

# Radiological Evidence of Costoclavicular Joint

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**Abstract-** Sometimes the ligamentous connection between clavicle and first rib can be converted into a diarthrodial union and a new joint: costoclavicular joint comes into existence. Very scanty literature is available documenting the presence of faceted apophysis on the under surface of clavicle at the attachment area of costoclavicular ligament, suggesting an articular area for costoclavicular joint. It is said that when such type of joint is present, the costoclavicular ligament acts as a joint capsule. 120 CT scout films (cervical and thoracic region) and 245 digital chest X-ray films (postero-anterior view) were observed. Out of 365 radiological images (males =202, females=163), 10 cases (2.7%) showed approximation of clavicle and ossified first costal cartilage at site of attachment of costoclavicular ligament, suggesting presence of costoclavicular joint.

**Index Terms-** clavicle, costoclavicular joint, costoclavicular ligament, first rib.

## I. INTRODUCTION

Costoclavicular joint is an anomalous articulation, which if present, exists between medial end of clavicle and first rib or its cartilage. Earliest description of the this articulation was given by Buchanan (1946), who said that in 10% subjects a joint exist between clavicle and first costal cartilage, in that case costoclavicular (rhomboid) ligament forms part of joint capsule.<sup>1</sup> Cave in 1961 carried out an extensive study on the morphology of costoclavicular ligament and reported an incidence of 2.61% of this joint.<sup>2</sup> Almost half a century later in an osteological study faceted apophysis at the attachment area of costoclavicular ligament on clavicle was observed in 19.47% cases, whereas in only 9.24% cases such facet was observed on the corresponding area on first rib. The authors suggested that this joint can even exist between clavicle and ossified first costal cartilage.<sup>3</sup> To the best of our knowledge, single study, till date, has been published reporting two cases of costoclavicular joint in anteroposterior radiograph of lower cervical region of 2 patients.<sup>4</sup>

With the advancement in radiological techniques, this particular joint could be visualized and if radiologists are not

aware of the existence of this joint they can very easily misdiagnose it.

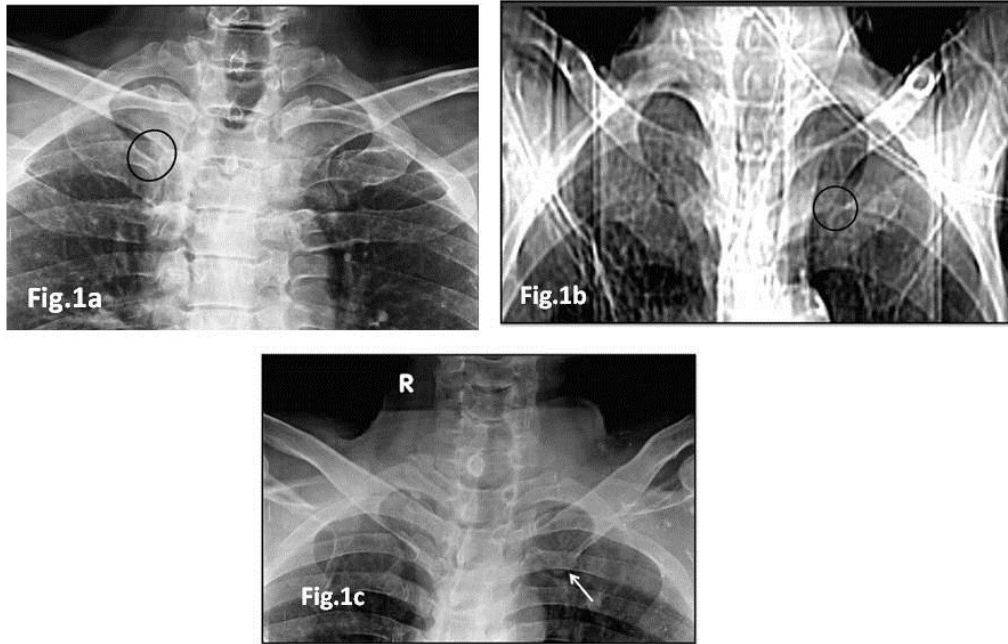
This radiological study was conducted to confirm the presence of costoclavicular joint in the native population.

## II. MATERIAL & METHODS

In the present study, 120 CT scout films (cervical and thoracic region) and 245 digital chest X-ray films (postero-anterior view) were observed. These radiological images were obtained from Radiology Department of King George's Medical University, Lucknow, UP. Out of 365 radiological images, 202 were of males and 163 of females. Age of patients ranged between 8 months to 73 years. Presence of a joint like space between the facet like elevation on the inferior margin of clavicle near its medial end and reciprocal facet on superior surface of first rib and or its ossified costal cartilage was considered as evidence of costoclavicular joint. Sternoclavicular joint was identified on both sides. The inferior margin of medial end of clavicle and superior margin of anterior end of first rib and its ossified costal cartilage was observed carefully for the presence of any reciprocal elevations intervened by joint like space.

