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A RETROSPECTIVE STUDY OF PRIMARY CARDIAC TUMOURS - ANALYSIS OF CLINICAL PRESENTATION, DIAGNOSTIC METHODS,SURGICAL MANAGEMENT, POSTOPERATIVE COMPLICATIONS AND FOLLOW UP RESULTS

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ABSTRACT

From July 2014, 44 patients have undergone excision of an intracardiac tumor. All of them were myxomas. The location of the tumors was in left atrium in 40 (90.90%), in the right atrium in 2 (4.5%), and in the right ventricle in 2 (4.5%) patients. Of the 44 patients there were 25(56.8%)female and 19(43.18%) male patients with a mean age of 46 ± 14 years (range, 7 to 68 years). Three patients (6.8%) were asymptomatic; the others were seen mostly with exertional dyspnoea, palpitation, signs of systemic illness, and syncopal episodes.There were no patients with petechial hemorrhages or palpable spleen in this series.Of the 40 patients with myxoma before operation, embolic episodes occurred in 10 patients with a left atrial myxoma. 8 of these patients first manifested with embolic events. Excision of the tumors were done under cardiopulmonary bypass and cold cardioplegic arrest.The left atrial myxomas were approached through right atrium in 26 (65%) patients.Biatrial approach 8(20%) and left atrial approach 6 (15%) were adopted in patients with large myxomas and in myxomas with attachment to sites other than inter atrial septum . For the left atrial myxomas venous cannulation was done by superior and inferior venacaval cannulation through the right atrium.For the right atrial myxoma and right ventricular myxoma the venous cannulation was by direct cannulation of the superior venacava and inferior venacava.During the surgery atmost care was taken to prevent tumor fragmentation and embolization by minimizing the manipulation of the heart. There were two early (4.5%) and two late deaths (4.7%) following the surgery. The survival at 4 yearss is 91% ± 4%, and most of the current survivors are asymptomatic at a mean follow-up of 6.5 ± 5 years (range, 0.2 year to 4 yearss). Noninvasive reevaluation was performed with echocardiographic studies in 37 patients and ECG in 30 patients. No instances of tumor recurrence were observed, and there was a low incidence of atrial fibrillation late postoperatively. We conclude that excision of intracardiac myxomas is curative and long-term survival is excellent. The right atrial approach provides adequate exposure and allows complete removal of the tumor in most of the patients with left atrial myxoma.Other approaches were adopted in left atrial myxomas depending upon the site and size of the tumor.

KEYWORDS :

INTRODUCTION

Primary intracardiac tumors were rare with an estimated incidence of 0.001%-0.03%. 70% of the primary cardiac tumours were benign. Of the benign tumours , myxomas were the most frequent involving the cardiovascular system. Other primary intracardiac tumours were very rare and we have not encountered any one of them during our study period. They included benign tumours like lipoma, papillary fibroelastoma, rhabdomyoma, fibroma, hemangioma, teratoma and malignant tumours like angiosarcoma, rhabdomyosarcoma, fibrosarcoma and malignant lymphoma. Clinical presentation of myxomas vary from asymptomatic to hemodynamic disturbances like dyspnoea, palpitation, petechial hemorrhages, enlarged spleen, embolic events and constituitional symptoms. Some of them mimicked mitral stenosis in their clinical presentation. Before the advent of echocardiography the clinical diagnosis of myxomas depended on repeated and careful clinical examination with regard to murmur varying in relation to posture. On suspicion it was confirmed by doing a right heart angiogram and visualization of the tumour in levophase. Cardiac angiogram carried risk in very sick patients. Routine echocardiogram of all cardiac cases and advanced imaging techniques like computerized tomogram and magnetic resonance imaging made the diagnosis of myxomas easier and without any risk. Myxomas could present in all the four chambers of the heart of which left atrial myxoma was the commonest. Left sided myxoma could embolize to the systemic circulation and right sided myxoma could embolize to the pulmonary circulation and could produce symptoms accordingly. Myxomas were defined as benign tumours with malignant potential. Some

times the tumour was sessile. The chance for embolization and fragmentation were more in those types of tumours. When the diagnosis of myxomas were made, early surgery was the dictum to prevent complications. The first successful removal of a cardiac myxoma was performed by Crafoord in 1954. The results of surgery for myxomas were gratifying.

