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Original Article

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Surgical Results of Chest Wall Tumors: Experience of 19 Years

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Abstract

Aim: We conducted a retrospective clinical, radiological and pathological evaluation of 90 consecutive patients with primary chest wall tumors.

Methods: From 1991 to 2011, 90 patients with the diagnosis of primary chest wall tumors were treated and their results were evaluated.

Results: There were 54 males and 26 females ranging in age from 12 to 69 years (median, 22.85 years); 37 had a primary malignant tumor and 53 had a benign tumor. Pain and palpable mass were prominent symptoms. All the patients underwent resection. Overlying soft tissue was resected en bloc in 15 patients. Chest wall defects were reconstructed with prosthetic material or autogenous grafts when the defects were large. Soft tissue reconstructive procedures were muscle transposition. There were no early postoperative complications. Follow-up was complete in all patients and ranged from 2 to 36 months (median, 24.5 months). All patients with benign tumors are currently alive. Tumor recurrence developed in 6 patients. There were no early mortality related to resection of the chest wall.

Conclusion: CWTs should be primarily considered malignant. Successful outcome depends upon adequate chest wall resection, according to histopathologic type of tumor. Large defects make reconstruction mandatory for thoracic restoration.

Keywords: chest, wall, tumor, reconstruction

INTRODUCTION

Primary chest wall tumors (CWT) are uncommon thoracic masses originating from various tissues such as bone, cartilage, soft tissues and infiltrating thoracic layers. The differential diagnosis of chest wall masses is diverse, enclosing both benign and malignant lesions, local extension of adjacent disease, and local manifestations of infectious and inflammatory processes. Their manifestations are variable and not specific even most of them present painfull enlarging. This condition may make the diagnosis delayed until histopathologic results provided. Surgical resection still remains mainstay treatment of choice despite advances in other treatment modalities (1-3). Treatment depends on histological subtype and location, but may include chemotherapy and radiotherapy in addition to surgical resection Resection is followed by careful reconstruction. This study is aimed to review our what we managed CWT. Evolving new tecniques and materials enable agressive resection safe and reliable. Wider resections are still problematic. The study consists of a history, physical examination and imaging of the tumor with surrounding structures, and evidence of histopathological results and describes our experience on demographic characteristics of and management modalities of on CWT.

CWT, bening or malignant, arise from thoracic soft tissues and bony structures of thorax and include/enclose both benign/malignant primary/secondary neoplasms. CWT comprise 5% of all thoracic malignancies and 1% of all primary tumors. They are classified into their origins (4).

MATERIAL & METHODS

Between 1994 to 2012, 90 patients with the diagnosis of chest wall tumors were reviewed with regarding to neoplasms arising from structures of the thorax, including bone, cartilage, and associated soft tissue. Patients with metastatic lesions to thorax, chest wall infection and inflammation were excluded. Tumors related to spinal cord area, mediastinum and thoracic outlet were also excluded. The medical data including history, gender, age, clinical symptoms, radiological features (chest X-ray [CXR], computed tomography [CT]), tumor extent, location, hospital stays, surgical methods, pathology reports, and outcomes were collected. Pathological diagnosis was made by needle biopsy and incisional biopsy was undertaken when neddle biopsy was failed or histologic examination from surgical resected specimens. The diagnosis was confirmed after all resected specimens were sent for histopathology. To rule out extention and metastasis, ultrasonography of the abdomen and imaging were used for malignant tumors. Simple resection for benign masses and wider resection for malignancies were carried out. The median follow-up period was 42 months (range 2–62 months) among 88 patients. The follow-up rate in this study was 97.8%. Two patients were lost to follow-up. Outcome was recorded as with or without recurrence or metastasis. Cases of Ewing's sarcoma, osteosarcoma and lymphoma underwent chemo and radiotherapy before surgery. Adjuvant postoperative irradiation and chemotherapy were used when necessary. Origins of neoplasms were classified into osseous and cartilaginous, soft tissue (e.g. muscle, vessel, peripheral nerve, fibrous tissue), and hematologic (e.g. lymphoma, plasmacytoma). The follow-up period was determined from the latest admission date of medical records of the outpatient unit.

