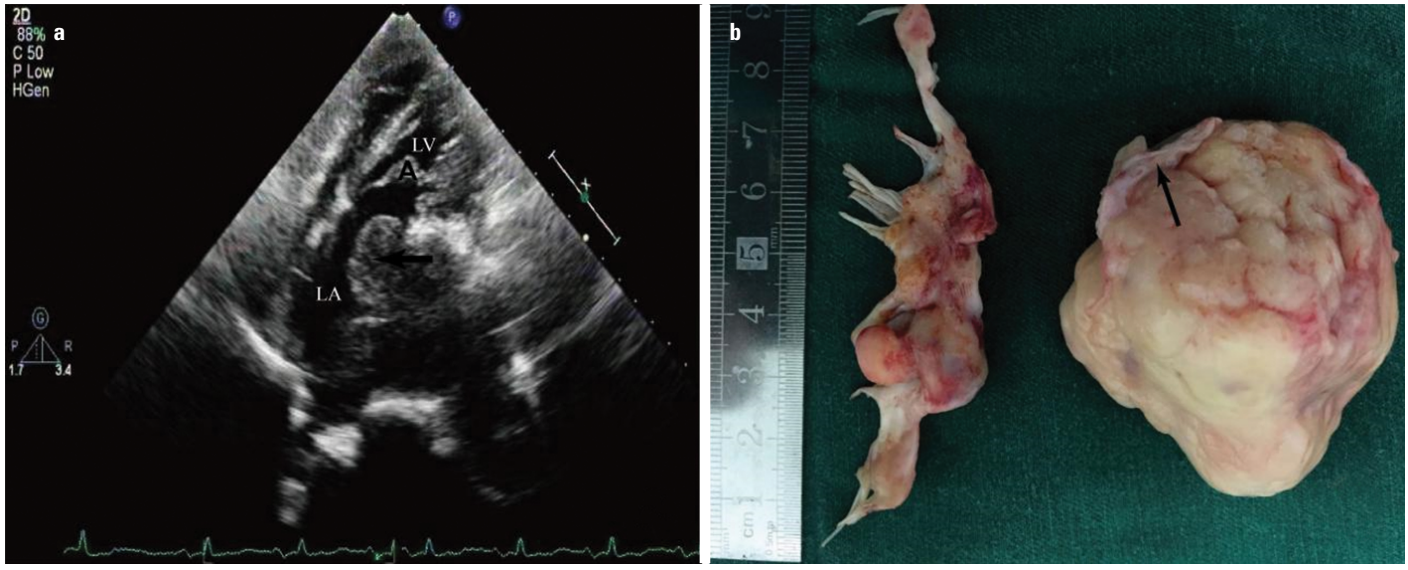

Figure 2. A representative data of patient with primary cardiac valve tumor (case 9).
(a) Cardiac ultrasound. The arrow indicates large mitral valve tumor attaching to the posterior mitral valve.
(b) Resected mitral valve and tumor (approx. 6×4.0×2.5 cm^3). The arrow indicates the posterior mitral valve

