

Evidence of Costoclavicular Joint as A Synovial Joint

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Abstract

Introduction: The present study was conducted to note the osteological evidence of a synovial joint between clavicle and first rib in Indians. **Material and Methods:** The present study was conducted on 310 pairs of adult clavicles and first ribs, out of which 210 pairs were males and 100 pairs were females obtained from the Anatomy department of Pt. B. D. Sharma Postgraduate Institute of Medical Sciences, Rohtak. The articular facets were studied and measured with the help of a sliding Vernier caliper (Micropole). **Results:** Among 210 pairs (420 no.) of male clavicles examined, 6 clavicles (2.86%) had a circumscribed smooth articular facet with well-defined margins. Out of these 6 clavicles, 3 (1.43%) were of right side and 3(1.43%) were of left side. A corresponding facet was present on the first ribs of the same skeletons. The facets were found to be present unilaterally and that too in males only. The measurements of the articular facets on the rhomboid area of the clavicles and ribs were-the average length, width and elevation was 7mm, 5.4mm and 2.2mm respectively. **Conclusion:** These articular facets on the rhomboid area of clavicles and first ribs are osteological evidence of a synovial articulation between clavicle and first rib.

Keywords: Articular Facet, Clavicle, First Rib, Rhomboid Area, Synovial Articulation

1. Introduction

The text books of anatomy describe the costoclavicular joint as a fibrous joint made by costoclavicular ligament or Rhomboid ligament. Earliest description of costoclavicular articulation was given by Buchanan, who proposed that in 10% subjects a joint exist between clavicle and first costal cartilage, and in such cases rhomboid ligament forms part of the joint capsule.^[1] This fact was further supported by the study of Cave.^[2] A synovial costoclavicular articulation has been reported in European population by Poirier, Fick, Wood Jones and Cave.^[1-4] The costoclavicular joint was described as a variant of the ligamentous connection between the medial part of the clavicle and the first rib.^[5]

In early primates also costoclavicular ligament was not a separate entity, but it was continuous with

sternoclavicular joint capsule.^[2] Presence of bursa in the costoclavicular ligament was reported by Poirier, Fick, Testut, Bryce, Wood Jones and Cave.^[1-4,6,7]

The impression area of the costoclavicular ligament on the clavicle is either described as a rough impression^[8] or tuberosity^[9] or rough oval depressed area^[10] which is also commonly termed as rhomboid fossa. A smooth articular facet in the rhomboid area of clavicle has been reported by Poirier, Fick, Wood Jones and Cave.^[1-4] The knowledge of normal morphological variants of costoclavicular impression areas is clinically useful for radiologists, orthopedicians, anaesthetists and cardiologists.

The present study was conducted to note the presence of smooth, elevated articular facet on the clavicle and first rib in the rhomboid area as the osteological evidence of a synovial joint between clavicle and first rib in Indians.

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2. Materials and Methods

The present study was conducted on 310 pairs of adult clavicles and first ribs, out of which 210 pairs were males and 100 pairs were females obtained from the Anatomy department of Pt. B. D. Sharma Postgraduate Institute of Medical Sciences, Rohtak. The incidence of an articular facet in the form of an elevated, smooth faceted apophysis in the area of the attachment of costoclavicular ligament on the clavicles and first ribs was recorded as an osteological evidence of a synovial costoclavicular articulation. The facets were measured with the help of a sliding Vernier caliper (Micropole).

3. Observations and Results

The inferior surface of clavicle near its sternal end provides attachment to costoclavicular ligament. This area was well demarcated from rest of the bone in most of the cases and was invariably oval in outline. Among 210 pairs (420 no.) of male clavicles examined, 6 clavicles (2.86%) had a circumscribed smooth articular facet with well-defined margins. Out of these 6 clavicles, 3 (1.43%)

were of right side (Figure 1-3) and 3(1.43%) were of left side (Table 1) (Figure 4-6). A corresponding facet was present on the first ribs of the same skeletons (Table 2). All the 6 clavicles and first ribs were from different skeletons. Evidence of bilateral articular facets was not observed in any case.

