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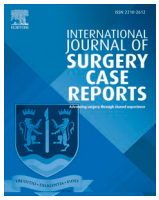

Case report

Case report on the approach to surgical management for a large chest wall chondrosarcoma

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ABSTRACT

Introduction and importance: Primary chest wall tumours are uncommon. Challenges arise in management due to delays in diagnosis and timing of treatment. The mainstay of treatment remains complete resection as adjuvant therapy has a limited role. Choice of repair and materials for chest wall reconstruction vary depending on the size and location of the defect. There are no published reports on management of chondrosarcomas arising from the rib in the Caribbean.

Case presentation: A 61-year-old female was referred from a rural clinic with a 10-month history of a progressively enlarging, painless right anterior chest wall lump. Computed Tomography (CT) shows features of a conventional chondrosarcoma arising from the ribs and including surrounding soft tissue, muscle and pleura. Surgical specimen confirms a grade 2 chondrosarcoma.

Clinical discussion: This case illustrates the importance of a multidisciplinary team discussion. Differentiating a chondrosarcoma from a benign cartilaginous tumour requires consideration of clinical features, radiological characteristics and histological features. Chest wall reconstruction aims to preserve functional and structural integrity with adequate soft tissue coverage. The patient had good cosmesis as well as pulmonary function postoperatively and no recurrence at the 3 year follow up.

Conclusion: This case highlights that the MDT is essential to a good outcome for the surgical management of a chest wall chondrosarcoma. Wide *en-bloc* resection followed by reconstruction using polypropylene mesh and a latissimus dorsi flap as a one-stage procedure can be successful.

1. Introduction

Chondrosarcomas are the most common primary chest wall tumour where this was representative of 1.5% of malignant bone tumours in Trinidad and Tobago [1]. There are no cases of chondrosarcomas affecting the ribs currently reported in the Caribbean. Surgical resection with wide margins remains the mainstay of treatment [2] as these tumours are generally resistant to chemo-radiotherapy [3]. Chest wall reconstruction restores chest wall integrity and functionality while minimizing deformity [4]. We present a large chest wall chondrosarcoma and discuss the management options at a tertiary care hospital in Trinidad and Tobago.

2. Presentation of case

A 61-year old female was referred by a rural clinic for a painless lump on the right anterior chest wall that had been progressively enlarging for over 10 months. She was a known hypertensive compliant with Nifedipine. She was asymptomatic with no prior chest trauma, surgeries or genetic predisposition from family history. She was Eastern Cooperative Oncology Group (ECOG) 0 with good social support and had a 44 pack-year smoking history.

There was a raised, round, right-sided anterior chest wall mass with no overlying skin changes. It was firm, non-compressible, non-pulsatile, non-tender and not warm. The overlying skin was free but the mass was fixed to the right upper ribs. There were no lymph nodes and all systems were normal.

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This case was discussed at a Multi-Disciplinary Team (MDT) meeting. Surgery was delayed and the mass grew rapidly over 10 weeks, measuring 10x8x10 cm (Fig. 1) prior to operation. Sequential chest radiographs (Fig. 2) and Computed Tomography (CT) scans (Fig. 3) showed the increase in size. The CT scan showed a large, heterogeneous right anterior chest wall mass with coarse, central calcifications and destruction of the right third rib. It involved the right third costal cartilage, the right pectoralis muscles and extended into the right pleura compressing the lung. There was no metastasis present.

Core needle biopsy showed either a well-differentiated chondrosarcoma or benign cartilaginous tumour. MDT discussion recommended radical chest wall resection with reconstruction followed by adjuvant therapy.

2.1. Surgery

The patient was advised on smoking cessation and had pre-operative spirometry. The patient did not want breast reconstruction citing her age. She was fasted for at least 6 h prior to General Anaesthetics.

A right sided infra-mammary elliptical skin incision was made from the sternum to the right mid-axillary line keeping 3 cm from the tumour margin in all directions (Fig. 4). *En bloc* resection of the mass included the site of the core needle biopsy, the right breast, pectoralis major, pectoralis minor, the first to fourth intercostal muscles and a wedge of the anterior aspect of the right upper and middle attached lobes. The second, third and fourth costal cartilages were removed along with the associated rib extending to the anterior axillary line. A 0.5 cm margin was also excised from the adjacent sternum.

Chest wall reconstruction involved covering the defect with polypropylene mesh. This was stretched tautly and attached to the edges of sternum, first to sixth ribs using polypropylene sutures (Fig. 5). A right latissimus dorsi myocutaneous flap (LDF) was mobilised on a vascular pedicle with the patient in a left lateral decubitus position. This was tunnelled through the axilla and trans-positioned into the anterior chest wall defect.

