Case Report

Robotic-assisted thoracoscopic rib resection for fibrous dysplasia: a case report

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Background: Fibrous dysplasia is an uncommon, benign, congenital skeletal anomaly of failed bone maturation. There is no treatment to prevent systemic disease progression, and medical therapy focuses on maintaining adequate bone density. Surgical treatment is utilized for treatment of pathologic fractures, symptomatic lesions, and significant deformities. We present a case of robotic-assisted rib resection for a symptomatic lesion secondary to fibrous dysplasia with minimally invasive rib transection and extraction techniques using a high-speed drill.

Case Description: A 21-year-old male patient presented after an incidental finding of a lytic-appearing mass of the right eighth rib on abdominal computed tomography (CT) scan. History included multiple years of intermittent, focal right-sided chest pain and a "popping" sensation along the right chest wall. Biopsy confirmed the diagnosis of fibrous dysplasia. The patient underwent robotic-assisted thoracoscopic surgery for removal of the rib. Percutaneous rib transection was performed using a stylus-style surgical drill and the rib was removed through a port-site incision. There were no surgical complications. The diagnosis of benign fibrous dysplasia was confirmed on final pathology, and the patient had an unremarkable postoperative course.

Conclusions: Fibrous dysplasia is an uncommon, benign, congenital bone deformity condition that can result in symptomatic lesions that require surgical removal. When rib resection is required, there are many approaches available with varying levels of morbidity. Our experience with robotic-assisted thoracoscopic rib resection utilizing minimally invasive rib transection and extraction techniques demonstrates a reproducible, low-morbidity approach.

Keywords: Rib resection; robotic video-assisted thoracoscopic surgery; fibrous dysplasia; high-speed drill; case report

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Introduction

Fibrous dysplasia is an uncommon, benign, congenital skeletal anomaly of failed bone maturation secondary to a mutation of the G-protein receptor. This condition can affect one bone or multiple bones in the body, and ribs, craniofacial bones, and long bones are most often involved (1). Most presentations of the disease affect only one bone and are asymptomatic. When identified, fibrous dysplasia is typically managed with bisphosphonates and other medical treatments focused on maintaining adequate bone density. Surgical treatment is reserved for symptomatic lesions, prevention and repair of pathologic fractures, and repair of significant deformities (2). There are rare reports of malignant transformation, but the vast majority are benign (3). For patients with symptomatic fibrous dysplasia affecting the ribs, resection is definitive treatment. There are many approaches available for isolated rib resection, including a variety of open and minimally invasive techniques, with rarely reported use of robotic surgery in the treatment of these patients (4). We present a case of robotic-assisted rib resection for a symptomatic lesion secondary to fibrous dysplasia with minimally invasive rib transection and extraction techniques utilizing a high-speed percutaneous drill. We present this case in accordance with the CARE reporting checklist (available at https://vats.amegroups.com/article/view/10.21037/vats-23-25/rc).

Highlight box

Key findings

- We present a case of robotic-assisted rib resection for a symptomatic lesion secondary to fibrous dysplasia with minimally invasive rib transection and extraction techniques.

What is known and what is new?

- Fibrous dysplasia is an uncommon, benign, congenital skeletal anomaly of failed bone maturation that can affect the ribs. Surgical treatment is utilized for treatment of pathologic fractures, symptomatic lesions, and significant deformities.
- Our experience with robotic-assisted thoracoscopic rib resection demonstrates a reproducible, low-morbidity approach.

What is the implication, and what should change now?

- While multiple methods for rib resection are available, an approach utilizing minimally invasive rib transection and extraction techniques allows for smaller incisions and early recovery.

Case presentation

Clinical presentation

A 21-year-old male was referred to the thoracic surgery clinic for workup of a mass of the right eighth rib discovered incidentally by abdominal computed tomography (CT) scan. He complained of several years of pain and an uncomfortable 'popping' sensation along the right chest wall. The patient had no personal or family history of bone disorders. Physical examination was unremarkable except for tenderness at the right eighth rib. A dedicated CT chest demonstrated an expansile, lytic lesion of the right eighth rib that was stable in appearance from initial imaging and was without malignant imaging features (*Figure 1*). Positron emission tomography CT revealed moderate hypermetabolic activity within the lesion and could not rule out malignancy. An image-guided core-needle biopsy was performed which confirmed the diagnosis of benign fibrous dysplasia (*Figure 2*). The patient had presented on two occasions to the emergency department within the prior year due to severe right-sided chest pain but did not require chronic pain medications. After a discussion of the risks and benefits of surgery he opted to proceed with resection in order to achieve definitive symptomatic relief. After informed consent and discussion of operative strategies, a muscle-sparing, robotic-assisted thoracoscopic resection was offered, with the intent to limit incisional enlargement for instrument exchange or specimen extraction.

