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# Reconstruction with titanium mesh following wide excision in chest wall myxofibrosarcoma: A case report

Ivan Joalsen<sup>a,\*</sup>, David Christian<sup>a</sup>, Amy Rosalie<sup>b</sup>, Made Angga<sup>b</sup>

<sup>a</sup> Division of Thoracic, Cardiac and Vascular Surgery, Mulawarman University – Abdul Wahab Sjahranie Hospital Samarinda, East Borneo, Indonesia

<sup>b</sup> Intern Doctor of Thoracic, Cardiac and Vascular Surgery, Abdul Wahab Sjahranie Hospital Samarinda, East Borneo, Indonesia

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## ABSTRACT

**INTRODUCTION:** Some chest wall tumors require extensive excision that alters its stability and integrity. Various materials are available as a prosthetic albeit currently lacking in clear guidelines regarding the material of choice. Titanium-based mesh offers appropriate properties for chest wall reconstruction, making it a promising choice of prosthetic.

**PRESENTATION OF CASE:** A 50-year-old male presenting with a chest lump was suspected of a chondrosarcoma of the chest wall. Preoperative pulmonary rehabilitation and smoking cessation was performed 1 month prior to surgery. After a wide excision procedure, we utilized titanium mesh as a reconstructive material. Pathology evaluation reported the examined tissue as a myxofibrosarcoma. The patient was successfully weaned off of ventilator in less than 24 h with satisfactory postoperative outcome.

**DISCUSSION:** The various available material has each of its strengths and drawbacks and it is crucial to choose the most fitting option to acquire better postoperative outcome as well as maintaining the quality of life. The use of titanium mesh in thoracic reconstruction has not been widely explored and reported, therefore, it is important to underline its advantages and disadvantages as a potential choice for prosthetic.

**CONCLUSION:** Titanium mesh provides appropriate features for a chest wall reconstruction; therefore, it can be considered as a promising alternative material.

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## 1. Introduction

Chest wall stability and integrity are key elements for effective respiration and protection of intrathoracic organs. In the case of chest wall malignancy, extensive resection is mandatory, oftentimes leaving significant defect that requires adequate reconstruction to achieve normal function. A number of materials are available along with each of its advantages and disadvantages as prosthetics. In recent years, meshes made out of titanium or titanium alloy has been studied as an alternative. Literature search shows only few studies have reported and evaluated the use of titanium mesh in chest wall reconstruction. The scarcely available data are mainly due to the lack of a common guidelines. Described below is a report of our patient who underwent anterior chest wall reconstruction with titanium mesh due to myxofibrosarcoma. This work has been reported in line with the SCARE 2018 guideline [1].

\* Corresponding author at: Division of Thoracic, Cardiac and Vascular Surgery, Mulawarman University – Abdul Wahab Sjahranie Hospital Samarinda, East Borneo, 75123, Indonesia.

E-mail address: [aesculap99@gmail.com](mailto:aesculap99@gmail.com) (I. Joalsen).

