

Cardiac tumors: analysis of surgical treatment

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Aim. To analyze the preoperative status, intraoperative tumor characteristics and further clinical manifestations in patients after surgery for a cardiac tumor.

Material and methods. The study included 54 patients who were operated on for a heart tumor from 2014 to 2020. We assessed clinical performance, diagnostic investigations before and after (during hospitalization) surgery, tumor size and histological characteristics.

Results. Among patients operated on for cardiac tumors, women predominated (74%). Among comorbidities, hypertension (79,3%), chronic kidney disease (48,3%), and obesity (25,9%) were most common.

There were following clinical manifestations before surgery: shortness of breath — 47 (81%) patients, palpitations and heart rhythm disturbance — 26 (44,8%), chest pain — 25 (43,1%), chest discomfort — 28 (49,1%), edema — 6 patients (10,3%).

The predominant tumor localization was the left atrial fossa ovalis area (50%).

According to histological analysis, myxoma prevailed — 38 cases (86,4%).

After surgery, atrial fibrillation prevalence decreased from 8 patients before surgery to 6 after surgery ($p=0,034$), while left atrial size decreased by 0,6 mm (95% confidence interval, 4,39-6,2 mm) ($p<0,001$).

Conclusion. According to presented analysis over a 6-year period, cardiac neoplasms are more common in women (74,1%), while the mean age of patients is 59,7 years. Among comorbidities, hypertension prevails — 79,3%. Histological examination revealed a predominance of

myxoma (86,4%). Predominant tumor location was the left atrial fossa ovalis area (50%).

Surgical treatment of neoplasms was effective. So, prevalence of atrial fibrillation decreased by 25%, while left atrial size decreased by 0,6 mm. Postoperative complications and in-hospital deaths were not registered.

Keywords: cardiac tumors, neoplasms, surgical treatment, myxoma, fossa ovalis, left atrium.

Relationships and Activities: none.

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For a long time, cardiac tumors were characterized by a multiform clinical presentation and were detected more often at autopsies and extremely rarely during cardiac surgery [1-3].

An increase in life expectancy, the influence of pre-existing and novel factors contribute to an increase in the risk of cancer, including cardiac tumors. Many authors associate an increase in the detection rate of cardiac tumors with research and technological progress, which contributes to the improvement of preoperative diagnostics using modern investigations and with highly qualified specialists [4].

Identification of cardiac tumors remains a difficult task, since there are no pathognomonic signs and the disease can be asymptomatic for a long time. Therefore, when the patient first visits a doctor, the correct diagnosis is established only in 3-10% of cases [5].

Cardiac tumors are rare compared to other heart diseases. Primary cardiac tumors can be both benign and malignant and are 30 times less common than secondary (metastatic) tumors. According to autopsy data, the prevalence of primary cardiac tumors ranges from 0,001 to 0,03% [2, 6-10]. According to a 6-year continuous sample study, an echocardiography detected cardiac tumors in 54 patients (14 men and 40 women; mean age, 59,7 years). Despite the low prevalence, timely detection of tumors is very important, since there are effective methods of treatment. Therapy for benign cardiac tumors is surgical resection, and how urgently the intervention should be performed is determined by the patient's symptoms and the type of tumor.

The aim of the study was to analyze the preoperative status, intraoperative tumor characteristics and further clinical manifestations in patients after surgery for a cardiac tumor at the Federal Center of Cardiovascular Surgery from 2014 to 2020 (Krasnoyarsk).

Material and methods

This retrospective analysis included 54 case records of patients who underwent surgery for a cardiac tumor from 2014 to 2020. We studied clinical and investigational data before and after surgery during hospitalization, as well as assessed the size and histological characteristics of the tumor. Mathematical analysis of the data was performed using the IBM SPSS program. Quantitative variables were examined for distribution normality using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Data are presented as $M \pm SD$. Differences were considered significant at $p < 0,05$.

Results

Among those operated on for cardiac tumors, women predominated (74%); 42,6% of patients were aged 55 to 64 years (Table 1). Among comorbidities, hypertension prevailed and was revealed in 79,3% of patients, chronic kidney disease — in 48,3%, and obesity — in 25,9% (Table 1). Heart failure (HF) was revealed in 55,2% of patients as a manifestation of the underlying disease and concomitant disorder. In most patients, there was class I-II HF.