Operative technique

The patient was brought to the operating room where general endotracheal anesthesia was induced using a dual lumen tube and routine perioperative safety precautions carried out. The patient placed in the left lateral decubitus position and the da Vinci Xi robot (Intuitive Surgical, Sunnyvale, CA, USA) was targeted and docked per manufacturer recommendations with placement of five ports. See *Video 1* for demonstration of surgical technique. CO_2 insufflation to 10 mmHg was initiated with a Veress needle and a high axillary 10 mm port was used for access to the right chest with an Optiview port and 0 degree 10 mm thoracoscope. Two additional 8 mm anterior axillary ports, a superior-anterior port, and a retroscapular posterior port were placed. The parietal pleura over the eighth rib

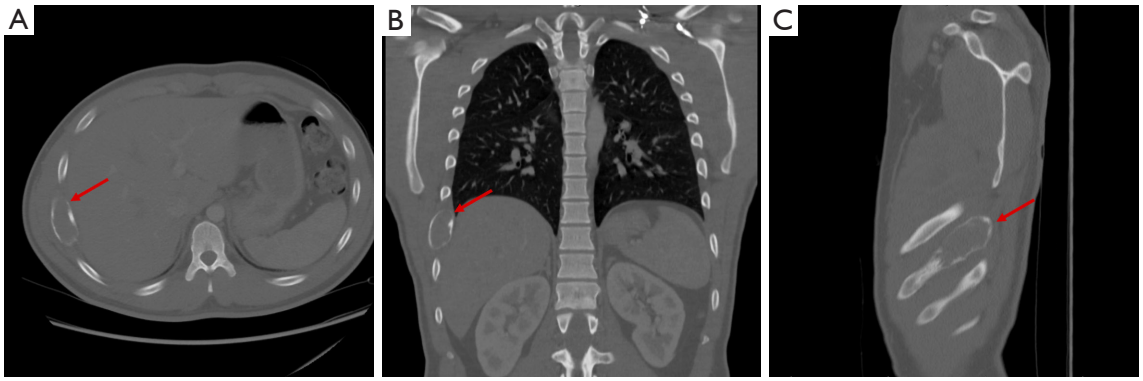


Figure 1 Computed tomography imaging demonstrating expansile right eighth rib lesion (arrows) with findings suggestive of fibrous dysplasia. (A) Axial image. (B) Coronal image. (C) Sagittal image.

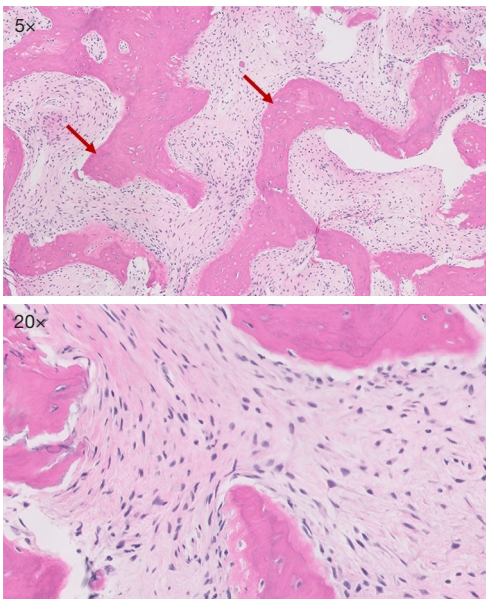
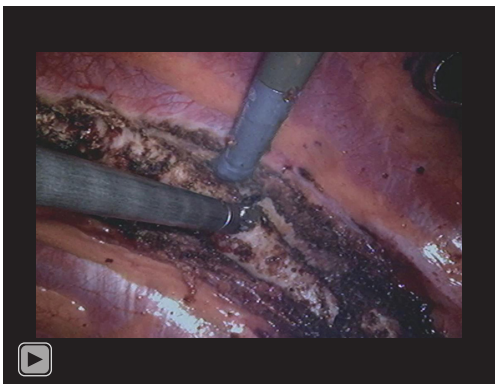


Figure 2 Hematoxylin and eosin stain of right eighth rib biopsy, with findings consistent with fibrous dysplasia. Low-power view (×5) demonstrates thin, anastomosing, and irregular trabeculae of woven bone (arrows) in a fibrous stroma background. High-power view (×20) demonstrates a lack of tumor osteoblastic rimming in the bone trabeculae and a fibrous stroma consisting of bland spindle cells.



