Letter to the Editor

Single-port thoracoscopic intrathoracic rib resection: a case description

Chuxu Wang[1#], Guodong Hu[1#], Bo Min[1], Zewen Cheng[2], Xiaohua Zuo[3]

[1]Department of Thoracic Surgery, Huai'an Second People's Hospital, The Affiliated Huai'an Hospital of Xuzhou Medical University, Huai'an, China; [2]Department of Thoracic Surgery, The First Affiliated Hospital of Soochow University, Medical College of Soochow University, Suzhou, China; [3]Department of Pain Management, Huai'an Second People's Hospital, The Affiliated Huai'an Hospital of Xuzhou Medical University, Huai'an, China

[#]These authors contributed equally to this work and should be considered as co-first authors.

Correspondence to: Xiaohua Zuo. Department of Pain Management, Huai'an Second People's Hospital, The Affiliated Huaian Hospital of Xuzhou Medical University, 62 South Huaihai Road, Huai'an 223003, China. Email: zuoxiaohua618@163.com.

Submitted Apr 27, 2022. Accepted for publication Sep 16, 2022. Published online Oct 09, 2022.
doi: 10.21037/qims-22-421
View this article at: https://dx.doi.org/10.21037/qims-22-421

Introduction

Rib anomalies effect approximately 1% of the general population, and supernumerary intrathoracic rib abnormalities are even less common (1). This abnormality mainly manifests as supernumerary ribs originating from the spine or other normal ribs, and those ribs traversing the thorax or floating directly in the thorax without bony structural connections (2,3). About 60 cases have been reported since Lutz first reported rib anomalies in 1947 (1). Ribs in the thoracic cage rarely produce clinical symptoms and are generally discovered by accident; however, the purpose of identifying such ribs is to exclude or identify some types of malignant tumors (4). Not all intrathoracic ribs cause symptoms, but some have been reported to cause pain, pneumothorax, and even liver damage (1,5). The diagnosis of intrathoracic ribs mainly relies on chest computed tomography (CT) and three-dimensional (3D) rib reconstruction (6). Thus, research on intrathoracic ribs has mainly focused on the following: (I) the diagnosis of intrathoracic ribs; and (II) the treatment of symptomatic intrathoracic ribs. Currently, there is no uniform treatment for symptomatic intrathoracic ribs, although a patient with painful intrathoracic ribs was successfully treated with robotic-assisted thoracoscopic surgery (7).

Case presentation

All the procedures in this study were performed in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient's parents for the publication of this case report and the accompanying images. A copy of the consent form is available for review by the editorial office of this journal.

A 7-year-old female patient was admitted to the hospital. She had experienced "chest pain, [and] dyspnea on movement for 1 year" before admission, and her symptoms had worsened over the last 2 months. The CT examination showed that her left 5th rib had an intrathoracic rib that originated from the starting part of the normal rib (*Figure 1A*,*1B*), and that the parietal pleura was being pulled by the protruding inner part of the intrathoracic rib was also observed (*Figure 1C*). The abnormality had been discovered 5 years ago on a chest X-ray which had been performed after presentation at the hospital due to fever (*Figure 2A*). During hospitalization, no abnormalities were found in the routine blood test, pulmonary function, electrocardiogram, or echocardiography results. Following discussion with the doctors of thoracic surgery, respiratory, pediatric, radiology