There were following clinical manifestations of the disease before the operation (Figure 1): shortness of breath — 47 (81%) patients, palpitations and heart rhythm disturbance — 26 (44,8%), chest pain — 25 (43,1%), chest discomfort — 28 (49,1%), edema — 6 patients (10,3%) (Figure 1). Before surgery, 16 (27,6%) patients had atrial fibrillation (AF), 1 (1,7%) — atrial flutter. In 3 (5,2%) patients, premature beats were detected, while in 2 (3,4%) — coronary atherosclerosis.

Echocardiography was the main method for detecting cardiac tumors (Table 2).

There were following laboratory parameters before surgery: while blood cell count, $7,05 \pm 0,48 \times 10^9/L$; red blood cell count, $4,68 \pm 0,16 \times 10^{12}/L$; hemoglobin, $134,3 \pm 4,6$ g/L; erythrocyte sedimentation rate, $19,1 \pm 6,2$ mm/h. Anemia (hemoglobin < 120 g/l) was observed in 9 (15,5%) patients.

In all patients, on-pump cardiac surgery was performed. Aortic cross-clamp time was $63,83 \pm 8,0$ min, and artificial circulation time — $89,7 \pm 9,5$ min. In most patients, tumor removal was performed with excision of underlying tissues, as well as with the

Table 1
Characteristics of the included patients

Parameter	Patients (n=54)
Mean age (SD), years	59,7
Male sex, n (%)	14 (25,9%)
Female sex, n (%)	40 (74,1%)
Age groups, years, n (%)	
<55	11 (20,4%)
55-64	23 (42,6%)
65-74	16 (29,6%)
≥ 75	4 (7,4%)
Comorbidities	
Hypertension, n (%)	46 (79,3%)
Diabetes, n (%)	6 (10,3%)
Chronic kidney disease, n (%)	28 (48,3%)
Obesity, n (%)	15 (25,9%)
Peripheral atherosclerosis, n (%)	3 (5,2%)
Psoriasis, n (%)	2 (3,4%)

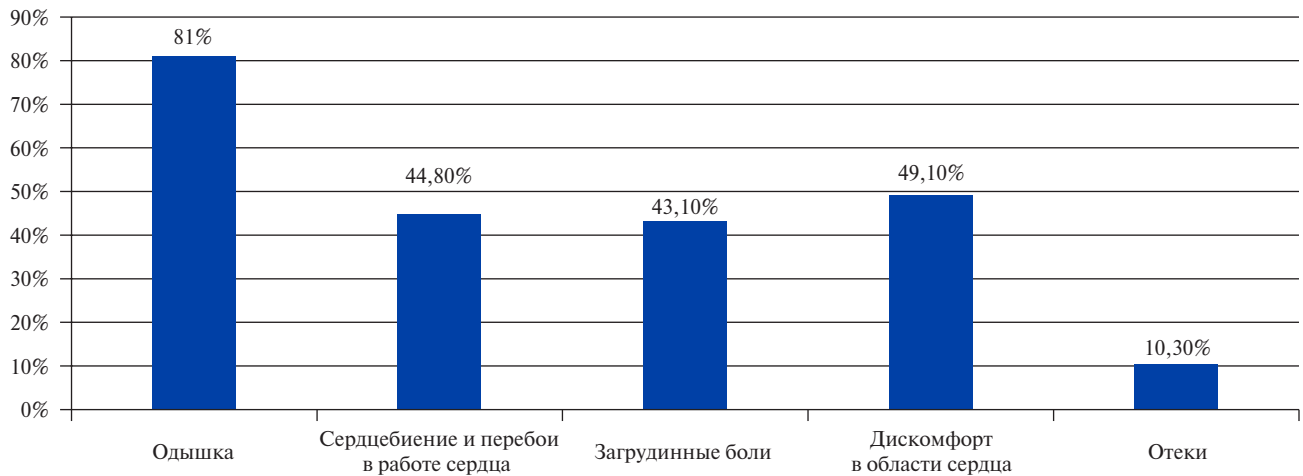


Figure 1. Clinical manifestations before surgery.

closure of atrial septal and endomyocardial defect and with a continuous locking stitch.