In our centre we came across 44 myxomas which were excised from July 2014 to June 2014. Other cardiac tumours were not encountered. Of the 44 tumours, left atrial myxomas were 40, right atrial myxomas were 2 and right ventricular myxomas were 2.

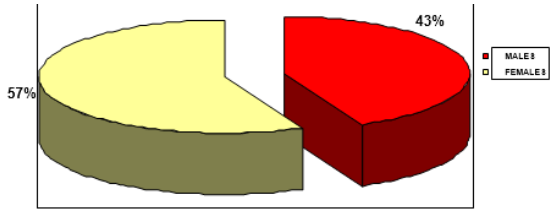
In view of this we wanted to analyze the clinical presentation, the modalities used in diagnosing them ,surgical techniques used to excise them and the surgical results of patients who had undergone excision of myxomas.

AIM OF THE STUDY

To study primary cardiac tumours from July 2014 to June 2014 to analyse
Their clinical presentation
Diagnostic methods used to detect them
Surgical techniques used to excise
And the results of surgery – early and late

RESULTS

Total number of patients studied during the 4 years starting from July 2014 to June 2014 was 44. There were 25 females and 19 males with a male to female ratio of 1:1.3. All the tumours we encountered were sporadic myxomas. This clearly showed the female preponderance of sporadic myxomas(24,25). Other types of primary cardiac tumours were not encountered during this study.



Sex distribution of myxomas

The mean age of the patients who underwent the surgery was 46 ±14 years(range 7 to 68 years). Mean age of the patients with left atrial myxomas was 50 ±13 years. Two patients with right atrial myxomas were 27 and 59 years of age and the two patients with right ventricular myxomas were 17 and 21 years old.

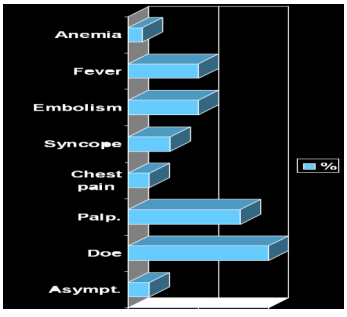
Site distribution of myxomas

The myxomas were located in the left atrium in 40(90.90%)patients. Other sites of myxomas encountered in this study were right atrial in 2 (4.5%) and right ventricle in 2(4.5%) patients.

There were varying clinical presentation of the myxomas. Majority of the left atrial myxomas presented with features of hemodynamic disturbances. Three patients with left atrial myxomas (6.8%) were asymptomatic. They were referred as mitral stenosis and further investigations revealed left atrial myxoma. The left atrial myxomas presented with dyspnoea in 20 (45.45%), palpitation in16 (36.36%), chest pain in 3(6.8%) and syncopal attacks in 6 (13.6%) patients.

Systemic embolization was seen in 10 (22.7%) patients with left atrial myxoma. Of this 8 patients had features of embolization as the first manifestation of the tumour. All these patients presented with features of central nervous system involvement. Eight of these patients presented with history of hemiplegia or hemiparesis. Two of the patients presented with visual disturbances. Surprisingly there were no manifestations of peripheral embolization.

Constitutional symptoms like fever and weight loss were seen in 10(22.7%) patients with left atrial myxoma. Hypochromic anemia was seen in 2(4.5%) of patients.Two patients with left atrial myxoma presented with pulmonary edema.Two of the left atrial myxoma patients had right sided pleural effusion and 3 patients had mild to moderate pericardial effusion. Of the 40 patients with left atrial myxoma 35 patients were in sinus rhythm and 5 patients were in atrial fibrillation.



Distribution of patients with symptoms in myxoma.

