Surgery for Cardiac Tumors (Primary and Secondary) – Clinical Experience and Surgical Results in 22 Patients: Queen Elizabeth Hospital

KAR-WAI LAM,[1] CHAN-CHUNG MA,[1] KWOK-KEUNG HO,[1] CHEUNG-WAH CHENG,[2] KAM-TIM CHAN[2]

From [1]Department of Cardiothoracic Surgery; [2]Cardiology Division, Department of Medicine, Queen Elizabeth Hospital, Hong Kong

LAM ET AL.: ***Surgery for Cardiac Tumors (Primary and Secondary) – Clinical Experience and Surgical Results in 22 Patients: Queen Elizabeth Hospital. Purpose:*** *Retrospective review of surgical management of the 22 cardiac tumors resected in Queen Elizabeth Hospital during the period of March 1995-December 2002.* ***Methods:*** *Presenting symptoms, diagnostic data, anatomical findings, surgical techniques, morbidity and complications of surgery were recorded. Follow up data was retrieved from out-patient records.* ***Results:*** *There were 12 male (54.5%) and 10 female (45.4%) patients. Median age was 61. 50% (11/22) of the cases were myxoma. Of the remaining cases, 27.3% (6/22) were various types of secondary metastastic tumor, 13.6% (3/22) were tumor of mediastinum with cardiac invasion, and 9.1% (2/23) were primary malignancy. Left sided masses were dominated by myxoma, which were sited either on the inter-atrial septum (81.8%) or left atrium (18.1%). All other tumor groups were found on the right side. Dyspnea (81.9%) was the most common presenting symptom, followed by chest pain (31.8%), embolic events (13.6%) and superior vena cava obstruction. All tumors were resected with cardiopulmonary bypass under moderate hypothermia, undertaken via either right atriotomy, superior septal and trans-septal with full thickness excision. The average cross-clamp time and bypass time were 48.6 minutes and 101.4 minutes respectively. The average blood loss was 813 ml. Post-operatively, 2 of the cases were complicated by junctional bradycardia and one of them required permanent pacing. Other complications including pericardial effusion, superior vena cava obstruction, pneumonia, secondary hemorrhage had been reported. The average follow up period was 40 months ranging from 3 months to 8 years. All patients with primary benign myxoma remained asymptomatic except one died 3 years after surgery. This patient had known co-existing history of breast cancer. She suffered from embolic complications and finally succumbed from multiple organ failure. All patients with secondary neoplasms died during the course of follow-up. One with germ cell tumor was lost to follow up. Survival for primary benign tumors and cardiac metastasis from secondary tumors, were 34 and 6 months respectively. The median survival of all tumors was 25 months. Surgical resection, when possible, is the treatment of choice for all patients with cardiac neoplasms. It is curative in benign tumors. On the other hand, palliative surgical procedures may be carried out for malignant tumors for relief of obstructive symptoms and allow time for adjuvant therapy. (J HK Coll Cardiol 2004;12:7-15)*

Cardiac tumor, myxoma, superior septal approach, survival

摘要

目的：回顧性地分析從1995年3月至2002年12月間伊利沙伯醫院手術切除的22例心臟腫瘤病人的資料。**方法：**記錄臨床症狀、診斷資料、解剖發現、手術技術、病殘狀況和手術併發症。並從門診記錄中獲取隨訪資料。**結果：**共有12 位男性(54.5%) 和10位女性(45.4%)病人，平均年齡爲61歲。50%(11/22)的病例爲粘液瘤。其他剩餘的病例中，27.3%(6/22)爲各種類型的繼發性轉移腫瘤，13.6% (3/22)爲縱隔腫瘤伴有心臟侵犯，其他9.1% (2/23)爲原發性惡性腫瘤。左側腫塊都爲粘液瘤，部位或在房間隔內(81.8%)或在左心房(18.1%)。其他腫瘤則位於右側。呼吸困難(81.9%)是最常見的臨床症狀，其次爲胸痛(31.8%)，栓塞事件(13.6%)和上腔靜脈阻塞。所有腫瘤均在適中的低溫下通過心肺轉

Address for reprints: Dr. KW Lam
Department of Cardiothoracic Surgery, Queen Elizabeth Hospital, Kowloon

