PATTERNS OF DEGENERATIVE CHANGE IN THE GLENOHUMERAL JOINT

J. G. EDELSON

From Poriya Hospital, Tiberias, Israel

Examination was made of 486 skeletons of subjects over the age of 60 years to study patterns of degenerative change in the glenohumeral joint. Three distinct types were found. Useful clinical implications are drawn from these distinctions.

Received 23 February 1994; Accepted after revision 23 May 1994

Examination of a large number of skeletal specimens showed three distinct forms of degenerative change in the glenohumeral joint. An appreciation of the distinctions between these three types may be helpful to the clinician and in the planning of surgery (Keyes 1935; Petersson 1983; Kerr et al 1985).

MATERIALS AND METHODS

Examination was made of the glenohumeral joint in 486 skeletons from subjects over the age of 60 years (61 to 100) from the Terry Collection of the Smithsonian Museum of Natural History, Washington. There were 96 specimens from white males, 171 from white females, 111 from black males, and 108 from black females. The Terry Collection was compiled during the early part of this century from individuals whose forbears had been born in America for four generations or more. The specimens are documented for age, gender, race, and cause of death.

RESULTS

Three major patterns of degenerative change were seen. Type I, the most common, was found in 144 skeletons (29.6%). At its extreme expression it showed a large bald head with a sclerotic, eburnated superior surface, rounding and dissolution of the greater tuberosity, a worn or obliterated superior portion of the bicipital groove, and relatively modest inferior osteophytes in a ring-like pattern around the lower two-thirds of the head (Figs 1a, 1b and 1c). These changes were bilateral in 112 specimens (78%) although often of varying degree on either side. Males predominated in a ratio of 3 to 2. There were no significant differences between the races.

In the type-I pattern the glenoid had a modest osteophytic formation circling the joint with sclerotic changes most prominent in the posterosuperior portion (Fig. 1d). Occasionally, specimens showed more bony proliferation, but even in these cases the glenoid was not greatly distorted.

The acromion was always involved in the type-I pattern. There was undersurface wear, cupping and capture of the head, and end-stage acromial thinning (Fig. 1d). Occasionally, these changes were accompanied by indentations in the head (Fig. 2a) underlying the tip of the acromion or changes near the lesser tuberosity adjacent to the coracoid (Fig. 2b), which appeared to develop as the head moved superiorly. There was no evidence of generalised head collapse.

The type-II pattern of degenerative change was less common (17 specimens, 3.5%), but was seen in a consistent and predictable fashion (Fig. 3a). The head showed prominent osteophytes forming a beard-like excrecence around its lower half most often on the inferior and anterior aspects (Fig. 3b) and sometimes overlapping the lesser tuberosity. The heavy beard of osteophyte around the head gave an illusion of head flattening when viewed from the front, but when seen from above (Fig. 3c) there was no flattening or true collapse of the head. The greater tuberosity, in contrast to that in the type-I pattern, was well maintained (Fig. 4). These changes were always bilateral (Fig. 5) but sometimes with significant differences in degree between the two sides.

In type II the glenoid was augmented by osteophytes principally around the lower half, but these changes were usually mild compared with those in the head. Sclerosis and wear pattern in advanced cases tended to localise on the posterosinferior aspect (Fig. 6), but there was no evidence of exaggerated posterior wear leading to obvious architectural deficiency. The acromion often showed thickening and enthaphathic 'hooks' (Fig. 7), but not to a degree unusual for this age group. As in the type-I pattern, type-II specimens showed no significant gender or racial characteristics.
Fig. 1c
Type-I pattern with bilateral rounding and sclerosis of the humeral heads (a,b), congruent capture of the right humeral head under a thinned acromion (c), and sclerosis of the posterosuperior glenoid (d, arrow).

Fig. 2a
Indentation in the humeral head underlying the acromial spur (a). Osteophytes near the lesser tuberosity appear to result from coracoid impingement as the head subluxes superiorly (b).
Typical bilateral picture of severe type-II pattern (a). 'Beard' osteophyte circles the lower head and overlaps the lesser tuberosity anteriorly (‘a’ in Fig. 3b). The head appears to be flattened on the anteroposterior view but when viewed from above (c) does not show collapse or true flattening.