Consultant thoracic, general and plastic surgeons performed the surgery. The patient had necrosis of the most medial (distal) tip of the LDF skin paddle that required debridement and left pectoralis advancement (Clavien-Dindo Grade IIIb). At interval follow up, the wound had completely healed (Figs. 6 and 7) and there was no recurrence after three years precluding the need for adjuvant therapy.

Histology confirmed a chondrosarcoma that was mostly Grade 1 with areas of Grade 2 growth. All resection margins were clear of tumour cells and there was no lympho-vascular invasion. Pre- and post-operative pulmonary function tests showed no significant change.

This case has been written in compliance with the SCARE 2020 criteria [5].

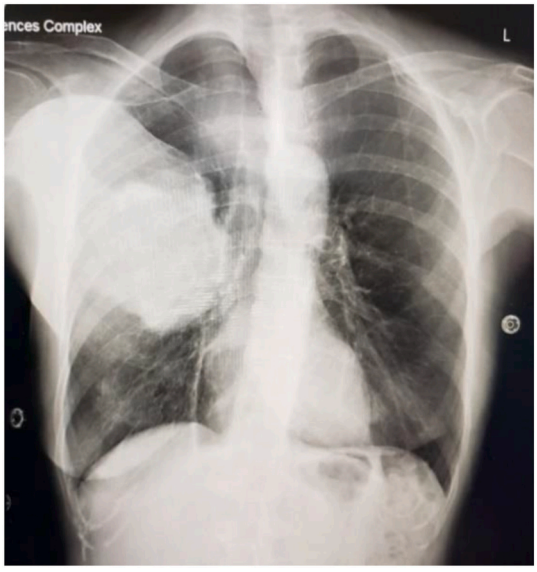


Fig. 2. Chest X Ray showing right sided chest wall mass.

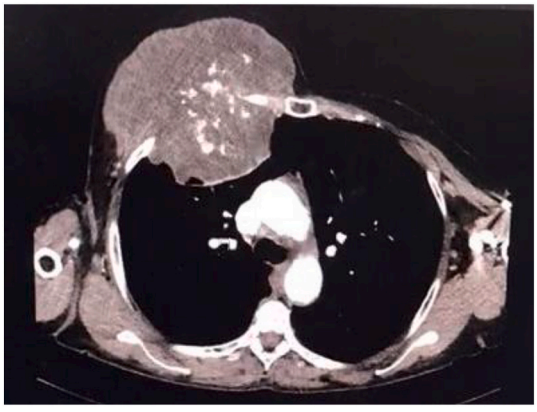
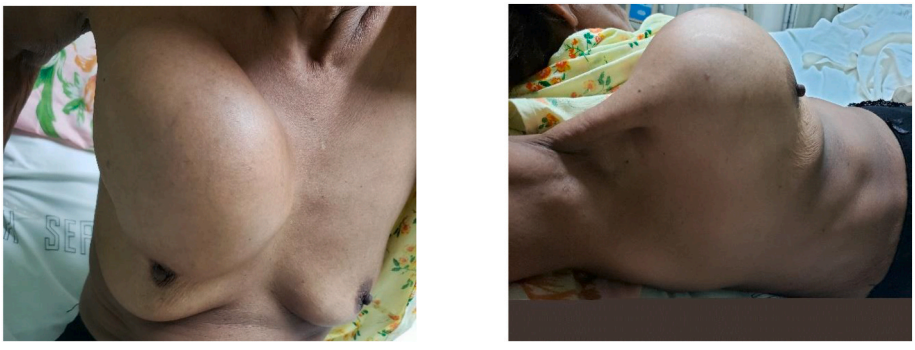


Fig. 3. CT Scan showing a right sided large heterogeneous mass involving underlying soft tissues and destruction of the third rib.

3. Discussion

Primary chest wall tumours are uncommon. They occur in less than 2% of the population and account for 5% of all thoracic neoplasms [6]. Overall, bone sarcomas account for 0.2% of all malignancies diagnosed in the United States, and the age adjusted incidence for all bone and joint malignancies is 0.9 per 100,000 persons per year [7]. In Trinidad and



a **b**

Fig. 1. a and b showing the Anterior and Lateral views of the right sided chest wall mass.

