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Case Report

Large Sternal Foramen: a case report

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ABSTRACT

Sternal foramen is a common developmental anomaly of the sternum, resulting from impaired fusion of the two mesenchymal halves. Though most cases are harmless and only detected incidentally, proximity to heart and lungs may lead to hazardous complications like pneumothorax or cardiac tamponade during acupuncture or sternal puncture procedures. Sound anatomical knowledge of the sternum and pre-procedural screening may help minimize the risk of these complications.

Keywords: Developmental anomaly, Sternal puncture, Cardiac tamponade, Screening

INTRODUCTION

Human skeleton often exhibits variations that need to be distinguished from pathological changes. Sternum, an important component of the thoracic cage is prone to frequent variations. Sternal foramen (SF) is a congenital defect, usually oval or round in shape at the lower part of the sternum that is generally asymptomatic and is often detected incidentally during CT scanning. The sternum is formed by fusion of two cartilaginous sternal plates flanking the median plane. The arrangement and number of ossification centres vary according to the level of completeness and time of fusion of the sternal plates and to the width of the adult bone. Incomplete fusion during this process leaves a sternal foramen[1].

The incidence of sternal foramen determined by chest computed tomography[2]is 10.5% whereas the incidence in autopsy population[3] has been found to be 6.7%. The frequency of sternal notch and focal defects has been found to be 7.7% by MDCT[4].

Most SFs are located in the lower third of the sternal body (78.8%) and their diameters range from 2 mm to 16 mm[5]. Though apparently insignificant, awareness of a sternal foramen is important in acupuncture practice and sternal bone-marrow aspiration because of the danger of damage to the heart[6].

OBSERVATION

During routine osteology class in the department of anatomy, involving dry bones, a sternal specimen was discovered to have a large, oval foramen in the lower one-third of the body continuing slightly inferolaterally to a notch on the left as shown in Figure 1.

Measurements of the sternal foramen were taken with the help of digital caliper. It was found that the foramen measured 19.78 mm × 14.41 mm in size andwas located at a distance of 51.23 mm from the sternal angle.

Figure 1: Large foramen with notch in lower part of the body of sternum

DISCUSSION

The sternum develops from a pair of longitudinal mesenchymal condensations, the sternal bars that form in the ventrolateral body wall. The sternal bars meet in the midline and begin to fuse in a cranio-caudal sequence[4]. Ossification of the sternal bars happen in cranio-caudal succession from the fifth month until shortly after birth, producing the definitive parts of the sternum: the manubrium, the body, and the xiphoid process[7]. Any failure in this developmental process results in various sternal anomalies, such as fissure or foramen.

Choi PJ et al.[8] mentioned that it is a relatively common anatomical variation found in 2.5% to 13.8 % of all individuals in lower third of sternal body and their average diameter is 6.5 mm. The sternal foramen in the present case is also located in the lowest part of the body of sternum. But its size is fairly large (19.78 x 14.41mm) and is more in line with the findings of Boruahet al[5].

These foramina are rarely detected in life due to non-visualization of sternal details in routine chest radiographs. However, due to its close proximity to the thoracic organs, i.e., the heart and lungs, there is always a chance of serious complications like pneumothorax and cardiac tamponade[9,10] from invasive procedures involving the sternum. Additionally, a sternal foramen can occasionally be misinterpreted as a gunshot wound, fracture or even an osteolytic lesion[11].

Using CT scans, Gossner J[12] observed that in most people the directly adjacent structure to the SF was lung (53.3%), mediastinal fat (33.3%) and heart (20%). Detailed anatomical knowledge of the sternum therefore becomes necessary to avoid injury to these vital structures. During sternal biopsy, needle placementshould be done carefully and if it appears deeper than the adjacent sternal body suspicion of a sternal foramen should be made.It has been suggested that almost all pericardial punctures can be avoided if the needle is inserted no deeper than 2.5cm from the skin[12].

CONCLUSION

Sternum has different developmental anomalies and sternal foramen is one such minor variation. Due to congenital sternal foramen, serious complications and fatality after sternal puncture for bone marrow biopsy or acupuncture have been reported in literature. Thus, during sternal puncture or biopsy, inferior part of the body of the bone should be avoided to prevent these fatal complications. Also, it is advisable to go for pre-procedural screening by ultrasound or CT scan to minimize the risk of hazardous complications.

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