Fractures of the clavicle in the adult

Epidemiology and Classification

C. M. Robinson
From the Royal Infirmary of Edinburgh, Scotland

From 1988 to 1994 a consecutive series of 1000 fractures of the adult clavicle was treated in the Orthopaedic Trauma Clinic of the Royal Infirmary of Edinburgh. In males, the annual incidence was highest under 20 years of age, decreasing in each subsequent cohort until the seventh decade. In females, the incidence was more constant, but relatively frequent in teenagers and the elderly. In young patients, fractures usually resulted from road-traffic accidents or sport and most were diaphyseal. Fractures in the outer fifth were produced by simple domestic falls and were more common in the elderly.

A new classification was developed based on radiological review of the anatomical site and the extent of displacement, comminution and articular extension. There were satisfactory levels of inter- and intraobserver variation for reliability and reproducibility. Fractures of the medial fifth (type 1), undisplaced diaphyseal fractures (type 2A) and fractures of the outer fifth (type 3A) usually had a benign prognosis. The incidence of complications of union was higher in displaced diaphyseal (type 2B) and displaced outer-fifth (type 3B) fractures. In addition to displacement, the extent of comminution in type-2B fractures was a risk factor for delayed and nonunion.

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Most fractures of the clavicle have a good prognosis; patients have few or no residual symptoms once the fracture has healed.1,2 and the overall incidence of nonunion is less than 1%.3,4

Previous epidemiological studies have shown that such injuries occur mostly in young men5 and comprise 5% to 10% of all fractures.6,7 Little has been reported about their natural history and prognosis.

The two main classifications are that of Allman8 for anatomical site and of Neer9 for lateral third fractures. There is no single classification which allows an accurate description of displacement, instability and comminution, in relation to the outcome and prognosis. The aim of this study was to evaluate the epidemiology of a consecutive series of fractures to produce a more detailed descriptive classification.

Patients and Methods

From 1988 to 1994 the medical records and radiographs of 1000 consecutive adult patients treated for isolated fractures of the clavicle in the Orthopaedic Trauma Unit of the Royal Infirmary of Edinburgh were reviewed. The unit had an estimated mean catchment population over 13 years of age for this period of 556 469. Patients under 13 years and those with ligamentous injuries or dislocations without fracture were excluded as were those with double disruptions of the shoulder involving a clavicular fracture, since these were initially managed by surgical stabilisation.

All patients were seen within 72 hours of injury and details of their age, gender, mechanism of injury and other injuries were recorded. The cause of the fracture was grouped as a simple fall on the same level, a fall from a height, sport, road-traffic accident (RTA), a direct frontal blow or others.

All patients were reviewed after six to eight weeks, with further radiographs. Follow-up continued until there was evidence of clinical and radiological union. The mean follow-up was 15.7 weeks (5 to 145). Delayed union was defined as healing between 12 weeks and 24 weeks and nonunion when healing had not occurred by 24 weeks. Potential risk factors for delayed or nonunion, including age, gender, mechanism of injury and type of fracture were analysed using statistical analysis by constructing 2 × 2 or 2 × k tables to calculate the odds ratios (OR) and 95% confidence intervals.

For all fractures the anatomical site, configuration and type and extent of comminution were recorded. A classification was developed from these data and assessed by using 20 randomly selected series of radiographs. These
Diagrams of type-1 (a), type-2 (b) and type-3 (c) clavicular fractures.
were independently classified by five orthopaedic specialist registrars on two occasions, separated by a two-week interval. Interobserver reliability and intraobserver reproducibility were determined by calculating adjusted kappa coefficients. The Landis and Koch guidelines\textsuperscript{10} for interpretation of the kappa coefficients were used: a value of 1.00 indicated perfect agreement; 0.81 to 0.99, excellent; 0.61 to 0.80, substantial; 0.41 to 0.60, moderate; 0.21 to 0.40, fair; 0.00 to 0.20, slight; and less than 0.00, poor.

Results

Classification of fractures. Three different areas of fracture were identified: the diaphysis and the medial and lateral ends (Fig. 1). Type 1 was the fifth of the bone lying medial to a vertical line drawn upwards from the centre of the first rib. Type 3 was the fifth of the bone lateral to a vertical line drawn upwards from the centre of the base of the coracoid process, a point normally marked by the conoid tuberosity. Type 2 was the intermediate three-fifths of the diaphysis (Fig. 1).