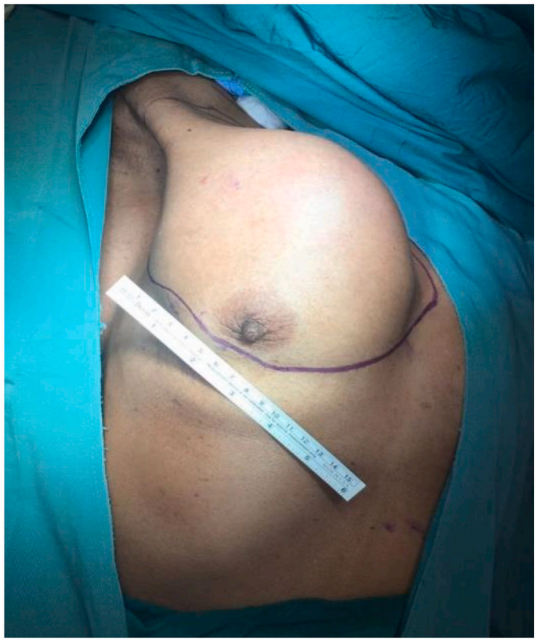


Fig. 4. Showing surgical skin incision made.

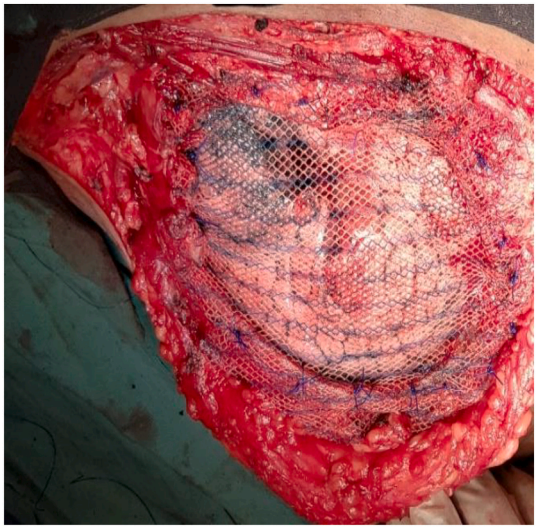


Fig. 5. Chest wall defect covered with polypropylene mesh.

Tobago, malignant bone tumours are also rare with an incidence of 0.18 per 100,000 population according to a study of an 8-year analysis of bone tumours in a Caribbean island [8]. Chondrosarcomas are the third most frequent malignant bone tumour after multiple myeloma and osteosarcoma [9]. They are the most common primary malignant chest wall tumour [6].

Chondrosarcomas are a heterogeneous group of malignant bone tumours characterized by the production of chondroid (cartilaginous) matrix [10]. These can be classified as conventional, mesenchymal, dedifferentiated and clear cell [11]. Conventional chondrosarcomas make up 85% of chondrosarcomas [12]. Conventional intramedullary chondrosarcomas typically occur in the fourth or fifth decades, with a male to female predominance of 1.5 to 2:1 [13]. Chondrosarcomas occurring in the chest wall account for 15% of cases, more common sites include the long bones (45%) and head of femur (25%) [2,3]. They are classified by the World Health Organization into Grade 1–3 based on histology and can be used both as a prognostic factor as well as a guide for

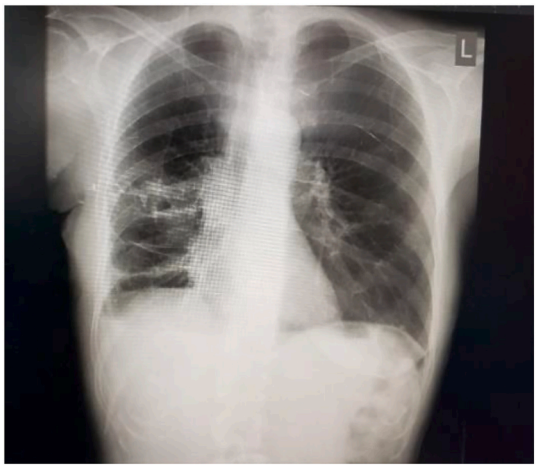


Fig. 6. Post op Chest X ray without the chest wall tumour.

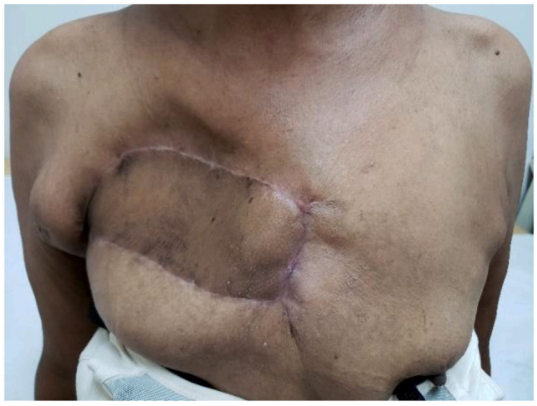


Fig. 7. Post op Chest wall resection and reconstruction.

management [14].

