



RESEARCH ARTICLE

**SURVIVAL AND PROGNOSIS IN PRIMARY CHEST WALL TUMORS:  
A SINGLE CENTER EXPERIENCE**

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**ABSTRACT**

**Objectives:** Primary chest wall tumors are originating from bone and soft tissue and consist 1-1.5% of all malignant tumors. The purpose of this study is to determine the diagnosis, survival and treatment methods of primary chest wall tumors in a single-center.

**Methods:** All patient who had primary chest wall tumor and underwent surgery between 01.03.2007 and 01.04.2016 included in this study.

**Results:** We evaluated 10 male and 9 female patients with ages ranging from 14 to 86 years (mean 50,7). Symptoms were swelling in 10 (52,6%), thoracic pain in 5 (26,3%), both pain and swelling in 3 (15,8%) patients. There was no symptom in a patient. Tumors were originating from bone in 3 patients (15,7%) and soft tissue in 16 patients (84,3%). All tumors were widely resected. Histopathological outcomes were malignant in 12 cases (63%) and benign in 7 cases (37%). There were six morbidities (32%) which is 4 flail chests, a wound infection and a pleural effusion. Ten patients underwent reconstruction: 5 autologous grafts, 5 synthetic grafts. The mean survival were 47 months (range: 3-107 months) in malignant cases and 57 month (range: 6-144 months) in benign cases. Recurrent tumor developed in 5 patients (26,3%).

**Conclusions:** Wide resection of chest wall tumors is essential to adequate local control and survival.

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**INTRODUCTION**

Primary Chest wall tumors(PCWT) are 2% of all tumors and 5% of all thorax malignancies (1). Fifty five percent of primary malignant chest wall tumors are originating from bone and cartilage, 45% are from soft tissue (2). PCWT are usually asymptomatic and 20% of all diagnosed coincidentally by chest radiographies (3). PCWT can be seen in all decades but specifically Ewing's Sarcoma is seen in early ages and plasmocytoma in older ages. Although there is no gender majority, dermoid tumor is commonly seen in females and osteochondroma is seen in males. They are slowly grown tumor group and can be symptomless and symptoms appear by the tumor progression. Rapid development, invasion of surrounding tissue suggests malignancy but they are not certain. Aim of treatment is extended resection and reconstruction of chest wall with autologous and synthetic graft if needed with less morbidity and mortality. In this study we report a single-centre experience of 19 cases who underwent operation with chest wall tumor and review the literature.

**MATERIALS AND METHODS**

We retrospectively evaluated 10 male and 9 female patients with ages ranging from 14 to 86 years (mean 50,7), who had PCWT and underwent surgery between March 1, 2007 and April 1, 2016. Metastases to the chest wall and intrathoracic tumors invading chest wall were not included. The cases were evaluated according to age, gender, history, clinical presentation, radiography techniques, type and size of tumor, surgical technique, duration of hospitality, reconstruction material, complications, prevalence of recurrence and factors of affecting survival. Chest X-ray, CT, respiratory function test and routine blood test performed all patients before surgery. Tumors larger than 5 cm diagnosed histopathological with incisional, less than 5 cm diagnosed with excision. Complete resection was performed in all cases. Benign lesions were resected with their capsule. Surgery applied with 4 cm tumor free margins in malignant lesions all except one who is myxoid liposarcoma . Frozen sectioning applied if there was a suspect of