Fractures were also divided into subgroups A and B

Fig. 2a

30° caudal-tilted radiographs showing displacement in type-2B2 (a) and type-3B1 (b) fractures.

Fig. 2b

Fig. 3

Modified axial view showing displacement in a type-3B1 fracture.
depending on displacement (greater or less than 100% translation) of the major fragments. This is often difficult because of the sigmoid shape of the clavicle, particularly at the ends of the bone, but weight-bearing, oblique, caudad-tilted (Fig. 2) or modified axial views (Fig. 3) were used in cases in which uncertainty existed.

Type-1A and type-1B fractures were further subdivided into extra- or intra-articular (Fig. 1). Type-2A fractures were subdivided according to the presence of angulation, but in all these injuries there was residual bony contact. In the type-2B subgroup there was no residual contact between the major fragments and variable degrees of shortening which was usually apparent both clinically and radiologically. Two further subgroups of type-2B were simple or wedge comminuted fractures (type 2B1) and isolated segmental or segmentally comminuted fractures (type 2B2). Type-3A and type-3B fractures were also subdivided according to articular involvement (Fig. 1). Displacement in type-3B injuries showed a characteristic pattern of elevation and posterior displacement of the shaft fragment, with either a simple oblique configuration or with avulsion of an inferior bone fragment (Fig. 4).

**Validation.** For the first and second viewings the average interobserver kappa coefficients for the classification were 0.74 (0.55 to 0.82) and 0.80 (0.70 to 0.94) giving an overall mean of 0.77 indicating substantial reliability. The average individual intraobserver kappa coefficient was 0.84 (0.69 to 0.88) indicating excellent reproducibility.

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Number</th>
<th>Mean age in yr (range)</th>
<th>Male</th>
<th>Female</th>
<th>M:F ratio*</th>
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<tbody>
<tr>
<td>Simple fall</td>
<td>309</td>
<td>46.3 (13 to 96)</td>
<td>186</td>
<td>123</td>
<td>1.5:1</td>
</tr>
<tr>
<td>Fall from a height</td>
<td>108</td>
<td>34.5 (13 to 94)</td>
<td>68</td>
<td>40</td>
<td>1.7:1</td>
</tr>
<tr>
<td>Sport</td>
<td>234</td>
<td>21.2 (13 to 74)</td>
<td>204</td>
<td>30</td>
<td>6.8:1</td>
</tr>
<tr>
<td>RTA</td>
<td>272</td>
<td>30.1 (13 to 85)</td>
<td>208</td>
<td>64</td>
<td>3.3:1</td>
</tr>
<tr>
<td>Direct violence</td>
<td>46</td>
<td>31.9 (13 to 83)</td>
<td>36</td>
<td>10</td>
<td>3.6:1</td>
</tr>
<tr>
<td>Other</td>
<td>31</td>
<td>30.9 (13 to 85)</td>
<td>18</td>
<td>13</td>
<td>1.4:1</td>
</tr>
<tr>
<td>Total</td>
<td>1000</td>
<td>33.6 (13 to 96)</td>
<td>720</td>
<td>280</td>
<td>2.6:1</td>
</tr>
</tbody>
</table>

* male-to-female ratio

Table I. Mechanism of injury in the 1000 fractures of the above

Radiographs of two-part (a) and three-part (b) type-3B fractures.
Epidemiology. The estimated incidence of new fractures in adults over the age of 13 years was 29.14 per 100 000 population per year, over the review period of six years two months. The mean age of the fracture population was 33.6 years (13 to 96), the male-to-female ratio was 2.6:1 (Table I) and the ratio of left- to right-sided fractures was 1.28:1.

Fractures were most common in males aged from 13 to 20 years with a subsequent fall in incidence with age until the seventh decade (Fig. 5). In females, the incidence remained more constant with age, with smaller peaks under 20 years and over 80 years of age (Fig. 5). The mean age for fracture in men and women was 29.2 and 45 years, respectively.

Sport was the commonest cause of fracture in the young, the mean age for this cause being 21.2 years (13 to 74). Fractures due to simple falls had a mean age of 46.3 years (13 to 96). The other causes had intermediate mean ages (Table I).

