

Chondrosarcoma of the anterior chest wall: surgical resection and reconstruction with titanium mesh

Elçin Ersöz, Serdar Eyman, Levent Alpay, Mustafa Akyıl, Mustafa Vayvada, Deniz Gürer, Serkan Bayram, Çağatay Tezel

Department of Thoracic Surgery, Süreyyapaşa Training and Research Hospital, Istanbul, Turkey

Correspondence to: Çağatay Tezel. Associate Professor, Thoracic Surgery Department, Süreyyapaşa Göğüs Hastalıkları ve Göğüs Cerrahisi, Eğitim ve Araştırma Hastanesi, D blok Başbüyük Maltepe İstanbul, Turkey. Email: caगतaytezel@hotmail.com.

Abstract: Primary malignant tumors of the chest wall are uncommon. Chondrosarcoma is the most common malignancy of the sternum. The current therapy for chondrosarcoma requires adequate surgical excision. A 52-year-old man presented with a lower-sternal mass. Thorax computed tomography (CT) revealed a well-lined, hypodense and round mass, which highly suggested the sarcoma of the chest wall. The tumor involved 1/3 distal part of the corpus sterni. Incisional biopsy of the mass was reported as chondrosarcoma. In order to obtain disease-free surgical margins, 1/3 distal part of the sternum with costochondral junctions was resected and reconstruction of anterior chest wall was performed with titanium mesh. The postoperative course was uneventful. The titanium mesh provided the essential rigidity and minimal elasticity over the surgical wound. Our findings show that this technique is adequate even for reconstructing extensive defects of the anterior chest wall.

Keywords: Chondrosarcoma; reconstruction; sternum; titanium mesh

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Background

Primary malignant tumors of the chest wall are a heterogeneous group of uncommon tumors developing from the bones, cartilages or the soft tissues (1). Chondrosarcoma is the most common primary malignancy of the sternum, and the successful treatment of choice includes en-bloc removal of the tumor with the surrounding tissue with a minimum clear margin of 2 to 6 cm (2,3). Reconstruction of an oversized defect can be difficult, and sometimes needs the use of a synthetic prosthesis. Hereby, our experience with titanium mesh reconstruction of a large anterior chest wall defect is presented.

Case presentation

A 52-year-old man admitted to our clinic with progressive pain and swelling on the anterior chest wall. Past medical history was unremarkable. Physical examination showed a large solid mass fixed to the sternum. Thorax computed

tomography (CT) demonstrated a hypodense 6×7 cm round mass located on the lower part of corpus sterni, with no sign of subcutaneous invasion radiologically (*Figure 1A*). Incisional biopsy revealed as chondrosarcoma. Positron emission tomography (PET-CT) scan demonstrated 66×46×74 mm mass originating from the 1/3 lower part of corpus sterni, with a fluorodeoxyglucose (FDG) maximum standard uptake value of 3.8, with no other sign of distant organ or lymphatic metastasis (*Figure 1B*).

The patient underwent an en-bloc resection of the lower half of sternum with approximately 4-5 cm of the 5th to 8th ribs, bilaterally. In order to reconstruct and recuperate the stability of the thoracic wall, a titanium mesh was placed and fixed to the edges of the remaining sternum and the ribs over a polypropylene mesh placed beneath, to protect the lung parenchyma from direct contact with the rigid titanium mesh (*Figure 2*). It was then covered with the pectoral muscle and the subcutaneous tissue. The postoperative course was uneventful, and the patient was