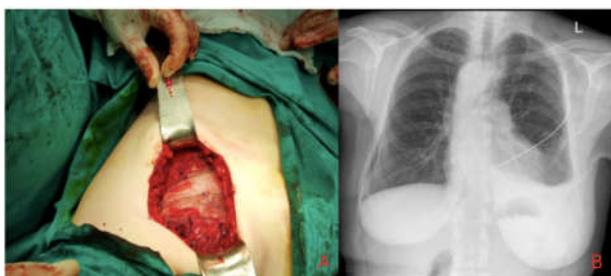
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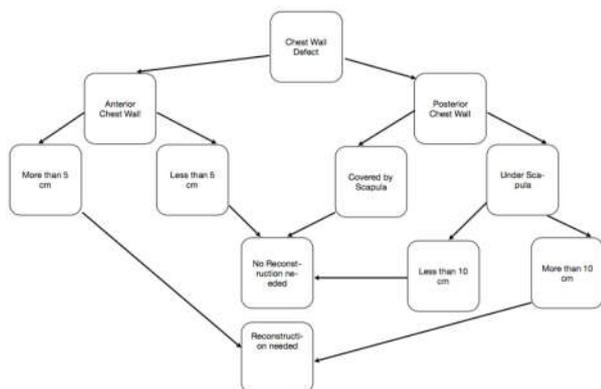
macroscopic tumor free margin in soft tissue. Chest wall defect, which can cause instability and flail chest, larger than 5 cm at the anterior wall and larger than 10 cm at posterior wall were constructed with synthetic and autologous materials. In all cases non-steroidal anti-inflammatory drugs and personal controlled analgesia applied to control the postoperative pain. All data were analyzed using SPSS software version 17.0 (Chicago IL, USA). Survival rates are described as mean value. Kaplan-Meier method applied in total survival analysis.

## RESULTS

The common symptoms were swelling (n=10, 52,6%), pain (n=5, 26,3%), pain and swelling (n=3, 15,8). One of the cases was symptomless and diagnosed by coincidence in chest radiography. Tumors were right sided in 6 cases (31,6%) and left sided in 13 cases (31,6%). Nine cases (47,3%) were anterior, 6 cases (31,6%) were posterior and 4 cases (21,1%) were laterally located in chest wall. The origin of tumor were bone (rib and sternum) in 3 cases (15,7%) and soft tissue in 16 cases (84,3%). The character of tumor were malignant in 12 cases (63%) and benign in 7 cases (37%) (Table 1). There were pulmonary invasion in 3 cases (Patients number 6,14,15 in Table 1) and wedge resection applied. The mean duration of hospitalization was 11,4 (range: 5-30) days



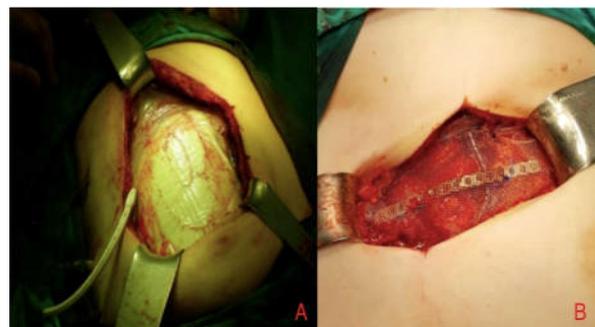
**Figure 1** Perioperative view and postoperative chest X-ray of hemangioma case which is reconstructed with Kirshner wire and prolene mesh



**Figure 2** Reconstruction algorithms

Postoperative morbidity was seen in 6(32%) cases (flail chest n=4, wound infection=1, effusion and seroma n=1). Three of flail chests' tumor location were front and one was back, and all cases were the patient which solide reconstruction did not applied. This cases treated conservatively and there were not a disability in respiration pattern and hemodynamic parameters. A case with liposarcoma operated after neoadjuvant chemotherapy and wound infection developed postoperatively.

Free skin graft reconstruction applied after debridement and VAC (Vacuum Assisted Closure) treatment. Chest wall resection and sandwich graft (methyl methacrylate bone cement and prolene mesh) reconstruction applied for a case with rhabdomyosarcoma. Effusion and seroma occurred in postoperative one month. Effusion and seroma drained but the patient died in postoperative fourth month because of sepsis and respiratory failure.



**Figure 3** For rigid reconstruction A. Methyl methacrylate sandwich graft B. Titanium plates

Five autologous and 5 synthetic reconstruction applied in 10 (52%) cases. These autologous flaps were latissimus dorsi muscle (n=3), serratus anterior muscle (n=1) and a skin graft. Synthetic grafts were prolene mesh (n=2), sandwich graft (methyl methacrylate bone cement and prolene mesh, n=2) and a case with hemangioma reconstructed with prolene mesh and intramedullary Kirshner wire (Figure 1) after rib resection.