Fax: (852) 2958 6875

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流將其切除，途徑或者是右心房切開，或者是上間隔和經間隔全層切開。平均阻斷時間和轉流時間爲48.6分鐘和101.4分鐘，平均失血量爲813 ml。手術以後，2例病人併發接點心動過緩，其中1人需要永久性心臟起搏。其他併發症包括有心包積液、上腔靜脈阻塞、肺炎和繼發性出血。平均隨訪時間爲40個月，從3個月至8年。除了1位病人術後3　年死亡以外，所有的原發性良性粘液瘤病人均無症狀。死亡的那位病人有同時存在乳房癌的病史，她出現了栓塞的併發症，並最終因多器官功能衰竭而死亡。在隨訪期間所有的繼發性腫瘤病人均死亡。有一位生殖細胞腫瘤的病人失去了隨訪。原發性良性腫瘤和繼發性腫瘤心臟轉移的生存期分別爲34個月和6個月。所有腫瘤的平均生存期爲25個月。當可能的情況下，手術切除是所有這些心臟腫瘤病人的治療選擇。對於良性腫瘤這是可治癒的。另一方面，對於惡性腫瘤姑息性手術可以緩解阻塞症狀，並爲輔助治療提供時間。

關鍵詞：心臟腫瘤、粘液瘤、上間隔途徑、生存期

Introduction

Primary cardiac tumor is rare entities.[1] Three quarters of tumor are benign and nearly half of the benign tumors are myxoma. Metastatic tumor component, on the other hand, is relatively frequent. It is generally located in the pericardium.[1] Diagnosis is usually difficult since clinical manifestations varied and sometimes patients may be asymptomatic. Surgical results in patients with primary cardiac tumors depend upon the anatomical and histological type of tumors. Conduction disturbances and supra-ventricular arrhythmias are common complications following excision of left atrial myxomas. Superior-septal approach can injure sinus node function because incision interrupts the sinus node artery.[2] Benign cardiac tumors are generally curable if surgically excised, and the prognosis is excellent. Aggressive surgery can palliate obstructive symptoms in malignant tumors and allow time for adjuvant therapy even though it may result in incomplete excision.[3]

Patients and Methods

Cardiac tumors (primary and secondary) were resected from 22 patients in Queen Elizabeth Hospital between the period of March 1995-December 2002. There were 12 male (54.5%) and 10 female (45.5%) patients (age between 14-72). Median age was 61 and mean age was 56.7.

Tumors were mainly divided into 3 groups: primary (benign and malignant), secondary (metastatic) and mediastinal tumor with cardiac invasion. Primary, benign cardiac tumor, myxoma (n=11), accounted for 50% of all cases. Primary malignant composed of 9% of all cases. One of them was angiosarcoma (n=1) and the other malignant fibrous histiocytoma (n=1). Of the secondary cardiac tumors, 3 were metastasis from carcinoma of lung (13.6%), including one large cell carcinoma and 2 non-small cell carcinoma. In the remaining cases, 2 were metastasis from the liver (hepatocellular carcinoma) and one from the bladder (transitional cell carcinoma). Lastly, the mediastinal group with cardiac invasion accounted for 13.6%, of all which 2 were malignant thymoma (n=2) and one germ cell tumor (n=1) (Tables 1 & 2).

Presenting Symptom

The majority (81.8%) of patients presented with shortness of breath and chest pain (31.8%). Embolic events (including recurrent TIA and pulmonary embolus) were noted in 3 patients (13.6%). One of the pulmonary embolus was located in the right pulmonary artery with extension into the right ventricle. Three of the patients presented with Superior Vena Caval Obstruction (SVCO) syndrome. Various cardio-pulmonary symptoms (including dizziness, cough, hemoptysis and fever) had been reported (Table 3).