	La Myxoma	Ra Myxoma	Rv Myxoma
NO OF PATIENTS	40	2	2
M/F	16/24	1/1	2/0
AGE (YRS)			
MEAN	50±13		
RANGE	7-68	27,59	17,21
PREOPERATIVE SYMPTOMS			
ASYMPTOMATIC	3	0	
EXERTIONAL DYSPNOEA	17	2	2
NOCTURNAL DYSPNOEA	3	0	0
PULMONARY EDEMA	2	0	0
PALPITATION	16	2	1
CHEST PAIN	3	0	0
LOW GRADE FEVER	10	1	0
INCREASED ESR	9	1	1
HYPOCHROMIC ANEMIA	2	2	0
SYSTEMIC EMBOLI	10	0	0
SYNCOPE	6	2	0
PLEURAL EFFUSION	2	1	0
PERICARDIAL EFFUSION	3	0	0
PREOPERATIVE RHYTHM			
SINUS RHYTHM	35	2	2
AF	5	0	0

Clinical examination of the patients with left atrial myxoma revealed a loud first heart sound, tumour plop and a mid diastolic murmur in 31(77.5%) patients. Two patients (5%) had pansystolic murmur at the mitral area which was conducted to the left axilla.

Signs of mitral regurgitation was seen in all patients with left atrial myxoma varying from trivial to mild in 38 (95%) and moderate in 2 (5%) patients. Mitral valve was found to be competent in all of these patients after the excision of myxoma. None of these patients required mitral valve replacement during further follow up period.

The two right atrial myxomas we encountered in this study presented with exertional dyspnoea, palpitation, and syncopal attacks . Low grade fever and hypochromic anemia was seen in one patient. Pleural effusion was seen in one of the patient with right atrial myxoma. Both the patients with right atrial myxomas were in sinus rhythm.

The two right ventricular myxomas presented with exertional dyspnoea and palpitation. Clinical examination of these patients revealed a harsh ejection systolic murmur at the pulmonary area. Elecrocardiogram was showing sinus rhythm and chest x-ray was not diagnostic. Echocardiogram of these patients revealed abnormal echoes in the right ventricle.The diagnosis was confirmed by an angiogram. Surprisingly none of the patients had petechial haemorrhages or palpable spleen.

Prior to the advent of the echocardiogram the site of myxomas in 25 patients were diagnosed by angiogram alone. In rest of the 19 patients site of myxomas were diagnosed by echocardiogram alone. There was no need for any other imaging techniques.

Surgical Findings

Different surgical approaches were used for the excision of the myxomas depending upon the site, size and accessibility of the tumour. Left atrial myxomas were excised through the right atrium in 26(65%) patients. Biatrial approach was used in 8(20%) and left atrial approach was used in 6(15%) of patients. Right atrial and right ventricular myxomas were approached through the right atrium.

LEFT ATRIAL MYXOMA	NO	%
APPROACH		
RIGHT ATRIAL	26	65
BIATRIAL	8	20
LEFT ATRIAL	6	15
LOCATION		
FOSSA OVALIS	24	60
BASE OF IAS	7	17.5
POSTERIOR WALL OF LEFT ATRIUM	6	15
LA ROOF	3	7.5

Out of 40 patients with left atrial myxomas 24 (60%) patients had tumour attached to the fossa ovalis , 7 (17.5%) patients had low inter atrial septal attachment, and in another 6 (15%)patients had tumour arising from the posterior wall of the left atrium and in 3 (7.5%) patients tumour was attached to the left atrial roof.

Right atrial myxomas were attached to the right atrial wall near the tricuspid valve in both the patients. Right ventricular myxomas were located on the free wall of the right ventricular out flow tract and in the body of the interventricular septum.

RIGHT ATRIAL MYXOMA	NO	%
APPROACH		
RIGHT ATRIAL	2	100
LOCATION		
ATRIAL WALL NEAR THE TRICUSPID VALVE	2	100

RIGHT ATRIAL MYXOMA	NO	%
APPROACH		
RIGHT ATRIAL	2	100
LOCATION		
ATRIAL WALL NEAR THE TRICUSPID VALVE	1	100
BODY OF THE IVS	1	100

Size of the tumours ranged from 1cm to 8 cm for the left atrial myxomas. The right atrial myxomas were 1 cm and 3 cm each.The right ventricular myxomas were 1 cm and 2 cm in size.

