

An Osteological Study of the Clavicular Facet of the Coracoclavicular Joint

Sakthivel S¹, Dhakshnamoorthy N², Ilankathir S³, Sarala Devi KV⁴

¹Additional Professor, Department of Anatomy, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry, India

²Postgraduate Student, Department of Anatomy, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry, India

³Professor, Department of Anatomy, Aarupadai Veedu Medical College and Hospital, Pondicherry, India

⁴Professor, Department of Anatomy, ESIC Medical College and Hospital, Chennai, Tamil Nadu, India

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ABSTRACT

Introduction: the coracoclavicular joint is a rare diarthrotic synovial joint between the scapula and clavicle. Its presence has been established as an etiological factor in shoulder pain and could be associated with upper limb paraesthesia. The incidence of the joint varies in different ethnic populations. The present study aims to report the prevalence of this joint in South Indians.

Methods: the descriptive study was conducted on 118 right-sided and 159 left-sided adult human dried clavicles. The conoid tubercle of the clavicles was examined for the presence of a smooth articular facet for the coracoid process of the scapula. The transverse and anteroposterior dimensions of the clavicular facet were measured using a digital Vernier caliper.

Results: the clavicular facet for the coracoclavicular joint was observed in 4.69% of the 277 bones. The shape of the facet was horizontally oval, and the transverse diameter was longer than the anteroposterior diameter. The mean transverse diameter was 8.81 ± 1.86 mm, and the anteroposterior diameter was 6.16 ± 2.39 mm.

Conclusion: with a prevalence of 4.67% in this study in the South Indian population, the presence of CCJ could not be considered a rare anomaly. Although it is incidentally diagnosed, the possibility of CCJ occurrence should be considered in the differential diagnosis of unexplained shoulder pathology.

Keywords: Coracoid process; Conoid tubercle; Scapula; Clavicle.

Introduction

The coracoclavicular joint (CCJ) is a diarthrotic synovial joint present between the conoid tubercle of the clavicle and the superior surface of the horizontal part of the coracoid process of the scapula¹. In humans, its occurrence is rare whereas it is evident in primates. The joint has a capsule, synovial lined space, and hyaline articular cartilage that covers the facets on the coracoid and the clavicle close to the subclavius groove.² Though the coracoclavicular joint is often disregarded as a structure without any significance, its presence was established as an etiological factor in shoulder pain and could be associated with upper limb paraesthesia^{3,4,5}.

This joint was first described by Gruber in 1861⁶. During development, the cartilaginous procoracoid connects the coracoid process to the clavicle. The procoracoid ultimately forms the coracoclavicular ligament which usually contains chondrocytes and cartilaginous nodules. The conoid tubercle of the clavicle and coracoid process occasionally grow toward each other forming a joint covered by a capsule⁷. This joint was found to be more prevalent in Asians than in the other races⁸. In osteological studies, the prevalence ranged between 0.7% and 10%, and in the radiological studies it was between 0.6% and 21%⁹.

A higher prevalence of 1.7% to 30% was observed in cadaveric dissections due to the presence of articular cartilage and capsule^{9,10,11}. Thus, the incidence of CCJ shows wide variation according to the type of study. The present study was undertaken to determine the prevalence of the articular facet on the conoid tubercle of the clavicles in the South Indian population.

Materials and methods

The study was conducted on 277 adult human dry clavicles (118 right and 159 left) of undetermined sex that were available in the Department of Anatomy after excluding the damaged bones. These bones were accessible for undergraduate teaching during the study period of 2018-2022. The presence of CCJ was determined by the occurrence of a smooth articular facet present on the conoid tubercle. The maximum transverse diameter and anteroposterior diameter of the articular facets were measured using a digital Vernier caliper. The parameters were analyzed using SPSS software version 20 (IBM Corp. Armonk, NY).

