The translated two-part fracture of the proximal humerus

EPIDEMIOLOGY AND OUTCOME IN THE OLDER PATIENT

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We have undertaken a five-year prospective study of 126 translated two-part fractures of the proximal humerus and present an analysis of the epidemiology and of the factors which affect outcome in elderly patients.

The fracture has a unimodal age distribution and rarely affects adults under the age of 50 years. Analysis showed that patients with two-part translated fractures of the surgical neck tended to be independent and relatively fit, despite the fact that their mean age was 72 years. Outcome was determined by the age of each patient and the degree of translation on the initial anteroposterior radiograph. Surgery did not improve the outcome, regardless of the degree of translation.

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Translocated two-part fractures of the surgical neck account for 12.7% of all fractures of the proximal humerus. Their age-specific incidence is rising. In the Neer classification this injury represents a variant of the two-part fracture of the surgical neck (group III), whereas in the AO classification it is classified as the 1.1-A3.2 fracture (Fig. 1).

Treatment is usually based on a number of considerations of which the age of the patient and the degree of translation of the fracture are the most important. Many surgeons believe that failure to reduce the fracture will compromise the functional outcome and may result in nonunion. The usefulness of operative treatment for proximal humeral fractures in the elderly has been questioned since the results of the conservative management of Neer three- and four-part fractures are equivalent to those obtained after surgery. We have undertaken a prospective study to ascertain which factors determine the prognosis in the elderly patient presenting with this fracture.

Patients and Methods

Between June 1992 and May 1996, we studied prospectively 131 consecutive translated two-part fractures of the proximal humerus (Fig. 1). Our unit treats all fractures from a population of 700 000. The fractures were classified using the Neer and AO systems by one experienced orthopaedic trauma surgeon (CC-B) in order to avoid interobserver error. We are aware of the criticisms levelled at all classifications and, in particular, the Neer classification, but consider that the diagnosis of the two-part translated fracture of the surgical neck is straightforward and that the incidence of intraobserver error is low in both the Neer and AO classifications. We excluded five patients with Salter Harris II physeal fractures, since these differ from adult metaphyseal fractures, leaving 126 injuries for the study.

The choice between operation and conservative management for each fracture was determined by the admitting consultants, all experienced orthopaedic trauma surgeons. Later management was the same for all cases. The arm was immobilised in a sling for two weeks followed by a course of standard physiotherapy based on the Neer regime. Follow-up was undertaken by two orthopaedic trauma surgeons (CC-B and MMcQ) and the outcome was assessed by an independent research physiotherapist who was not involved in the treatment of the patients. They were reviewed at 6, 12, 26 and 52 weeks, and the outcome measured using Neer's criteria and assessment of flexion and abduction strength by a spring-balance technique. Since handedness does not affect shoulder function, abduction and flexion strength were expressed as a percentage of the normal side. Standardised AP and modified axial radiographs were taken at each review and examined to assess the degree of translation and posterior angulation. Union was defined as complete when there was trabeculation across the fracture or, in those which were displaced, when the lateral bone bridge was complete (Fig. 2). Anteroposterior (AP) translation was calculated as a percentage of the diameter of the surgical neck of the proximal humerus.
proximal humerus. Posterior angulation was compared with the normal value of 7° for the local population, having been previously measured in a control group of normal subjects. The ability to undertake a number of essential activities before injury, such as shopping, dressing, personal hygiene and housework, was assessed, as was the number of patients who were able to return to these activities after treatment.

Information at follow-up was available for 108 patients; 14 (11.1%) died from unrelated causes and four were lost to follow-up. The association between outcome and prognostic factors was tested using Pearson’s correlation, and the effect of treatment on outcome by two-sample $t$-tests. Multiple linear regression was used to test whether factors significantly affected outcome after adjusting for one another.