Pathological examination of all tumours was routinely performed. Weight ranged from 5 to 89 g (mean weight, 40+/- 21 g) for left atrial myxomas and 10 g and 15 g for the two right atrial myxomas. The two right ventricular myxomas weighed 14 and 20 g. The external appearance of the tumours was usually that of a gelatinous, sessile mass with either a villous or smooth surface. Frequently, areas of hemorrhage were observed within the neoplasm.

EARLY AND LATE RESULTS

There were two operative deaths (<30 days) (4.5%), both involving patients with a left atrial myxoma. The cause of death was intraoperative hemorrhage in 1 and bowel infarction in the other. Early postoperative complications occurred in 10 patients, episodes of atrial fibrillation controlled with medical treatment in 7; sternal dehiscence in 2; and postoperative bleeding in 1 .

There were two late deaths (4.7%); 1 patient died of myocardial infarction 18 months after excision of a left atrial myxoma and 1 died of bowel carcinoma 6 years after operation for a right atrial myxoma. Survival of the patients after surgery was 91% ± 4% after 6.5+/-5 years of follow up . Of 37 current survivors surveyed, 35 were in functional class I and 2 were in class II; 33 were in sinus rhythm, and 4, all who had excision of a left atrial myxoma, were in atrial fibrillation. All of them were maintained on digoxin .

Postoperative echocardiographic studies were performed in 34 patients with left atrial myxoma, 2 with a right atrial myxoma, and 1 with an right ventricular myxoma 0.8 year to 16 years (mean interval, 7 ± 4 years) after operation. For 20 patients with a left atrial myxoma, preoperative and postoperative echocardiographic data were available for comparison. The analysis showed a significant reduction of the left atrial diameter (47 ± 9 versus 33.6 ± 7 mm; $p < 0.001$). But left ventricular systolic (34 ± 8 versus 34 ± 6 mm; p = not significant) and diastolic (52 ± 7 versus 50 ± 6 mm; p = not signficant) dimensions and left ventricular ejection fraction (68% ± 12% versus 69% ± 9%, p = not significant) remained unchanged. Residual mild mitral incompetence was detected in 7 patients.

Data on preoperative electrocardiogram were available for comparison in 30 patients postoperatively. Twenty seven patients had left atrial myxoma, 2 patients had right atrial myxoma and 1 patient had right ventricular myxoma. Wide excision and patch closure of the interatrial septum had been performed in 20 of them. 4 patients were detected to have atrial fibrillation.

Most of the arrhythmias were observed in the few patients in whom a biatrial approach was used. No correlation was found between arrhythmias and size of the myxoma.

Out of 44 patients 3 patients were lost to follow up. There were 4 deaths during the follow up period. Two patients died during immediate post operative period. The other 2 patients died due to reasons unrelated to myxomas. Hence the mortality related to myxomas in this series was 4.5%. Total mortality was 9%.

DISCUSSION

Approximately 70% of cardiac tumours were benign, and 30% were malignant and potentially capable of invasion or metastasis(4). Of the benign tumours myxomas were the commonest tumours(2,50). Rarely myxomas might metastasize. Such metastases had been reported in cerebral arteries, sternum, vertebral column, pelvis, scapula, and in soft tissues of the back (2,4,6,7). Inspite of being benign in nature both microscopic and macroscopic tumour metastasis could occur in rare cases (2,4,6,7). In this study we encountered only myxomas. Other types of tumours were not encountered during this study. Myxomas were intracavitary tumours occurring within any of the cardiac chambers, but they had a predilection for the atria particularly the left (4,12,13,14). Majority of the myxomas encountered in this study were left atrial myxomas followed by right atrial and right ventricular myxomas. Nearly all solitary myxomas were nonfamilial. Nonfamilial ("sporadic") cardiac myxomas were disorders primarily of middle-aged women. The tumours were usually single (94%) and in the left atrium (about 75%). They usually did not have associated disorders and they rarely recurred (24,25). In this series all the tumours were nonfamilial myxomas.The left atrial myxomas constituted around 91% of the myxomas in this series. Middle aged females were primarily involved with sporadic myxomas as evidenced by the mean age at surgery of 46±14 years and a male : female ratio of 1:1.3. There were no multiple or bilateral myxomas and they were not associated with any other disorders.