Results

The prevalence of CCJ was 4.69%. On the left side, it was observed in 10 bones, and on the right side, in three bones. The shape of the facet was

horizontally oval, and the transverse diameter was longer than the anteroposterior diameter (Figure 1). The mean transverse diameter was 8.81 ± 1.86 mm, and the anteroposterior diameter was 6.16 ± 2.39 mm. On the right, it was 10.82 ± 1.6 mm and 8.06 ± 1.09 mm, respectively, and on the left, it was 8.21 ± 1.51 mm, and 5.60 ± 2.41 mm, respectively. The differences between the right and left sides were not statistically significant.

Discussion

The coracoclavicular joint is a rare synovial joint with articulation between the conoid tubercle of the clavicle and the superior surface of the horizontal part of the coracoid process of the scapula. In radiological studies, the CCJ was determined by the presence of

triangular bony outgrowth near the conoid tubercle. However, slight axial rotation of the clavicle while taking an X-ray will exaggerate the conoid tubercle, which could be mistaken for CCJ. A cadaveric study is more reliable because the presence of the articular capsule and cartilage confirms the CCJ although the sample size might be small. Nevertheless, the dry bone study provides a large sample size to identify the facet on the clavicle or the coracoid process of the scapula¹¹.

Gruber studied 350 cadavers and observed CCJ in eight specimens⁶. Gumina *et al.* observed CCJ in eight drybones(0.78%)among1020clavicles⁸. In a radiological study on 1040 individuals from Northern India, the reported prevalence was 3.37%¹². An osteological study from India demonstrated an increased prevalence



Figure 1. Clavicular facet on the conoid tubercle of the right clavicle (inferior view).

Table 1. Geographical distribution and differences in the prevalence of CCJ in different modes of study.

Study	Population	Sample Size	Prevalence	Type of Study
Kaur and Jit ¹⁵ 1991	Northwest Indian	1000	18.4%	Osteology
Cockshott ¹⁶ 1992	Chinese	600	21%	Radiology
Nalla and Asvat ¹⁷ 1994	South African	240	9.6%	Osteology
Gumina <i>et al.</i> ⁸ 2002	Italian	1020	0.8%	Osteology
Nehme <i>et al.</i> ¹⁰ 2003	France	2192	0.82%	Radiology
		784	1.78%	Osteology
Joy E <i>et al.</i> ¹⁴ 2008	Nigerian	1637	0.55%	Radiology
Das <i>et al.</i> ¹³ 2016	Indian	144	5.6%	Osteology
Chopra <i>et al.</i> ¹² 2017	North Indian	1040	3.37%	Radiology
Paparoidamis <i>et al.</i> ¹⁹ 2018	Greece	216	6.5%	Osteology
Harlow <i>et al.</i> ¹⁸ 2021	African American	2724	12%	Osteology
	Caucasian American		6%	
Present study 2023	South Indian	277	4.69%	Osteology

of 5.6%¹³ whereas in the adult Nigerian population, the prevalence was 0.55%¹⁴. In a radiological study, it was observed in 0.82% (18 individuals) of the 2192 individuals examined, and in their osteological study on 392 skeletons, the incidence was 1.78%¹⁰. Thus CCJ has been studied by radiological, cadaveric, and osteological methods with differences in rate of prevalence. Many studies found the clavicular facet to be oval with a long horizontal axis followed by a circular shape^{15,10}. The size of the facet in the study by Kaur and Jit ranged between 8 x 6 mm and 17 x 9 mm¹⁵. In the present study, the size ranged between 4 x 6 mm and 11 x 6 mm.

The geographical distribution and prevalence of CCJ in various studies in the literature are shown in Table 1. The occurrence of CCJ is observed to be higher in Asia than in Western Europe, particularly in people of Chinese ancestry, which confirms geographical variations in its existence¹⁶. Several studies reported that CCJ was more prevalent in males^{12,15,17}. The incidence of clavicular facet was 10.1% in males and 8.3% in females in Northwest India¹⁵. Similarly, Nalla and Asvat also found the CCJ to be more prevalent in males (56.5%) than females in the South African population (43.5%)¹⁷. CCJ was found to be more common on the left side¹², and the same was observed in the present study.