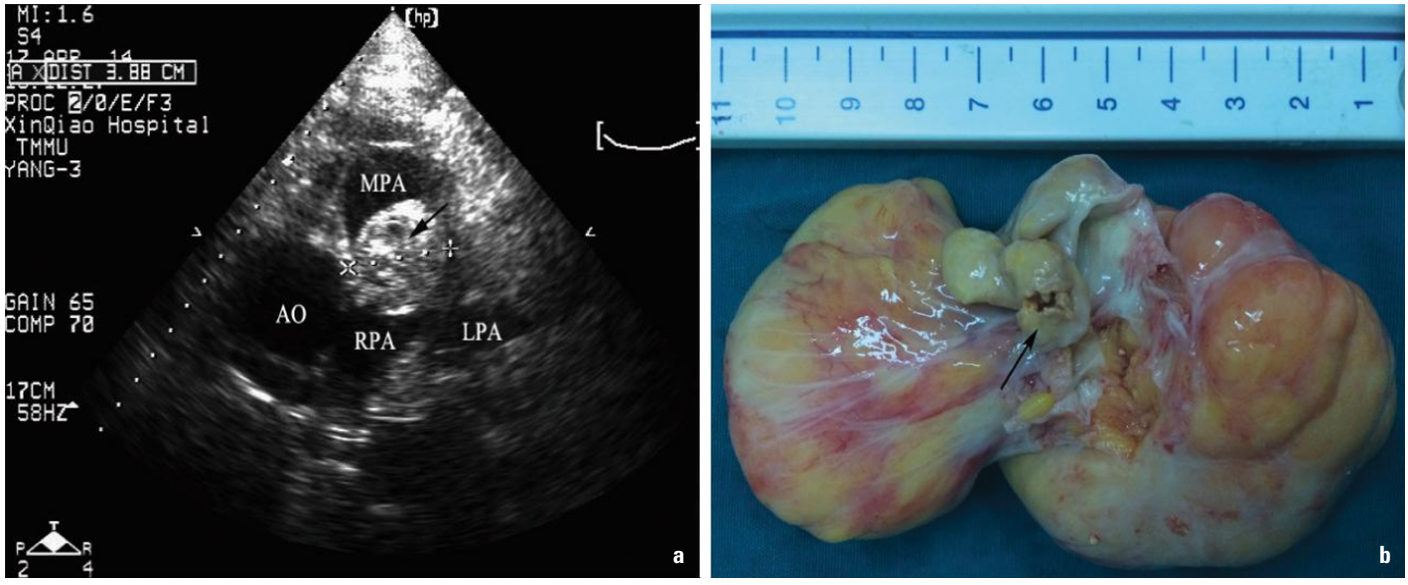

Figure 3. A representative data of patient with primary cardiac valve tumor (case 8).
(a) Cardiac ultrasound. The arrow indicates large pulmonary valve tumor blocking the right ventricular outflow tract.
(b) Resected tumor (10×5.5×4.5 cm^3) growing from the pulmonary valve. The arrow indicates the pulmonary valve

percutaneous replacement surgery. Apart from all the complications of a major surgery, arrhythmia was one of the complications.

Results

The 11 patients studied included 6 mitral valve tumors (Fig. 1 and 2), 3 aortic valve tumors, 1 tricuspid valve tumor, and 1 pulmonary valve tumor (Fig. 3). There were 5 cases of papillary elastic fibroma, 2 cases of myxoma, 2 cases of lipoma, 1 case of rhabdomyoma, and 1 case of low-grade malignant tumor (Table 2). The size of the resected tumors was approximately 1.0–10 (2.6±2.7) cm. One case of aortic valve myxoma involving right coronary ostia underwent artificial aortic valve replacement+coronary artery bypass grafting. One case of large pulmonary valve tumor involving pulmonary artery underwent artificial pulmonary valve replacement+partial pulmonary artery resection and reconstruction. There were a total of seven cases of artificial valve replacement (four cases of artificial mechanical valve and three cases of biological valve) and four cases of valvuloplasty (two cases of valve suturing and two cases of an-