Fractures due to sport, a direct blow or an RTA were seen predominantly in males (male-to-female (M:F) ratios of 6.8:1, 3.6:1 and 3.3:1, respectively); in females larger proportions were due to a simple fall or a fall from a height (M:F ratio 1.5:1 and 1.7:1, respectively). Rugby and soccer injuries accounted for 39% and 33% of all sports injuries, respectively. Of the fractures caused by RTAs 39% were in cyclists, 26% in car drivers or passengers, 17% in pedestrians and 17% in motorcyclists.

Inpatient care was required for 142 (14.2%) patients, usually for social reasons, treatment of other injuries, or surgery for complications. Of the 142 patients, 96 had other injuries: 75 had other orthopaedic injuries, 29 had head or facial injuries, 27 had serious chest injuries and four had abdominal injuries.

Type-1 fractures were uncommon, at 2.8% of the fracture population (Table II); most were undisplaced and extra-articular (type 1A1). Type-2 injuries were the most common (69.2%) and most were displaced (type 2B); the most

### Table II. Details of the fracture subgroups

<table>
<thead>
<tr>
<th>Fracture subtypes</th>
<th>Number of fractures (% of popn)</th>
<th>Incidence (/100 000 popn/year)</th>
<th>Mean age (yr; range)</th>
<th>Male</th>
<th>Female</th>
<th>M:F ratio*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A1</td>
<td>17 (1.7)</td>
<td>0.5</td>
<td>34.1 (15 to 78)</td>
<td>15</td>
<td>2</td>
<td>7.5:1</td>
</tr>
<tr>
<td>1A2</td>
<td>6 (0.6)</td>
<td>0.17</td>
<td>39.6 (14 to 67)</td>
<td>3</td>
<td>3</td>
<td>1.0:1</td>
</tr>
<tr>
<td>1B1</td>
<td>2 (0.2)</td>
<td>0.06</td>
<td>20.5 (13 to 67)</td>
<td>2</td>
<td>0</td>
<td>2.0:0</td>
</tr>
<tr>
<td>1B2</td>
<td>3 (0.3)</td>
<td>0.09</td>
<td>38.0 (14 to 87)</td>
<td>2</td>
<td>1</td>
<td>2.0:1</td>
</tr>
<tr>
<td>All type 1</td>
<td>28 (2.8)</td>
<td>0.82</td>
<td>37.2 (13 to 78)</td>
<td>22</td>
<td>6</td>
<td>3.7:1</td>
</tr>
<tr>
<td>2A1</td>
<td>54 (5.4)</td>
<td>1.57</td>
<td>27.8 (13 to 89)</td>
<td>42</td>
<td>12</td>
<td>3.5:1</td>
</tr>
<tr>
<td>2A2</td>
<td>135 (13.5)</td>
<td>3.93</td>
<td>19.0 (13 to 45)</td>
<td>109</td>
<td>26</td>
<td>4.2:1</td>
</tr>
<tr>
<td>2B1</td>
<td>375 (37.5)</td>
<td>10.93</td>
<td>31.1 (13 to 96)</td>
<td>273</td>
<td>102</td>
<td>2.7:1</td>
</tr>
<tr>
<td>2B2</td>
<td>128 (12.8)</td>
<td>3.73</td>
<td>35.1 (13 to 89)</td>
<td>105</td>
<td>23</td>
<td>4.6:1</td>
</tr>
<tr>
<td>All type 2</td>
<td>692 (69.2)</td>
<td>20.17</td>
<td>29.3 (13 to 96)</td>
<td>529</td>
<td>163</td>
<td>3.3:1</td>
</tr>
<tr>
<td>3A1</td>
<td>162 (16.2)</td>
<td>4.72</td>
<td>46.7 (14 to 95)</td>
<td>92</td>
<td>70</td>
<td>1.3:1</td>
</tr>
<tr>
<td>3A2</td>
<td>19 (1.9)</td>
<td>0.55</td>
<td>48.7 (15 to 95)</td>
<td>9</td>
<td>10</td>
<td>0.9:1</td>
</tr>
<tr>
<td>3B1</td>
<td>85 (8.5)</td>
<td>2.48</td>
<td>43.6 (13 to 94)</td>
<td>61</td>
<td>24</td>
<td>2.5:1</td>
</tr>
<tr>
<td>3B2</td>
<td>14 (1.4)</td>
<td>0.41</td>
<td>49.2 (19 to 84)</td>
<td>7</td>
<td>7</td>
<td>1.0:1</td>
</tr>
<tr>
<td>All type 3</td>
<td>280 (28.0)</td>
<td>8.16</td>
<td>45.3 (13 to 95)</td>
<td>169</td>
<td>111</td>
<td>1.5:1</td>
</tr>
<tr>
<td>Total population</td>
<td>1000</td>
<td>29.14</td>
<td>33.6 (13 to 96)</td>
<td>720</td>
<td>280</td>
<td>2.6:1</td>
</tr>
</tbody>
</table>