Myxomas had a familial occurrence in about 5% of patients (24,25). But in this study there were no familial myxomas.The myxomas were usually 5 to 6 cm in diameter, with a range of 1 to 15 cm (4).

They were polypoid and pedunculated in character projecting into a cardiac chamber. They were either gelatinous or mucoid in nature with areas of hemorrhage. Their surface was either smooth and soft or papillary in appearance. Generally, they were not sessile but have a short, broad-based attachment (4). In our series the size of the tumours varied from 1cm to 8 cm for left atrial myxomas, 1cm and 3cm for right atrial myxomas and 1cm and 2 cm each for right ventricular myxomas. The external appearance of the tumours were that of gelatinous polypoid or sessile mass with either a villous or smooth surface. Frequently areas of haemorrhage were observed within the neoplasm. Systemic embolization was usually associated with tumours which were broad based or sessile(21,22). In our series out of 10 patients who had embolic manifestations 8 patients had sessile myxomas and 2 patients had broad based myxomas with villous surface. Right atrial myxomas tended to be more solid than the left atrial myxomas, with a wider attachment to the atrial wall or septum (4,21). In our study both the right atrial myxomas were sessile and were attached to the atrial wall. There was no evidence of pulmonary embolism or pulmonary artery hypertension in these two patients. The weight ranged from 5g to 89 g for left atrial myxomas ,10g and 15 g for right atrial myxomas and 14g and 20 g for right ventricular myxomas. There were no association between the size of the tumour and embolization.

80% to 90% of myxomas were in the left atrium .Most atrial myxomas, whether left or right, originated from the atrial septum, usually in the region of the limbus of the fossa ovalis. About 10% had other sites of origin, particularly the posterior and anterior atrial walls and the roof of left atrium(4,12,13,14). Of the 44 myxomas we encountered 91% of them were left atrail myxomas.

Most of them were attached to the fossa ovalis (60%). Other sites of attachment included base of the inter atrial septum in 17.5% ,posterior wall of left atrium in 15% and left atrial roof in 7.5% of patients. This clearly showed the predilection of the myxomas to the fossa ovalis. Atrial myxomas might be multicentric (within a single chamber) or biatrial (12,13,14). In this study there were no multicentric or biatrial myxomas.Atrial myxomas might be complicated by the presence of associated atrial septal defect. Such cases might have right-to-left shunts (12,13,14). There were no myxomas associated with atrial septal defect in our study.

Ventricular myxomas were found mainly on the right ventricular free wall or in the ventricu- lar septum. Ventricular myxomas sometimes infiltrated the ventricular myocardium. Right ventricular myxomas were sometimes associated with other cardiac myxomas(15). The two right ventricular myxomas encountered in this series were found mainly on the interventricular septum. There were no associated myxomas with right ventricular myxomas in our series. Left ventricular myxomas were rare, and little information about them was available (15,50). There were no left ventricular myxomas in this series.

Hemodynamic derangement symptoms due to myxomas might be

in the form of obstruction to the blood flow in the cardiac chambers or obstruction of flow through the valves. The valves might be obstructed or deformed . Sometimes they might be associated with embolic phenomena either to the systemic or pulmonary circulation. The least common manifestation might be due to constitutional changes (18,19).