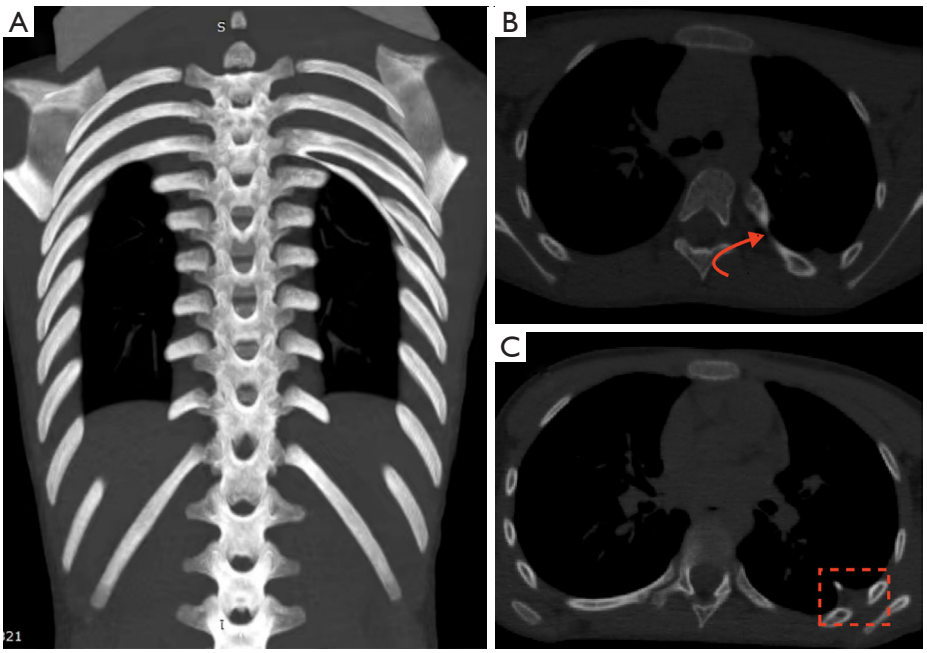

Figure 1 CT image of the intrathoracic rib. (A) Coronal position of the abnormal rib. (B) The arrow points to the origin of the abnormal rib. (C) The pleura within the dashed line is stretched. CT, computed tomography.

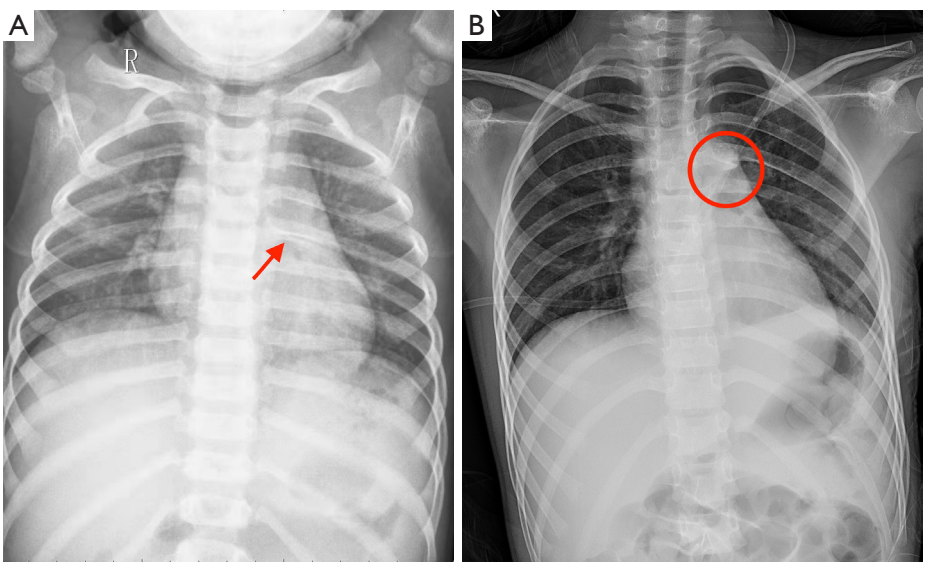

Figure 2 Chest image of intrathoracic rib. (A) The red arrow on the chest X-ray shows the intrathoracic rib at 2 years old. (B) A bedside X-ray on the first postoperative day showed the broken end of the intrathoracic rib as indicated by the red circle.

and pain management with multi-disciplinary treatment (MDT), it was confirmed that her symptoms were related to the intrathoracic rib.

After informing the patient and her family about the relevant conditions and risks, and with her parents' consent, surgery using a single-port thoracoscope was performed. A bedside X-ray on the first postoperative day showed the broken end of the intrathoracic rib (*Figure 2B*). Before the surgery, a 3D reconstruction of the ribs showed the shape and origin of the redundant rib more clearly (*Figure 3A,3B*)

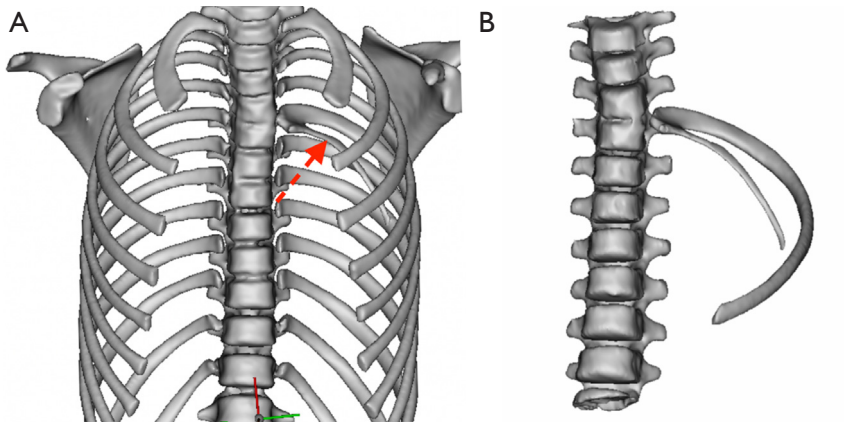

Figure 3 3D reconstruction of intrathoracic rib. (A) A CT scan with 3D reconstruction showed an abnormal rib articulated with an anterior aspect of the left 5th rib as indicated by the arrows. (B) The relationship between the intrathoracic rib and the normal rib shown alone. 3D, three-dimensional; CT, computed tomography.