* male-to-female ratio
common was type 2B1. Of the type-2B1 fractures, 28.9% had wedge comminution and the remainder were simple. Type-2B2 fractures had an incidence of 25.5%. Of the type-2B2 injuries 21.1% were the isolated segmental type and the remainder were comminuted segmental. Type-3 fractures, 28% of all, were predominantly undisplaced (type 3A).

Type-1 and type-2 fractures were seen in a younger population and with a greater M:F ratio than type-3 fractures (Table II). Type-2A2 fractures occurred in a younger population than the other fractures; all but two were in patients aged 13 to 25 years (Table II). Type-2 fractures were mainly caused by sport or RTAs whereas simple falls were the commonest cause of type-1 and type-3 fractures (Table III).

**Fracture outcome.** Most fractures (89%) healed uneventfully with conservative treatment in a collar-and-cuff sling until acute pain had settled. Only 6% required operative treatment (Table IV). Undisplaced (A) and displaced (B) fractures are considered separately.

Undisplaced (type-A) fractures. The prognosis for the undisplaced (type A) fracture subgroups in all three anatomical regions was good. Stable, undisplaced fractures of the bone ends (types 1A and 3A) did not become displaced and nonunion was seen in only one patient with a type-3A1 fracture. Two type-2A1 (3.7% of subgroup) and six type-2A2 (4.4%) fractures became displaced significantly during treatment. One type-2A1 and three type-2A2 fractures subsequently shifted and shortened, developing a type-2B1 pattern, but they all, along with all other type-2A fractures, united uneventfully. The commonest complication after type-2A2 fractures, seen in 5.2% of this subgroup, was local prominence at the fracture site; treatment was by excision of the prominent bone (Table IV).

Displaced (type-B) fractures. Displaced medial-third fractures (type 1B) were rare, but all five united uneventfully.
The prognosis for other displaced fractures (types 2B and 3B) was less favourable than for type-A fractures, mainly because of the higher incidence of complications of union. The overall prevalence of delayed union was 2.7% and of nonunion 4.8% for the whole study population, giving estimated incidences of 0.79 and 1.40 per 100,000 population per year, respectively (Table IV). These complications were seen almost exclusively after displaced diaphyseal (type 2B) and displaced lateral-end (type 3B) fractures.

The OR for delayed or nonunion after a displaced diaphyseal fracture (type 2B) when compared with an undisplaced type 2A, was 18.47 (95% confidence intervals (CI) 2.51 to 135.89). The OR for delayed or nonunion after a displaced lateral-end fracture (type 3B), compared with type-3A, was 74.57 (95% CI 9.89 to 560.48). Despite this more patients with delayed and nonunion were seen after type-2B injuries, because of their greater prevalence (Table IV).

For the whole series, the risk of delayed and nonunion was slightly greater after high-energy injuries such as falls from a height, RTAs and direct violence, than from low-energy injuries from simple falls and sport (OR = 1.64, 95% CI 1.03 to 2.64) (Table V). The OR of such complications in type-2 and type-3 subgroups, comparing high- with low-energy injury, were 1.55 (95% CI 0.85 to 2.85) and 2.07 (95% CI 0.97 to 4.46), respectively. There were no significant differences in the rates of union or incidence of complications between the different age and gender cohorts. Among the diaphyseal subgroups, the risk of complications of union was higher in the severely comminuted and segmental type-2B2 fractures than in the more simple type-2B1 pattern (OR = 2.59, 95% CI 1.38 to 4.84).

All type-2B fractures which had not united after 24 weeks, except for one type-2B1 fracture, had symptoms and required operation for compression plating and bone grafting. By contrast, nine patients (50%) with nonunion after type-3B fractures had no symptoms; the other nine required either coracoclavicular screw stabilisation (for type-3B1 fractures) or excision of the lateral end of the clavicle (for type-3B2 fractures).

Operation was required for only three patients with skin problems caused by prominent fragments (Table IV); two were treated by primary internal fixation and one by simple manipulation of the fracture. Only two (type-2B1) fractures in the series were open; both were Gustilo and Anderson grade I and were treated by primary debridement and plate fixation.