There were 96 women and 30 men with a mean age of 72 years. The mean age of the women was 73 years and of the men 69 years. The age and gender-specific incidences of the translated two-part fracture of the surgical neck are shown in Figure 3 revealing a unimodal distribution in adults. There is an increasing age-specific incidence in both men and women with the highest level in women over the age of 80 years. The fracture is extremely rare in patients under the age of 40, with 67.4% of the patients being at least 70 years of age. In 114 patients (90.5%) the fracture had been caused by a simple fall, in four (3.2%) by a fall from a height, in five (4%) by a road-traffic accident and in two (1.6%) by a direct blow. The remaining patient was injured playing sport.

The fracture was the only injury in 111 patients; 15

**Fig. 1a**
Anteroposterior (a) and modified axial (b) radiographs showing a translated fracture of the surgical neck in a 52-year-old woman. Treatment was conservative and the final Neer score was 92.

**Fig. 2a**
Pre- (a) and postoperative (b) radiographs showing a completely displaced A3.2 fracture in an 81-year-old man. Union was achieved through a lateral bridge of bone and the Neer score at one year was 88.
(11.9%) had other injuries which included a fracture of the proximal femur in five, of the ipsilateral distal radius in two and of the olecranon in two. Five patients presented with a coexisting fracture of the pubic ramus, mandible, fibula, distal humerus or scapula.

**Results**

Before sustaining their fracture, 109 (86.5%) patients lived at home and only 27 (21.4%) required help with their household activities. Table I gives an analysis of the functional status of the patients before injury. Assessment of the initial radiographs indicated that 51.5% of patients had at least 67% displacement on the initial AP radiograph and that most presented with increased posterior angulation.

Outcome was assessed in the 97 patients who were at least 50 years of age. Figure 3 shows that very few patients younger than 50 years will present with a translated two-part fracture; there were only 11 in our study. The fractures united in all of these patients and all had a high Neer score at one year (Fig. 4). Decisions regarding treatment were therefore usually made in older patients and it is on these that we have focused.

Table II shows the overall Neer score at 6, 13, 26 and 52 weeks together with the component scores for pain, function and range of movement. The radiological score as assessed by the surgeon has been omitted, but was included in the overall Neer score. There was progressive improve-
The results, Neer score and ability to return to activities of daily living, according to the age of the patients, the percentage AP translation and treatment

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number of patients</th>
<th>AP translation (%)</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>50 to 59</td>
<td>6</td>
<td>38</td>
<td>18</td>
</tr>
<tr>
<td>60 to 69</td>
<td>15</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>70 to 79</td>
<td>29</td>
<td>37</td>
<td>73</td>
</tr>
<tr>
<td>80 to 99</td>
<td>25</td>
<td>12</td>
<td>78</td>
</tr>
<tr>
<td>0 to 100</td>
<td>38</td>
<td>12</td>
<td>73</td>
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<tr>
<td>&gt;100</td>
<td>18</td>
<td>31</td>
<td>78</td>
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The correlation between the degree of initial translation or angulation and the final outcome was also tested. There was none between angulation and outcome, but there was a significant association between translation and outcome at one year \( (r = -0.36, p < 0.01) \). This was confirmed by examining the Neer scores shown in Table III. There was no correlation between translation or angulation and the ability to return to daily activities.

The effect of surgery was examined by comparing the results of operative and conservative management in those patients who presented with at least 66% translation on the initial AP radiograph; these are the patients in whom many surgeons would consider operation. Preoperative assessment showed that the two groups were very similar in terms of age (Table III) and their ability to undertake routine daily activities. The results at one year were very similar, and statistical analysis showed no difference between the Neer scores; the 95% confidence interval (CI) for the difference was -9.2 to +14.2. The ability to return to normal daily activities after union of the fracture was similar in both groups. There were five cases of nonunion in the 108 patients for whom results were available, an incidence of 4.6%. The mean age of the nonunion group was 84 years (75 to 90); three patients with nonunion showed an initial translation of 67% to 100%, one had less than 33% translation and the remaining patient showed translation between 34% and 66% on
the initial AP radiograph. Four of these patients had been treated conservatively and one by operation, which is almost identical to the overall ratio of conservative to operatively managed patients in the series.