Video 1 We present a case of robotic-assisted rib resection for a symptomatic lesion secondary to fibrous dysplasia with minimally invasive rib transection and extraction techniques.

was elevated and dissected sharply. The rib surface was circumferentially skeletonized, and the intercostal bundles judiciously dissected. Care was taken to identify and preserve the sympathetic chain along the posterior aspect of the rib at its origin from the spine to achieve a clear rib transection site. Two 2 mm skin incisions were made at this posterior location and at the anterior transection site close to the costochondral junction and beyond the clinically abnormal-appearing rib segment. A Midas Rex Legend EHS Stylus High-Speed Surgical Drill (Medtronic, Minneapolis, MN, USA) was carefully introduced through each incision at the bedside under intrathoracic visualization provided by the robotic camera, and percutaneous rib transection using gentle inward traction was performed. The rib was then freed intracorporeally of all soft tissue attachments. The anterior working port was removed and the incision extended less than 1 cm to accommodate port site extraction of the dysplastic rib (*Figure 3*). Regional intercostal nerve block from the second to eighth rib space using 0.5% bupivicaine with epinephrine was infiltrated, a 24-french blake drain was placed, and port sites were closed in layers. The patient recovered uneventfully and was discharged on postoperative day 4. At his first follow-up

Figure 3 Excised right eighth rib. Use of a high-speed drill to perform a percutaneous rib transection allows for rib extraction without significant enlargement of the minimally invasive incisions.

visit he reported complete resolution of presenting pain and discomfort.

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Publication of this case report and accompanying images was waived from patient consent according to East Carolina University institutional review board policy.

Discussion

This report demonstrates the use and benefits of minimally invasive robotic dissection and rib transection with a percutaneous high-speed drill in the treatment of benign fibrous dysplasia where pain and aesthetics were key outcomes for patient satisfaction. Our report adds to the small but growing body of literature that demonstrates clear benefits of minimally invasive thoracoscopic approaches for chest wall resection for both benign and malignant processes. These benefits include shorter postoperative length of stay, improved postoperative pain management, and enhanced quality of life and aesthetic outcomes (5-7). In the last 5 years there has been an increase in the reporting of robotic-assisted minimally invasive techniques for rib resection, most commonly in the setting of a first rib resection performed for thoracic outlet syndrome (8-10). While there have been no studies to date comparing surgical outcomes in rib resection between a conventional minimally invasive approach and a robotic-assisted minimally invasive approach, benefits of the robotic approach include improved optics, articulation, and operator ergonomics (11). There are potential limitations to the use of the robot in thoracoscopic surgery, and prolonged operative time due to equipment exchanges, patient repositioning, and the docking process may counteract the benefits of this approach (12). As demonstrated in this report, the addition of the stylus-type high-speed drill in place of intrathoracic instrumentation for rib division simplifies instrument exchange and allows for smaller port site incisions, reducing operative time and maintaining the aesthetic and pain-reducing benefits of minimally invasive thoracoscopic surgery.

Our study is limited by having only one patient. Additional experience with the use of these robotic-assisted video-assisted thoracic surgery (VATS) and percutaneous high-speed drill rib resection techniques will help clarify their role in the management of symptomatic benign rib diseases such as fibrous dysplasia, and potentially demonstrate the benefit of these techniques in the treatment of malignant processes that require adequate margins in addition to maintaining improved pain control and aesthetics.

Conclusions

Fibrous dysplasia is an uncommon, benign, congenital bone deformity condition that can result in symptomatic lesions that require surgical removal. When rib resection is required, there are many approaches available with varying levels of morbidity. Our experience with robotic-assisted thoracoscopic rib resection utilizing minimally invasive rib transection and extraction techniques demonstrates a reproducible, low-morbidity approach.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at https://vats.amegroups.

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Peer Review File: Available at https://vats.amegroups.com/article/view/10.21037/vats-23-25/prf

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://vats.amegroups.com/article/view/10.21037/vats-23-25/coif). ABM is an Intuitive Surgical Proctor for the Da Vinci robotic system. CJA is a J&J Surgical Proctor for anti-reflux implant LINX placement. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Publication of this case report and accompanying images was waived from patient consent according to East Carolina University institutional review board policy.

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