Fractures involving splitting of the humeral head

T. J. S. Chesser, I. J. Langdon, C. Ogilvie, P. P. Sarangi, A. M. Clarke

From Bristol Royal Infirmary, Southmead Hospital, Bristol and Musgrove Park Hospital, Somerset, England

Splitting fractures of the humeral head are rare; part of the humeral head dislocates and the unfractured part remains attached to the shaft. We report eight cases in young patients. In five the diagnosis was made at presentation: three had minimal internal fixation using a superior subacromial approach, one had a closed reduction and one a primary prosthetic replacement. All five patients regained excellent function with no avascular necrosis at two years. In three the injury was initially unrecognised; two developed a painless bony ankylosis and one is awaiting hemiarthroplasty.

It is important to obtain the three trauma radiographic views to diagnose these unusual fractures reliably. CT delineates the configuration of the fracture. In young patients open reduction and internal fixation seems preferable to replacement of the humeral head, since we have shown that the head is potentially viable.

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Fractures which split the humeral head are extremely rare, and are usually caused by a direct fall on to the shoulder with impaction of the head against the glenoid. They are often associated with dislocation or subluxation of the glenohumeral joint and with fractures of the proximal humerus. We report our experience in eight patients and comment on the treatment and outcomes.

T. J. S. Chesser, FRCS (Tr & Orth), Specialist Registrar in Orthopaedic Surgery

P. P. Sarangi, MD, Consultant Orthopaedic Surgeon
Bristol Royal Infirmary, Marlborough Street, Bristol BS2 8HW, UK.

I. J. Langdon, FRCS (Tr & Orth), Specialist Registrar in Orthopaedic Surgery
Avon Orthopaedic Centre, Southmead Hospital, Westbury-on-Trym, Bristol BS10 5NB, UK.

C. Ogilvie, MD, Consultant Orthopaedic Surgeon

A. M. Clarke, FRCS(Orth), Consultant Orthopaedic Surgeon
Taunton and Somerset Hospital, Musgrove Park, Taunton, Somerset TA1 5DA, UK.

Correspondence should be sent to Miss I. J. Langdon.

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Patients and Methods

Details of eight cases of splitting fractures of the humeral head are given in Table I. Seven were caused by direct falls on to the shoulder, of which two occurred during witnessed epileptic seizures. One fracture was sustained in a road-traffic accident with an unknown mechanism of injury. In all cases, the posterior part of the head had subluxed out of the joint; only one was associated with a fracture of the proximal humerus. The fractures, initially recognised on plain radiographs, showed a double shadow on the anteroposterior (AP) view (Fig. 1); however, this was seen retrospectively after axillary and lateral views had been performed (Fig. 2). Three cases were initially unrecognised; one patient presented three months after injury, and for two patients only AP and oblique views had been taken. CT was helpful in delineating the pattern of the fracture and in planning the surgical reduction and fixation (Fig. 3).

The fractures were reduced through a superior subacromial approach¹ which gave an excellent view of the fracture, allowing anatomical reduction without disruption to the blood supply. Stable reduction was maintained with one or two screws (Fig. 4). The affected arm was immobilised in a sling for three weeks and then movement commenced under the supervision of a physiotherapist.

Fig. 1

Radiograph showing the double shadow of a splitting fracture.

Table I. Details of the eight patients, mechanisms of injury, treatment and results

Case	Age (yr)	Gender	Mechanism of injury	Radiological findings	Treatment	Follow-up (yr)	Result
1	21	M	Cyclist hit by car, fall on shoulder	Humeral head split, fracture subluxation	Open reduction and minimal internal fixation through a superior subacromial approach	3	Painfree, full range of movement, Constant score 100
2	41	F	Fell off horse on to shoulder	Humeral head split, fracture with spiral, proximal humeral fracture	Open reduction and minimal internal fixation through a superior subacromial approach	2	Painfree, full range of movement, Constant score 76
3	40	M	Motorcycle accident, fall on shoulder	Humeral head split, fracture subluxation	Neglected, presented at three months with stiffness; radiographs showed ankylosis	5	Working as a farmer Constant score 41
4	19	M	Road-traffic accident passenger	Humeral head split, fracture subluxation	Open reduction and minimal internal fixation through a superior subacromial approach	5	Full range of movement but continued shoulder pain. Arthroscopy shows posterior instability. Awaiting posterior stabilisation. Constant score 89
5	23	M	Cyclist hit by car, fall onto shoulder	Humeral head split, fracture subluxation	Initially missed. Bony ankylosis at 2 months	2	Painfree bony ankylosis Constant score 34
6	55	M	Epileptic seizure	Humeral head split, fracture subluxation	Primary hemiarthroplasty	4	Painfree, full range of movement Constant score 86
7	56	F	Fall onto shoulder	Humeral head split, fracture subluxation	Initially unrecognised. Painful. Awaiting hemiarthroplasty	1.5	Awaiting hemiarthroplasty with stiff and painful joint Constant score 31
8	54	M	Epileptic seizure	Humeral head split, fracture subluxation	Closed reduction under general anaesthesia	2	Painfree, full range of movement Constant score 89

Fig. 2a

Fig. 2b

Lateral a) and axillary b) radiographs showing a splitting fracture of the humeral head.