Investigation

All patients had echocardiogram (transthoracic) as their diagnostic modalities. Transoesophageal echocardiogram and CT thorax were performed in

Table 1. Results (primary cardiac tumor)

Lesion		No	Sex (M/F)	Site
Myxoma	(benign)	11	3/8	LA (2), interatrial septum (9)
Malignant fibrous histiocytoma	(malignant)	1	0/1	LA
Angiosarcoma	(malignant)	1	1/0	RA

LA: left atrium; RA: right atrium

Table 2. Results (secondary / metastasis)

Lesion		No	Sex (M/F)	Site
Mediastinal	Thymoma / thymic CA	2	2/0	Thymus
	Germ cell	1	1/0	Mediastinal with bilateral pleural extension, right bronchus and trachea
Secondary	HCC	2	2/0	RV, IVC
	TCC	1	1/0	RA
	Lung CA	3	2/1	RV, LA, RVOT

CA: cancer; HCC: hepatocellular carcinoma; TCC: transitional cell carinoma; RV: right ventricle; IVC: inferior vena cava; RA: right atrium, AV: atrio-ventricular; RVOT: right ventricular outflow tract

Table 3. Clinical presentations

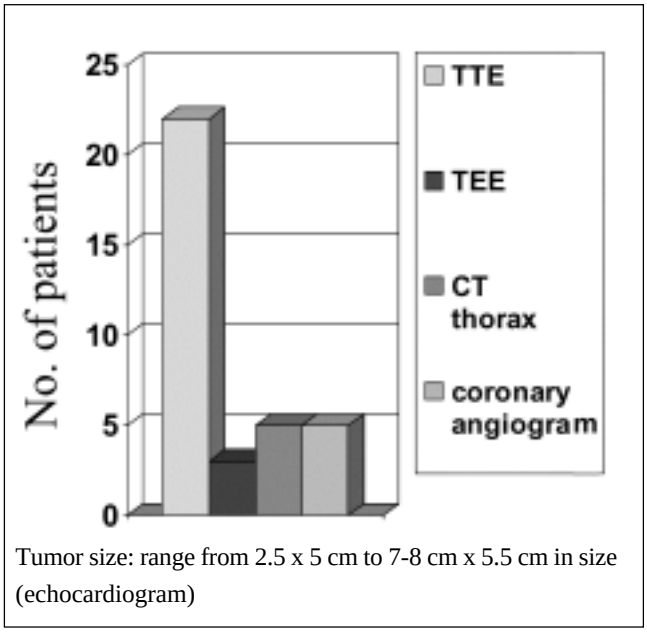
Symptom		Myxoma	Primary malignant	Secondary malignant	Mediastinal tumor
Dyspnea		8/11 (72.7%)	2/2 (100%)	5/6 (83.3%)	3/3 (100%)
CHF		4/11 (36.3%)	1/2 (50%)	1/6 (16.7%)	0
Chest pain		5/11 (45.4%)	1/2 (50%)	1/6 (16.7%)	0
Syncope		0	0	0	0
Embolism	Cerebral	1/11 (9.09%)	0	0	0
	Peripheral	0	0	2/6 (33.3%)	0
	Coronary	1/11 (9.09%)	0	0	0
	AII 3		0	0	0
Constitional manifestation		3/11 (27.2%)	1 (hemoptysis)	0	0
SVCO		0	0	0	3/3 (100%)

CHF: congestive heart failure; SVCO: superior vena caval obstruction

selected patients. One patient with history of ischemic heart disease also had coronary angiogram as part of the preoperative investigation (Figure 1).

Tumor size range from 2.5 x 5 cm to 7-8 cm x 5.5 cm in size. Of all the atrial myxoma, 4 had narrow stalk and one was pedicled. Two had broad sessile base. For the non-myxomatous tumor group, only one of them had narrow stalk. One patient had tumor arising from the pulmonary valve annulus (Figures 2 & 3).

In each case, tumor was excised during total cardiopulmonary bypass under moderate hypothermia. The average cross-clamp time and bypass time were 48.6 minutes and 101.4 minutes respectively. The average blood loss was 813 ml.



