

The Variant Sternum: MDCT-Based Assessment And Clinical Implications

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Abstract

Background: The sternum demonstrates a wide spectrum of anatomical variations frequently encountered on multidetector computed tomography (MDCT). Many variants may mimic pathology or lead to procedural complications.

Objective: To determine the prevalence of sternal anatomical variants and discuss their clinical significance.

Materials and Methods: A record-based cross-sectional study was conducted from December 2023 to August 2024 including 70 patients who underwent thoracic MDCT using a 16-slice scanner. Multiplanar reconstruction and volume-rendered images were analyzed using bone algorithms.

Results: Sternal variants were identified in 47 out of 70 patients (67%). Variants were seen in 66% of males and 67% of females. Identified variations included suprasternal ossicles, sternal tubercles, sternal foramina, sternal clefts, elongated and ventrally deviated xiphoid processes, and fusion anomalies.

One variant that has never been mentioned before in the referred literature has been identified in the study.

Conclusion: Sternal anatomical variants are common incidental findings on MDCT. Awareness is essential to avoid misdiagnosis and prevent procedural complications.

Keywords: Sternum, MDCT, Sternal foramen, Xiphoid process, Anatomical variants

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I. Introduction

The sternum is a flat midline bone forming the anterior thoracic cage. It consists of the manubrium, body, and xiphoid process. Developmental variations arise from incomplete fusion of sternebrae. With increased use of MDCT, these variants are frequently detected and may mimic pathological conditions.

II. Objectives

1. To determine the prevalence of sternal anatomical variants.
2. To describe the imaging spectrum.
3. To discuss clinical and procedural significance.

III. Materials And Methods

Study Design: Record-based cross-sectional study.

Study Duration: December 2023 to August 2024.

Sample Size: 70 patients.

Inclusion Criteria: All patients undergoing thoracic MDCT.

Exclusion Criteria: Inconclusive imaging due to artifacts.

Imaging Parameters: 120 kVp, 100–180 mAs, 16 × 0.625 mm collimation, 2-mm axial and 3-mm MPR images.

IV. Results

A total of 70 patients were included in the study. Of these, 42 (60%) were males and 28 (40%) were females. The majority of patients were between 41–60 years of age.

Sternal anatomical variants were identified in 47 patients (67%). Variants were seen in 28/42 males (66%) and 19/28 females (67%), showing no significant gender predilection.

Multiple variants were observed in several patients. Among the identified variants, sternal foramina were the most common finding, observed in 14 patients (20.0%). Sternal tubercles were seen in 11 patients

(15.7%), while elongated xiphoid process was noted in 9 patients (12.9%). Manubriosternal fusion was identified in 7 patients (10.0%). Suprasternal ossicles were seen in 4 patients (5.7%), and sternal cleft was the least common variant, observed in 2 patients (2.9%).

Sternal foramina were the most common variant in our study (20%), which is slightly higher than the 16% reported by Hari Hara Gupta et al., and markedly higher than the 4.5% reported by Yekeler et al. This variation may be attributed to differences in sample size and population characteristics.

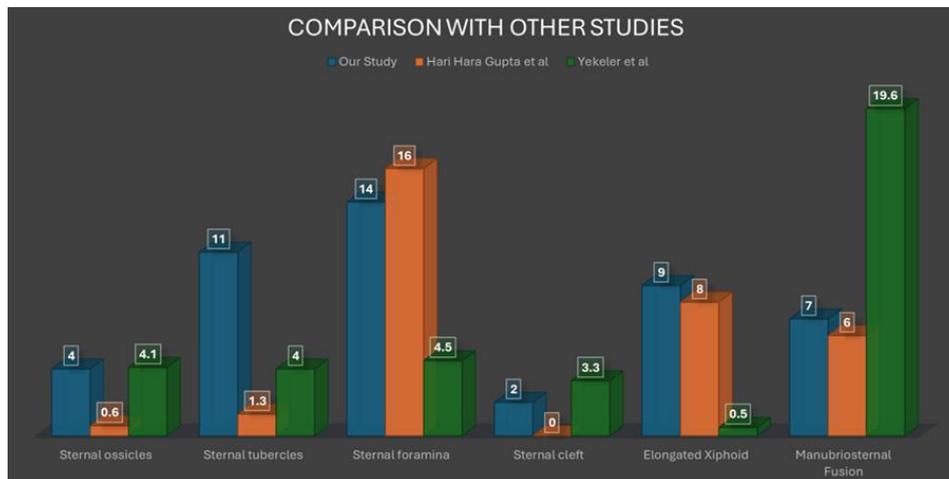
Sternal tubercles were observed in 15.7% of cases in our study, significantly higher than the 1.3% reported by Hari Hara Gupta et al. and 4% in Yekeler et al. This difference may reflect improved detection due to multiplanar reconstruction and volume rendering techniques.

Suprasternal ossicles were identified in 5.7% of cases in our study, which is comparable to the 4.1% prevalence reported by Yekeler et al., but higher than the 0.6% reported by Hari Hara Gupta et al.