Tumor was located on the interventricular septum in 3 (5,5%) cases, left ventricular (LV) apex — 1 (1,9%), LV posterior-medial papillary muscle — 1 (1,9%), LV posterior wall — 1 (1,9%), left atrium (LA) (without specification) — 4 (7,4%), LA near pulmonary veins — 3 (5,6%), LA mitral-aortic contact — 1 (1,9%), LA fossa ovalis — 27 (50%), medial commissure — 1 (1,9%), anterior mediastinum — 1 (1,9%), anterior mitral leaflet — 1 (1,9%), right atrium (RA) (without specification) — 3 (5,6%), RA fossa ovalis — 3 (5,6%), RA near inferior vena cava — 1 (1,9%), atrial surface of the posterior tricuspid leaflet — 1 (1,9%), LA appendage — 1 (1,9%), RA appendage — 1 (1,9%) (Figure 2).

The maximum size of the removed tumor, which was noted in this study, was 7,5×4,0 cm, while the minimum was 0,5×0,7 cm.

According to histological examination, the tumors were divided as follows: myxoma — 38 (86,4%), fibroelastoma — 1 (2,3%). A cyst was found in one case (2,3%). The diagnosis was not confirmed in one (2,3%) case — pathological examination revealed a thrombus. Necrotic areas were detected once (2,3%) (Figure 3).

AF prevalence decreased after surgery decrease as follows: from 8 cases before surgery to 6 after surgery ($p=0,034$). LA size decreased by 0,6 mm (95% confidence interval, 4,39-6,2 mm) ($p<0,001$). In 54 (100%) patients, the postoperative period was without adverse events and there was no in-hospital mortality.

Discussion

This 6-year analysis revealed that cardiac tumors are more common in women (74,1%), while

Table 2

Echocardiographic data before surgery

Parameter	Data
Right atrium, cm	5,08±0,74
Left atrium, cm	5,86±0,84
Right ventricle, cm	3,77±0,61
Mitral valve orifice area, cm	3,52±0,39
Tricuspid valve orifice area, cm	3,39±0,35
LV end diastolic dimension, cm	4,57±0,33
LV end systolic dimension, cm	36,3±9,88
LV end diastolic volume, cm	83,11±13,32
LV ejection fraction, %	56,67±9,09

Abbreviation: LV — left ventricle.

the mean age of patients is 59,7 years. Among comorbidities, hypertension prevails, which was detected in 79,3% of patients. The most frequent clinical manifestation of pathology before surgery was shortness of breath in 81% of patients.

Before the operation, laboratory blood parameters in the vast majority of patients was within normal range. Anemia was noted in 15,5% of patients.

According to histological examination, myxoma prevails, which was detected in 86,4% of the operated patients. The predominant tumor location was observed in LA fossa ovalis (50% of patients).

Surgical treatment of tumors led to favorable results as follows: AF prevalence decreased by 25%; according to echocardiography, the LA size decreased by 0,6 mm; postoperative complications and in-hospital mortality were not recorded.

According to literature data, the treatment of cardiac tumors is an urgent issue that has been studied for a long time. Soloviev G. M. et al. (2000) describe the period from 1981 to 1999, during which

