# THE CORACO-CLAVICULAR JOINT*

By V. K. Pillay, M.B., B.S., M.Ch.Orth., F.R.C.S. (Eng.).

(Department of Orthopaedic Surgery, University of Singapore.)

## INTRODUCTION

Gruber described this joint in 1861. Lane (1886; 1887; 1888) thought that this was an acquired joint seen in labourers. Gowland (1915) stated that this was possibly a congenital joint. Kohler (1935) believed that this joint was a regular feature in the gorilla and gibbon. Lewis (1959) while not stating any definite view felt that sometimes this joint may be an inherited character present before birth.

## DESCRIPTION OF THE JOINT

The joint lies between the inferior surface of the clavicle at the lateral end of the groove for the subclavius, and the coracoid where the trapezoid ligament is normally attached (Figs. 1, 2, & 3). The clavicular facet lies at the junction of the inner two-thirds and the outer third, at the site of the conoid tubercle and extending medially. It often produces an enlargement and an elevation of the clavicle at this site. This feature causes the enlarged "conoid tubercle" which is the criterion for the picking up of this joint radiologically (Fig. 3).

The coracoid facet appears as a cartilagenous metaplasia of the trapezoid ligament. This facet is reciprocal to the clavicular facet (Fig. 1). Together they form a gliding surface. There is no corresponding elevation in the coracoid at the site of the articular facet but in well developed joints the radiological appearance of the coracoid facet is definite (Fig. 3).

The joint so formed is surrounded by a capsule lined with synovial membrane and the conoid ligament, incorporated at the posterior part, thickens and strengthens the capsule in this region.

The articular surface is in all cases lined by fibro-cartilage though Lewis (1959) claimed that in some areas of a well developed joint there was hyaline cartilage.

Every gradation of the articulation between the clavicle and the coracoid from the presence of a bursa (a simple joint) to a fully developed and elaborate joint can be seen on dissections of this area. However the joints can be usually placed in one of the following two grades.

Grade I: The fully developed joint with fibro-cartilage lined articular surfaces on both the clavicle and the coracoid and the presence of a well marked capsule lined by synovial tissue (Figs. 1 & 4).

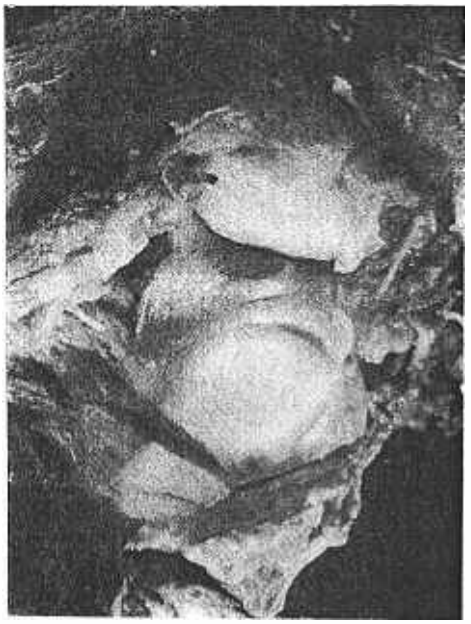

Fig. 1. A Grade I Coraco-clavicular joint. Note the clavicular facet on the top surmounting an enlargement of the conoid tubercle and the reciprocating coracoid facet on the bottom. The capsule and glistening synovial membrane can also be made out.

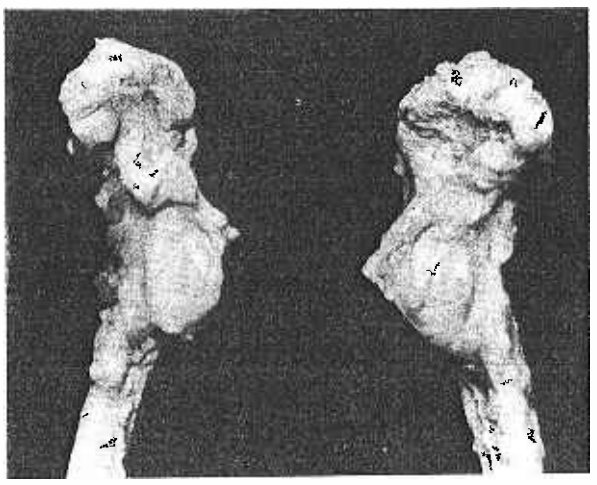

Fig. 2. Well marked clavicular facets in a bilateral case.