## III. RESULTS

Careful observation of 365 radiological images of concerned area revealed that in majority of cases undersurface of medial end of shaft of clavicle and superior surface of first rib or its ossified costal cartilage were separated by a wide gap (Fig. 1a). In 2.7% cases the two surfaces were closely approximated suggesting presence of costoclavicular joint (Fig.1b). In all the cases joint was present between clavicle and ossified first costal cartilage and not between clavicle and first rib. Joint was observed on left side in 7 cases and on right side in 3 cases (Table). In none of the case joint was present bilaterally. In two cases inferior surface of medial end of shaft of clavicle, at the site of attachment of rhomboid ligament exhibited an elevation but no corresponding facet on first costal cartilage could be commented upon as the costal cartilage was unossified (Fig. 1c).



**Figure 1:** Postero-anterior lower cervical radiograph showing (a) absence of costoclavicular joint (encircled area); (b) presence of costoclavicular joint on left side (encircled area); (c) facet like elevation on under surface of clavicle (arrow) and unossified first costal cartilage.

**Table: Incidence of costoclavicular joint in studied population**

	Right	Left	Total
<b>Male (n=202)</b>	<b>2 (0.99%)</b>	<b>5(2.47%)</b>	<b>7(3.46%)</b>
<b>Female (n=163)</b>	<b>1 (0.61%)</b>	<b>2(1.23%)</b>	<b>3(1.84%)</b>
<b>Total(n=365)</b>	<b>3(0.82%)</b>	<b>7(1.91%)</b>	<b>10(2.7%)</b>

#### IV. DISCUSSION

Apart from forming sternoclavicular and acromioclavicular joints clavicle may also form diarthrodial articulation with first rib (costoclavicular joint) or coracoids process of scapula (coracoclavicular joint). These two unusual joints are formed due to modification in already existing fibrous connections between respective bones.

Coracoclavicular joint is a true synovial joint which is occasionally present not only in humans but also in non human primates.<sup>5</sup> The incidence of this joint varies from 0.8%-10%.<sup>6,7</sup> Diarthrodial costoclavicular articulation is said to be a modification of ancestral syndesmosis. In Galogo and Loris costoclavicular ligament was not a separate unit, but was part of

sternoclavicular joint capsule. In Gibbon, Orang and Chimpanzee it became a separate entity. Further, in Perodictius the costoclavicular ligament became bifascicular. In humans this ligament is larger in size, fibres are conical or cylindrical and comprises of anterior and posterior lamina with an intervening constant bursa suggesting an attempt towards formation of synovial joint.<sup>1,2,8</sup> 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.<sup>2</sup> Other possible factors responsible for the development of such variation could be attributed to environment, genetic constitution, rate and pattern of growth and type of bone remodeling.<sup>9,10</sup> Till date only one study has been published in which evidence of both the anomalous articulations of clavicle ie costo and coracoclavicular joints were observed in the form of facets at the area of attachment of costo and coracoclavicular ligaments respectively.<sup>11</sup>

In the present study an incidence of 2.7% of costoclavicular joint was observed. In all the cases the joint existed between under surface of clavicle and ossified first costal cartilage. In two cases though clavicle exhibited facet but it was not possible to comment on the presence of joint as first costal cartilage was unossified. In the later part of twentieth century 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.<sup>4</sup>

While studying the morphological features of area of attachment of costoclavicular ligament on 153 clavicles of European origin, Cave observed smooth, elevated, circumscribed facet like area in 2.6% cases and regarded it as evidence of

existence of synovial variety of costoclavicular joint.<sup>2</sup> Recently similar study was conducted on the dried specimens of adult clavicles (118) and first ribs (184) of Indian origin. In 19.47% clavicles facet was observed at the area of attachment of costoclavicular ligament where as on corresponding area of first rib demifacet was observed in 8.15% cases and complete facet in only 1.09% ribs. They also reported presence of demi as well as complete facet on ossified first costal cartilage. It can be inferred from the above study that costoclavicular articulation may exist between (i) clavicle and first rib (ii) clavicle and first costal cartilage (iii) clavicle and first rib and its costal cartilage.<sup>3</sup> In the present study all the observed joints were between clavicle and ossified first costal cartilage. To overcome the limitations of the present study, ie non visibility of unossified costal cartilage, authors strongly recommend to further investigate the existence of this unusual joint by magnetic resonance imaging technique. Pathological involvement of costoclavicular joint may cause pain in this region which will be very difficult to differentiate from the pain due to involvement of sternoclavicular joint. Therefore, orthopaedic surgeon must have in mind the fact that this particular joint could exist and should be considered as one among many possible causes of pain in this region. Further, author wants to make aware the anesthetists and intensive care interventionists about the presence of costoclavicular articulation as it may cause narrowing of costoclavicular space, which can increase the risk of compression of subclavian catheter during intravenous catheterization.

## V. CONCLUSION

In the present radiological study, a 2.7% incidence of costoclavicular joint was observed suggesting transformation of fibrous type of joint into a synovial variety. The knowledge of this joint is clinically important for radiologists, orthopedicians, anaesthetists and cardiologists.

## ACKNOWLEDGEMENT

We would like to thank Dr Neera Kohli, Professor, Department of Radiology, King George's Medical University, Lucknow, UP for providing CT Scans and digital chest X-rays and giving expert advice regarding the presence of anomalous articulation.

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