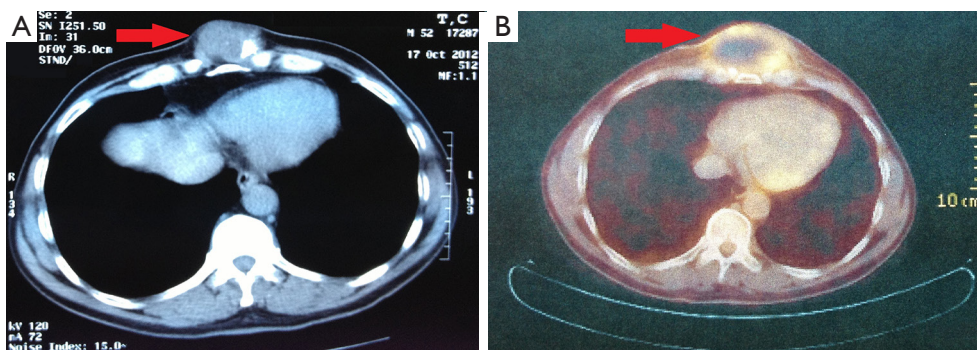


Figure 1 (A) Chest computed tomography (CT), showing 6×7 cm mass adjacent to the sternum; (B) positron emission tomography revealing intermediate metabolic activity in the mass, with the suspicion of bone/soft tissue malignancy.

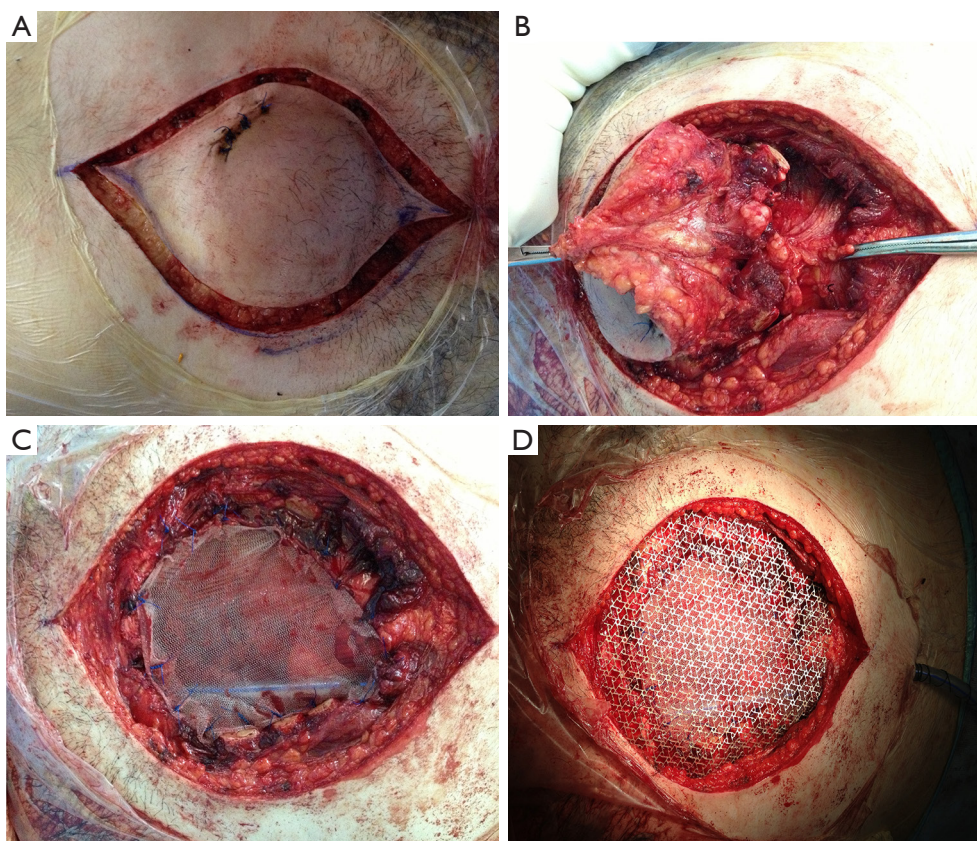


Figure 2 (A) Fish mouth wide skin incision of the tumor with previous incisional biopsy site; (B) En-bloc resection of lower-half of sternum and bilateral 5th to 8th ribs, with the involved superficial tissue; (C) parenchyma protective polypropylene mesh reconstruction under the titanium plates; (D) titanium plate coverage, with screws fixed over the remaining rib edges.