Myxomas might obstruct pulmonary or systemic venous drainage or impair flow across the atrioventricular valves, the likelihood of these events being greater with larger tumours. The obstruction was characteristically progressive (15,20,21). Left atrial myxomas produced symptoms of hemodynamic origin similar to those of mitral stenosis. Symptoms were commonly of short duration and episodic. They might rapidly become severe and intractable and were associated with heart failure. There were varying clinical presentation of myxomas in our series. 6.8% of patients were asymptomatic. Majority of the left atrial myxomas presented with features of hemodynamic instability. Dyspnoea was seen in 45 % ,palpitation in 36% and chest pain in 6.8%. Pulmonary edema was seen in 4.5% of patients. Right atrial myxomas might also produce episodic symptoms, and these may progress rapidly despite medical treatment. Pedal edema , hepatomegaly and ascites were frequent presenting complaints. In the review by Morrisey and colleagues, all 18 patients with right atrial myxomas had signs of right heart failure with raised jugular venous pressure, a prominent *a* wave, hepatomegaly, ascites, and pedal edema (28). Orthopnoea and paroxysmal nocturnal dyspnoea were absent.. In this series both right atrial and right ventricular myxomas presented with exertional dyspnoea and palpitation.

Obstruction to the flow of blood through a valve might result in syncopal attacks if it was varying with posture and prolonged obstruction might result in sudden death. Sudden death was possible in one fourth of patients with left atrial myxomas and one third of those with right atrial or right ventricular myxomas. This could happen in 50% of left ventricular myxomas (20,21). In our study 13.6% of the patients had syncopal attacks irrespective of the location of the myxoma.

Impairment of valve closure by tumour obstruction or leaflet damage could cause regurgitation (15,20,21). Structural damage to the valve by frequent tumour impingement could also cause regurgitation. In our study signs of mitral regurgitation were seen in all patients with left atrial myxoma varying from mild to moderate in 95% of patients and moderate in 5% of patients.

Mitral valve was found to be competent in all these patients after the excision of myxoma. None of these patients required mitral valve replacement during subsequent follow up period also. Post operative echocardiogram during the follow up period revealed mild mitral regurgitation in 7 patients.Symptoms of peripheral embolization included pain, pallor, paraesthesia and pulselessness. Angina from coronary embolization and dyspnea from pulmonary embolization could also occur. Systemic emboli occurred in 30% to 45% of patients with left atrial myxomas(21,22). About 50% of embolization occurred to the central nervous system. Cerebral emboli could cause permanent neurological deficits. In our study we encountered 10(22.7%) patients with systemic embolization preoperatively. All these patients had features of central nervous system involvement. 90% of the patients recovered fully in due course. The remaining 10% of the patients had mild residual neurological deficit. Surprisingly there were no evidence of peripheral embolization.

Embolism from right-sided tumours occurred in about 10% of cases and might cause massive fatal pulmonary obstruction (21,22). Multiple emboli from right-sided tumours could cause pulmonary hypertension. There were no evidence of embolization from right atrial or right ventricular myxomas in this study.Diagnosis of atrial myxoma was sometimes made immediately after hospital admission by histologic examination of an embolus removed from a peripheral artery (21,22). However, absence of myxoma cells in the embolus did not rule out myxoma, because thrombus forming on the neoplasm might be the cause of the embolism.

The only manifestations of a cardiac myxoma in 30% of patients were constitutional symptoms and certain laboratory findings. Large left atrial myxomas were particularly apt to produce constitutional symptoms(23). These symptoms included fever, weight loss, clubbing, Raynaud's phenomenon, myalgia and arthralgia(23). Hemolytic anemia occurred in about one third of cases with myxoma. This was due to mechanical destruction of formed blood elements by the tumour. These features were reversible with tumour removal(23). In this study 23% of the patients presented with constituitional symptoms like low grade fever and weight loss. Hypochromic anemia was seen in 4.5% of the patients.

Myxomas can present with petechial hemorrhages, palpable liver and spleen, ascites, raised jugular venous pulse and pedal edema(18,27). Surprisingly none of our patients exhibited these signs.