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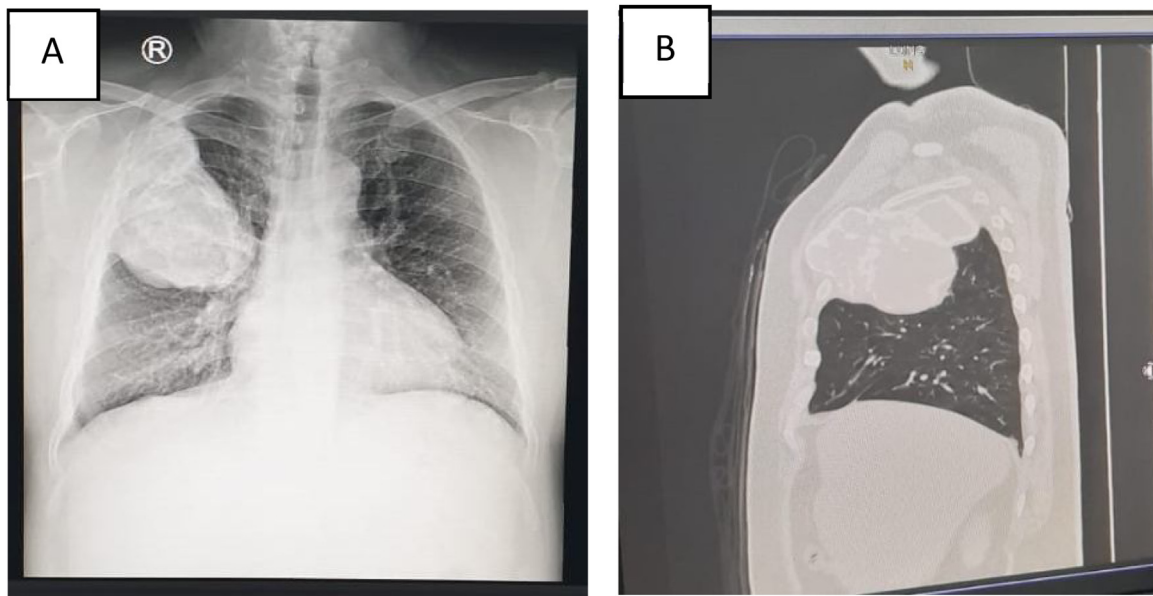
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## 2. Presentation of case

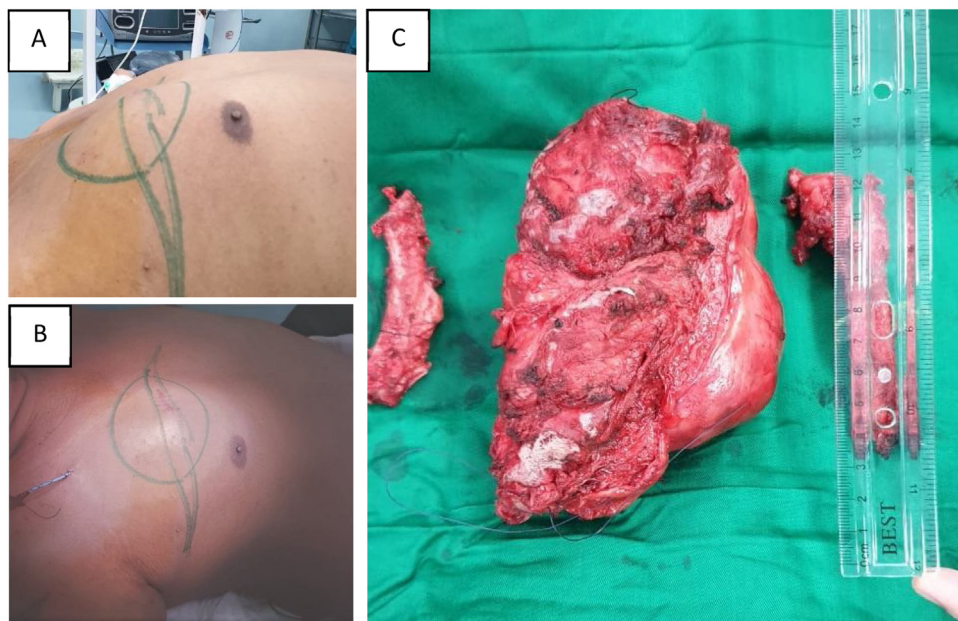
A 50-year-old Asian man presented from a secondary referral hospital with a painful lump on the right chest which rapidly enlarged and dyspnoea within the last two months. Aside from a history of diabetes mellitus (DM), he consumes aspirin daily due to coronary artery disease (CAD) and is a heavy smoker. He is employed as a security staff. Other family members had no similar complaints. General physical examination was unremarkable except for the dullness and slightly reduced breath sounds on the upper right hemithorax. The lump was tender and fixated to the underlying tissue. Chest X-ray and contrast-enhanced CT evaluation (Fig. 1) revealed cauliflower-like mass on the anterior costochondral junction of the 3rd right rib, 7.7 × 9.9 × 11.39 cm in size, which was reported as a suspected chondrosarcoma.