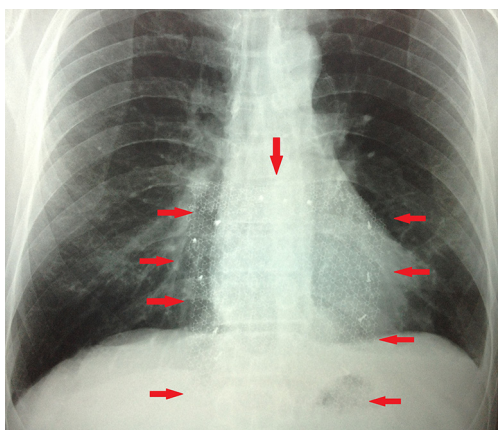


Figure 3 Post-operative chest X-ray, arrows showing the screwed mesh plate over the resection area.

discharged on the postoperative day 8, with mesh present in proper location on chest X-ray (*Figure 3*). He is still being followed-up on 37th month, asymptotically, without adjuvant chemo or radiotherapy.

Discussion

Tumors are rare, forge almost 0.5% to 1% of the primary bone tumors, with chondrosarcoma being the most common subtype. It mostly arises after the 6th decade of life, and has a slight male predominance (3,4). It is usually presented with a gradually growing, solid and fixed mass on the sternum, occasionally with concomitant chest pain, which is a sign of bad prognosis (3).

Chest wall resection and reconstruction procedures require adequate radical resection associated with the maintenance of chest stability, adequate lung function, and an acceptable cosmetic result (5).

Surgery is still accepted as the major treatment of primary malignant chest wall tumors, since they tend to be resistant to chemo or radiotherapy. The purpose of adequate radical surgery is removal of the tumor with a wide disease-free margin along with maintenance of chest wall stability. Inadequate tumor resection is associated with a high incidence of recurrence. Total sternectomy must be avoided if the sternum is not entirely involved. Subtotal resection is recommended, whenever possible, in order to partially preserve the chest wall stability (5,6).

The treatment of sternal tumors may be complicated because of anatomical proximity to vital neurovascular structures which can limit the surgical margins. The optimal

incision should be 2 to 6 cm from the margin of tumor, in order to minimize the risk of local recurrence (7).

Reconstruction is essential to maintain original respiratory functions and protect other mediastinal organs. These reconstruction techniques include pedicled skin and muscle flaps, free skin grafts, and autologous bone transplants. The choice of reconstruction technique depends on the extent and localization of the defect. If the defect is less than 5cm, then the skeletal reconstruction is not necessary. Muscle flap reconstruction may be used alone in cases with sole upper-half sternal resections. Resection of the lower sternum requires synthetic materials to stabilize the rigid chest wall, in order to protect the vital organs (2-4,8).

The prosthetic material used during the reconstruction should have sufficient rigidity to prevent paradoxical chest motion, must have adequate radiolucency to allow radiographic follow-up, and must be a biocompatible structure which allows growth of fibrous tissue, without causing any infection (1,4). It is not always possible to use autologous tissue for reconstruction of large chest wall defects because of possible surface area limitation, lack of adequate rigidity, and extended operation time. Surgical prosthetic materials may be preferred for thoracic reconstruction, but they are either too weak to provide sufficient stability, or excessively rigid with risk of erosion of neighboring structures, or causing restriction in the movements of the chest. Polypropylene mesh (Marlex[®]) is usually used for the reconstruction of large defects in the chest wall. It is relatively cheap and has a high affinity for tissue growth, but its lack of rigidity in patients with extensive defects may result in paradoxical motion of the chest wall (9).

Titanium mesh is more rigid, flexible, biocompatible and osteoconductive than polypropylene mesh, but it may as well be complicated by infection or fragmentation of the graft. It is quite rigid like a methyl methacrylate mesh, but relatively easier to shape, minimally elastic, less opaque on radiological examinations, and incorporates well with adjacent soft tissues, therefore cause minimal trauma (10). Shorter operation time through fast and easy instillation with no need for additional autologous tissue transplantation is other advantages of the titanium mesh.

Hereby, we described a rare chondrosarcoma case that has undergone subtotal sternal resection and reconstruction of the sternum. Reconstruction of large defects on the anterior chest wall with titanium mesh can rapidly, safely, and effectively be performed on patients with large malignant lesions of the sternum, with ideal rigidity and biocompatibility.

Acknowledgements

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

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