SUPRAGLENOIDAL PSEUDARTHROSIS

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The rarest dislocation of the shoulder is the supraglenoidal; Astley Cooper (1823) and Codman (1934) had never seen a case, but a few have been described (Malgaigne 1855, Holmes 1858, and others). Because of their rarity the present dissecting-room specimen is described.

Clinical history—The subject had worked as a farm labourer until his seventieth year. The remaining seventeen years of his life were spent in an institution, and during this time osteoarthritis had caused pain and weakness in the hips, knees, wrists and, less frequently, the elbows. Although he occasionally suffered pain in both shoulders there was no weakness or disability, and gross derangement was not suspected.

ANATOMICAL FINDINGS

As the conditions were virtually the same in both shoulder joints, the right joint is described in detail, with a note of any minor differences in the left.

The humerus was supported by well developed muscles, and its upper extremity occupied an abnormally high position relative to the scapula and acromio-clavicular arch, a feature also noted in radiographs of the cadaver (Fig. 1). The humerus was in contact with concave, polished, marble-like facets on the lower surfaces of hard plaques in the deltoid and with similar facets raised from the lower surfaces of the clavicle and acromial process of the scapula (Figs. 2, 4 and 5). A plaque about four centimetres in diameter was present in each deltoid; some smaller ones were confined to the right side; in the region of the plaques both deltoids were markedly fibrous. Histological examination revealed that the plaques were composed of bone with dense free surfaces. The head of the humerus presented a large convex area which was confluent medially with the roughened cartilage of the natural articular surface and which extended in lateral, anterior and posterior directions almost to the surgical neck. This area, which thus involved the anatomical neck and the greater and lesser tuberosities, was polished, pitted and bounded by irregular lipped margins. Above and medially it made contact with the facets on the deltoïd, clavicle and scapula (Figs. 2 and 3). The acromio-clavicular joint opened directly inferiorly into the pseudarthrosis. The scapula was of normal size and proportions except in the following two respects: firstly, the presence of the acromial facet described above; and secondly, the fact that the glenoid cavity was enlarged, particularly in its vertical diameter, the increase being due to upward extension of the cavity, as indicated by the considerable decrease in the normal distance between the upper margin of the cavity and the horizontal part of the coracoid process.
Figure 2—Lateral photograph of the dissected right shoulder.

Figure 3—Superior photograph of right shoulder after removal of deltoid and clavicle. Note bifurcation of supraspinatus tendon.

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The capsule of the pseudarthrosis was attached medially to the margin of the enlarged glenoid cavity, superiorly to the margins of the facets on the acromial process, clavicle and deltoid, and inferiorly around the surgical neck of the humerus (Fig. 2). The joint cavity was thus considerably larger than normal and the capsule extended medially into the spino-glenoid and coraco-glenoid notches of the scapula. No separate subdeltoid bursa was present. On the right side, the subscapular bursa formed an extension of the joint cavity that admitted the tip of the index finger; no subscapular bursa was present on the left side. Numerous fatty processes of the synovial membrane projected into the joint above and medially.

![Figure 4](image1) ![Figure 5](image2)

**Figure 4**—Inferior aspect of left clavicle showing facet at acromial end. **Figure 5**—Inferior aspect of one of the bony plaques in the left deltoid.

The muscles related to the joint showed anomalies in their attachments. The tendon of the long head of the biceps arose from the front of the humerus immediately distal to the articular surface. The infraspinatus and the teres minor were inserted into the back of the surgical neck of the humerus just beyond the false articular surface; small osseous nodules were present in the upper margin of the infraspinatus near its humeral insertion but, although they had free surfaces facing the joint cavity, they did not have facets and did not articulate with the humerus. The subscapularis was inserted into the front of the surgical neck and into the edge of the nodular articular surface that occupied the site of the lesser tuberosity. The supraspinatus was inserted by means of a bifid tendon (Fig. 3), one limb of which passed through the spino-glenoid notch of the scapula to become attached to the tendon of the infraspinatus, and the other through the coraco-glenoid notch to gain insertion into the tendon of the subscapularis.

Of the other joints, the knees, hips, wrists and elbows showed osteoarthritic changes in that order of severity. There was also calcification in the carpal flexor retinaculum and in the cruciate ligaments of the right knee.