Symptomatic osteoarthritis of the acromioclavicular joint was associated with the relatively uncommon intra-articular fractures of the lateral end (types 3A2 and 3B2). In refractory cases this required excision of the lateral end of the clavicle (Table IV).

Refracture within one year of the original injury was an occasional complication seen predominantly in young males after diaphyseal fracture usually after resuming a contact sport (Table IV). All refractures were successfully managed conservatively.

### Discussion

It has been estimated that fractures of the clavicle account for 1 in 20 of all fractures and 44% of all injuries to the shoulder girdle. In this series, the incidence of all fractures in adults over the age of 13 years remained constant over six years at 29.14 fractures per 100,000 population per year. The only other major epidemiological review of fractures of the clavicle was carried out in Malmö by Nordqvist and Petersson who found an overall incidence of 64 per 100,000 population per year. The previous study examined fractures over the 35-year period from 1952 to 1987 during which the incidence appeared to increase by approximately 50%, and in addition included paediatric fractures. Direct comparison with the current study is therefore not possible, although the overall incidence of fractures in adults in the 1980s in the Malmö study was similar.

In this series, fractures were most common in males under the age of 30 years typically as a result of a contact sport or after an RTA. Fractures in females were more constant with age, with a smaller peak in those under 30 years of age. The relative proportion of females to males increased with age; simple falls were the predominant cause of injury in the elderly. These clinical findings are supported by previous biomechanical studies which have suggested that the usual mechanism of the fracture, irrespective of site, is a direct force applied to the point of the shoulder such as occurs during a fall or RTA.

As Müller has indicated, classification systems are only of value if they serve as a basis for treatment and can be used to predict outcome. Recent studies have also focused on the role of pre-existing factors such as obesity, smoking and alcohol consumption in influencing the outcome of clavicle fractures.
attention on the importance of the reliability and reproducibility of classification systems.\textsuperscript{17-19} Allman’s classification into three anatomical regions is generally used to describe fractures of the clavicle, but it gives no guide to prognosis in terms of displacement,\textsuperscript{1,20-25} comminution\textsuperscript{21,23} or ligamentous injury.\textsuperscript{9,11,24} Other studies have modified the original descriptive system to include some of these factors,\textsuperscript{5,9,20,25} but there is no validated system giving classification of all the common fracture patterns.

The new classification system evolved from review of the fracture patterns seen in 1000 consecutive cases and included factors thought to influence the prognosis. It shows associations between fracture subtypes and favourable or poor prognoses and may provide a basis for treatment by predicting those fractures which are at particular risk of nonunion or further complications. The classification is more complex, but blinded assessment of inter- and intraobserver variation showed substantial to excellent levels of reliability and reproducibility among orthopaedic trainees. This compares well with some other classification systems.\textsuperscript{18,19}

The new classification showed diaphyseal fractures (type 2) in 69.2\% of patients, lateral-end (type 3) in 28\% and medial-end (type 1) in 2.8\% of patients. These figures correlate with previous estimates of anatomical distribution,\textsuperscript{1,4,5} but the relative prevalence of lateral-end fractures was higher, probably because this study was confined to adults.

Type-1 fractures were rare, usually caused by simple falls and were predominantly undisplaced and extra-articular. There were few complications or need for operation. This type has not previously been studied in detail, although the prognosis is usually regarded as favourable.\textsuperscript{8}

Type-2 fractures, the commonest subgroup, had a good prognosis for the two patterns with residual cortical contact (types 2A1 and 2A2 distinguished by the degree of angulation). Type 2A2 fractures were seen in a younger population than the other type-2 fractures, and were considered as a variant of the angulated greenstick fracture commonly seen in children,\textsuperscript{8} in which angulation shows an intact inferior periosteal hinge. There were few complications after type-2A fractures: the commonest was in type-2A2 fractures in which skin tenting or bony prominence produced local symptoms. In contrast to the fractures of this type in children, remodelling was poor and removal of prominent bone after union was required in 5.7\% of these fractures.