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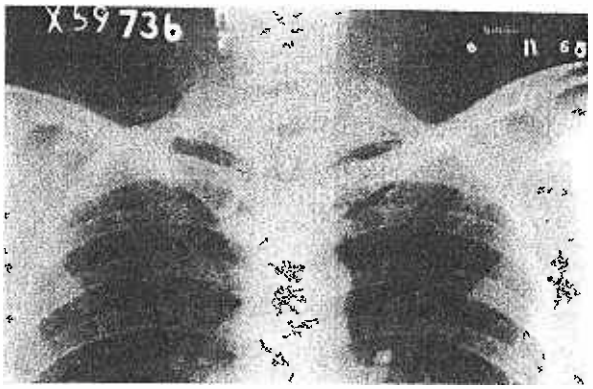



Fig. 3. The Coraco-clavicular joints as seen on roentgenograms. The facets on both the clavicle and coracoid can be easily made out. Note also the enlargements of the conoid tubercles and the fact that it is the lateral sloping surfaces of these tubercles that articulate with the coracoid.

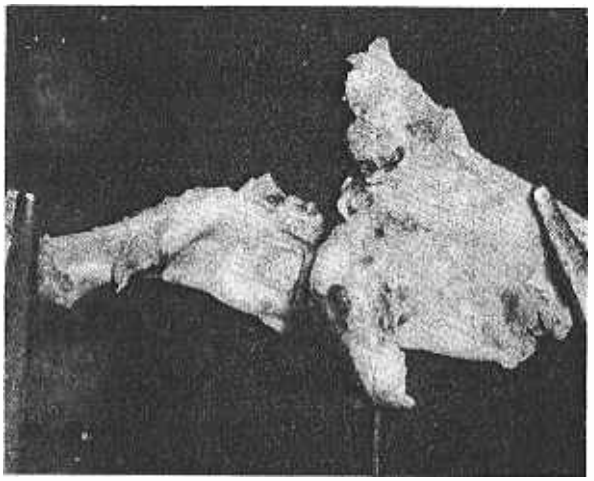


Fig. 4. A specimen from a six month old showing a well-developed or Grade I joint.

Grade II: A "primitive" or "imperfect" joint where there is no doubt that the clavicle and the coracoid are in "articulation" but there is no articular surface lined with fibro-cartilage and there is no evidence of a complete capsule (Fig. 5). The contacting surfaces are lined with fibrous tissue. Sometimes the facet is present only on the clavicular surface.

## CADAVERIC DISSECTION

TABLE I

CADAVERIC DISSECTION ON 150 INDIVIDUALS. (300 SHOULDERS).

| | MALE | FEMALE |
|---|---|---|
| MALAYS | 4 | |
| INDIANS | 7 | |
| CHINESE | 107 | 32 |

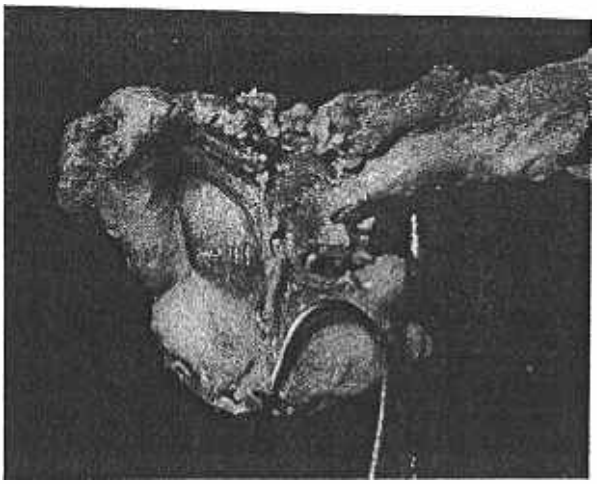


Fig. 5. A specimen from a neonate to show "articulation" between the clavicle and the coracoid process but not a true Grade I coraco-clavicular joint. This has been designated a Grade II joint.

