Experience of Surgical Resection and Reconstruction of Chest Wall Tumor in Dhulikhel Hospital

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Citation

Karmacharya RM, Vaidya S, Bhatt S, Guragai M, Sharma S, Bhandari S, et al. Experience of Surgical Resection and Reconstruction of Chest Wall Tumor in Dhulikhel Hospital. *Kathmandu Univ Med J.* 2025;90(2):234-8.

ABSTRACT

Background

Chest wall tumors are rare thoracic tumor which can be either primary or metastatic. Conventional radiography is the first line of investigation followed by further imaging like computed tomography or magnetic resonance imaging. When indicated preoperative biopsy by fine-needle aspiration need to be done. Small chest wall tumor can be surgically treated by excision and primary repair. Bigger chest wall tumor is treated by excision and chest wall reconstruction.

Objective

To know the features of chest wall tumor, symptoms, histopathological findings, surgical procedures performed and outcome following the surgery.

Method

This is the retrospective study that included chest wall tumor subjected for excision and repair during January 2018 till December 2023 in Thoracic surgical unit of Dhulikhel Hospital. Variables such as presenting complaints, size and extent of tumor, type of surgery, outcome of the surgery, hospital stay, neoadjuvant chemotherapy and post excision chemo or radiotherapy and recurrence of the tumor were included. When primary repair is not possible following wide excision, reconstruction using double prolene sandwich mesh was done.

Result

There were 38 cases of chest wall tumor. Mean age of the patient was 42 years (SD 15.25 years, range 20 - 68 years). Of them, 22 patients were female (57.9%) and 16 patients were male (42.1%). Chest pain was the most common symptoms (84.2%) followed by lesion in chest (81.6%). Average size of the tumor was 14.8 ± 3.6 cm (Range 5 cm to 25 cm). Most common histopathological finding was neurofibroma (31.6%) filled by schwannoma (15.8%). All the patients underwent wide local excision. In terms of repair, primary repair was possible in 68.4% while in 31.6% patients repair using double prolene and bone cement sandwich was done. Average hospital stay was 6.6 days (SD 2.3, range 3-9 days).

Conclusion

Chest wall tumor can have different histopathological findings. In patients where wide resection is possible, it can be repaired by either primary repair or by repair using double prolene and bone cement sandwich.

KEY WORDS

Chest wall tumor, Reconstruction, Resection

INTRODUCTION

Chest wall tumors represent a diverse set of lesions that pose significant diagnostic and therapeutic challenges for surgeons. These tumors are relatively rare, comprising less than 5% of thoracic malignancies, and they can arise from any of the various structures that make up the chest wall, leading to a wide range of pathological types.[1] Chest wall neoplasms can be either primary or metastatic, with approximately 50% of these tumors being malignant.[2] It can arise as an extension from the primary lung tumor arising from muscle, fat, blood vessel, nerve sheath, cartilage, or bone of the chest wall or via dissemination of malignant foci present elsewhere.[3] Around 85% of primary bone tumors in the chest wall arise from the ribs, with 88% of these being malignant. The remaining 15% originate in the sternum, and these sternal tumors are nearly always malignant.[4]

Primary soft tissue chest wall tumors usually present as painless, palpable masses, often found incidentally during imaging for other conditions. Rapid growth and pain suggest malignancy. Initial evaluation should focus on the mass's history, growth and characteristics, as well as prior malignancies and imaging, to determine the lesion is primary or secondary, which guides treatment.[5] The initial approach in diagnosis is to locate the tumor using imaging techniques, with Chest X-rays being commonly employed. These X-rays help determine the lesion's size, location, and detect features such as calcification, erosion, and bone destruction. While chest X-rays can identify many bone tumors due to their distinct characteristics, early-stage tumors might be missed. Conventional radiography is the first line of investigation followed by further imaging like computed tomography or magnetic resonance imaging. When indicated preoperative biopsy by fine-needle aspiration need to be done.[6]

Chest wall tumors are primarily managed with excision followed by primary repair when possible. When primary repair is not possible owing to big size of excised segment and multiple ribs excision, reconstruction of chest wall need to be done.[7,8] Although titanium mesh is an easier option for reconstruction, its use is limited in our setting due to the cost. However, a low cost option is double prolene sandwich mesh which employs two layers of polypropylene mesh inside bone cement (methyl methacrylate) prepared and contoured into desired shape.[9,10] Some tumors benefit from preoperative chemotherapy. Chemotherapy is crucial for sensitive tumors like osteosarcoma and rhabdomyosarcoma, while chondrosarcomas and most adult sarcomas are controlled by excision and radiation.[11] This study is done to know the features of chest wall tumor, symptoms, histopathological findings, surgical procedures performed and outcome following the surgery.