Displaced diaphyseal fractures (type 2B) were more common than displaced type-2A fractures. There was frequently significant comminution, either wedge (type 2B1) or segmental (type-2B2), probably because of the sigmoid shape of the bone causing eccentric loading from mediolateral forces on the shoulder against the sternoclavicular joint.\textsuperscript{14}

Most type-2B fractures healed uneventfully, but 3.2\% showed delayed union beyond 12 weeks and 5.8\% of patients had nonunion at 24 weeks. This incidence is much higher than the 0.1\% to 0.8\% previously reported.\textsuperscript{3,4} Both displacement (all type-2B fractures) and segmental comminution (type-2B2 fractures) were associated with an increased risk of delayed or nonunion, with a much weaker association with high-energy injuries, and none with age or gender. The initial morphology of the fracture therefore provided the best indication of the risk of delayed or nonunion, irrespective of the mechanism of injury.

Displacement with segmental comminution probably reflects the severity of bone and soft-tissue injuries, in a region with few muscle and soft-tissue attachments. In those patients who required operation for nonunion after a segmental fracture, the intermediate segment was often completely devoid of soft-tissue attachments. Previous studies have suggested that nonunion may be asymptomatic in from 24\% to 40.5\% of all type-2B fractures,\textsuperscript{23,26,27} but at 24 weeks all but one patient with nonunion had continuing symptoms which required operation.

Lateral-end fractures (type 3), 28\% of all fractures, were seen in an older population and a higher proportion was due to simple falls. As in previous studies,\textsuperscript{9,28} most were undisplaced (type 3A) and had a benign prognosis.

Current terminology for lateral-end fractures is confusing: Allman\textsuperscript{8} included only those lateral to the coracoclavicular ligaments, but the Neer\textsuperscript{9} classification, further refined by Craig,\textsuperscript{25} includes fractures medial to the ligaments, and attempts to delineate the extent of ligamentous injury. In practice, with access to plain radiographs only, identification of the site and extent of ligamentous injury is difficult. The new system offers a more pragmatic approach to classification, as the subgroup depends solely on the displacement of the fracture, produced mainly by trapezius pulling the proximal fragment superiorly and posteriorly. Most type-3B injuries showed a two-part fracture but in 29\% there were three parts with avulsion of the inferior bony portion of the lateral surface. In these, the coracoclavicular ligaments are probably intact and attached to the inferior fragment.\textsuperscript{29} This fracture has previously been regarded as more unstable than the pure ligamentous injury,\textsuperscript{25} but in this study they behaved similarly.

Displaced lateral-end fractures (types 3B1 and 3B2) have been regarded as having low rates of bony union after conservative treatment;\textsuperscript{3,9,11,24,28} the prevalence of delayed union has been reported as between 45\% and 66\%,\textsuperscript{9,24} with nonunion in 22\% to 33\%.\textsuperscript{9,24,28} Because of these high incidences, primary surgical stabilisation has been advised for all displaced lateral-end fractures\textsuperscript{9,11,24,25} although nonunion may be asymptomatic in up to 80\%\textsuperscript{28} and the results of surgery may not be optimal.\textsuperscript{30} In this series, the incidence of delayed and nonunion for these fractures was 11.1\% and 18.2\%, respectively. Half of the cases of nonunion were asymptomatic and only 9.1\% of patients with displaced lateral-end fractures ultimately required surgery. Most of these fractures occur in older patients with limited functional expectations, and therefore initial non-operative
treatment is justified. Further prospective study is required of younger patients with type-3B injuries to assess whether surgical stabilisation improves the functional outcome and decreases the prevalence of nonunion.

Symptomatic osteoarthritis of the acromioclavicular joint was seen only after intra-articular fractures of the lateral end (types 3A2 and 3B2) and was found in 15.2% of these cases. This has been well described, but its prevalence has not previously been established. Resection of the distal 2 cm of the lateral end of the clavicle has given good results as a late procedure.

Other complications which have been described include pressure on neurovascular structures by callus formation, pneumothorax and post-traumatic aneurysm. No cases were seen in this series but longer follow-up would be required to exclude late compression syndromes.

The most appropriate management for most clavicular fractures is non-operative; the optimal treatment-based classification suggested by Bernstein et al is therefore not feasible. The new classification provides a reliable and reproducible prognostic guide by identifying subgroups at risk of delayed or nonunion and other complications. These high-risk subgroups require more prolonged and vigilant follow-up. Any new fracture classification system should be feasible. The new classification provides a reliable and reproducible prognostic guide by identifying subgroups at risk of delayed or nonunion and other complications. These high-risk subgroups require more prolonged and vigilant follow-up. Any new fracture classification system should reliably predict functional outcome. This has not yet been done, but a future prospective study is planned.

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