TABLE II

JOINTS PRESENT

| | MALE | FEMALE |
|---|---|---|
| MALAYS | | |
| | 2 (bilateral Grade II) | |
| INDIANS | | |
| | 1 (unilateral Grade II) | |
| CHINESE | | |
| | 18 (bilateral Grade II) | 4 (bilateral Grade II) |
| | 14 (unilateral Grade II) | 2 (unilateral Grade II) |
| | 7 (bilateral Grade I) | 1 (bilateral Grade I) |
| | 1 (unilateral Grade I) | |

INCIDENCE FOR GRADE I JOINTS:

5·7% in 300 mixed arms

(Bilateral 5·3%, Unilateral 0·3%)

7% in 214 arms of male Chinese.

INCIDENCE FOR GRADE II JOINTS:

21·6% in 300 mixed arms.

In a study of 300 shoulders of 150 cadavers (Table I) the incidence for Grade I joints was 5·7% and for Grade II joints it was 21·6% (Table II). Lewis (1959) found the joint on 13 occasions (28·3%) in a study of 46 European arms. He did not classify the joints into particular types though he noted that they were of "ranging degrees of elaboration". Abe (1964) found the incidence for fully developed joints to be 7·3% in a series of 96 Japanese arms. If this

figure is compared to the present author's figure of 7% in the Chinese Male arms (214) the figures are strikingly similar.

## X-ray study

TABLE III

| | |
|---|---|
| SERIES I | 480 FILMS |
| BILATERAL JOINTS . . . . | 10 |
| UNILATERAL JOINTS . . . . | 2 |
| INCIDENCE: | 2.3% in 960 arms. |
| | 2.1% for bilateral joints. |
| | 0.4% for unilateral joints. |

| | |
|---|---|
| SERIES II | 1842 FILMS |
| BILATERAL JOINTS . . . . | 47 |
| UNILATERAL JOINTS . . . . | 8 |
| INCIDENCE: | 2.8% in 3,684 arms. |
| | 2.6% for bilateral joints. |
| | 0.4% for unilateral joints. |

The radiological incidence is given in Table III. Nutter (1941) found this incidence to be 1·2%. However it is easy to miss this joint on routine roentgenograms. Figure 6 shows the clavicles of an individual taken with the arms to the side. The joints are not obvious on this film and will be missed by most observers. Fig. 7 shows the same individual's clavicles with the arms elevated. Here by clavicular rotation the coraco-clavicular joints are brought into full view. However the incidence as given in Table III was obtained from routine chest roentgenograms and it is suspected that it will be higher if individuals are X-rayed with the arms elevated.

## GENETIC STUDY

From a study of first degree relatives of some individuals showing the joints radiologically, it has been concluded that the joint is inherited as a Mendelian dominant autosomal trait (Tables IV and V). One pedigree (Pedigree I in Table V) is illustrated in Figs. 8-11.

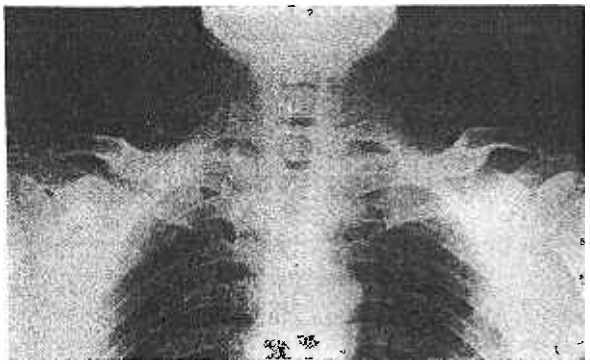


Fig. 6.

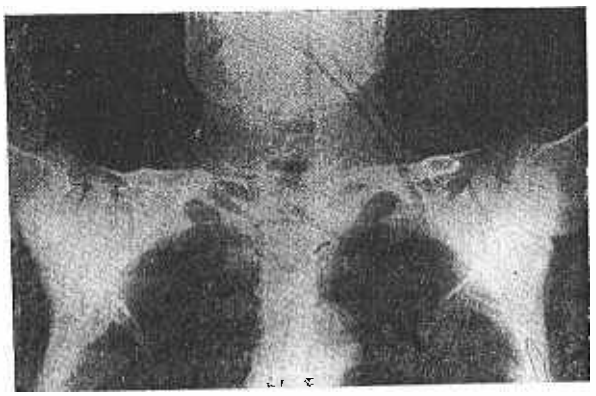


Fig. 7.

