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MINI SYMPOSIUM: ADULT ELBOW PROBLEMS

(v) Fractures of the adult elbow☆

O. Ennis*, D. Miller, C.P. Kelly

The Hand and Upper Limb Unit, Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry, Shropshire SY10 7AG, United Kingdom

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Summary
Fractures of the elbow comprise 5% of fractures. Most are minimally displaced and can be managed conservatively. Displaced fractures or those associated with elbow dislocation are likely to require operative intervention. Displaced distal humeral fractures present a particular clinical challenge. Elbow stiffness is the most common complication and can follow seemingly innocuous/minimally displaced fractures.
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Introduction

The management of fractures around the elbow can be challenging due to the complex anatomy and biomechanics of the joint. Consequent incongruity of the articular surface can lead to loss of range of movement and function. This article gives an overview of the management of such fractures, taking account of joint anatomy and biomechanics, their epidemiology and classification.

Clinical anatomy and biomechanics

The elbow is a hinge joint between the humerus proximally and the ulna distally, while a further articulation between the humerus and radius allows rotation of the forearm around the ulna around a single axis. The distal humerus is described as comprising lateral and medial columns separated by the trochlea lying in 4–8 degrees of valgus and 3–8 degrees of external rotation with respect to the longitudinal axis of the humerus. The distal articular surface is angulated anteriorly by 30 degrees in the lateral plane projecting further distally on its medial aspect (Fig. 1). Articular cartilage covers the trochlea for almost 300 degrees of its circumference, which is divided into medial and lateral portions by a groove running from anterolateral to posteromedial. This articulates with a ridge on the trochlea notch of the proximal ulna (Fig. 2). The two parts of the trochlea notch, the coronoid anteriorly and the olecranon posteriorly are, in most patients, separated by an area bare of articular cartilage, usually occupied by fatty tissue. Therefore undisplaced fractures through this area may have little effect on elbow function. Similarly, osteotomies can be undertaken through this area without damaging the articular surface.

The trochlear notch is angled approximately 1–6 degrees laterally and by about 30 degrees posteriorly to the ulna shaft. The latter confers stability on the elbow joint by matching the anterior orientation of the distal humerus,

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* Corresponding author. 1 Tilley Terrace, Mill Street, Wem, Salop SY4 5EZ, UK.
E-mail addresses: oennis@doctors.org.uk (O. Ennis), dvmill@aol.com (D. Miller), jackie.ball@rjah.nhs.uk (C.P. Kelly).

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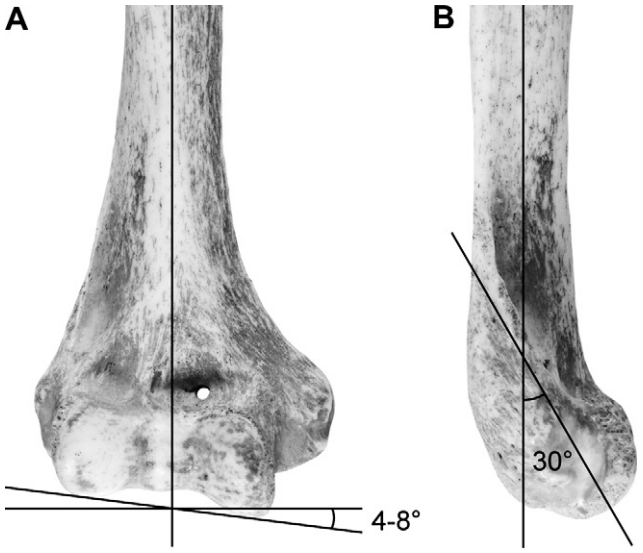

Figure 1 The normal anatomical alignment of the distal humerus.

giving maximum stability in full extension when the coronoid forms a large buttress due to its angulation.

The capitellum is hemispherical and articulates with the concavity of the radial head which is covered with articular cartilage. Additionally about 240 degrees of the outer circumference of the radial head is covered with articular cartilage, where it articulates with the ulna forming the proximal radio-ulnar joint. The remaining antero-lateral 1/3rd of the outer circumference is an area prone to fracture because it lacks subchondral bone. However, being bare of articular cartilage makes it suitable for the application of a plate. The radial neck is narrower than the head and both are at an angle of approximately 15 degrees to the longitudinal axis of the radial shaft (Fig. 3). While the radial head shares the axial load forces across the elbow joint, it also reduces forces acting on the medial collateral ligament during valgus loading. It also prevents proximal migration of the radius in relation to the ulna.