Discussion

Most studies of fractures of the surgical neck have concentrated on the treatment of Neer three- and four-part injuries, despite their relative rarity. Those studies which have investigated two-part fractures have invariably combined the results with those of more comminuted lesions. As a result little is known about the translated fracture of the surgical neck and there are no guidelines as to how they should be treated. Most authors have suggested that conservative management is preferable in minimally displaced fractures, but that operation is required for irreducible fractures or those with significant displacement. ‘Significant displacement’, however, has never been defined.

Figure 3 shows that the translated two-part fracture of the surgical neck does not have the classical bimodal age distribution associated with most fractures. The distribution is unimodal with most patients being over 70 years of age. Fractures in young adults are rare; only four (3.2%) occurred in patients under 40 years of age and all of these were due to high-energy injuries in road-traffic accidents. It is not appropriate to compare injuries seen in young patients with the much commoner low-energy injuries encountered in the elderly population.

Our study reveals that most of our patients were independent and relatively fit before the fracture, but subsequently the elderly lost considerable shoulder function, which handicapped their routine daily activities (Tables I, II and IV). The clear implication is that a number of previously independent elderly patients will require domestic assistance and some will not be able to return home.

The age of the patient and the degree of translation on the initial AP radiograph are the main determinants of outcome. In all age groups, the subjective components of the Neer scoring system (strength, reaching and stability) showed better results than suggested by the objective measurement of shoulder function and power. This indicates that this scoring system overestimates patient satisfaction and reinforces the work of Constant who demonstrated deterioration of normal shoulder function with age.13

Translation is difficult to measure accurately, even on standardised radiographs, and we therefore assessed it in broad groups. There seems little doubt that the degree of initial translation is important, but reduction and fixation of the fracture do not improve the result. Our study was observational and the comparison between operatively and conservatively managed patients was not randomised. Table III shows the results for those with major displacement (>66%), and statistically there was no difference in the results between the two groups. We further analysed the 12 patients who presented with more than 100% displacement (Fig. 2). The four treated operatively and the eight treated conservatively had similar functional characteristics before injury, and there was no difference in the final outcome between the groups. Figure 2 indicates that completely displaced two-part fractures of the surgical neck will unite with a lateral bone bridge.

Nonunion may be related to the age of the patient. The mean age of the nonunion group was 85 years, but the numbers were insufficient for significance. It is certainly conceivable that some of the 14 elderly patients who died before adequate follow-up might have developed a nonunion. It would, however, be unreasonable to institute a regime of operative management for all translated two-part fractures of the surgical neck based on the fact that 5% of the patients will develop nonunion.

Our data have allowed us to construct graphs to predict the outcome of translated two-part fractures of the surgical neck given the age of the patient and the degree of translation on the initial anteroposterior radiograph. For completion we have included the results of younger patients in these graphs. They are easy to use and are shown in Figure 4. It can be seen that a patient of 80 years with an initial translation of more than 100% will have an average Neer score of about 65 at one year compared with about 95 for a 50-year-old patient with an initial translation of less than 33%.

Operation in this group of elderly patients is extremely difficult and analysis of the 18 patients treated surgically showed that in seven there had been incomplete reduction, further impaction of the fracture and cut-out of the implants, despite the treatment being undertaken by experienced orthopaedic trauma consultants. All but one of the patients had flexible intramedullary nailing and tension-band wiring.18,19 The results of surgery may improve in future with the introduction of better techniques and the use of bone-strengthening agents, but currently we do not advocate the use of internal fixation to treat two-part fractures of the surgical neck of the proximal humerus regardless of the degree of initial displacement.

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References


