Peer Reviewed **Case Study**

RIB FORAMEN: A RARE CASE REPORT AND LITERATURE REVIEW

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Abstract

Variations in the anatomy of the thoracic cage are well described in the literature. Despite this, the prevalence of these variants differs, with some much less common and not as well reported on. This case reports presents an example of a rare case of a rib foramen that may pose a diagnostic dilemma.

Contributions: The case adds to the pre-existing knowledge of known rib variants described in the literature. The variant highlighted in this case is rare and may be misdiagnosed as a pathological finding.

Keywords: variants, lytic rib lesion

INTRODUCTION

The human body comprises 12 pairs of ribs: 7 pairs of true ribs, 3 pairs of false ribs and 2 pairs of floating ribs.[1,2] These ribs, along with the thoracic vertebrae and sternum, make up the bony framework of the thoracic cavity. This framework, known as the thoracic cage, serves to aid respiration and to protect the organs of the thoracic cavity. With regards to its structure, the typical rib (ribs 3 to 9) is made up of a head, neck, tubercle and shaft1, while the atypical rib (ribs 1, 2, 10, 11 & 12) exhibits unique morphological features. The known anatomical variants of the ribs relate to the number, the structure of a rib or how the ribs relate to each other (as in the instance of rib fusion).[2] This case report serves to demonstrate an example of a rare rib foramen variant which may be mistaken for pathology.

CASE REPORT

A 19-year-old male, with no previous comorbidities, presented to the emergency centre with an acute 1-day history of a fluctuant mass on the left chest wall. The laboratory work up was unremarkable. A contrast computed tomography (CT) of the chest was performed. The radiological findings demonstrated a left chest wall, multi-lobulated peripherally-enhancing collection with an estimated density of 2.33 HU in keeping with an abscess. The collection extended into the 4th and 5th intercostal space. The collection abutted the adjacent pericardium and pleura. There was an incidental finding of a well circumscribed rib foramen with a sclerotic border and ivory exostosis of the anterior left 4th rib (Figures 1 and 2). The collection did not communicate with the rib foramen described. There were no pathological fractures of the rib. The 5th rib was normal in outline.

DISCUSSION

The thoracic cage consists of 12 pairs of ribs,[1,2] the sternum, and the thoracic vertebrae. The ribs articulate with the sternum anteriorly, and posteriorly to the thoracic vertebral bodies. Ribs may be classified as true, false or floating, which is determined by the sternal articulation, or as typical or atypical, which is determined by their morphology.[2]

True ribs are described as such when they articulate directly with the sternum via their costal cartilages: ribs 1 to 7. False ribs articulate with the sternum indirectly via the adjacent superior costal cartilage: ribs 8 to 10. The remaining two ribs (11 & 12) are described as floating due to the absence of an anterior costal joint.[3]

Morphologically, the 3rd to 10th ribs are described as typical, due to the presence of two articular facets, an elongated body which is connected to the rib head by the neck, as well as the presence of a tubercle.[2] The head of a typical rib articulates with the thoracic vertebral body through the costovertebral joint. The tubercle of a typical rib articulates with the transverse process of the thoracic vertebra via the costotransverse joint.[1,3] Atypical ribs have different anatomy compared to the aforementioned typical ribs; the difference in morphology does not relate to variant anatomy. The first rib is short and wide compared to the typical ribs, with the second rib longer and narrower compared to the first rib. Rib 1 only has one facet on its head for articulation with its corresponding rib. Rib 10 has a single facet, which

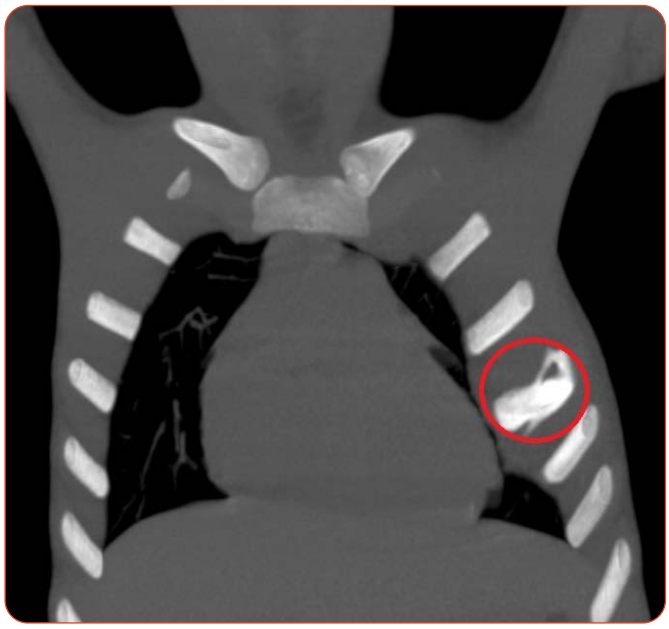

Figure 1. The bone window setting of a CT coronal view of the thorax demonstrates a left 4th rib foramen (red circle).