In left atrial myxomas first heart sound may be preceded by a loud ejection sound resulting from forceful ejection of the tumour from the left ventricle back into the left atrium. When the tumour stays in the left atrium during the entire cardiac cycle a mid diastolic murmur might be heard like mitral stenosis. The second heart sound was normally split, of low intensity, and followed by a third heart sound described as either an opening snap or a ventricular gallop. The opening snap occurred after the mitral valve opened and was thought to be due to the tumour striking the heart wall. Systolic murmurs had also been recorded and had been attributed to associated mitral regurgitation(1,18,30). In our study 78% of the patients presented with loud first heart sound, tumour plop and a mid diastolic murmur. 2 patients had pansystolic murmur at mitral area(1,18).

With right atrial myxomas, a loud and split first heart sound was heard corresponding to expulsion of the tumour from the right ventricle. A pulmonary ejection systolic murmur , a loud second heart sound and a tricuspid diastolic murmur may be heard. A systolic murmur due to tricuspid regurgitation could also be heard(1,18).Ventricular myxomas were rare and hence their auscultatory features were not fully known, but murmurs might suggest aortic or pulmonary stenosis(1). Friction rubs might be heard as a result of contact of the tumour with the endocardium of one of the cardiac chambers. In our study two of the patients with right ventricular myxoma presented with a harsh ejection systolic murmur at the pulmonary area .Results of laboratory studies were usually normal. In rare instances some laboratory findings were characteristic. Among them were anemia, thrombocytopenia, and reversal of albumin : globulin ratio.

There were no characteristic electrocardiographic changes in myxoma except for atrial fibrillation and bundle branch block (50). Some times abnormal p waves might be noted due to chamber enlargement. In our study electrocardiogram of 5 patients revealed atrial fibrillation. Otherwise electrocardiographic changes were not significant.

Features on a plain chest radiography were not specific(1,50). Generalized cardiomegaly or left atrial enlargement might be seen in left atrial myxoma. In our study 10(23%) patient's chest X –ray revealed cardiomegaly and features of pulmonary venous congestion.

Two dimensional echocardiography was the most appropriate diagnostic imaging modality for myxomas and other cardiac tumours(1,31,50). In our series prior to the advent of echocardio gram myxomas in 25 (57%) patients were diagnosed by a careful and repeated clinical examination and angiogram alone. But after the advent of echocardiogram rest of the 19 (43%) myxomas were diagnosed by echocardiogram alone.The presence of a cardiac

myxoma was an indication for immediate surgical excision. Such an aggressive approach was justified by the constant threat of pulmonary or systemic embolization and to prevent occlusion of the valve orifices and sudden death (22,44,50).

There were different surgical approaches for the left atrial myxoma. Left atrial myxomas could be excised through the right atrium, left atrium or by biatrial approach (50). Most of the tumours could be excised through the right atrial approach.In right atrial approach the defect in the inter atrial septum was closed with a patch. Careful manipulation of the myxoma was recommended to avoid fragmentation and possible embolization during cannulation and excision of myxoma. When fragmentation occurred generous irrigation of the heart with cold saline solution and direct inspection of the aortic root or pulmonary trunk before release of the aortic cross clamp was advocated(50). In our series different surgical approaches were used for the excision of the myxomas depending upon the site, size and accessibility of the tumour. Left atrial myxomas were excised through the right atrium in 26(65%) patients. Biatrial approach was used in 8(20%) and left atrial approach was used in 6(15%) of patients where the tumour was attached to inaccessible areas or when the tumour was very large. All the right atrial and right ventricular myxomas were excised through the right atrium.

Excision of tumour must include a wide resection of the base of implantation, which most often is in the fossa ovalis. When the tumour was attached to the atrial or ventricular wall removal of the endocardium with part of the underlying myocardium might be required. Such a wide excision minimized the recurrence (50). None of our patients had recurrence.

Hospital mortality after removal of atrial myxomas was about 5% (15,37,50). Most of the deaths were seen in older patients. The mode of death being generally related not to the atrial myxoma but to coexisting cardiac or degenerative disease (27).Early risks were higher after removal of myxomas from the ventricular cavities (27,15,37,38). In our series there were 2 early deaths for patients with left atrial myxoma. The early mortality in our series was 4.5%. One patient died of excessive bleeding during the immediate post operative period probably due to the coagulation defects associated with myxoma. The second patient died following bowel infarction and septicemia probably due to tumour embolization during the excision.