Anatol J Cardiol 2019; 21: 11-7
DOI:10.14744/AnatolJCardiol.2018.40325

Table 2. Clinical data of primary cardiac valve tumor

Case	Age (year)	Sex	Tumor location	Tumor size (cm^3)	Appearance of tumor	Pathological type	Surgical strategy	Follow-up time (year)
1	21	Male	Mitral valve	1.5x0.8x0.5	Pale brown, gelatinous	Myxoma	VP	9, normal mitral valve function, NYHA I
2	63	Male	Aortic valve	1.5x1.1x0.8	White, oval	Papillary elastic fibroma	AVR (biological valve)+CABG	7, mild artificial valve regurgitation, NYHA II
3	33	Male	Tricuspid valve	2.0x1.5x0.7	Light yellow, long and narrow	Papillary elastic fibroma	VP	8.5, normal tricuspid valve function, NYHA I
4	1	Male	Mitral valve	1.0x0.8x0.4 (Fig. 1)	Red, oval	Rhabdomyoma	VP	16, normal mitral valve function, NYHA I
5	48	Female	Mitral valve	3.8x3.0x1.5	Yellow, cauliflower-like	Papillary elastic fibroma	MVR	7, normal artificial valve function, NYHA I
6	26	Female	Mitral valve	1.2x1.0x0.5	Yellow, sea anemone-like	Papillary elastic fibroma	MVR (biological valve)	7.5, mild artificial valve regurgitation, NYHA II
7	10	Male	Mitral valve	Multiple tumors 0.2x0.1x0.1; 0.4x0.2x0.1	White, multiple granuliform	Myxoma	MVR	5, normal artificial valve function, NYHA I
8	62	Male	Pulmonary valve	10x5.5x4.5 (Fig. 2)	Yellow, oval	Lipoma	PVR (biological valve)+PAR	2, normal artificial valve function, NYHA I
9	53	Male	Mitral valve	6x4x2.5 (Fig. 3)	Light yellow, oval	Lipoma	MVR	2, normal artificial valve function, NYHA I
10	61	Female	Aortic valve	2x2x1.5	White, long and narrow	Papillary elastic fibroma	VP	1, normal aortic valve function, NYHA II
11	36	Female	Aortic valve	1.5x1x0.5	Light red, wide infiltration	Low-grade malignant tumor	AVR	0.6, lost to follow-up

VP - valvuloplasty; AVR - aortic valve replacement; CABG - coronary artery bypass grafting; MVR - mitral valve replacement; PVR - pulmonary valve replacement; PAR - pulmonary artery reconstruction

nuloplasty ring placement). Pathological results indicated that there were five cases of papillary elastic fibroma, two cases of myxoma, two cases of lipoma, one case of rhabdomyoma, and one case of low-grade sarcoma (Table 2). There was no case of death during the perioperative period, and all patients were followed up for 0.6–16 years. There was no case of death during the perioperative period, and all patients were followed up for 1–16 years. There were five cases of grade I cardiac function and five cases of grade II cardiac function. As for valves, (1) after biological valve replacement, one patient developed mild regurgitation after 6 years of artificial mitral valve replacement, and no worsening was observed during follow-up for 1.5 years; one patient developed mild regurgitation after 5 years of artificial aortic valve replacement, and no worsening was observed during follow-up for 2 years; the valve function of other patients was normal. (2) After artificial mechanical valve replacement, valve function was normal, international normalized ratio was maintained between 1.5 and 2.0 on routine warfarin anticoagulation therapy, and no coagulation complication occurred. (3) No patient developed valve dysfunction after valvuloplasty. As for tumors, one case of low-grade sarcoma was lost to follow-up at 7 months after surgery, and no other patients had tumor recurrence (Table 2).