The incidence is also found to be higher in people above 30 years of age¹⁸. Papparoidamis *et al.* observed a higher incidence of CCJ (13.9%) in individuals more than 76 years of age than in those between 61-75 years of age (3.7%)¹⁹. Likewise, in South Koreans, the joint was observed in 9.5% of the age group between 40-49 years and 11.4% of those aged 60 years.² In individuals below 40 years of age, the CCJ was not found, suggesting that the occurrence could be due to aging². However, CCJ has also been reported in children. Nehme *et al.* observed CCJ in a 5-year-old and a 7-year-old child¹⁰. Similarly, Kaur and Jit observed CCJ in a 13-year-old child but none in neonates or fetuses¹⁵. Thus, they concluded that environmental factors such as activity could not play a role in its occurrence and it could not be a congenital anomaly as well. Although it was assumed to be an autosomal dominant trait, there was no genetic evidence²⁰. According to Saunders, the CCJ does not follow the Mendelian pattern of inheritance. Despite sharing the same genetic makeup, individuals may or may not exhibit the trait. A physiological threshold determines whether the phenotype will be expressed or discontinued, and individuals will manifest the trait

only when the threshold is crossed²¹. Furthermore, the genetic cause could not be ruled out because of the variations observed in the prevalence of CCJ between different races¹⁶.

Although some authors say that there is no relation between the presence of the CCJ and the size of the clavicle and scapula, Nalla *et al.* observed an increase in the size of neighboring bones. They observed longer first ribs and lengthened superior, medial, and lateral borders of the scapula with a significant increase in superior angle and proposed that CCJ develops to compensate for the space restrictions caused by the long and narrow scapula with normal thoracic inlet size, which could cause restriction of scapular movements¹⁷. The presence of a CCJ in patients may present as thoracic outlet syndrome²².

Degenerative changes in the CCJ could be one of the causes for painful shoulders⁴. CCJ could also predispose to the development of degenerative changes in other neighboring joints such as the acromioclavicular joint⁹. Cheung *et al.* studied the microscopic structure of a resected CCJ and observed that the facet on the coracoid process had fibrocartilage lining, resembling the repair tissue following cartilage injury whereas the clavicular facet was lined by mature hyaline cartilage³. Thus, the presence of CCJ has been established as an etiological factor in shoulder pain and could be associated with upper limb paraesthesia as well^{3,4}. Shoulder pain due to the confirmed presence of CCJ by imaging could be managed conservatively or by surgical resection depending on the severity of symptoms³.

Conclusion

In the South Indian population, with a prevalence of 4.69% in this study, the presence of CCJ could not be considered a rare anomaly. Awareness of the CCJ is important in diagnosing and managing shoulder pain. Even though it is usually asymptomatic and incidentally diagnosed, the possibility of CCJ occurrence should be considered in the differential diagnosis of unexplained shoulder pathology.

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Mini Curriculum and Author's Contribution

1. Dr Sulochana Sakthivel – MBBS, MS, PhD. Design of the study; Effective scientific and intellectual participation for the study; data acquisition; data interpretation; preparation of and draft of manuscript; critical review and final approval. ORCID: 0000-0002-5113-1647
2. Dr. Nithya Dhakshnamoorthy – MBBS, Postgraduate Student. Effective scientific and intellectual participation for the study; data acquisition; data interpretation; preparation of and draft of manuscript; critical review and final approval. ORCID: 0009-0009-0481-6449.
3. Dr. Ilankathir Sridharan – MBBS, MD. Design of the study; Effective scientific and intellectual participation for the study; data interpretation; preparation of and draft of manuscript; critical review and final approval. ORCID: 0000-0003-1942-0462.
4. Dr. K V Sarala Devi – MBBS, MS. Guiding Professor; responsible for technical procedures; Effective scientific and intellectual participation for the study; preparation of and draft of manuscript; critical review and final approval. ORCID: 0000-0002-9156-1668.

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Corresponding author
BK.V. Sarala Devi
E-mail: sarala.shrihari@gmail.com