Among 100 pairs (200 no.) of female clavicles and first ribs studied in the present study, there was no incidence of an articular facet on any of the bones (Table 1 and 2). The articular facets were present in 6 clavicles and first ribs (1.93%) among 310 skeletons studied. The facets were found to be present unilaterally and that too in males only.

The measurements of the articular facets on the rhomboid area of the clavicles were- the length was ranging from 5mm to 8mm (mean 7mm), width ranged from 3mm to 8mm (mean 5.4mm) and elevation was ranging from 2mm to 3mm (mean 2.2mm) (Table 3). The measurements of the articular facets on the rhomboid area of the first ribs were the length was ranging from 4.9mm to 8.1mm (mean 7mm), width ranged from 2.9mm to 8.1mm (mean 5.4mm) and elevation was ranging from 1.9mm to 2.1mm (mean 2.2mm) (Table 3).

Table 1. Showing incidence of articular facet in clavicles

	Number of clavicles examined	Total number of clavicles with smooth articular facet	Percentage(%)	Number of clavicles with smooth articular facet on right side	Percentage(%)	Number of clavicles with smooth articular facet on left side	Percentage(%)
Male	420	6	2.86	3	1.43	3	1.43
Female	200	-	-	-	-	-	-

Table 2. Showing incidence of articular facet in first rib

	Number of ribs examined	Total number of ribs with smooth articular facet	Percentage (%)	Number of ribs with smooth articular facet on right side	Percentage (%)	Number of ribs with smooth articular facet on left side	Percentage (%)
Male	420	6	2.86	3	1.43	3	1.43
Female	200	-	-	-	-	-	-

Table 3. Showing the measurements of articular facets

	Measurements of articular facets on clavicle (Range)(mm)	Mean(mm)	Measurements of articular facets on first rib (Range)(mm)	Mean(mm)
Length	5-8	7	4.9-8.1	7
Width	3-8	5.4	2.9-8.1	5.4
Elevation	2-3	2.2	1.9-2.1	2.2



Figure 1

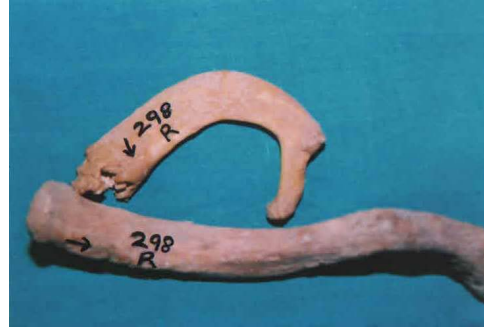


Figure 2

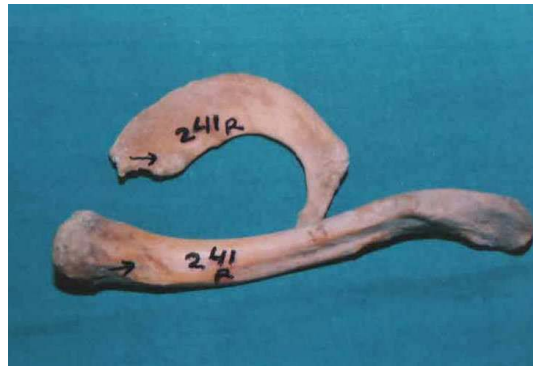


Figure 3

Figure 1-3: Showing the articular facets on ribs and clavicles on right side.

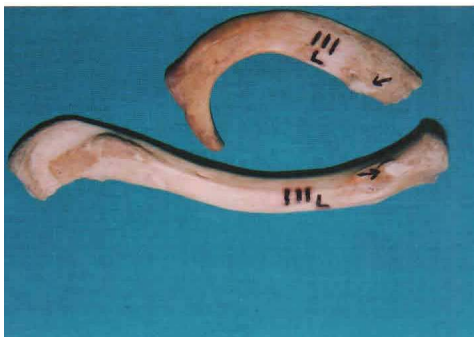


Figure 4



Figure 5



Figure 6

Figure 4-6: Showing articular facets on ribs and clavicles on left side.