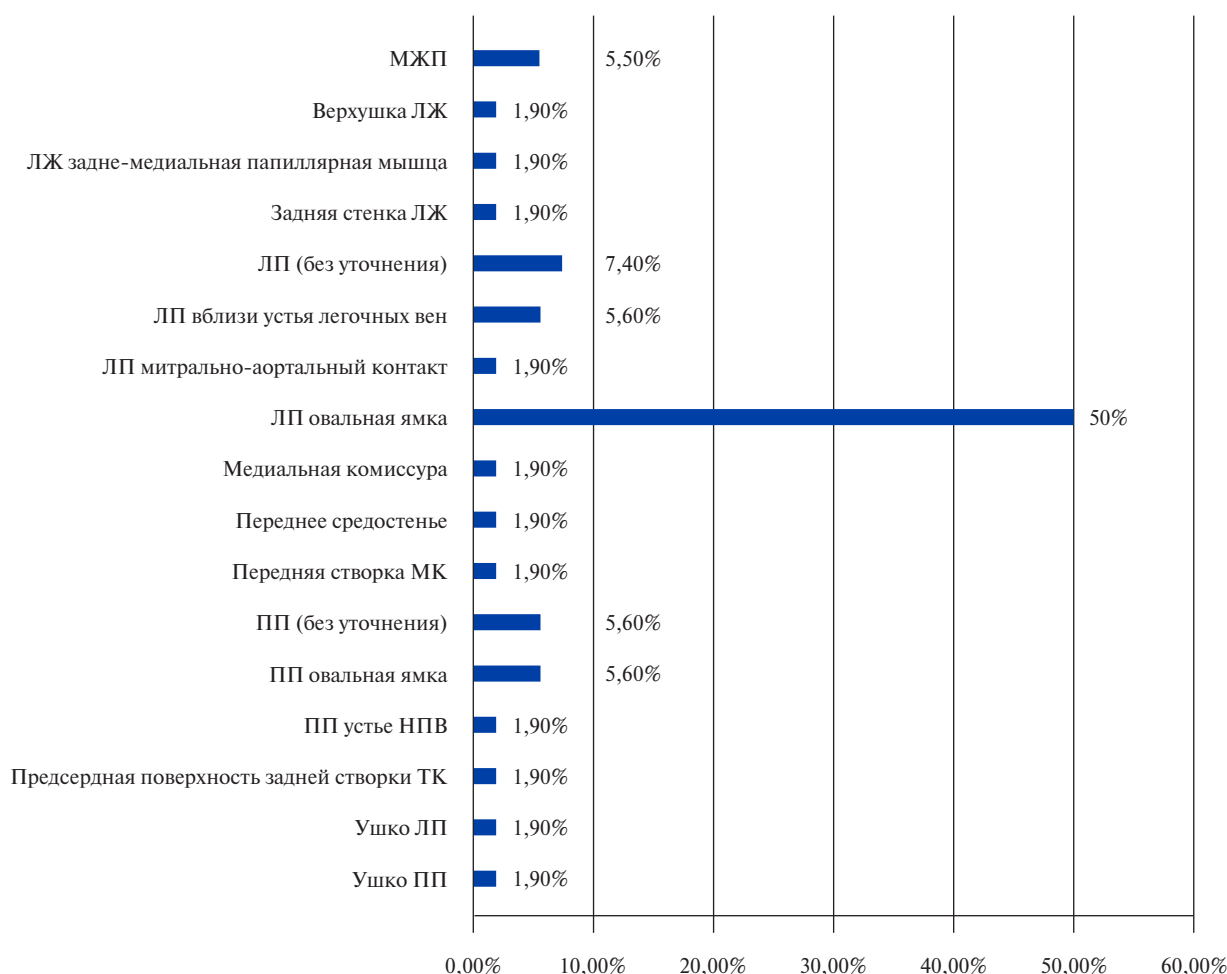


Figure 2. Tumor location.

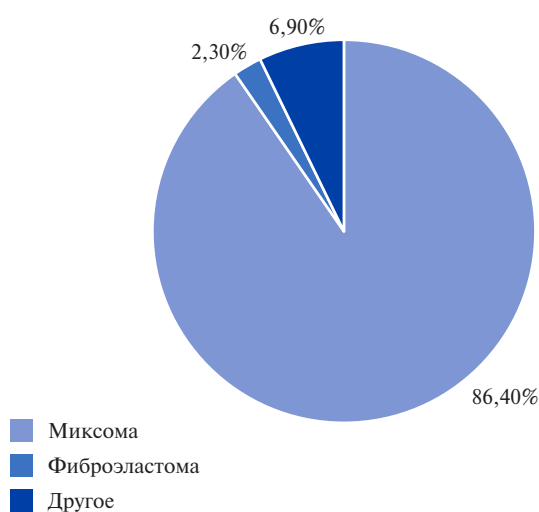


Figure 3. The pattern of cardiac tumors according to histological examination (%).

36 patients were operated on for heart tumors. The age of patients ranged from 17 to 57 years. According to histological examination, myxomas were detected

in 33 cases, 75-80% of which were localized in the LA. One female patient had 2 prior embolisms with tumor fragments into the lower limb vessels. Reembolism involved coronary arteries and led to acute myocardial infarction. In 8 cases, signs of systemic and pulmonary circulatory decompensation were noted. Within 18 years after surgical removal of the tumor, not a single recurrence case was revealed, which allows the authors to consider it possible to remove the atrial myxomas without septum excision. There were only off-pump operations with normothermic perfusion. In the early postoperative period, two severe patients died due to acute cardiovascular failure.