Because these are slow-growing tumours and often painless, malignancy may not be suspected and these patients often present or are referred late in management. Factors attributed to treatment delays include the rarity of chondrosarcomas, wrong interpretation of radiographs as normal and lack of specialist surgical expertise [15]. Proper histological grading is also difficult with heterogeneous tumour and requires specialist sarcoma pathologists. The consequences of delay include inoperability, inadequate treatment, higher risk of recurrence and lower survival rate. An MDT approach can improve diagnostic accuracy and treatment delays.

The MDT includes cardiothoracic and plastic surgeons, radiologist, oncologist, and pathologist. The aims are to ensure the correct diagnosis, stage the tumour and appropriate treatment plan. The preferred treatment of intermediate and high-grade chondrosarcoma cases is wide, *en-bloc* surgical excision. Low-grade chondrosarcoma can be treated with extensive intra-lesional curettage followed by local adjuvant treatment for those confined to the bone. Wide, en-bloc resection is required where curettage proves inadequate because of large tumour size, soft tissue involvement or either intra-articular or pelvic localization [10].

Slow-growing chondrosarcomas have a low fraction of dividing cells and are therefore relatively resistant to radiotherapy (with the exception of mesenchymal chondrosarcomas). With incomplete resection, adjuvant radiotherapy can be curative. However, doses greater than 60 Gy are required to achieve local control. The large radiation field required may result in significant collateral damage. Radiotherapy can be palliative in situations where resection is not feasible. Chondrosarcomas are also often resistant to chemotherapy due to slow growth, large amount

of extracellular matrix and poor vascularity [3]. The use of neoadjuvant chemoradiotherapy was precluded at MDT for the aforementioned reasons.

The principles for chest wall defect repair and reconstruction aim to regain structural stability and chest wall movements, obliterate intrathoracic dead space (that may promote sepsis), protect intrathoracic structures and provide soft tissue coverage [16]. Structural stability can be achieved, either with autogenous tissue (such as fascia lata or bone) or prosthetic material such as synthetic mesh [17]. Depending on the size and location of the defect, extra skeletal wall stability can be achieved using a composite graft of methyl methyacrylate (bone cement) sandwiched between two layers of synthetic mesh [18]. Soft tissue reconstruction includes pedicled muscle transposition, free muscle and omental flaps. Latissimus dorsi, pectoralis major and rectus abdominis [17] are often used. Chest wall reconstruction done with synthetic polypropylene mesh and local muscle flaps can be performed as a safe, effective one-stage surgical procedure for a variety of major chest wall defects [16]. The 5-year survival rate after resection with adequate surgical margins (4 cm on each side) was 100% compared with 50% in patients with inadequate surgical margins [19]. This group also had local recurrence rates of 15 to 25%. Prognostic factors for survival depend on the grade, location and presence of metastases [20].

This case was a grade 2 chondrosarcoma in an elderly female that was large (>5 cm) and involved 3 ribs, soft tissues and underlying muscles but no metastasis. A R0, *en bloc* resection was planned. Chest wall reconstruction was done in one stage with synthetic polypropylene mesh and a total LDF. The patient had a postoperative complication of medial tip flap necrosis which was adequately managed with debridement and advancement of contralateral pectoralis major muscle. Post operatively, she was compliant with chest and limb physiotherapy and wound dressings. She was satisfied with the cosmetic outcome and had no functional deficits. In our case, adjuvant radiation therapy was precluded as she had no recurrence.

4. Conclusion

This case illustrates that in a resource limited Caribbean island, a MDT approach was essential in the diagnosis and surgical management of a chest wall chondrosarcoma. A good prognosis can be expected with grade 2 disease excised with adequate surgical margins. Complete tumour resection with chest wall reconstruction can be successfully performed as a single-step surgical procedure using synthetic mesh and autologous muscle flap.

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Ethical approval

N/A- not applicable.

Informed consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Research registration

N/A – not applicable.

Guarantor

Kimberly Ramsingh, Department of Surgery- Cardiothoracic Unit, University of the West Indies, Eric Williams Medical Sciences Complex, Uriah Butler Highway, Champ Fleurs, Trinidad and Tobago.

Provenance and peer review

Not commissioned, externally peer-reviewed.

CRediT authorship contribution statement

Kimberly Ramsingh- Conception of the study, acquisition of data, drafting the original article.

Fayard Mohammed – Performed the surgery, Drafting the article, revising it critically for important intellectual content, and final approval of the version to be submitted.

Dale Hassranah- Performed the surgery, Drafting the article, revising it critically for important intellectual content, final approval of the version to be submitted.

Ian Ramnarine- Performed the surgery, Drafting the article, revising it critically for important intellectual content, final approval of the version to be submitted.

Declaration of competing interest

The authors declare no conflicts of interest.

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