Sternal cleft was noted in 2.9% of patients in our study. While not observed in Hari Hara Gupta et al., Yekeler et al. reported a similar prevalence of 3.3%, suggesting comparable detection rates.

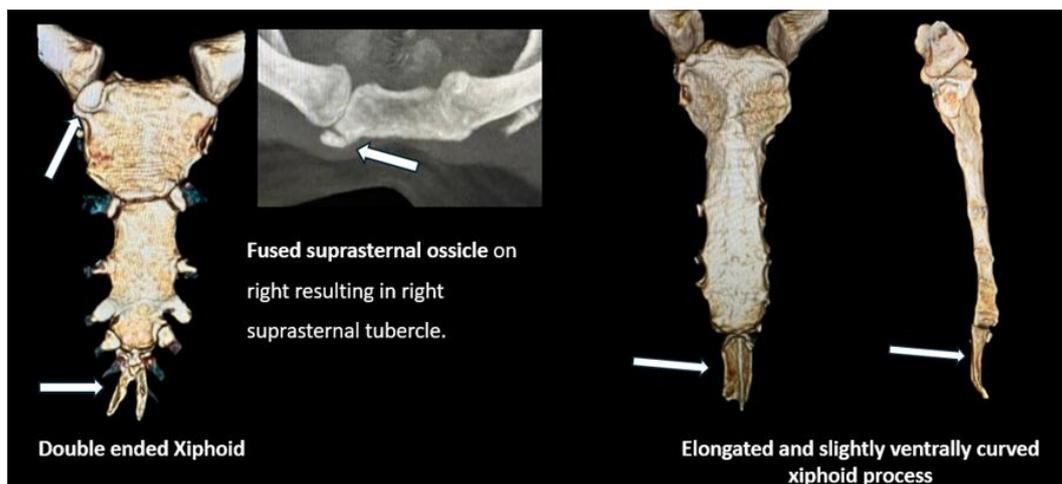
Elongated xiphoid process was observed in 12.9% of cases in our study, higher than the 8% reported by Hari Hara Gupta et al. and substantially higher than the 0.5% reported by Yekeler et al. Differences in definition criteria (e.g., >4 cm length threshold) may account for this variation.

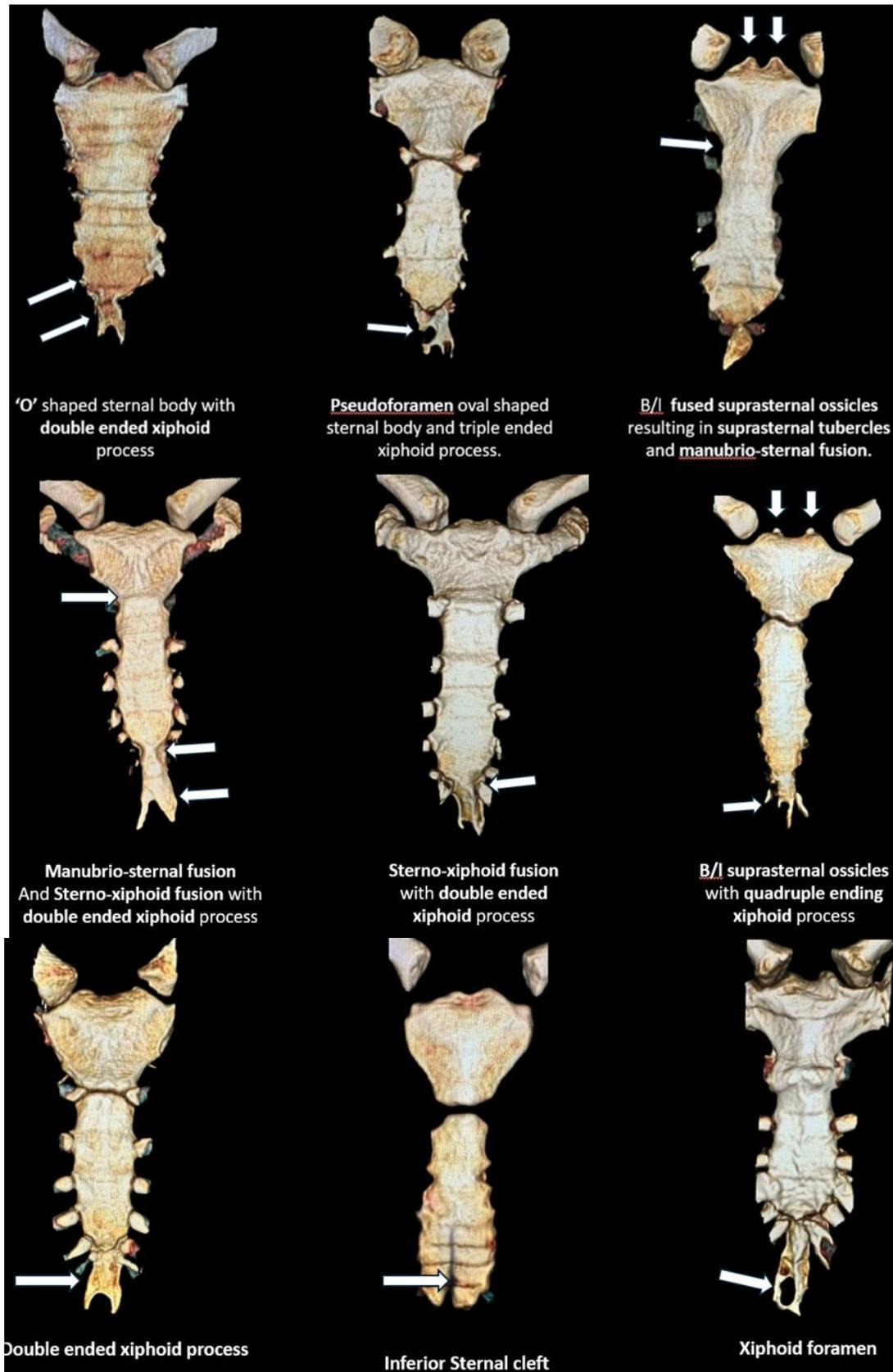
Manubriosternal fusion was seen in 10% of our patients, which is intermediate between the 6% reported by Hari Hara Gupta et al. and the 19.6% reported by Yekeler et al. The higher prevalence in Yekeler et al. may be related to inclusion of older individuals and degenerative cases.