Nuzhdin M.D. et al. (2011) analyze 30-year (1981-2011) experience of cardiac tumor surgery in the Chelyabinsk Regional Clinical Hospital, which involved 129 patients aged 1-78 years. There were 111 patients with benign tumors, and 18 with malignant ones. The most common benign tumor was myxoma (78,3%). In 96,9% of patients, the indication for surgery was HF and arterial embolism. There were on-pump operations with normo- and hypothermia,

as well as with pharmaco-cold cardioplegic protection. The most frequent postoperative complications were paroxysmal arrhythmias (27,9%), of which ~50% were due to AF. There were following risk factors for malignant tumors: disease duration <8 months in combination with stage 2b HF or with RA tumor location. In-hospital mortality rate was 6,2% (n=8), 4 of which occurred in the period from 1981 to 1983, when the on-pump technique was being mastered.

Case report

We report a case of a rare myxoma location — at the LV apex, which, according to the literature, occurs in 1%.

On May 2, 2017, female patient was admitted to the cardiac surgery department of the Federal Center of Cardiovascular Surgery in Krasnoyarsk with a following diagnosis: LV tumor. Stage 2A, class II heart failure. Background: stage III hypertension, very high risk. Hemodynamically insignificant head-and-neck artery atherosclerosis. Concomitant diagnosis: stage I discirculatory encephalopathy of atherosclerotic and hypertensive genesis with mild cognitive impairment, vestibulocerebellar syndrome.

The patient has been working as a teacher at school for 30 years, undergoes medical examinations every year. Previously, no cardiac pathology has been detected. Since 2012, the patient noted shortness of breath during household exertion, increased fatigue, pain in chest and under the left shoulder blade not related with physical activity but with relief at rest, blood pressure increase up to 200/100 mm Hg. Since 2016, she began to note episodes of severe weakness during hypertensive crisis, periodic presyncope episodes, and a significant decrease in body weight. In March 2016, she was hospitalized in the Abakan Central District Hospital with a hypertensive crisis, where an echocardiography revealed a LV tumor. In April 2017, repeated echocardiography was performed (06.04.2017): end-diastolic dimension (EDD) — 4,8 cm, ejection fraction (EF) — 60%, end-diastolic volume (EDV) — 85 ml, RA — 4,5 cm, LA — 4,9 cm, right ventricle (RV) — 3,4 cm. In the LV apex region, an additional hyperechoic pedunculated (0,4x0,8 cm) formation

~2,2x2,0 cm with a clear contour at the border of 7 and 13 LV segments was revealed. Mixoma. She was consulted by a cardiac surgeon, who revealed indications for surgical treatment. On April 7, 2017, coronary angiography was performed (no coronary artery pathology was revealed). On May 4, 2017, the operation was performed by Gross Yu.V. The aorta was opened with a transverse aortotomy approach. The LV cavity was revised by transaortic approach. Near LV apex, pedunculated (3-4 mm) tumor-like spherical filamentous formation attached along the posterior wall up to 2 cm in diameter was identified. The tumor was excised in a single block with a part of the adjacent septal trabecula. The attachment point has been processed with radiofrequency energy. The diagnosis of myxoma was confirmed with histological examination.

The postoperative period was uneventful. There are following postoperative echocardiographic characteristics (15.05.2017): EDD — 4,8 cm, EF — 56%, EDV — 70 ml, RA — 4,3 cm, LA — 4,9 cm, RV — 3,4 cm. Mitral regurgitation was not recorded. There was no pericardial effusion. On the 13th day, she was discharged in satisfactory condition.

A year after the surgery, the patient feels good, has no complaints and works in her specialty. There is following data from the control echocardiography (10.05.2018): EDD — 4,7 cm, EF — 59%, EDV — 74 ml, PP — 4,2 cm, LA — 4,7 cm, RV — 3,5 cm. Mild mitral and tricuspid regurgitation (0-I). There is no pericardial effusion. Twenty-four-hour Holter ECG monitoring did not reveal life-threatening arrhythmias.

This case report describes the symptoms of myxoma, diagnostic algorithm, surgery types and good long-term outcomes of surgical treatment.

Conclusion

The presented retrospective 6-year analysis of cardiac tumor surgery is consistent with the literature data. Myxomas (86,4%) predominated in the tumor pattern. Postoperative complications and in-hospital deaths were not registered.

Relationships and Activities: none.

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