The patient was admitted for an initial open biopsy. A smoking cessation and respiratory physiotherapy was done for a month as preoperative preparation. The routinely-administered aspirin was also halted 5 days prior to surgery.

The patient then underwent wide excision procedure in supine position with a pad propped under the right shoulder into a slight left decubitus state (Fig. 2a, b). The surgery was performed by a



**Fig. 1.** Initial radiographic findings showed that (A) the tumor was located adjacent to the 2<sup>nd</sup>–4<sup>th</sup> rib and (B) extends into the mediastinal cavity with no attachment to the lung parenchyma.

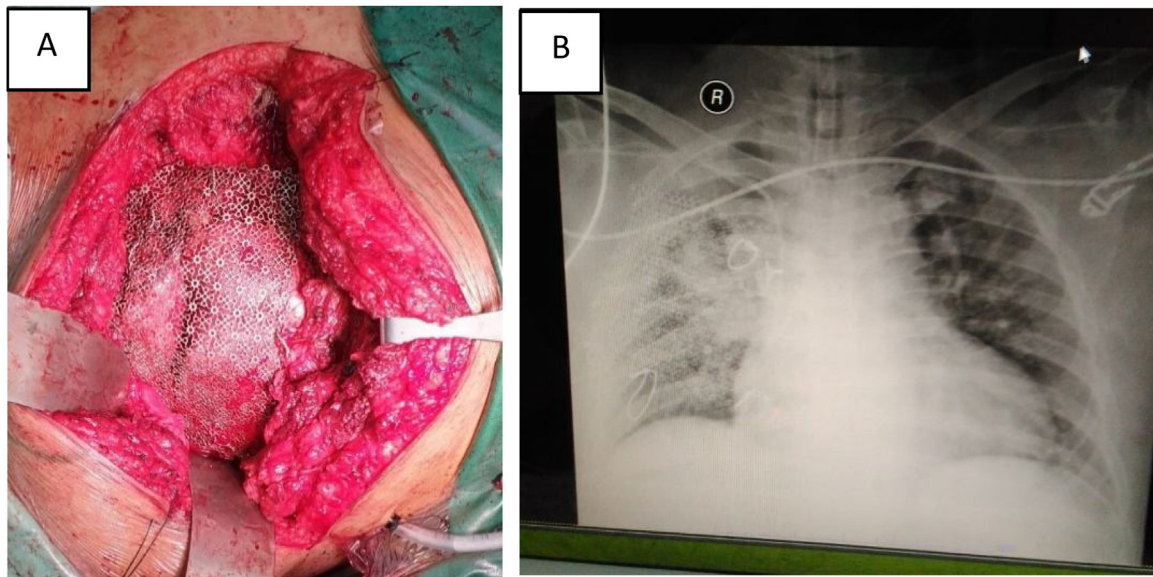


**Fig. 2.** (A–B) Lateral and upper view of the lump and the preparation for wide excision. (C) The removed tumor along with the 2<sup>nd</sup>–4<sup>th</sup> rib.