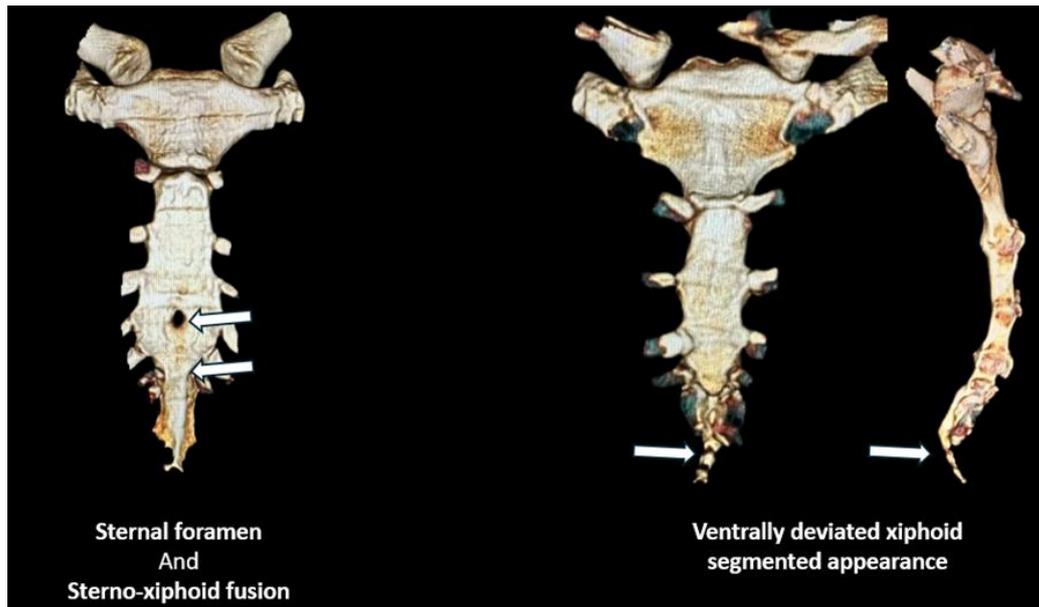


One variant- A ventral deviation with segmented xiphoid process, that has never been mentioned before in the referred literature has been identified in the study.

Xiphoid-related variations were the most frequently encountered findings. Fusion anomalies were more common in older age groups. Volume-rendered reconstructions improved visualization of morphological patterns and helped in better spatial assessment.







V. Discussion – Clinical Significance

Although most sternal variants are incidental findings, their recognition is clinically important.

Sternal foramen may mimic a lytic lesion on imaging and carries significant procedural risk. Unrecognized sternal foramen during bone marrow aspiration, biopsy, or acupuncture may result in cardiac tamponade or vascular injury due to its proximity to mediastinal structures.

Suprasternal ossicles can simulate calcified lymph nodes, vascular calcifications, fracture fragments, or foreign bodies. Sternal clefts may be mistaken for fractures in trauma settings, particularly when clinical history is limited.

Elongated or ventrally deviated xiphoid processes may present as an epigastric mass and cause localized pain, leading to unnecessary diagnostic workup if not correctly identified.

Manubriosternal fusion may be degenerative in elderly patients or associated with inflammatory arthropathies such as ankylosing spondylitis. Recognition assists in appropriate clinical correlation and avoids misinterpretation as pathological ankylosis.

Knowledge of sternal morphology is also important in surgical planning, sternotomy procedures, trauma reconstruction, and forensic assessment.

Therefore, careful evaluation of the sternum on MDCT and systematic reporting of variants are essential to avoid misdiagnosis and prevent potentially catastrophic complications during invasive procedures.

VI. Conclusion

Sternal anatomical variants are common and clinically significant. Proper identification on MDCT prevents misdiagnosis and avoids catastrophic complications during invasive procedures.

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