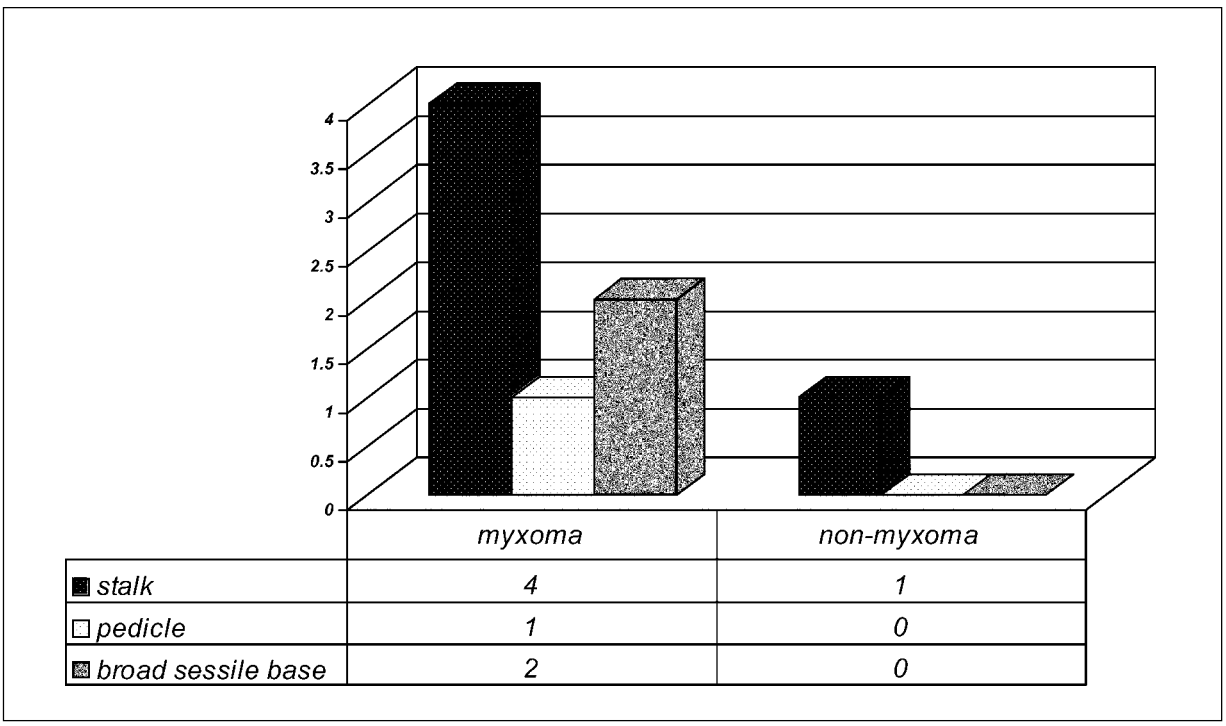
Tumor size: range from 2.5 x 5 cm to 7-8 cm x 5.5 cm in size (echocardiogram)

Figure 1. *Diagnostic modalities.*

Surgical approaches were mainly accessed via the right atrium (right atriotomy). Amongst these 17 cases, superior-septal approach was employed in 6 of the cases. Trans-septal approach was used in 3 cases. One of them required the extension of incision into the left atrium. Another required incision into pulmonary artery because of the extent of the tumor mass.

Tumor excision was performed in 17 cases and the remaining 5 were performed as palliative procedures (Figures 4 & 5).

Excision of the atrial tumor with an adequate margin was generally performed in each of these cases. Atrial septal defect (ASD) was created in 5 of these cases, in which 2 of them required patch repair. Primary closure (of ASD) was performed in the remaining case. One patient also had co-existing mitral valve replacement (Figure 6 & Table 4).