Two patients presented with a bony ankylosis which was painfree (Fig. 5) with a good functional range of scapulothoracic movement; no treatment was required. One patient, whose diagnosis was delayed, has continuing pain and is awaiting hemiarthroplasty.

Results

All fractures treated by open reduction and internal fixation united within eight weeks, without significant complications. One screw was removed at six months because of local irritation. At the last follow-up (minimum two years), no patient had developed avascular necrosis of the humeral

head. One patient had a primary hemiarthroplasty with an excellent result. Table I gives the Constant and Murley² scores for all patients.

Discussion

Splitting fractures of the humeral head are rare and usually occur in younger patients. A segment of the humeral head is fractured and subluxes or dislocates, while the articular surface of the unfractured part of the humeral head remains attached to the shaft. There are only a few case reports³ in the literature. These fractures can be difficult to diagnose⁴ by plain radiography. Three trauma radiographic views are

Fig. 3

CT image of a splitting fracture of the humeral head.

recommended for all injuries with potential fracture or dislocation of the proximal humerus.⁵ AP perpendicular to the plane of the scapula; lateral, in the plane of the scapula; and axillary. In the three patients who did not have the three views, the nature of the injury was initially unrecognised. The 'trough line' has been reported to be a radiographic sign of posterior dislocation with an impaction fracture.⁶ This is seen as two parallel lines of cortical bone, representing the medial cortex of the humeral head and the margin of the impaction fracture. On careful inspection of the AP radiographs, a double shadow of the humeral head can be seen; nevertheless, it is felt that three trauma radiographs are required for reliable diagnosis. CT is valuable for delineating the configuration of the fracture and helping to plan surgical reconstruction. It also demonstrates fractures not clearly seen on plain radiographs.⁷

Fractures which split the head were not included in the initial classification of shoulder fractures by Neer⁸ or the AO group,⁹ probably due to their rarity, but were added as

Fig. 4a

Fig. 4b

AP (a) and axillary (b) radiographs after minimal internal fixation.

Fig. 5a

Fig. 5b

AP (a) and axillary (b) radiographs showing bony ankylosis three months after an unrecognised splitting fracture of the humeral head.

a separate subgroup in 1990.¹⁰ Randelli¹¹ classified four types of posterior and fracture dislocation of the shoulder, and his type-III fracture is described as a posterior fracture dislocation with two fragments, which corresponds to the splitting fracture of the humeral head that we have described. These fractures are often grouped with articular impression fractures but have a different aetiology. They result from a linear force applied through the humeral head from the rim of the glenoid, while impression fractures are usually formed from a large reverse Hill-Sachs lesion suffered during a posterior dislocation.

There is little advice about the treatment of splitting fractures of the humeral head. In cases in which a defect of more than 45% of the articular surface is seen on the axillary view, hemiarthroplasty by replacement of the humeral head was advised to allow immediate mobilisation without instability,¹² although the description is of impression fractures rather than head-splitting fractures. Some authors have recommended replacement of the humeral head for these fractures, because of the potential risk of avascular necrosis, damage to articular cartilage and secondary joint degeneration.¹³ A recent analysis,¹⁴ however, of hemiarthroplasty for fractures of the proximal humerus in patients under 50 years of age showed many unsatisfactory results, and alternative treatment was advised when possible.

Our eight reported cases illustrate the importance of making an early diagnosis using the three trauma radiographs. With a stable closed reduction, confirmed by CT, a good functional result was achieved after early mobilisation. If closed reduction was not possible, a superior approach with splitting of the rotator cuff was found to give a good view of the injury, and allowed reduction and stable internal fixation with screws, without disruption of the blood supply. This also allowed early mobilisation and good functional results, with no subsequent avascular necrosis.

Good functional results can be achieved with closed reduction, or open reduction and minimal internal fixation.

Secondary hemiarthroplasty as an option, should avascular necrosis occur, is made technically easier after an initial anatomical reconstruction, because the joint surfaces are normally aligned.

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