METHODS

This is the retrospective study that included chest wall tumor subjected for excision and repair during January 1st 2018 till 31st December 2023 in Thoracic surgical unit of Dhulikhel Hospital. Prior approval from institutional review committee was taken for the study. Variables such as presenting complaints, size and extent of tumor, type of surgery, outcome of the surgery, hospital stay, neoadjuvant chemotherapy and post excision chemo or radiotherapy and recurrence of the tumor were included. The patients were evaluated by two thoracic surgeons with experience of and four twelve years.

Following chest radiograph, the patient were subjected for contrast enhanced computed tomography was done to know the extent of tumor. When indicated and feasible, fine needle aspiration cytology was performed. Treatment plan including the type of surgery was decided after getting consensus by both the thoracic surgeons. Standard preoperative preparation was done.

The patients were not included in the study if the tumor are metastatic tumor or surgical excision is not possible. Following wide local excision, if primary repair is not possible, repair using double prolene mesh reinforced by methyl methacrylate was done. For this procedure, prolene mesh (Bard Davol Inc) of size 26 x 36 cm was cut into desired shape. Two such layers were placed in methacrylate paste. While the methacrylate paste starts to set, it was contoured to desired shape. After the prosthesis is completely set, few holes were made in the edge of it which was later attached with multiple ribs using no 2 sternal wires (Ethicon sutures). Other layers were closed in standard fashion.

The specimen were sent for histopathology examination. Details on hospital stay was noted. All the patients also had oncology consultation for discussion on need of neoadjuvant or postoperative chemo/radio therapy. Details on the follow-up of the patients and any features of recurrence of chest wall tumor was also noted.

Database was created in Microsoft access (version 2021). Data analysis was done in SPSS (version 21). Nominal variables were expressed in terms of frequency and percentage. Scalar variables were expressed in terms of mean, standard deviation and range.

RESULTS

There were 38 cases of chest wall tumor. Mean age of the patient was 42 years (SD 15.25 years, range 20-68 years). Of them, 22 patients were female (57.9%) and 16 patients were male (42.1%). Left side was involved in 23 patients (60.5%) while right side was involved in 15 patients

Table 1. Number of patients with different symptoms.

Symptoms	Number	Percentage
Chest pain	32	84.2
Lesion in chest	31	81.6
Shortness of breath	10	26.3

(38.5%). Table 1 shows a number of patients with different symptoms. Chest pain was the most common symptoms followed by lesion in chest.

Table 2. Number of patients with different histopathological findings.

Histopathological findings	Number	Percentage
Neurofibroma	12	31.6
Schwannoma	6	15.8
Ewing's sarcoma	5	13.2
Chondroma	4	10.5
Teratoma	4	10.5
Hemangioma	4	10.5
Carcinoid tumor	3	7.9

Average size of the tumor was 14.8 ± 3.6 cm (Range 5 cm to 25 cm). Table 2 shows number of patients with different histopathological findings. Most common histopathological finding was neurofibroma filled by schwannoma.

In terms of treatment, all patients underwent wide local excision with repair. Of them, primary repair using local muscle flap was done in 26 (68.4%) patients. Repair using sandwich prolene mesh with bone cement was done in 12 (31.6%) patients. Imaging pictures of one of the patient

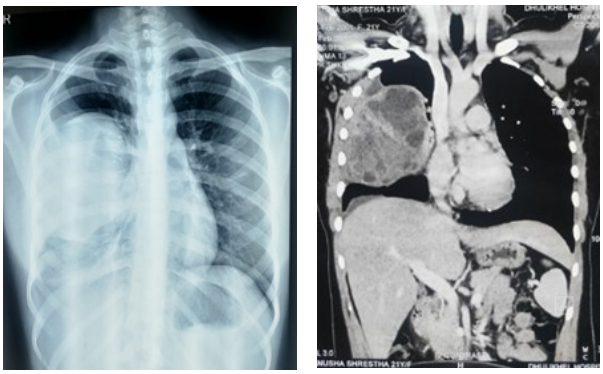

Figure 1. Chest xray and CECT image of a patient with chest wall tumor originating from right 3-7 ribs.

with right sided chest wall tumor involving 3rd to 7th rib is shown in figure 1. Intraoperative pictures of a patient showing resected segment along with sandwich prolene mesh with bone cement is shown in figure 2.