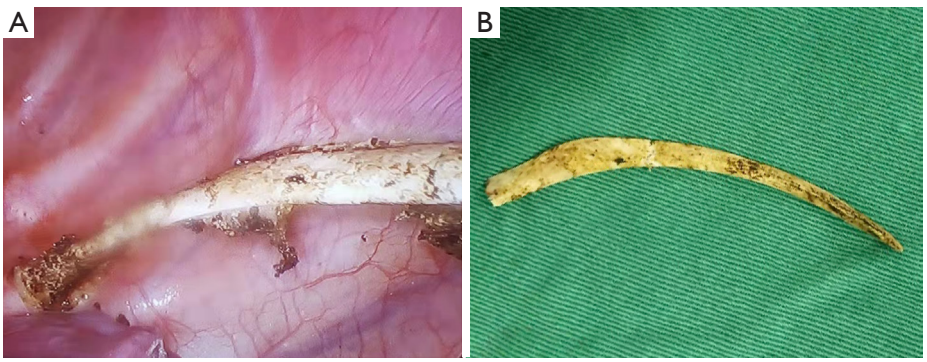

Figure 4 Intraoperative and postoperative images of the intrathoracic rib. (A) Intrathoracic rib exposed after parietal pleura incision during surgery. (B) Excised rib specimen.

and provided guidance for the surgery.

The patient underwent general anesthesia with double-lumen tracheal intubation and contralateral single-lung ventilation. A 3 cm mini-incision was made in the 4th intercostal space of the anterior axillary line to provide an observation and operation hole (8). A 10 mm 30-degree lens thoracoscope was used. The intrathoracic exploration revealed a deformed rib at the beginning of the 5th rib that ended at the level of the posterior axillary line of the 7th rib. The parietal pleura on the surface of the rib was intact but stretched, which was consistent with the preoperative CT assessment.

An electric hook was used to separate the parietal pleura to free the supernumerary rib. There were no intercostal arteries, veins, or intercostal nerves on the upper and lower edges of the ribs. The end was gently pulled with sponge forceps, cauterized with an electric hook at the root, and cut with scissors. Finally, the broken end bone was cleaned (*Figure 4A*,*4B*). After ensuring that there was no bleeding, sputum suction and double-lung ventilation was performed, but no drainage tube was placed.

Discussion

An intrathoracic rib is a rare congenital anomaly that results from the failure of the fusion of adjacent sclerotomes (1). At present, there are over 60 reports of intrathoracic ribs, and 85% of intrathoracic ribs are found by accident (1). A diagnosis of intrathoracic rib is mainly based on a chest X-ray, but chest CT and 3D rib reconstruction have increased the simplicity and accuracy of its diagnosis (9). As an intrathoracic rib itself is a benign disease, researchers

have mainly sought to differentiate it from some other diseases, such as lung consolidation, pleural lesions, peripheral lung parenchymal lesions, bony lesions, and subpleural malignant diseases (9).

Many cases are discovered by chance, but more than a third of patients experience clinical symptoms, such as chest pain, chest tightness, and hemoptysis, and the symptoms may be related to ribs in the thorax (1). There are several reasons why an intrathoracic rib may not cause severe clinical symptoms. First, the intrathoracic rib is a congenital deformity. The child from our hospital had a chest X-ray at the age of 2 and 7. Two chest X-rays have shown an intrathoracic rib starting from the 4th rib and ending at the 6th posterior rib, which indicates that the abnormal rib most likely grows alongside the normal rib. Thus, the abnormal rib should have no effect on the surrounding typical structure. Additionally, based on our analysis of previous reports, as intrathoracic ribs cannot break through the parietal pleura and enter the thoracic cavity, they do not have any direct effects on normal lung tissue, which was also confirmed in 3 previous surgical cases and 3 autopsy cases (1). However, this does not mean that intrathoracic ribs will not produce clinical symptoms.