Figure 4 – Comparison of humeral heads in severe expressions of type-I (right) and type-II patterns. In type II the greater tuberosity (arrow) is maintained and the osteophyte is more prominent. Figure 5 – The type-II pattern is usually bilaterally symmetrical, but the changes are not always equal on both sides.

Figure 6 – An extreme example of glenoid involvement in type II. There is predominantly posterosuperior glenoid wear. The anterosuperior subchondral surface is spared. Figure 7 – An acromial ‘hook’ is often seen in type II. Moderate inferior ring osteophytes of the glenoid are also present.
The third type (Figs 8 and 9), found in 23 specimens (4.7%), was different from the other two patterns in that it showed usually unilateral presentation (Figs 8a and 9a), true head flattening (Figs 8c and 9a) and extensive distortion of the glenoid (Figs 8d and 9b).

There were 13 male and 10 female specimens and 15 white and 8 black in this category.

DISCUSSION

The first pattern of degenerative change described is classically associated with rotator-cuff disorders. These must be distinguished from ‘rotator-cuff arthropathy’ (Neer, Craig and Fukuda 1983) which is unlike the picture shown here and may be a rare and poorly understood form of inflammatory disease (McCarty et al 1981) in which the rotator-cuff tear is a secondary phenomenon.

The second pattern of degeneration is usually associated with ‘primary’ osteoarthritis (Cofield 1990), which appears to be a relatively uncommon, bilateral process with well-described changes. Other joints in these skeletons often showed bilateral and unusually severe degrees of arthrosis. This consistent and reproducible picture may be that of a systemic disease, perhaps of an autoimmune or inflammat-
ory nature, rather than the random expression of wear-and-tear changes alone (Bollet 1969; Cooke 1986).

The third category is more confusing. There are elements which resemble primary osteoarthritis but the degree of flattening of the head, the severe involvement of the glenoid and a predisposition to unilateral involvement distinguish it as a separate type. The aetiology is uncertain but local trauma, avascular changes, low-grade infection, metabolic disorders and other precursors of ‘secondary osteoarthritis’ must be considered (Riordan and Dieppe 1989).

We did not see any examples of a classical rheumatoid shoulder (McNair et al 1969; Petersson 1986), perhaps because of the peculiarities of our particular population group. It may be that during the early part of this century patients with severe rheumatoid arthritis did not live over the age of 60 years.

Other patterns of major degenerative disease were occasionally seen which did not fit into our three categories. There were a few cases which appeared to be secondary to osteomyelitis and others which showed avascular necrosis of the head secondary to fracture, but these were isolated examples.

The three major patterns of degenerative change demonstrated here have clinical implications. The primary osteoarthritis would require a Neer-type arthroplasty. Sufficient bone stock is available on both sides of the joint, and the large osteophyte on the head can be removed to gain movement without compromise of the stability provided by an adequate rotator cuff. The glenoid is not grossly deformed and its replacement is relatively straightforward.

In the pattern characteristic of degeneration of the rotator cuff it would be logical to replace the large head with a prosthesis to avoid painful bone-on-bone contact (Pollock et al 1992; Arntz, Jackins and Matsen 1993). There should be minimum interference with the surrounding bony structures which provide stability in the absence of the cuff. In this pattern sufficient bone stock is available for relatively easy replacement of the glenoid, but the high riding head will eccentrically stress and compromise the stability of contemporary glenoid designs.

The third category of degenerative change poses most problems for the surgeon. True flattening of the head of the humerus will not always provide sufficient calcar support for a Neer-type prosthesis. The implant may need to be cemented proud or may require to have a more acute head-neck angle. Elaborate distortion of the anatomy of the glenoid may be a formidable challenge in seating and stabilising a prosthetic component. An appreciation of the bony patterns shown here, which can be confirmed by standard imaging techniques, will warn the surgeon of possible difficulties.

I sincerely appreciate the encouragement and support of Dr Joseph Zuckerman, Chief of Staff and of Orthopedic Surgery, the Hospital of Joint Diseases, New York City. I also thank Dr David R. Hunt of the Department of Anthropology, Smithsonian Institute, Washington and Jaymie L. Brauer, Department of Anthropology, American Museum of Natural History, New York, for their invaluable assistance in examining their museum collections, Frank Martucci for his superb photographic work and Hadas Sasson for her technical assistance.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