Figs. 6 & 7. To show the effect of abduction on the clavicle. Note that by clavicular rotation the enlarged conoid tubercules that were not obvious in Fig. 6 have come into prominence in Fig. 7 where bilateral joints can be made out easily.

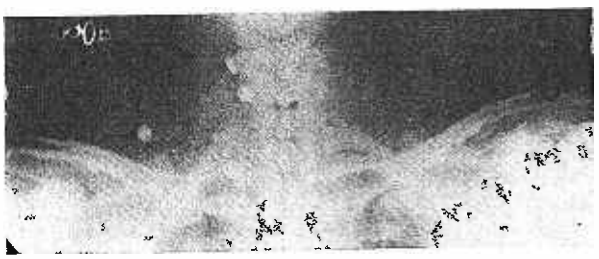


Fig. 8. Coraco-clavicular joints in the mother of $P_1$ in Pedigree I.

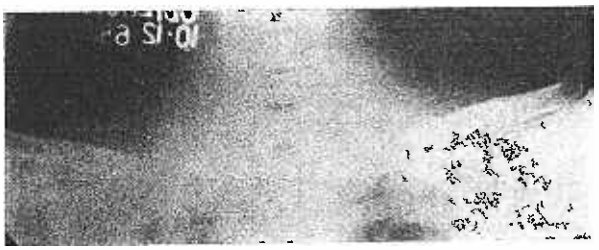


Fig. 9. Coraco-clavicular joints in $P_1$ the propositus in Pedigree I.

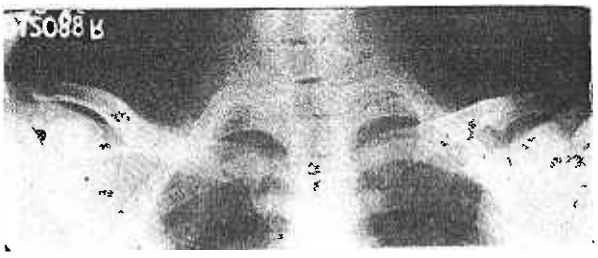


Fig. 10. To show the unilateral coraco-clavicular joint of the brother of $P_1$ in Pedigree I.

TABLE IV

| | |
|---|---|
| FIRST DEGREE RELATIVES LIVING .. .. .. | 154 |
| FIRST DEGREE RELATIVES AVAILABLE FOR STUDY .. | 70 |
| FIRST DEGREE RELATIVES SHOWING JOINTS .. .. | 33 |

BREAKDOWN OF FIRST DEGREE RELATIVES

| GROUP | | | PERCENTAGE OF OCCURRENCE OF JOINT |
|---|---|---|---|
| | NUMBER OF PARENTS SEEN | 13 | |
| 1 | NUMBER OF PARENTS WITH BILATERAL JOINTS .. | 6 | 53·8 |
| | NUMBER OF PARENTS WITH UNILATERAL JOINT .. .. .. | 1 | |
| | NUMBER OF SIBLINGS SEEN .. .. | 34 | PERCENTAGE OF OCCURRENCE OF JOINT |
| 2 | NUMBER OF SIBLINGS WITH BILATERAL JOINTS .. | 14 | 47·0 |
| | NUMBER OF SIBLINGS WITH UNILATERAL JOINT .. | 2 | |
| | NUMBER OF OFFSPRING SEEN .. .. .. | 23 | PERCENTAGE OF OCCURRENCE OF JOINT |
| 3 | NUMBER OF OFFSPRING WITH BILATERAL JOINTS | 8 | 43·5 |
| | NUMBER OF OFFSPRING WITH UNILATERAL JOINT .. .. | 2 | |

Fig. 11. Note that no joints are seen in the father of $P_1$ in Pedigree I.