Statistical Analysis

Median values were calculated for discrete variables. All categorical variables were presented as number of patients and percentages. The median of two groups were analysed by using Mann-Whitney U test and also, The mean of two groups were analysed by using Student's t test.

Two-sided p values were considered statistically significant at $p \leq 0.05$. Statistical analyses were carried out by using the statistical packages for SPSS 15.0 for Windows (SPSS Inc., Chicago, IL, USA).

RESULTS

The study population were 56 male and 38 female patients with a median age of 39.41 ranging from 3 to 71 years. Nine patients were symptom free. Most prominent clinical symptoms were pain in 51 (58.95%) and swelling in 62 patients (68.87%). Other complaints included neurological and respiratory symptoms. Patients' characteristics are shown in (Table 1). Table 2 shows the distrubition of all tumors. CT was more useful in discrimination of malignant CWT. The overall tumor was located in the lateral chest wall in 37 patients (41.10%) and in the posterior in 30.35% and the anterior thorax in 28.57% of cases. They all were solitary and no distant metastases were found at the time of diagnosis. Histological confirmation of diagnosis, therefore, was always obtained by means of incisional biopsy (n . 48), excisional biopsy (n . 35), or wide resection (n . 7). There were malign tumor in 37 patients (41.11%) and benign tumor in 53 patients(58.88%) .

In osseous and cartilagenous origin, benign tumors were present in 20 cases and the remaining 18 cases were malignant. Excisional biopsy was carried out for diagnosis in nearly all bony and cartilagenous tumors except one chondrosarcoma and two Ewing's sarcomas.

Reconstruction and wider resection in tumors with size more than 7x7 cm in four cases of 18 malignant osseous and cartilagenous neoplasms. Polypropylene mesh with

methylmethacrylate was used in these four patients. Prosthetic material was removed in two cases due to ongoing infection. The defect in remaining 14 cases were primarily repaired. Seven patients of them developed metastasis in the follow up period. Tumor recurrence occured within 2 years of treatment in 6 patients, including 5 chondrosarcomas, 1 osteosarcoma. Of these patients, 2 died due to disease-related complications, 2 died of unrelated conditions. In 5 patients with Ewing's sarcoma, additional chemotherapy and radiotherapy was used.

Tumors originating from soft tissues were bening in 33 cases and malignant in 17 cases. No recurrence occured in in the follow up of bening cases. Malignant neoplasms were located ventrally in 4, laterally in 6 and posteriorly in 7 patients. The diagnosis was made by incisional biopsy in 15 patients and excisional biopsy in 7 patients. Procedures in soft tissue tumors were predominantly completed by muscle transpositions. The defect was closed by using pectoralis major and latissimus dorsi muscles in 3 cases. Thirteen patients with malignant tumor received chemo-radiotherapy. Prosthetic material was not used in these patients because the defects were not large. Tumor recurrence or metastasis was found in 2 patients with leiomyosarcoma. All recurrences or metastases developed in the first years after treatment. Of these two patients, one died of disease-related complications.

Among the patients with hematologic origin of CWT, there was male preponderance compared with tumors of bone or soft tissue origins ($p=0.03$). Patients with tumors of hematologic disease origin were not older than those with tumors of other origins.

Four patients with myeloma of hematologic origin received radiotherapy following surgical resection. Presence of pain, mean tumor size, symptomatic period and the age of two groups were found significantly different ($p<0.05$). The patients with a malignant tumors were found to be older than those with a benign tumors (mean age 43 vs. 27 years, respectively).

Table 1. Characteristics of the patients with chest wall tumors.

	benign n=53 (%)	malignant n=37 (%)	*p*
Gender (male/female)	30/23	24/13	>0.05[x]
Age, median, (year)	3-67(29)	14-71(43)	<0.05[**]
Swelling	39 (75.2)	23 (62.4)	>0.05
Pain	23(42.7)	28 (75.2)	<0.001
Symptom free	6 (11.3)	3 (8.1)	>0.05
Others*	3 (5.6)	3 (8.1)	>0.05
Tumor diameter, mean (cm)	3-18(10.5)	4-15(6.3)	<0.05
Symptoms'period, mean, (month)	6-24(13)	3-12(7)	<0.05

* cutaneous discharge, neurologic and respiratory symptoms,
** The median of two groups were analysed by using Mann-Whitney U test,
x The mean of two groups were analysed by using Student's t test

Table 2. Distrubition of primary chest wall tumors.