Death after hospital discharge was uncommon(13,40). Most of the late deaths were due to causes other than the cardiac tumour(13,39,40). Two late mortality (4.7%) in our series were not related to the excision of myxoma. One patient died of myocardial infarction 18 months after the surgery and the second patient died of bowel carcinoma 6 years after the surgery .

There were excellent long term results reported from several studies after the removal of myxoma(13,39,40). In our study the long term survival of the patients were comparable to other studies with a survival of 91± 4% at a mean follow up period of 6.5±5 years. Nonfamilial myxomas had better survival than familial myxomas(24,25).Recurrence of a nonfamilial myxoma was unusual, occurring in only about 1% to 3% of patients(8,10,24). Where as 30% to 70% of the familial myxomas might recur(35,40,41). Recurrences might become apparent as early as 6 months and as late as 11 years after excision, but the average was about 30 months after removal of the first myxoma(40,41). In our series there were no recurrences. There fore close follow up of patients after excision of a cardiac myxoma was necessary. Follow up could be done by repeating the echocardiogram. Echocardiographic studies done in our patients have excluded any recurrence up to a mean follow up period of 6.5±5 years postoperatively. The analysis showed a significant reduction of the left atrial diameter (47 ± 9 versus 33.6 ± 7 mm; $p <$ 0.001). But left ventricular systolic (34 ± 8 versus 34 ± 6 mm; p = not significant) and diastolic (52 ± 7 versus 50 ± 6 mm; p = not signficant) dimensions and left ventricular ejection fraction (68% ± 12% versus 69% ± 9%, p = not significant) were unchanged. Trivial to moderate mitral regurgitation, which was present in all patients with a left atrial myxoma disappeared after excision of the tumour. This concurs with the opinion that mitral incompetence was reversible unless the valve was severely damaged by the myxoma(43,50) .A high incidence of arrhythmias and conduction disturbances early and late after resection of an left atrial myxoma had been reported by Bateman and colleagues (42). This might be due to possible surgical injury to conduction pathways. Data on preoperative electrocardiogram were available for comparison in 30 patients postoperatively. Twenty seven had had excision of a left atrial myxoma, 2 of right atrial myxoma and 1 of right ventricular myxoma. Wide resection and patch closure of the interatrial septum had been performed in 20 of them. 4 patients were detected to have atrial fibrillation. Most of the arrhythmias were observed in the few patients in whom a biatrial approach was used. No correlation was found between arrhythmias and size of the myxoma. In this study, no conduction disturbances had been observed.Living patients after removal of myxoma were in good health and they have improved in functional class after removal of the myxoma.

CONCLUSION

- Myxomas were the commonest primary tumors of the heart.
- Sporadic myxomas were most commonly seen in middle aged females. Familial myxomas were rare.
- Multiple myxomas were rare.
- Clinically myxomas might be asymptomatic or present with hemodynamic disturbances, neurological symptoms and embolic events.
- Commonest site of myxoma was the left atrium followed by right atrium and right ventricle.Left ventricular myxomas were rare.
- Myxoma could be easily diagnosed by echocardiography and hence early detection and surgery was possible. Angiography was indicated only in patients with associated heart diseases.
- Most of the myxomas were attached to the fossa ovalis. Wide excision of the tumor with patch closure was the treatment of choice for myxoma
- Most of the left atrial myxomas could be approached through right atrium.If the tumour was large a left atrial or biatrial approach was advocated.
- Post operative complications were minimal. They included mainly rhythm abnormalities which could be managed medically.
- Most of the patients with atrial fibrillation reverted back to sinus rhythm after the surgery.
- Early and late results of surgery were gratifying with low mortality and almost nil recurrences
- Most of the patients became symptomatically better after the surgery with an improvement in the functional class.
- Long term follow up of the post operative patients was mandatory to rule out recurrences.

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