	myxoma	non-myxoma
stalk	4	1
pedicle	1	0
broad sessile base	2	0

Figure 2. *Morphology of tumor masses.*

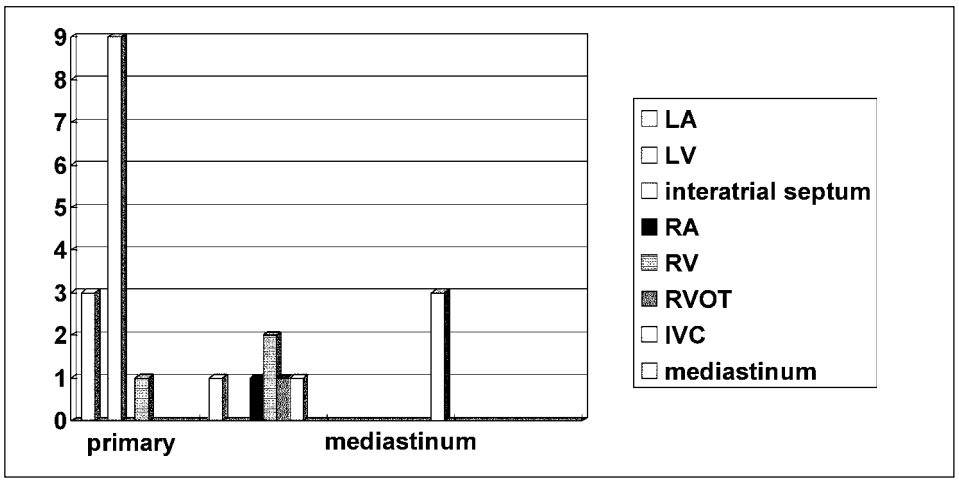


Figure 3. *Site and distribution of tumor.*

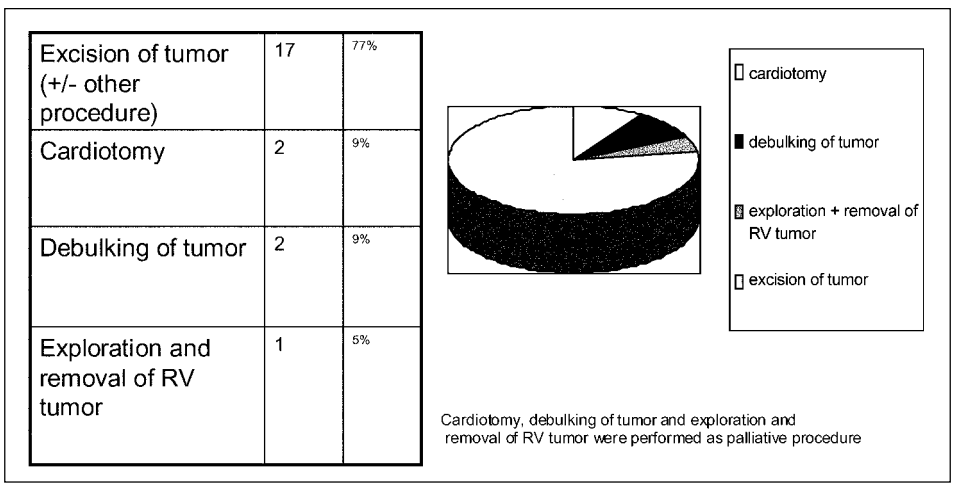


Figure 4. *Surgical procedures.*

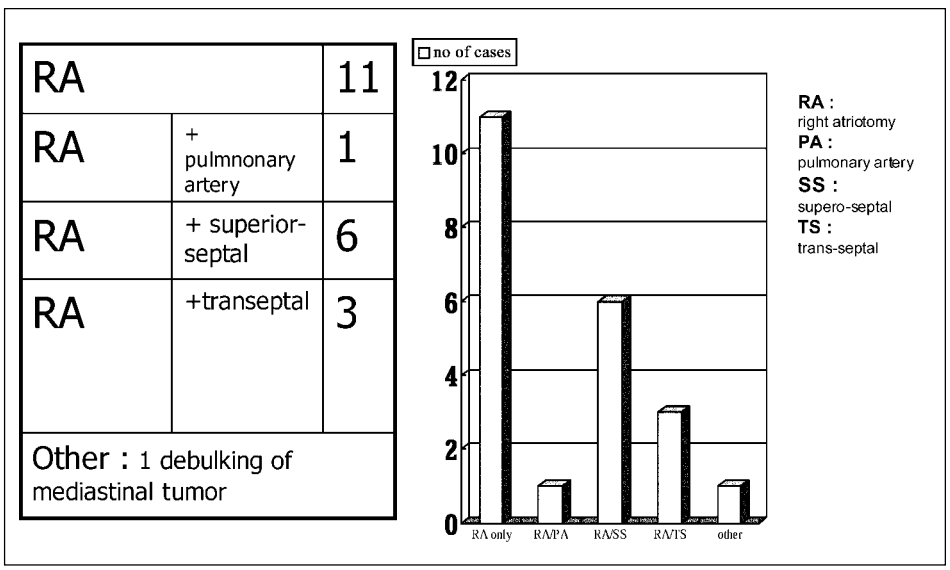


Figure 5. *Surgical approaches.*

Excision of tumor only			10	58%
	+ ASD	Repair	3	18%
		Patch closure	2	12%
	CABG		1	6%
	MVR		1	6%