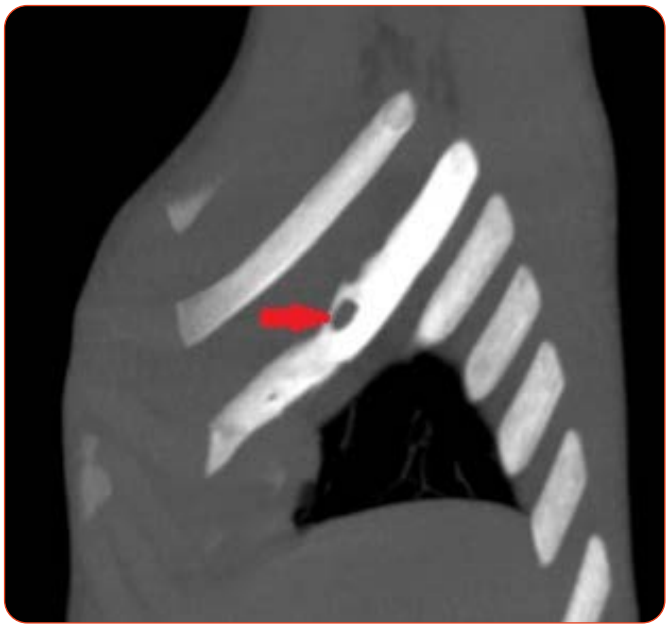

Figure 2. The sagittal view with the same settings as Figure 1 demonstrates a left 4th rib foramen (red arrow).

allows for articulation with the respective thoracic vertebra. The last two ribs (11 & 12) are atypical because they do not have a neck and only possess a single facet.[4]

Variation of the above-mentioned anatomy is usually identified incidentally as they are asymptomatic.[2] However, in some cases, they may be related to anomalies or clinical syndromes.[4] The known anatomical variants of the ribs include cervical ribs, short ribs, bifid ribs, intrathoracic ribs, rib fusion, rib notching, and, as in this case, a rib foramen.[2]

Rib foramina are well circumscribed defects located in the bony component of the rib and do not have clinical significance. They are however included in the differential diagnosis of bone lesions of the ribs.[2,4] A rib foramen may be found on one rib, as shown in this case, or it may be found on multiple ribs.[4] The incidence of these lesions is not well described. According to Oner and colleagues, it is recorded as one of the lowest prevalences of all the rib variations studied4. Oner and colleagues were the first to describe this variant that was noted in a 26-year old female who had symmetrical rib foramina (one on each first rib).[2] The aetiology of rib foramina is not described in the literature. They may either occur in isolation or be associated with clinical syndromes. This, coupled with the limited information in the literature we reviewed, bespeaks to the rarity of this variant, which entails that therein lies a risk of unnecessary intervention in response to the identification of the rib foramina.

It is therefore imperative to assess patients wholly, correlating their clinical presentation, blood results, and imaging studies to produce the most appropriate diagnosis.

CONCLUSION

The case report accentuates the importance of knowledge of the normal anatomical variants of ribs. This enables clinicians and radiologists to provide a fitting diagnosis, thus lessening the chances of unnecessary intervention.

ETHICAL CONSIDERATIONS

The article followed all ethical standards for research. A written informed consent was obtained from the patient for publication along with approval from the management of the institution. Their identity is not disclosed in this case report.

COMPETING INTERESTS

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in the writing and publishing of this case report.

AUTHORS' CONTRIBUTIONS

SMM (WPH) and TVA (WPH) compiled the literature review and drafted the original manuscript. LG (WPH) analysed the images, edited the manuscript and provided mentorship guidance, and oversight.

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DISCLAIMER

The views and opinions expressed in this article are those of the authors and are the product of professional research. They do not reflect the views of the affiliated institutions nor that of the publisher.

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