The valgus carrying angle of the elbow in extension is due to the distal articular surface projecting further distally on its medial aspect, the groove in the distal articular surface running anterolaterally to posteromedially

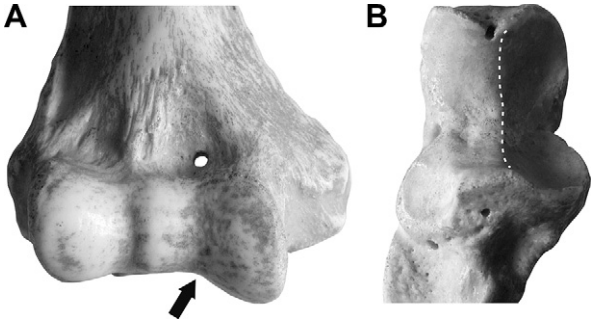

Figure 2 The ridge on the trochlea notch of the ulna and the groove it articulates with on the trochlea of the distal humerus.

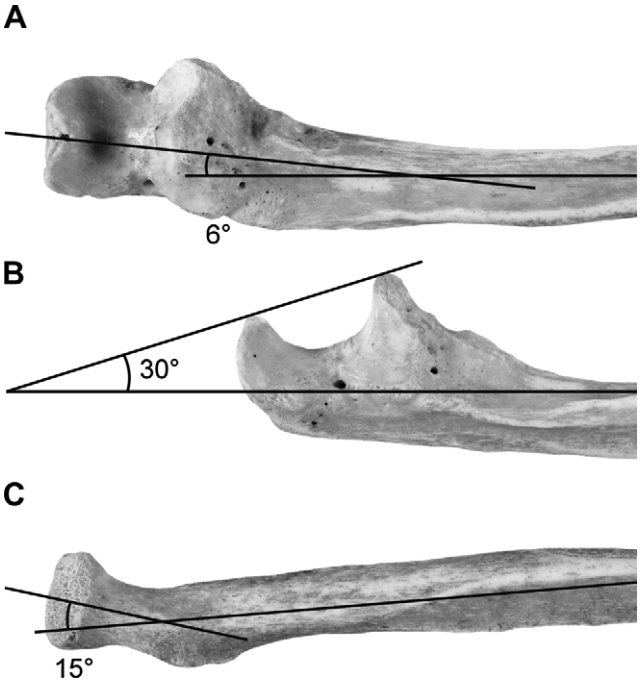

Figure 3 The normal anatomical alignment of the proximal ulna and radius.

and the trochlear notch being angulated approximately 1—6 degrees laterally to the ulnar shaft (Fig. 4). The angle can be lost in fracture malunion, particularly seen in paediatric supracondylar fractures, necessitating corrective osteotomy.

The two epicondyles and the tip of the olecranon lie in a straight line in extension and a roughly equilateral triangle in 90 degrees of flexion. This latter can be useful in the clinical assessment of elbow fractures or dislocations (Fig. 5). The medial epicondyle is the more prominent and is part of the origin of the flexor/pronator group, whereas the lateral epicondyle is that of the extensor and supinator group.

Stability of the elbow

The epicondyles are also the origin of the collateral ligaments, which, with the bony articulation of distal humerus and trochlea notch, are the main static stabilisers of the elbow. Dynamic stabilisers include the muscles and tendons crossing the joint, i.e. brachialis and the flexor pronator group, and to a lesser extent triceps and the extensor supinator group.

The collaterals are important in bony injury. The medial collateral ligament comprises an anterior, posterior and oblique portion. The anterior band is the most important and attaches to the anterolateral margin of the coronoid — the sublime tubercle. Also attaching to the coronoid is the anterior capsule and brachialis. The parts of the lateral collateral ligament (LCL) are less well defined. They include the radial LCL which blends with the annular ligament which is the main stabiliser of the radial head. The ulnar LCL also blends with the annular ligament, but has

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