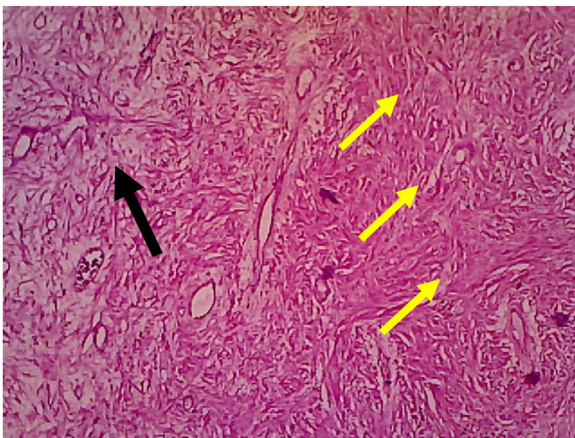
board-certified thoracic, cardiac, and vascular senior consultant surgeon under general anaesthesia with single-lumen endotracheal tube (ETT). The tumor adheres to the 2nd, 3rd, and 4th costochondral junction without lung attachment. It was removed along with the 2nd–4th ribs with 2.5 cm free margin to the adjacent soft tissue (Fig. 2c). A challenge worth noting was that in this case, frozen section procedure was unfavorable as it would have taken too long (1 h in approximation) due to limited human resources, thereof, the attempted free margin was based on macroscopic observation alone. A 160 × 95 × 0.6 mm titanium mesh (165 mm × 95 mm Pre-Formed OsteoForm Mesh Plate) was fixed to the resected ribs ends and sternum with steel wire to close the defect. Each sides of the defect were overlapped by the prosthesis by 1–2 cm (Fig. 3). A 28 F chest tube and 14 F Penrose drain was inserted for chest cavity and subcutaneous drainage, respectively.

After a total of 5 h of surgery, the patient was transferred to the ICU. Morphine was administered during the ventilator-bound period. The patient was successfully extubated within less than 24 h and continued on intravenous tramadol. Pathology evaluation of the initial biopsy tissue demonstrated characteristics of a myxofibrosarcoma (Fig. 4). Postoperative pathology reported that no malignant cells were observed on the sides of the removed tumor. Considering the aforementioned comorbidities, the patient was hospitalized for a total of 10 days to ensure that postoperative clinical status, wound healing, and aggressive breathing rehabilitation results were favorable. After discharge, the patient was continued on oral tramadol and was able to carry out daily activities with tolerable pain (Karnofsky score 80) within one month follow-up.





**Fig. 3.** (A) Implantation of the titanium mesh. The sides were fixed to the ribs ends and sternum with steel wire. (B) Radiologic evaluation following the implantation procedure.



**Fig. 4.** Microscopic evaluation demonstrated (black arrow) myxoid area with loosely-arranged cells and (yellow arrows) ovoid fibroblastic mesenchymal cells in swirling, whorled pattern.

### 3. Discussion

Surgery renders a significant burden to the overall physiological status. Aggravated by the fact of being a heavy smoker with a history of diabetes mellitus and coronary artery disease (CAD), this patient is deemed a part of the high-risk population. Preoperative physical conditioning, including pulmonary rehabilitation, prior to major surgeries has been known favorable in terms of postoperative complications and hospital length of stay [2–4]. The exercise regimens vary and are highly individualized but it is generally a safe and feasible method. We performed preoperative rehabilitation and smoking cessation which is presumed to be a significant contribution to the relatively short period of ventilator use, that is less than 24 h.

Chest wall neoplasm is rare, constituting only around 1% of all tumors [5]. Nevertheless, it can emerge from any bony structure or soft tissues of the thoracic wall. Myxofibrosarcoma (MFS) is a relatively rare sarcoma that arises from soft tissue specifically that of fibroblastic lineage. It largely occurs on the extremities (77%).

MFS of the trunk is uncommon (12%) and the even lesser known predilection area is the head-neck region (3%) [6]. This malignancy typically affects the elderly with most patients being in their fifth to seventh decades of life, and has slightly higher incidence in the male population. Patients typically present with a painless lump that enlarges in a lengthy manner. As with other types of soft tissue sarcomas, surgical resection remains the mainstay of treatment, and while adjuvant therapies might be considered due to possible local recurrence and metastatic development, the role of radiotherapy and/or chemotherapy in MFS is less defined [6].