**DISCUSSION**

The question arises whether the condition of the shoulder joints was a result of a congenital anomaly. In the clinical history there was no record of any severe injury to the shoulder joints; its absence, together with the bilateral nature of the lesion, is in favour of a congenital origin of the condition, although traumatic supraspinatus lesions are often bilateral. But against a congenital etiology are these facts. Observers who have described congenital lesions of the shoulder joint have not referred to any form of congenital supraglenoidal dislocation of the humerus (Smith 1839, Köster 1879, Scudder 1890, Cumston 1903, Peckham 1904, Roberts 1905, Openshaw 1908, Hitzrot 1912, Frosch 1925, Edwards 1928, Cozen 1937, Salaghi 1938, Flavell 1944, Andreasen 1948). Moreover, except for the acromial facets and the upward enlargement of the glenoid cavities, both of which were probably secondary results of supraglenoidal dislocation of the humeri, the scapulae were normal in their...
configuration; whereas in many congenital lesions there is bony disproportion, the glenoid cavities, for example, being often abnormally small and poorly developed.

In the normal shoulder the subdeltoid bursa to a large extent counteracts any tendency to trauma to which the superior part of the joint may be subject—particularly when, during abduction of the arm, the supraspinatus tendon is drawn under the coraco-acromial arch and when the humerus is pressed up against the accessory socket formed by that arch. The effects of trauma may be expected to be greatest in long-lived manual labourers, such as this man. Supraspinatus tendinitis has indeed been shown to be more common in such individuals (Codman 1934), and the importance of trauma in the pathogenesis of tendinitis has been supported by the studies of Wilson and Duff (1943) and Wilson (1948).

We suggest that repeated trauma was probably the cause of the dislocations and pseudarthroses in the present case; and further that the cases described by Smith (1834), Meyer (1921) and Skinner (1937) may have been produced in a similar way and represent various degrees of severity in an attritional process involving the supraspinatus tendon, the extremes of which are seen on the one hand in the early post-natal changes in the tendon described by Skinner, and on the other by the conditions in the present case.

The changes might be explained thus. The soft tissues below the acromial process were frayed and rubbed away (as in some of the cases reported by Meyer, 1921), and the proximal part of the long tendon of the biceps muscle was worn flat, frayed and attenuated, so that it finally disappeared; distal retraction of the muscle was prevented by secondary attachments to the front of the humerus, as in the cases reported by Meyer (1914). The upper part of the capsule of the shoulder joint, with which the supraspinatus was fused, became thinned and degenerated, as described by Meyer (1921) and by Skinner (1937) in their cases, and by Codman (1934) in cases of supraspinatus tendinitis. Later, normal use caused rupture of the attenuated supraspinatus, with little and probably soon forgotten pain, as in some of the cases of Fowler (1933), Codman (1934) and Armstrong (1947). The rupture probably occurred near the greater tuberosity of the humerus, where Meyer (1921) maintained that greatest wear of the capsule occurs. In the present case rupture of the supraspinatus became complete, so that the joint communicated with the subdeltoid bursa, the pull of the "cuff muscles" (subscapularis, supraspinatus, infraspinatus and teres minor) tending to enlarge and render crescent-shaped the gap in the manner suggested by Skinner (1937) and by McLaughlin (1944). A function of the normal supraspinatus is to prevent upward movement of the humeral head during abduction (Codman 1934, Watson-Jones 1938, Inman, Saunders and Abbott 1944). After the attrition and rupture of the supraspinatus, the deltoid pulled the humeral head upwards through the opening, so that it abutted against the acromial arch, which acted as a new fulcrum during abduction. Any tags of the supraspinatus left attached to the humerus laterally became gradually worn away and the margin of the opening became thickened to form the new falciform insertion of the "cuff muscles," as in the cases of supraspinatus lesions described by Wilson (1931) and Skinner (1937). By means of its new insertion, the supraspinatus held the humerus against the new fulcrum (Fig. 3), and the other "cuff muscles" were enabled to exert their couple action with the deltoid. Such a mechanism was described by Inman, Saunders and Abbott (1944). In its new elevated position the humerus pressed and rubbed against the acromio-clavicular arch and the deltoid, and induced the formation of the eburnated facets already described (cf. Smith 1834, Meyer 1921, Skinner 1937).

**SUMMARY**

Supragnlenoidal dislocation of the humerus is uncommon. The anatomical findings in a bilateral example in which efficient pseudarthrosis had developed are described, and the probable evolution of the lesion is discussed.

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