Two patients of Ewing's sarcoma had neoadjuvant chemotherapy followed by surgical resection. All patients were sent for oncology consultation for possible need of

Figure 3. Intraoperative pictures of one patient showing resected segments along with reconstruction using double prolene and bone cement sandwich mesh.

chemo/radio therapy. Of them, 30 required postoperative chemotherapy and 16 required postoperative radiotherapy. There was recurrence in one patient which was detected in one year follow-up and is currently under chemo and radiotherapy. Average hospital stay was 6.6 days (SD 2.3, range 3-9 days).

DISCUSSION

Chest wall neoplasms are either primary or metastatic, and may be symptomatic or asymptomatic, with about twenty percent found incidentally on chest radiograph.[1] Primary chest wall tumors are generally uncommon and represent less than two percent of all primary tumors.[12,13] Primary chest wall tumors represent five percent of all thoracic neoplasms.[12] Primary chest wall tumors occur mostly in the 5th and 6th decades of life with older patients having larger and more aggressive tumors in comparison to the younger population along with equal distribution in both sexes.[1,14] Metastatic chest wall tumor can be from locally spreading malignancies from nearby organs and tissues.[15] Due to low incidence of chest wall tumor, there is no TNM staging criteria for such tumor. Most of the published studies about chest wall tumor include few patients and are single center retrospective studies. Thus, there is lacking of appropriate evidences in relation to the clinical management of chest wall tumors. Multimodality treatment plans including surgical treatment need to be tailored according to the

individual patient. Also reconstruction of chest wall following excision of the tumor need to be individualized according the size, type of tumor and location of the defect.

In this retrospective study, we evaluated 38 cases of chest wall tumors excised and repaired at the Thoracic Surgical Unit of Dhulikhel Hospital between January 1st 2018 and 31st December 2023. The patient cohort had a mean age of 42 years, with a slight female predominance (57.9%). In an earlier case series, chest wall tumor was found more in male population.[16] Recent case series involving rigid chest wall reconstruction have mentioned 68% patients as female similar to our study.[17] Same study have mentioned mean age of the patient as 61 which was slightly higher than our study.[17]

In our study, the majority of tumors were located on the left side of the chest (60.5%). The most common presenting symptoms were chest pain (84.2%) and visible chest lesions (81.6%). Tumor sizes varied, with an average size being 14.8 cm. Histopathological analysis revealed neurofibroma as the most frequent diagnosis, accounting for 31.6% of cases, followed by Schwannoma and Ewing's Sarcoma. One study have mentioed sarcoma as the most common reason for chest wall resection.[17]

In our study, neoadjuvant chemotherapy was administered to two patients, and post-excision chemotherapy or radiotherapy was also utilized in selected cases. The recurrence rate was low, with only one case of neurofibroma recurrence encountered. The average hospital stay for patients was seven days, indicating a relatively quick postoperative recovery. In our study, primary repair using a local muscle flap was performed in 68.4% of cases, while the remaining 31.6% required reconstruction using a sandwich prolene mesh with bone cement. Studies have mentioned use of pectoralis major flap, lattissimus dorsi flap, transverse rectus abdominis myocutaneous flap in cases where the defect is large.[18-22] Where facilities are available, titanium mesh as rigid chest wall reconstruction is commonly preferred.[17,23] Titanium is gaining popularity as a prosthetic material due to its biocompatibility, strengh and ability to contour according to the size needed but has a significant cost associated with it. Advantages of sandwich prolene mesh is affordability, use of commonly available material and possibility of tailoring the size and contour as per the need during surgery. In both type of material, there is lack of adequate studies regarding the durability and need of removal due to implant fracture but regular follow-up is needed to identify such occurrence.

After resection it is important to maintain chest wall integrity to avoid respiratory compromise most notably by combination of local tissue grafts and biomaterials.[24,25] In curative treatment regimens, chest wall reconstruction enables complete resection of locally advanced tumors and subsequent adjuvant radiotherapy. In palliative disease treatment, plastic surgical techniques of thoracic wall reconstruction provide palliation of tumor-associated morbidity and can therefore improve patients' quality of life.[15]

Our study haven't studied on the recurrence of the tumor following the treatment modality. Local and distant reoccurrence mainly depends on histology the extent of excision of the tumor. Studies have mentioned at least 4cm margin for primary chest wall tumors and at least 2cm margin for metastatic tumor.[26] Similarly for benign tumor, 2 cm margin is considered enough.[26] Studies have found recurrence in chest wall tumor can be as high as 23%.[27]

Limited number of sample and wide variety of cases in this study is a limitation. Long term study with details on the durability of the reconstruction and any occurrence of recurrence need to be studied.

CONCLUSION

Chest wall tumor is a rare thoracic surgical condition with varieties of presentation and needs different treatment modalities for addressing such condition.

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