The rigid yet flexible nature of the chest wall is a key element that allows adequate respiration and protection of the intrathoracic organs. Although chest wall tumors are considered rare, the majority of them are malignant [7] and requires extensive resection to minimize recurrence and ensure complete removal. This leaves significant defects that leads to impaired respiratory mechanics, morbidity, and mortality. It is generally accepted that defects of 5 cm and larger in diameter is indicated for reconstruction, especially in anterolateral chest wall [8]. Choosing the right material among the available options is essential to reclaim normal respiratory functions. To this day, there is no clear guidelines on chest wall reconstruction. The choice on which materials to use is mainly based on the surgeons' experience and preference as well as the site and size of the defect [9].

The ideal chest wall prosthetic material should be (1) rigid enough to prevent paradoxical motion during respiration and protect intrathoracic organs, (2) malleable enough for proper contouring, (3) inert, (4) biocompatible as to allow tissue growth, (5) radiolucent to ease radiographic follow-up, (6) resistant to infection, and (7) affordable [7]. Most chest wall reconstructions have been utilizing synthetic (e.g. methyl methacrylate, polypropylene, polyester, polytetrafluoroethylene/PTFE) and biologic (e.g. bovine pericardium patch) materials. Each of these come with strengths and drawbacks. For instance, synthetic patches are inexpensive, generally simple to handle and well-tolerated; however, they lack the suitable rigidity which may lead to paradoxical chest movement. Some of them are non-permeable to fluid which allegedly causes excessive pain and infection [7,10,11]. Biologic mesh is well-tolerated and provide enough strength and elastic-

ity, yet doesn't give satisfactory rigidity [11] and might be limited in availability, as well as possible extended intervention time [12].

Titanium meshes have been widely utilized in skull defects repair and is recently proposed as an alternative in chest wall reconstruction. They are usually produced in 0.4 mm and 0.6 mm thickness; the latter being preferred for large anterolateral chest wall defects. Available studies reported good outcome with the use of titanium meshes [9,13]. They are highly biocompatible and provide enough strength, rigidity, flexibility, and relatively more resistant to infection [9]. For this reason, we applied titanium mesh to our patient and observed no abnormal chest wall movement nor infection. Moreover, he was able to carry out daily activities within one month. The patient had complaint of pain; however, it was within tolerable measure. Titanium meshes also possess suitable radiolucency and is compatible with magnetic resonance imaging [13] which eases radiologic follow-up as experienced in our case. Nevertheless, there have been reports of its potential disadvantages. One review [13] reported a 4% incidence in mesh fracture within the first 4 postoperative months. The authors suggested this to be the result of incompatible mesh thickness or continuous stress by torso flexion and rotation. Another hypothesis mentioned the considerable ribcage displacement during inspiration also takes part [14]. Another article [15] reported one case of postoperative bloody drainage due to injured intercostal vessel by the mesh and another case of infection by *Pseudomonas aeruginosa* on the reconstructed area. There was no such incident in our experience, although a drawback worth mentioning was that titanium meshes are relatively costly.

#### 4. Conclusion

Titanium mesh provides appropriate features that are required for a chest wall reconstruction. The outcome in available studies suggest that it is an effective and safe choice with satisfactory biomechanical features and relatively low incidence of complications. Our experience exhibits satisfactory postoperative outcome in terms of length of ventilator use, breathing functions, and degree of pain with no known evidence of infection. Therefore, it is a promising alternative as a prosthetic. Further evaluation on the current known limitations is needed to achieve better postoperative results.

#### Declaration of Competing Interest

The authors report no declarations of interest.

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#### Ethical approval

This study has been exempted by our institution.

#### 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.

#### Author contribution

Ivan Joalsen, MD: conceptualization, data curation, supervision.

David H. Christian, MD: conceptualization, data curation.

Amy Rosalie, MD: study design, writing – original draft, review & editing.

Made Angga, MD: study design, writing – original draft, review & editing.

#### Registration of research studies

NA.

#### Guarantor

Ivan Joalsen, MD. Division of Thoracic, Cardiac and Vascular Surgery, Mulawarman University – Abdul Wahab Sjahranie Hospital Samarinda, East Borneo, Indonesia.

#### Provenance and peer review

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