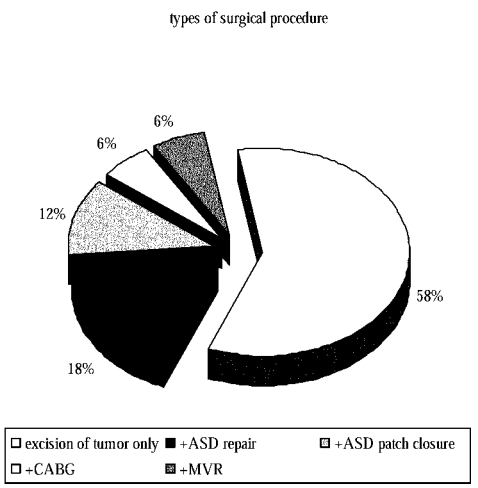


Figure 6. *Type of surgery (treatment group: tumor excision).*

Table 4. Early morbidity

• **Cardiac complications**	
- Junctional bradycardia	2
- Pericardial effusion	1
• **Respiratory complications**	
- Pneumonia	1
• **Thoracic complications**	
- SVCO obstruction	1
- Bilateral diaphagmatic paralysis	1
• **Systemic complications**	
- Secondary hemorrhage	1
- Wound infection	1
- Sepsis	1
- GI bleeding	2
- Hypoxic brain damage	1
- Multi-organ failure/DIC	1
- Embolic events	1

Early Deaths

Early deaths were defined as death within 30 days of operation which occurred in 3 of our patients.

One of them (with secondary metastasis from transitional cell carcinoma) died of complications as a result of tumor obstruction to the right ventricular outflow tract. The second patient (carcinoma of unknown origin, ? lung) died of gastrointestinal bleeding. The third patient with angiosarcoma died of multi-organ failure and sepsis (due to the rapid progression of the disease) (Table 5).

Recurrence had been reported in 2 patients. One with malignant fibrous histiocytoma and large cell carcinoma (lung), in which both received cycles of chemotherapy. The tumor size were large and in conjunction with its aggressive nature and rapid growth, debulking surgery had been performed for palliative purposes.

Follow up

All 12 survivors (10 myxoma, 1 thymic carcinoma and 1 malignant thymoma) remained asymptomatic during the time of follow-up of up to 7 years. One patient with germ cell tumor was lost to follow-up.

Discussion

Tumors of the heart remain a rare occurrence. The incidence of primary cardiac neoplasia ranges from 0.001% to 0.03% in autopsy report.[4]

In adult, approximately 75% of such tumors

Table 5. Late deaths

Tumor type	Sex/age	Time from presentation till death	Evidence of recurrence	Cause of death
Large cell carcinoma	M/58	5 months	Malignant pleural effusion	Large cell CA
HCC	M/62	6 months	(FU PWH)	Palliative resection of tumor (RVOTO) Progression of RHF
HCC	M/62	6 months	Palliative resection of tumor	HCC, RHF
MFH	F/64	2 years	Yes (LA wall with obstruction to MV valve prosthesis)	Progression of CHF Disseminated CA
Secondary cell carcinoma (lung)	M/59	3 years	Intraperitoneal metastatic spread	CA lung
Myxoma (background history of CA breast)	F/59	3 years	Emboli (recurrent TIA, popliteal and femoral artery thrombosis) septic encephalopathy	Sepsis, MOF

CA: cancer; HCC: hepatocellular; MFH: malignant fibroblastic histiocytoma; RHF: right heart failure; CHF: congestive heart failure; TIA: transient ischemic attack; MOF: multi-organ failure

are benign and 25% are malignant.[5] Eleven of 22 (50%) tumors in this surgical series were benign tumor and all were myxoma. Two (9.1%) were primary malignant tumors (Figure 1). In the remaining 8 cases were metastatic tumor (arising from lung, liver and bladder). 3/22 (13.6%) were mediastinal tumor with cardiac invasion (Figure 2).