## CLINICAL STUDY

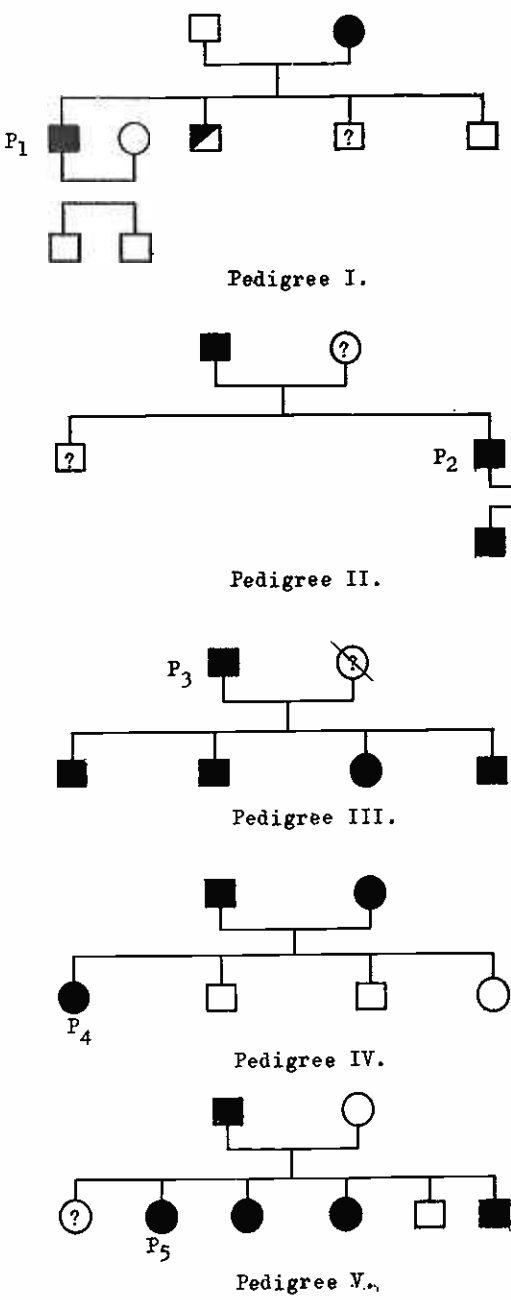
Though it has been said that the coraco-clavicular joint may give rise to trouble (Frassetto (1921); Wertheimer (1948); Hall (1950); it can be seen from Table VI that the incidence for this joint is not higher than the actual incidence in various lesions in and around the shoulder *i.e.* the coraco-clavicular joint when present does not predispose to any of those conditions listed in Table VI.

### Possible Significance of the Joint

A study of the works of Inman, Saunders and Abbot (1944) shows that the clavicle has a very important function in relation to the shoulder complex. Restriction of movement of the clavicle by passing a screw from the clavicle into the coracoid (Bosworth 1941) will restrict shoulder elevation, as now the crankshaft method of clavicular rotation is interfered with. That some sort of movement is occurring in this region is not in doubt. The fact that at least a bursa is normally found here lends support to this view. It would appear that there is a need for a joint in this region.

Whatever it may be that determines mutation in nature, it is possible that new conditions of use of the shoulder in the human, where the clavicles are more horizontally placed when compared with the other higher primates where they are more oblique, would call forth a change to occur here and instead of a bursa a better class of joint forms. In some, a Grade II joint results and this appears to be commoner (21·6%). In others a true diarthrodial joint is formed. For continuity the change must be imprinted in the germplasm and this would appear to be so from the present genetic study. Moreover from the literature and the present work it is obvious that the joint is found in all the various races: Caucasoid (Lewis 1959, and other reports), Mongoloid (Abe 1964 and the present author), Negroid (Frassetto 1921 and Wertheimer 1948) and Australoid (Ray 1959). It is therefore a truly hominid joint. Moreover in spite of Kohler's

TABLE V




● = Female with bilateral joints.
■ = Male with bilateral joints.
◪ = Male with unilateral joint.
○ = Female - No joint.
□ = Male - No joint.
(?) = Female but not available for study.
[?] = Male but not available for study.
(⊗) = Female : dead.
P = Proband or Propositus.