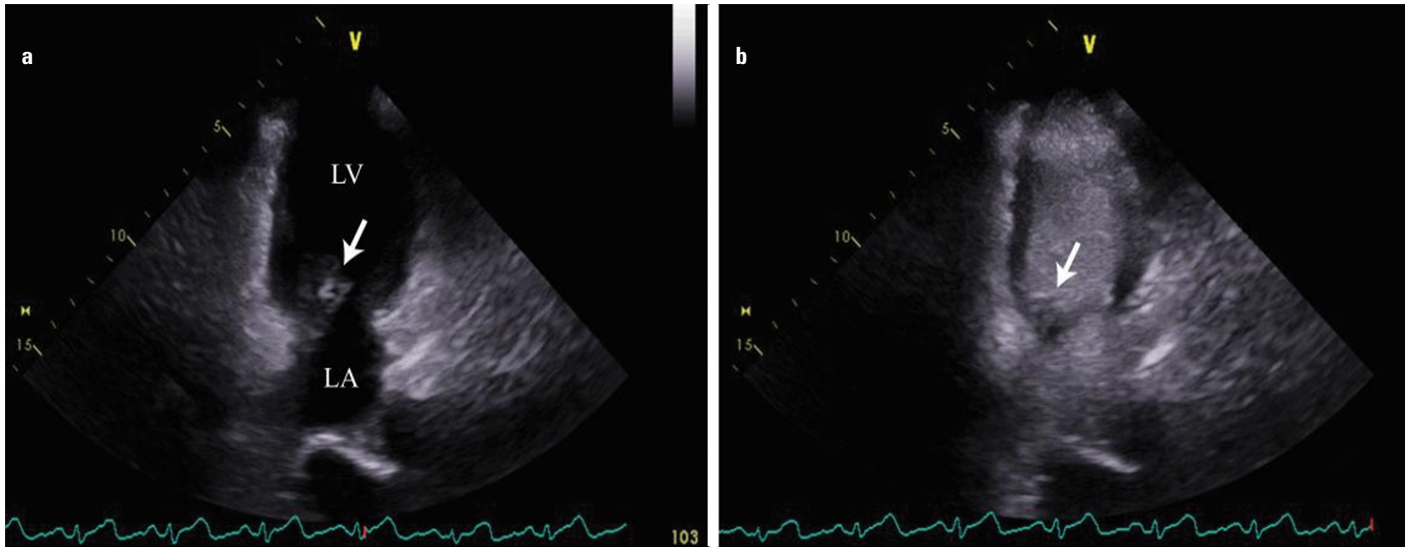

Figure 4. Intracardiac contrast echocardiography.
(a) Before injection of contrast. The arrow indicates the mitral valve and the attached neoplasia.
(b) After injection of contrast. In LVO contrast mode, the contrast develops in each cardiac chamber in sequence. The arrow indicates basically synchronous developing of mitral valve neoplasia and ventricular muscle

Discussion

In a multi-institutional experience report of 56 cardiac valve tumors including some malignant tumors, Edwards et al. (1) classified fibroblastoma as the most common benign valve tumor type (73%), followed by lipomas, myxomas, and blood disease cysts. It is generally believed that papillary fibroelastomas are both benign histologically and hemodynamically because these types of tumors differ from myxomas in that they never reach the size that causes obstruction, and the papillae has a firm consistency, meaning that embolism has a low fragmentation risk. The diagnosis of primary cardiac valve tumor is difficulty in a clinic, which is not because it is difficult to find neoplasia on the valve, but because there is no symptom during the early stage. Patients seek medical advice mainly because of obvious hemodynamic changes due to tumor growth, embolism symptoms due to partial tumor shedding, or systemic symptoms of recurrent fever and emaciation (5). Wang et al. (5) reported 8 cases of primary heart valve tumors, 75% of the patients mainly showed shortness of breath, fatigue, and weakness, 2 (25%) patients presented with vertigo or dizziness, and 2 (25%) patients had paroxysmal chest pain. Hemiplegia and blurring of vision caused by cerebral infarction were seen in 2 (25%) patients. In our study, congestive cardiac insufficiency was the most common clinical symptom of primary cardiac valve tumor. All 11 patients seeking medical advice were because of clinical symptoms: 4 cases of systemic symptoms, 8 cases of congestive cardiac insufficiency, and 2 cases of arterial embolism.

For differentiated diagnoses, the aforementioned clinical symptoms as well as the results of chest film and electrocardiogram can only be used as auxiliary diagnostic criteria. Cardiac ultrasound is the most valuable examination (6). The typical positive cardiac ultrasound result is neoplasia on the valve. However, it often needs to be differentiated with infective endocarditis, secondary cardiac valve tumor, intracardiac thrombus, and primary cardiac tumor. The differentiation with infective endocarditis shall be based on medical history and results of blood bacterial culture and contrast intracardiac echocardiography. Although transthoracic echocardiogram (TTE) and transesophageal echocardiogram (TEE) are currently considered to be the best tools for evaluating cardiac valve tumor, TEE may be superior to TTE in the evaluation of small cardiac valve tumor (3). Meanwhile, contrast intracardiac echocardiography and positron emission tomography–computed tomography (PET–CT) play an important role in the differentiation of secondary cardiac valve tumor (7, 8).

In the present study, all 11 patients underwent blood bacterial culture, and the results were all negative. Seven patients underwent intracardiac contrast echocardiography, and two patients underwent PET–CT. The typical positive intracardiac contrast echocardiography result was the shadow of valvular tumor formation (Fig. 4a and 4b), which is important for the differential diagnosis of valvular tumors.