Myxoma is the most common primary tumor of the heart (30-50% of all cases). They may affect patients of all ages, predominantly women. They are gelatinous masses (myxomatous), lobulated, attached to the endocardium via a variable sized pedicle or by a wide base that project toward the interior of the cavity without infiltrating the underlying tissue. 75-80% are found in the left atrium, especially associated to the fossa ovalis.[3]

Sarcoma accounted for almost all these malignant tumors, they have a rapid and fatal evolution. Surgical statistics show that the most frequent malignant tumors are angiosarcoma (35-40%), most of which (80%) are located in the right atrium.[1] They are invasive tumor masses, with areas of necrosis and hemorrhage affecting the myocardium, and may protrude into the atrial cavity. Because of its unique location, they can manifest as right heart failure. Pericardial effusion (usually hemorrhagic in nature with or without tamponade) as well as systemic manifestation (e.g. fever, weight loss) had also been reported in the literature.[1]

The only patient with angiosarcoma (primary malignant) in our series, the tumor was also sited in the right atrium. He presented acutely with marked shortness of breath and hemoptysis. His condition deteriorated rapidly despite palliative surgical resection of the tumor. He went on to develop multi-organ failure, septicaemic shock and eventfully died the next day after surgery.

Secondary cardiac neoplasms are 20-40 times more common compared with primary malignancies.[3] Metastases can reach the heart via blood stream and coronary arteries (e.g. melanoma, sarcoma and bronchogenic carcinoma). Other routes include the lymphatic channels or direct invasion of tumor from adjacent lung, breast, oesophagus and thymus. Pericardium is the most frequently involved structure through direct invasion by various thoracic tumors.

Clinical symptoms were commonly reported to be found in 10% of these patients[6] Pericardial effusion or cardiac tamponade was the most common symptom. Three of our patients (with mediastinal tumor) presented with symptoms of superior vena cava obstruction.

Abdominal and pelvic tumors may grow in a cephalad direction via the inferior vena cava to reach the right atrium. Up to ~10% of cases of renal cell carcinoma behave in this manner and nearly 40% of these reach the right atrium.[3]

Surgical Approaches

Various approaches had been described in the literature, depending on the site and extent of tumor involvement. The superior-septal approach (SS) had been adopted in the majority of the cases, however, trans-septal approach (TS) had also been used depending on the location of the tumor.

The proposed advantages of TS include only one atrial incision, adequate exposure for evaluation of the mitral valve, low recurrence rates and its long term efficacy.[7] The SS, on the other hand, provides an excellent exposure for en bloc removal of the tumor with simultaneous visualization of both sides (right and left) of the inter-atrial septum. It is associated with a lower risk of damaging the mass and thus tumor embolisation.

Supra-ventricular arrhythmias and conduction disturbances were commonly reported following this approach, as the sinus nodal artery is often interrupted during the incision and thus sinus nodal function.[2]

In our series, 3 cases of post-operative arrhythmia had been reported. Two of them were junctional bradycardia and the SS approach had been adopted in these cases. One required temporary pacing which subsequently self-reverted to sinus rhythm. The third patient had complete heart block prior to operation (likely relating to tumor invasion of the conduction system), she sustained such rhythm post-operatively, which lately required permanent pacing for treatment of her condition. The prognosis for resection of atrial myxoma, as repetitively reported in the literature, has been excellent. The optimal operative approach lacks uniformity. There is still considerable controversy concerning the extent of surgical resection necessary to prevent recurrence.[5] The rate of recurrence had been reported to be between 4-7% in different series.[5,8] In our series, only one patient with myxoma died 3 years after surgical treatment. She suffered from complications (including septic encephalopathy and multi-organ failure) likely relating to her past history of breast cancer. During the course of her follow-up, there had been no evidence of recurrence of myxoma.

Post-operative echocardiogram had been generally recommended to detect recurrence. Except for those patients with multiple, atypical or familial myxoma, few trans-thoracic echocardiogram at 5-year intervals throughout life should be adequate if there has been recurrence in the first few years.[9]

On the other hand, prognosis is generally poor in those with primary malignant or secondary neoplasms. Surgical treatment is directed at providing symptomatic relief with minimal patient discomfort and hospital stay.[3] All patients with secondary neoplasms died after a period of follow-up ranging between 3 months to 3 years.

In conclusion, surgical resection, when possible, is the treatment of choice for all patients with cardiac neoplasms. It is curative in benign tumors. Palliative procedures, on the other hand, may be carried out for malignant tumors for relief of obstructive symptoms. It may prolong life and allow time for effective adjuvant therapy, but this would depend on the histological type (thus natural behavior of the tumor) and the location of the lesion.

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