TABLE VI

CLINICAL STUDY

| | |
|---|---|
| FRACTURES NECK OF HUMERUS .. | 61 |
| JOINT SEEN IN .. .. .. | 1 |
| INCIDENCE .. .. .. | 1·6% |
| FRACTURES OF CLAVICLE .. .. | 172 |
| JOINT SEEN IN .. .. .. | 6 |
| INCIDENCE .. .. .. | 3·5% |
| DISLOCATIONS OF THE SHOULDER .. | 59 |
| JOINT SEEN IN .. .. .. | 2 |
| INCIDENCE .. .. .. | 3·4% |
| ACROMIO-CLAVICULAR AND STERNO-CLAVICULAR SUBLUXATIONS OF DISLOCATIONS .. .. .. | 22 |
| JOINT SEEN IN .. .. .. | 0 |
| PERIARTHRITIS AND RELATED LESIONS | 154 |
| JOINT SEEN IN .. .. .. | 7 |
| INCIDENCE .. .. .. | 4·5% |

belief (Kohler 1935) there is no account of this joint in any primate other than man (Napier 1966).

## SUMMARY

The present study shows that the coraco-clavicular joint should be recognised as a normal human joint that is present in a large number of people of all races. Its presence does not confer any overt advantage but neither does it give rise to any trouble. It is possibly an evolutionary joint that has arisen from the approximation of the clavicle to the coracoid and new conditions of use in man where complex movements are possible at the shoulder. The genetic basis for this joint has been elucidated and it is inherited in a simple mandelian fashion.

## ACKNOWLEDGEMENT

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## REFERENCES

1. Abe, K. (1964): "On the Coraco-clavicular joint and its incidence", Acta Anat. Nippon 39, 227.
2. Bosworth, B.M. (1941): "Acromio-clavicular separation: New method of repair", Surg. Gynae. & Obstet. 73, 866.

3. Frassetto, F. (1921): "Tre casi di articolazione coraco-clavicolare osservati radiograficamento sul vivente", Chir. Organi Moviment. 5, 116.
4. Gowland, W.P. (1915): "Preliminary note on a diarthrodial articulation between the clavicle and the coracoid", Journal of Anatomy 49, 187.
5. Gruber, W.L. (1861): "Die Oberschulterhaken-schleimbeutel (Bursae mucosae, supracoracoideae); Eine Monographie mit Vorbemerkungen enthaltend: Beitrage zur Anatomie der Regio infraclavicularis und deltoidea", Menn Acad. Imp. d. Sc. de St. Petersbourg (Sc.. Math., Phys., et Nat.), 7 Serie, Tome 3, No. 11.
6. Hall, F.J.S. (1950): "Coraco-clavicular joint. A rare condition treated successfully by operation", Brit. Med. Journal 1,766.
7. Inman, V.T., Saunders, J.B. de C.M. and Abbot, L.C. (1944): "Observations on the function of the shoulder girdle", Journal of Bone and Joint Surgery 26, 1.
8. Kohler A. (1935): "Rontgenology (2nd. ed. Eng. trans. by A. Turnbull)", London: Bailliere, Tindall and Cox.
9. Lane, W.A. (1886): "Some points in the physiology and pathology of the changes produced by pressure in the bony skeleton of the trunk and shoulder girdle", Guy's Hosp. Rep. 43, 321.
10. Lane, W.A., Poland, J. & Dunn, L.A. (1887): Abnormalities observed in the dissecting room of Guy's Hospital during the sessions 1885-86 and 1886-87", Guy's Hosp. Rep. 44, 399.
11. Lane, W.A. (1888): "The Anatomy and physiology of the shoemaker", J. Anat., London 22, 593.
12. Lewis, O.J. (1959): "The Coraco-clavicular joint", Journal of Anatomy 93, 296.
13. Napier, J.R. (1966): "Personal communication".
14. Ray, L.J. (1959): "Bilateral coraco-clavicular articulations in the Australian Aborigine", Journal of Bone and Joint Surgery, 41B, 180.
15. Wertheimer, L.G. (1948): "Coraco-clavicular joint; Surgical treatment of painful syndrome caused by anomalous joint", Journ. Bone and Joint Surgery, 36A, 570.