In theory, early tumor removal and valve function recovery are the best treatment schemes. It is not just because surgery may solve the increasingly worsening congestive cardiac insufficiency, surgery may also reduce death caused by cerebral infarction, pulmonary embolism, and myocardial infarction (9, 10). The surgery steps include tumor removal and valve function recovery. Removing tumor tissues as much as possible can effectively prevent tumor recurrence. All 11 patients in the present study underwent thorough removal of tumor tis-

Anatol J Cardiol 2019; 21: 11-7
DOI:10.14744/AnatolJCardiol.2018.40325

sues under cardiopulmonary bypass. Two patients underwent resection of partial infiltrated aorta and pulmonary artery in order to thoroughly remove tumor tissues and were remedied by coronary artery bypass grafting and pulmonary artery reconstruction. Valve function recovery is the most important part of the surgery. At present, valvuloplasty and valve replacement are important surgical methods to recover valve function. Undoubtedly, compared with valve replacement, valvuloplasty has fewer complications, better hemodynamics, and no need of life-long anticoagulation (11).

In the present study, four patients underwent valvuloplasty on the premise of valve tumor removal, and the valve function is stable during the follow-up time. The rest of the seven patients underwent valve replacement because of severe valve involvement. The application of mechanical valve and biological valve in valve replacement was the major topic during the past decade. Various studies (12, 13) indicated that the application of mechanical valve in patients <65 years old is characterized by an uneasy decay and high long-term survival rate. However, life-long anticoagulation is the fatal flaw. Among seven patients who underwent valve replacement, three were >60 years old. Early and precise diagnosis of primary cardiac valve tumor may lay the foundation for valvuloplasty and enhance the quality of life of patients.

The postoperative prognosis of benign primary cardiac valve tumor is good. Luo et al. (14) reported 11 cases of primary cardiac valve tumor during the past 25 years in 2011. Among these cases, nine were benign valve tumor. On the premise of tumor removal, seven cases underwent valvuloplasty, and four cases underwent valve replacement (all mechanical valves). Patients were followed up for 10.6±8.8 years. There were no tumor recurrence and valve dysfunction after surgery (14). Sun collected a patient with the largest cardiac papillary elastic fibroma in 2001; for 162 patients with cardiac papillary elastic fibroma, 134 patients had valve tumor. Out of 134 patients, 64 patients who underwent surgery were followed up for 630±903 days, and no tumor recurrence was observed (15). In the present study, 10 patients with benign tumors were followed up for 6.5±4.2 years without tumor recurrence. Four patients who underwent valvuloplasty and three patients who underwent mechanical valve replacement are followed up for 6.9±4.7 years with no valve dysfunction. Three patients who underwent biological valve replacement were followed up for 5.5±2.5 years, and two patients developed mild artificial valve regurgitation at 5 and 6 years after surgery, respectively. After treatment with cardiotonic and diuretic, they were followed up for 2 years and 1.5 years, and their condition did not worsen. Luo et al. (14) showed that two patients with malignant valve tumor died from local tumor recurrence and brain metastasis at 11 months and 12 months after surgery, respectively. Surgical resection mortality in primary cardiac tumors is low. The survival rate of benign tumors is satisfactory, but the prognosis of patients with malignant tumors is poor (16). Unfortunately, one patient with malignant tumor in our study was lost to follow-up at 7 months after surgery.

Study limitations

This study only demonstrates the standard medical procedures in 11 cases. In the future, it will be needed to collect more patients with primary cardiac valve tumors and to systemically analyze their TTE, TEE and PET-CT for early diagnosis.

Conclusion

Cardiac ultrasound and PET–CT help to diagnose primary heart valve tumors. Most of these tumors are papillary fibroblastomas located on the mitral valve, and surgery is the best strategy for primary valvular tumors of the heart. Benign primary valvular tumors have a good prognosis.

Conflict of interest: None declared.

Peer-review: Externally peer-reviewed.

Authorship contributions: Concept – Y.X., X.W., Y.W.; Design – T.L.; Supervision – C.L.; Fundings – T.L.; Materials – C.L.; Data collection &/or processing – S.G.; Analysis &/or interpretation – T.L.; Literature search – Y.L.; Writing – T.L.; Critical review – T.L., Y.W.

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