4. Discussion

The synovial articulation between clavicle and first rib and its costal cartilage has been reported earlier in European population. Poirier reported 10% incidence of this type of articulation and he also reported that costoclavicular ligament formed the capsule of the joint.^[3] The costoclavicular ligament is attached to the inner half of anterior end of first rib, medial to the groove for subclavian vein and extends to the adjoining part of first costal cartilage. Fick referred to a synovial articulation but has not reported any statistics.^[4] Wood Jones also reported 10% incidence of a synovial articulation of costo-clavicular joint.^[1] Cave has reported much lower incidence (2.6%) of smooth, elevated apophysis on clavicles and first ribs associated with a costo-clavicular synovial articulation.^[2] Diarthrodial costoclavicular articulation is said to be a modification of ancestral syndesmosis.

Costoclavicular ligament of Galogo and Loris was not a separate entity, but it was continuous with sternoclavicular joint capsule. In Gibbon, Orang and Chimpanzee the same ligament is recognized as a separate unit. Further, in Perodictius the costoclavicular ligament became bifascicular. In humans costoclavicular ligament is relatively larger in size, fibres are conical or cylindrical and has a distinct bursal cavity, suggesting an attempt towards diarthrodial articulation.^[2] It is proposed that the development of an emphatic type of costoclavicular ligament or a synovial type of costoclavicular joint is secondary to wide range of clavicular movements. So, probably it is a next step in the evolution. Cave proposed that the development of this joint may be secondary to wide range of clavicular movements in humans. So, probably it is a next step in the evolution.^[2] Cave has also reported that the wall of the bursa present in the costoclavicular ligament was smooth; shining like synovial membrane of a joint. He also reported that there was no incidence of communication of this bursa with the joint cavity of the sternoclavicular joint.^[2] Redlund-Johnell provided radiological evidence of the costoclavicular joint in anteroposterior radiographs of lower cervical region of two patients, out of 950 patients, he observed. The presence of this synovial variety of costoclavicular joint was also confirmed in this radiological study by Johnell.^[5] Rani et al., studied the various patterns of attachment area of costoclavicular ligament on clavicle. The roughened architecture of the attachment area of costoclavicular

ligament on clavicle and first rib, observed in her study, suggested that there was no intervening bursa and the ligament is attached throughout this roughened impression, forming a fibrous articulation between the clavicle and first rib. Whereas those clavicles and first ribs where this ligamentous attachment area showed smoothness indicated the presence of bursa between the two lamina of costoclavicular ligament.^[11] This bursa will form the synovial cavity of the diarthrodial articulation between clavicle and first rib. The probable factors responsible for the above morphological variations were environment, genetic constitution, rate and pattern of growth and type of bone remodeling.^[12,13]

In the present study, the presence of a smooth, elevated articular facet on the rhomboid area of clavicles and first ribs as the osteological evidence of a synovial articulation between clavicles and first ribs were found in 1.93% cases among 310 pairs of clavicles and first ribs studied. Higher incidence of faceted apophysis at the area of attachment of costoclavicular ligament on clavicle, first rib and first costal cartilage in Indians strongly suggests the development of a synovial type of costoclavicular joint. These findings were much lower than those reported in European population by Poirer, Wood Jones and Cave^[1-3]. These articular facets were found unilaterally in males only. There was no case in females.

Cave in his comparative study of the costoclavicular ligament in other primates with that of man had suggested that with changing habitual posture and range of movement of upper limb, there have been qualitative differences in the mechanics of the sternoclavicular joint and necessity of inferior strengthen of the joint by costoclavicular ligament.^[2] It may be responsible for an ancestral syndesmosis attempting functional modification in direction of a synovial joint.

5. Summary and Conclusions

- A smooth, elevated almost oval, circumscribed articular facet was present in 6 clavicles and corresponding first ribs in 1.93% cases among 310 skeletons studied.
- These articular facets were found to be present only unilaterally and there was no incidence of bilateral articular facets.
- The articular facets were found to be present only in male skeletons.

- The average measurements of these facets were length 7mm, width 5.4mm and elevation 2.2mm.
- These articular facets on the rhomboid area of clavicles and first ribs are osteological evidence of a synovial articulation between clavicle and first rib.

6. References

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