Median survival rate was 47 (range: 3-107) months in malignant cases and 57(range: 6-144) months in benign cases. In course of follow up recurrence detected in 5 (26,3%) cases and operated again. Tumor cells detected at microscopic histopathologic studies after surgery in 4 cases which have 4 cm tumor free margin macroscopically, and two of them re-operated with clear surgical margin. Radiotherapy performed to other 2 cases which are not able to operate again.

## DISCUSSION

Malignancy rate of PCWT is 60-70% (1,5,6) and also it is hard to diagnose the tumor as malignant or benign (6). Because of that all PCWT cases must be accepted as malignant and treat. In our study 7 case (37%) were benign and 12 cases (63%) were malignant. According to the literature PCWT originate from bone and cartilage (55%) and soft tissue (45%) (7,8,9). In our study the source were bone (rib and sternum) in 3(15,7%) cases and soft tissue in 16 (84,3%) cases. Pain and/or swelling are the common symptom (1). Although pain is usually associated with malignancy, chondroma and osteoma can be presented with pain. Burt et al. (8) detected that the most common symptoms are swelling (50%), pain and swelling (33%) and only pain (15%). In our study symptoms were swelling (n=10, 52,6%), pain (n=5, 26,3%), pain and swelling (n=3, 15,8) and a case was symptomless. Pain is the indicator of poor prognosis (7). Determination of metastasis and PCWT is difficult radiologically.

**Table 1** Tumor Types, treatment modality and recurrence **NeoCt:** Neoadjuvant Chemotherapy, **Neort:** Neoadjuvant Radiotherapy, **Adjkt:** Adjuvant Chemotherapy **Adjrt:** Adjuvant Radiotherapy

No	Age	Gender	Histopathology	Reconstruction Technic	Survival (month)	Neo CT	Neo RT	Adj CT	Adj RT	Recurrence
1	25	F	Desmoid Tumor	Lattismus dorsi muscle	107	-	-	-	-	4 times
2	78	M	Malignant Mesenchymal Tumor	-	50	-	-	+	+	-
3	75	M	Liposarcoma	-	84	+	+	+	+	2 times
4	14	M	Fibrosarcoma	Serratus anterior and Pectoralis major muscle	56	+	-	-	-	-
5	36	F	Leiomyosarcoma	Prolene Mesh	83	-	-	-	-	-
6	64	M	Osteosarcoma	Prolene Mesh+Methyl Methacrylate Bone Cement	5	-	-	+	+	-
7	45	M	Fibrosarcoma	-	93	-	-	-	+	-
8	55	M	Chondrosarcoma	Prolene Mesh	3	-	-	-	-	-
9	24	F	Chondrosarcoma	-	50	-	-	-	+	-
10	37	F	Schwannoma	Lattismus dorsi muscle	71	-	-	-	-	-
11	82	F	Schwannoma	-	97	-	-	-	-	-
12	51	M	Dermatofibrosarkoma Protuberans	Autologous Skin Graft	144	-	-	-	-	3 times
13	28	F	Malignant Mesenchymal Tumor	-	30	-	-	-	-	-
14	73	M	Liposarcoma	Lattismus dorsi muscle	18	-	-	+	-	4 times
15	49	M	Rhabdomyosarcoma	Prolene Mesh+Methyl Methacrylate Bone Cement	4	-	-	+	+	-
16	37	F	Schwannoma	-	18	-	-	-	-	-
17	86	M	Malignant Mesenchymal Tumor	-	18	-	-	-	-	1 times
18	46	F	Elastofibroma	-	7	-	-	-	-	-
19	60	F	Hemangioma	Kirchner wire + Prolene Mesh	6	-	-	-	-	-