When the angle between the supernumerary ribs and the normal ribs is too large, the normal lung tissue is prone to localized atelectasis and could be easily compressed, which in turn could cause chest tightness, cough, and even hemoptysis, and may also easily lead to lung infections. Basarslan *et al.* (10) reported a case of right lower atelectasis caused by an intrathoracic rib with infection. Conversely, when the angle between the supernumerary ribs and the spine is too small, it could cause compression in the intercostal nerves, resulting in chest pain. However, more research needs to be conducted to confirm these hypotheses.

Caution should be exercised regarding the surgical management of intrathoracic ribs. First, an intrathoracic rib is a benign disease that rarely affects a patient's life expectancy. Second, for intrathoracic ribs with symptoms, the possibility of other diseases should be evaluated, and the possibility of the intrathoracic ribs alone causing symptoms should be considered after the exclusion of other diseases with similar symptoms. For example, similar symptoms can also be caused by costochondritis, intercostal neuralgia, or malignant tumors (1). However, some intrathoracic ribs do cause clinical symptoms. Among 68 previously reported cases, 2 patients had symptoms related to the intrathoracic rib (1), 1 of whom underwent surgery (7).

Once surgery is selected, an appropriate surgical plan can be formulated on the basis of the intrathoracic rib classification proposed by Kamano *et al.* (2) in 2006, where type I-a originates from the vertebral body and type I-b originates from the regular rib. Our patient had type I-b, and we recommended single-port thoracoscopic surgery. It is recommended than an intercostal space as close as possible to the rib and the anterior axillary line be chosen for the incision, as this will enable surgeons to better observe the connection of the supernumerary ribs and reduce the compression of the intercostal nerve and postoperative pain. During this operation, the intrathoracic ribs are only connected to the normal ribs at the beginning, and electric hooks and appropriate traction can be used to completely remove the supernumerary ribs from the initial part.

We followed up the patient for 2 months after discharge. Her chest pain and dyspnea on movement had disappeared.

In summary, for symptomatic supernumerary ribs, after excluding the possibility of symptoms caused by other diseases, single-port thoracoscopic surgery is a simple and minimally invasive treatment option.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-22-421/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work, including ensuring that any questions related to the accuracy or integrity of any part of the work have been appropriately investigated and resolved. All the procedures in this study were performed in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient's parents for the publication of this case report and the accompanying images. A copy of the consent form is available for review by the editorial office of this journal.

References

1. Xue X, Zhao S, Li K, Zhao B. Intrathoracic rib: rare rib anomaly, review of the literature and proposal for classification. Int J Med Sci 2021;18:3800-7.
2. Kamano H, Ishihama T, Ishihama H, Kubota Y, Tanaka T, Satoh K. Bifid intrathoracic rib: a case report and classification of intrathoracic ribs. Intern Med 2006;45:627-30.
3. Mirzaei S, Moslemi S, Shafeghat F, Karimi S, Eftekharzadeh M. Bifid rib with fused vertebrae - A rare abnormality of the skeletal system: A case report. Int J Surg Case Rep 2021;86:106281.
4. Muise ED, Lee EY, Paltiel HJ, Gaffin JM. Supernumerary intrathoracic rib, a rare congenital anomaly: Case report and review of the literature. Pediatr Pulmonol 2020;55:1487-9.
5. Fischer B, Degenhardt P. A complex congenital anomaly: liver eventration because of intrathoracic rib and vertebral segmentation disorder--a case report. J Pediatr Surg 2008;43:E5-7.
6. Argyriou P, Pousios D, Tsocanas D, Psathakis C, Panagiotopoulos N, Piyis A. Demonstration of an intrathoracic rib with computed tomography and three-dimensional reconstruction. Ann Thorac Surg 2007;84:2117.
7. Coyan G, Daon E. Resection of supernumerary intrathoracic rib using robotic-assisted video-assisted thoracoscopic surgery. Surg Radiol Anat 2016;38:415-7.
8. Cai J, Song N, Jiang L. Left sleeve pneumonectomy via uniportal video-assisted thoracoscopic approach. Thorac Cancer 2022;13:506-9.
9. Abdollahifar MA, Abdi S, Bayat M, Masteri Farahani R, Abbaszadeh HA. Recognition of a rare intrathoracic rib with computed tomography: a case report. Anat Cell Biol 2017;50:73-5.
10. Basarslan F, Bayarogulları H, Tutanc M, Arica V, Yilmaz C, Davran R. Intrathoracic rib associated with pulmonary collapse in a pediatric patient. Iran J Radiol 2012;9:220-2.

Cite this article as: Wang C, Hu G, Min B, Cheng Z, Zuo X. Single-port thoracoscopic intrathoracic rib resection: a case description. Quant Imaging Med Surg 2023;13(1):507-511. doi: 10.21037/qims-22-421