Tumors	n=90	%
Benign	**53**	**58.88**
Bone & cartilage	*20*	
Chondroma	11	
Osteochondroma	4	
Fibrous dysplasia	3	
Aneurysmal bone cyst	2	
Soft tissue	*33*	
Lipoma	12	
Fibroma	7	
Hemangioma	6	
Schwannoma	2	
Fibrolipomatosis	2	
Elastfibroma	2	
Hemangioendotelioma	1	
Fibrous histiocytoma	1	
Malign	**37**	**41.11**
Bone & cartilage	*18*	
Chondrosarcoma	7	
Ewing' s sarcoma	6	
Fibrous histiocytoma	4	
Osteosarcoma	1	
Soft tissue	*17*	
Fibrosarcoma	8	
Rabdomyosarcoma	5	
Leiomyosarcoma	2	
Liposarcoma	2	
Hematologic origin	*2*	
Plasmacytoma	1	
Lymphoma	1	

DISCUSSION

Primary CWTs are best classified by their primary component: soft tissue or bone and cartilage. Primary chest wall tumors including both bony and soft tissue neoplasms comprise approximately 5% of all thoracic tumors and 1% to 2% of all primary tumors found in the body (4). Majority of CWT are benign. The malignancy rate is higher in osseous or cartilaginous tumors compared with soft tissue neoplasms. Primary CWT are uncommon among thoracic masses which present diagnostic challenges to the treatment. Primary malignant CWT account for approximately 4% of all new cancers diagnosed annually.

Specific tumors are found in particular areas of the bony thorax; the chondroma and endochondroma often arise anteriorly in the costal cartilages or sternum. All bening bony lesions were withi ribs in our series. Chondrosarcomas most often occur anteriorly at the costochondral junction. Pain is not formally a predictor of malignancy. Benign osteoma can present with severe painful swelling. Asymptomatic lesions are often benign, and most of these are detected on chest radiographs. Soft tissue sarcomas can present as a painless mass, but tumors of bone and cartilage, both benign and malignant, present with pain. This rate was 42.7% and 75.2% in benign and malignant tumors, respectively.

Generalized symptoms of fever, fatigue and malaise can be presenting complaints associated with malignancies. Rapidly growing tumors are more likely to be malignant. Patients with malignant chest wall tumors were seen in older patients according to those with benign tumors. Slight male predominance was found in the malignant cases of this study. The ratio of benign to malignant primary chest wall tumors was 1.4:1 in our series. Palpable mass and pain were the most prominent symptoms in patients with primary chest wall tumors(5). Other symptoms include neurologic symptoms such as numbness and weakness.(5,6).

Most of the patients with malignant tumors were symptomatic, whereas some patients with bening neoplasm were asymptomatic. Among bony neoplasms, the rib was the most common source.

Physical examination is not enough to differentiate a benign from a malignant chest wall tumor. Both malignant and benign tumors can be tender on palpation. No reliable clinical features for distinguishing benign from malignant CWT are present. The symptomatic period was signicantly shorter in the malignant CWT group, and the patients were significantly older in the study group, but these findings are not more diagnostic. Preoperative differential diagnosis between benign and malignant CWTs can be difficult until the histopathological examination is provided (6).