Vascular invasion and involving phlebolitis at hemangioma, target-like sign at neurofibroma, bony expansion and ground glass matrix at fibrous dysplasia, corticomedullary bone destruction at osteosarcoma can be helpful in differential diagnosis (3). The histopathologic diagnosis of tumor must be determined preoperatively. Because treatment of some tumor types as like Ewing's sarcoma require neoadjuvant chemotherapy, surgery is contraindication in some types as like solitary plasmocytoma. In our study we gave neoadjuvant chemotherapy in 2 cases. A case was 71 years old man with pleomorphic liposarcoma of major pectoral muscle. After neoadjuvant chemotherapy, resection applied. Tumor cells determined in surgical margins in histopathology report. The patient underwent surgery again and wide resection applied. Due to development of wound infection debridement, VAC therapy and skin graft reconstruction applied. Adjuvant chemoradiotherapy given. Recurrence determined twice in 3rd and 6. years follow up and resection repeated. Patient died in the 84 months of follow up. The other case was 14 years old man with swelling complaint on anterior chest wall. After radiological examination incisional biopsy applied. The tumor diagnosed as fibromyxoid sarcoma. Neoadjuvant chemotherapy has given as a decision of multidisciplinary meeting. After chemotherapy chest wall resection involving 2 to 7 ribs and autologous anterior serratus and major pectoral muscle flap construction applied. Adjuvant chemotherapy applied and there were no recurrences determined during 56 months of follow. Liposarcoma is the most common soft tissue malignancy but rarely seen in chest wall. 73 years old patient with myxoid liposarcoma who operated for 2 times before at another clinic. There were 8 cm mass with lung invasion. The patient had been discussed in multidisciplinary group meeting and decided to the operation before chemotherapy. Total excision of chest wall tumor and wedge resection of lung performed. During the follow up recurrence detected again.

The patient didn't accepted the surgery and died in the 16 month of follow. There are different opinions about the expanse of resection. Özçelik *et al.* (9) suggest wide resection with 4 cm margins and King *et al.* (10) reported that there is no significant difference in survival between 2 cm margin and 4 cm margin but recurrence rate is higher in 2 cm margin resection. In our study, there were 5 recurrence and all have less than 2 cm tumor free margins. The aim of treatment is wide resection providing minimal morbidity and mortality with tumor free margins (6). Expanse of resection is related to the histopathology of tumor (10). In chondrosarcomas with tumor free margins local recurrence rate is 4% but up to 73% with tumor positive margins (11). Malignant aggressive bone tumors expand through the periosteum of rib and resection must include entire rib with anterior and posterior joint points (12). Desmoid tumors are benign but has aggressive growth behavior. Therefore resection must include 4 cm tumor free margin as like malignant chest wall tumors (10). In our study a patient with desmoid tumor recurred 4 times after wide resection.

There is a few studies about survival in literature. Cangır *et al.* (4) reported survival 23,1 (range: 6-86) months in a study about 37 cases with malignant chest wall tumor. In our study survival is 47 (range:3-107) months in malignant cases. Reconstruction is necessary to prevent flail chest and pulmonary herniation, protect vital organs below and support respiration after wide resection. Defects should be closed by primary repair is if possible. This is commonly for anterior defects less than 5 cm and posterior defects less than 10 cm (13) (Figure 2). Autologous and synthetic materials are useful for larger defects (11). For medium sized defects, prolene mesh, Marlex mesh, PTFE (polytetrafluoroethylene), and Gore-Tex patch can be applied for nonrigid reconstruction. Silicone, Teflon, acrylic materials, methyl methacrylate sandwich (Figure 3a) and titanium plates (Figure 3b) can be used for rigidity (5). In our study we applied 10 reconstructions as mentioned in Table 1.

Rectus abdominis, latissimus dorsi muscle flaps in infraclavicular area and pectoralis major muscle flap in sternum resections are commonly used as autologous graft (12). Latissimus dorsi muscle and/or skin flap is preferred for reconstruction in anterior and lateral defects because of large vascularization (13). Greater omentum with split skin grafts can be useful in defects that are not appropriate for other muscle flaps (14). But it has high risk of abdominal complications as intestinal hemorrhage, perforation, epigastric hernia. We applied latissimus dorsi flaps in order to defect size and location and no momentum grafts needed.

## CONCLUSION

Primary chest wall tumors are rarely seen and best treatment is wide resection with tumor free margins. In some cases oncologic treatment may be useful for neoadjuvant therapy, prevention of recurrence and curative therapy. Range and location defect and experience of surgeon is the major factors of reconstruction style. In this single center study the frequency of primary chest wall tumors was not so high and more randomized studies of large groups are needed for better knowledge and results.

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## Ethical Responsibilities

No animal or human studies were carried out by the authors for this article

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