Case Report of a Complex Chest Wall Reconstruction with a Cadaveric Achilles Tendon

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Conflict of interest: None declared

Patient: Female, 46-year-old
Final Diagnosis: Right superior sulcus tumor-squamous cell lung cancer
Symptoms: Right shoulder pain
Medication: —
Clinical Procedure: Right upper lobectomy (lung) • chest wall resection/reconstruction
Specialty: Surgery

Objective: Unusual clinical course
Background: Chest wall reconstruction is sometimes needed after resection of a thoracic malignancy. Various materials and techniques have been utilized to restore stability and integrity to the chest wall. We report what we believe is the first use of a cadaveric Achilles tendon to restore stability and function to the chest wall of a young woman who underwent chest wall resection and right upper lobectomy for a superior sulcus tumor.

Case Report: A 46-year-old woman underwent resection of her first through fourth right ribs in addition to her right upper lobe for a squamous cell superior sulcus tumor. Because it was felt her right scapula provided sufficient coverage of her resultant chest wall defect, her chest wall was not reconstructed post-operatively. The patient experienced 2 episodes of scapular prolapse into her thoracic cavity several months after her resection. After the second episode, her right chest wall was successfully reconstructed with a cadaveric Achilles tendon to prevent further episodes of prolapse.

Conclusions: We believe this is the first description of chest wall reconstruction with a cadaveric Achilles tendon. The use of a cadaveric Achilles tendon should be considered for reconstruction of the chest wall after complex resection due to its strength characteristics, resistance to subsequent infection, and availability.

MeSH Keywords: Allografts • Carcinoma, Non-Small-Cell Lung • Pancoast Syndrome
Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/920910
**Background**

The goals of chest wall reconstruction after major resection are to maintain chest wall integrity, prevent lung herniation, provide protection of the underlying lung, optimize respiration, and provide acceptable cosmesis. The materials used for reconstruction should minimize complications, including infection, seroma formation, and future failure due to material reaction with the patient’s tissue. Many materials have been used, including methyl methacrylate, and synthetic meshes of polypropylene, including bovine pericardium and polylactic acid [1]. Additionally, evolving technology with three-dimensional printing and the use of polyetheretherketone (PEEK) implants, polytetrafluoroethylene (PTFE), polyglactin 910, and titanium plates, as well as biomaterials, has recently been used to reconstruct large chest wall defects to near-exact anatomical dimensions [2]. Biological materials such as cryopreserved allografts and homografts have also been increasingly utilized, with their major advantage felt to be tissue incorporation with revascularization and cellular repopulation, making them more resistant to infection; an attraction for use with previously irradiated tissue [3]. We present the case of a 46-year-old woman who underwent a right upper lobectomy with chest wall resection for a right superior sulcus squamous cell carcinoma who underwent subsequent reconstruction of her chest wall defect with a cadaveric Achilles tendon homograft. We believe this was the first time a cadaveric Achilles tendon homograft was used for chest wall reconstruction.

**Case Report**

A 46-year-old woman presented with a 4-month history of right upper back pain radiating down her right upper extremity. She was otherwise healthy, with a 25-pack-year history of cigarette smoking. Physical examination was unremarkable. A computed tomography scan of her chest revealed a large mass, 12 cm in diameter, with invasion and destruction of the right first and second ribs, possible involvement of the right third rib, and suggestion of right brachial plexus invasion located in the superior sulcus of her right pleural space (figure 1). The patient underwent endobronchial ultrasound evaluation of her mediastinal nodes, which revealed metastatic squamous cell carcinoma in a level-4R node. She was referred to medical and radiation oncology and underwent preoperative concurrent chemoradiation. She was restaged following treatment and was found to have no residual peritracheal nodal metastatic disease, as well as significant volume reduction of her right upper-lobe tumor.

She underwent an open resection with right upper lobectomy and en bloc chest wall resection of her right first through fourth ribs. The right brachial plexus and right subclavian artery and vein were not found to have tumor invasion with the exception of the first thoracic nerve, which was resected with the specimen. No attempt at chest wall reconstruction was made at the time of her operation as it was felt her scapula provided adequate coverage of her resultant defect. A viable residual tumor was found in the resected right upper lobe upon pathological review. She subsequently underwent post-resection chemotherapy and boost external beam radiation to the bed of her first thoracic vertebral body due to a close but negative
adequate coverage of her chest wall and reconstruction was consideration [4]. It was felt that the patient’s scapula would provide
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discussion

Discussion

Scapula prolapse into the intrathoracic space after resec
tion of a superior sulcus tumor is a rare but known complica
[4]. It was felt that the patient’s scapula would provide ade
quate coverage of her chest wall and reconstruction was
not necessary after her original surgery. The patient was young
and remained active following treatment for her malignancy.
She quickly returned to her preoperative activities, including
athletics, but that assessment proved incorrect.

Superior sulcus tumors represent less than 5% of all broncho
genic carcinomas, have a 5% operative mortality rate, and have
a complication rate of 7–38%; the overall 2-year survival rate
after induction chemoradiation and resection varies from 55%
to 70% [5]. Our patient’s chest wall had previously received
60 Gy of external beam radiation, with another 16 Gy provided
as a boost following her resection. Based on recurrence rates
and her age, it was felt she may require future chemotherapy
due to recurrence. The choice of material for her chest wall re
construction was strongly influenced by being resistant to in
fection. Previous studies have shown that biological materials
used in chest wall reconstruction are less prone to infectious
complications than are prosthetic materials [1,3].

Her previous closed scapula reductions had been performed
with the assistance of orthopedic surgery. After careful con
sideration of the materials available for her chest wall recon
struction, it was felt that a biological material would be best.
After collaborating with orthopedics, a cadaveric Achilles ten
don homograft was proposed as the optimal material for chest
wall reconstruction. This was chosen to minimize further mus
culoskeletal deformity as would occur with a muscle flap, its
properties as a biological material to resist infection, its avail
ability, and its strength properties. We believe this is the first
time a cadaveric Achilles tendon was used for chest wall re
construction. The biomechanics of a cadaveric Achilles tendon,
as well as the size and shape of the graft, allowing the entire
bed of the resected fourth rib to be filled, provided the incen
tive for its use [6]. The PTFE was placed overlying the homo
graft to allow the scapula a longitudinal surface to slide upon.

Conclusions

The Achilles homograft provided strength and form to the chest
wall, with the theoretical benefit of increased resistance to in
fection. It was readily available and straightforward in its place
ment. It does not appear to have the same complications as the
available prosthetic materials, such fracture failure and migra
tion [7]. It provided excellent cosmesis, with the ability to be
molded into the defect, much like a muscle flap. The patient has
returned to her baseline activities and has remained free of in
fection and cancer recurrence 30 months after her initial surgery.

Acknowledgments

The authors would like to thank Kim Delvechhio for her assist
ance in preparation of the manuscript.
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