Which method is more appropriate among excisional, incisional, or needle biopsy that is controversial. The careful planning of a wide resection and reconstruction shoul be considered in a multidisciplinary way. False negative results are possible with nonexcisional biopsies therefore they should be reserved for tumors of hematologic disease which benefit from chemotherapy. Careful use of fine needle biopsy prevents wrong diagnosis due to inadequate tissue specimen. Whatever the biopsy methot is it should not interfere subsequent resection for safe margin. A core needle biopsy is better than needle aspiration and can be easy for palpable soft tissue tumors, but difficult for bony neoplasms. Needle aspiration biopsy is not recommended for primary chest wall tumors, since it can not yield precise histologic results. Core needle aspiration seems to be much more reliable. Nonexcisional biopsy should be reserved for patients with a history of malignancy, suspicion of hematologic disease and high operative risk. Excisional biopsy is the preferred method of treatment of small practical standpoint, wide surgical resection is the preferred treatment for the majority

of chest wall tumors. Successful surgical resection makes establishment of a correct diagnosis and reconstruction of large chest wall defects.

Imaging findings can not be enough to make the diagnosis of chest wall tumors or to differentiate benign from malignant chest wall tumors from. CT is essential. A rapid increase in tumor size, cortical destruction, involvement of the surrounding tissues, and metastases suggest malignancy (7,8). However, the majority of the malignant CWTs in our series lacked these features. CT, are not only useful in determining the extent of tumor, but also valuable in surgical planning and follow-up evaluation. Soft tissue mass, bone destruction, calcification, and bone deformity are frequently described, but are not diagnostic for malignancy. MRI has become valuable in defining the extent of chest wall tumors and showing adjacent organ involvement. It precisely defines the anatomic extent of the tumor. When MRI is supplemental to the CT, both studies asist in the planning of extensive and difficult chest wall resections. Positron emission tomography (PET) is useful to define metastatic lesions if there are. A radionuclide bone scan can rule out multiple at least in a suspect malignant CWT (plasmacytoma, Ewing's sarcoma) (9). In our series, a bone scan was usually obtained if the CWT was located at the bones(i.e.plasmacytoma, chondrosarcoma, osteosarcoma).

Some neoplasms have their typical imaging features such as vascular enhancement in hemangioma, target-like view in neurofibroma, well-defined cortical and medullary connection in osteochondroma, fusiform expansion and ground glass matrix in fibrous dysplasia, expansile osteolytic lesion in giant cell tumors, chondroid or osteoid matrix in osteosarcoma, and diffuse osteolytic change with a soft tissue rib mass in multiple myeloma (7,8).

Osteochondroma, chondroma, and fibrous dysplasia constitute 60–70% of all benign CWT. In our study, they were the most common benign CWT and patients received surgical excision and recovered well. The most common primary malignant CWT were chondrosarcoma and Ewing's sarcoma in our series. Chondrosarcomas are at high risk of tumor recurrence (10-12). The recurrence rate after excision was 38.9% and found along the upper ribs in our cases. Bone destruction, irregular contours, and intratumoral mineralization are characteristics on CXR. Wide excision and careful postoperative evaluation are mandatory.

The aim is to achieve wide resection with tumor-free margin. A safe border of at least 4 cm is enough for chondrosarcoma which has high risk of tumor recurrence after surgical resection. This margin may not be sufficient for high grade malignant tumors such as osteosarcoma (10,13,14).

Chest wall involvement with lymphoma is not uncommon. However, isolated primary chest wall lymphoma is not frequently seen (6). Two patients with chest wall lymphoma received surgical excision followed by adjuvant chemotherapy in our series. To obtain a better outcome, chemotherapy following surgical intervention can be considered in patients with

solitary chest wall lymphoma without other organ involvement. Adjuvant chemotherapy and/or radiotherapy is considered for high grade sarcomas.

Our limited experience in the management of CWT showed that patients with malignant neoplasms were older in the malignant disease compared to those with benign tumors. The mean size of benign tumors was larger than that of malignant tumors.

Absence of symptoms was more frequently seen in patients with benign tumors than malignant primary chest wall neoplasms. Wide excision and careful postoperative evaluation are mandatory for risk of tumor recurrence after surgical resection (15,16). Sufficient surgical resection remains the treatment of choice for primary chest wall tumors. The thoracic wall reconstruction after wide resection is critical to successful treatment of primary chest wall tumors. We used synthetic materials in 4 cases.

As conclusion, CWTs should be considered malignant until proven otherwise. Aggressive surgical resection with tumor-free margins is mainstay for the best treatment in both benign and malignant tumors.

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