Shortening of clavicle after fracture

Incidence and clinical significance, a 5-year follow-up of 85 patients

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We evaluated the incidence and clinical significance of postfracture shortening of the clavicle in 85 patients. There were 71 mid-clavicular fractures and 14 of the lateral end of the clavicle. 46 fractures were primarily undisplaced and 39 displaced. All fractures were nonoperatively treated with sling immobilization. All patients were reexamined 5 years after the fracture.

35 clavicles had healed with at least 5 mm shortening. Clavicles with originally displaced fractures were shorter and radiologically more frequently malunited. Mobility, strength and the functional Constant score were similar in the injured and normal shoulders. Our findings suggest that permanent shortening of the clavicle is common after fracture, but has no clinical significance.

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Submitted 96-07-09. Accepted 97-05-12

Eskola et al. (1986) observed radiographic shortening of the clavicle in 47/89 patients 2 years after fracture. One third of the shoulders with shortening were painful. There are few other reports on symptomatic shortening after fractures of the clavicle. We evaluated the prevalence and clinical significance of permanent shortening of the clavicle after fracture.

Patients and methods

In 1987, 144 consecutive mid-part or lateral clavicular fractures were recorded at the Department of Orthopedics, Malmö University Hospital. All were nonoperatively treated. Obstetric fractures were not included. Between 1992 and 1993, 85 patients who continued to live in the city of Malmö came for a follow-up and 37 declined. There were 71 patients with fractures of the mid-part of the clavicle and 14 with lateral clavicle fractures, according to the Allman (1967) classification (Table 1). The average age was 25 (1–80) years. 33 midclavicular and 6 lateral fractures had been displaced by more than one bone width in the initial radiographs. There were no early or late neurovascular complications.

All patients were reexamined clinically and radiographically. The distance between the mid-point of the upper ridge of the manubrium sterni and the anterior lateral edge of the acromion, which is easily identified, was clinically measured with a tape measure calibrated in 5 mm intervals. This distance, representing the functional length of the clavicle, was measured in both the injured and the normal shoulders, as also were shoulder mobility and strength in flexion and abduction measured by a Nicholas manual muscle tester (1987). The functional assessment of the shoulder, as described by Constant and Murley (1987), was used (Constant score).

The radiographic examination included anteroposterior and 45° oblique views. Fracture union was evaluated. A fracture with persistent fragment displacement, which had healed with displacement by one bone width or more or had a fracture angulation of over 30°, was registered as a malunion.

Statistical analysis was performed with the chi-square test, the Student's paired t-test, correlation analysis and stepwise regression.

Table 1. Fracture location according to age and gender in 85 patients who had sustained a fracture of the clavicle

Fracture localization	n	Men	Women	Age at trauma medium (range)
Mid-clavicular	71	49	22	11 (1–71)
Lateral	14	8	6	42 (12–80)
All fractures	85	57	28	14 (1–80)

Table 2. The average length of clavicle (mm), muscle strength of abduction and flexion (pounds), and the Constant score (points) at the 5-year follow-up of 85 patients. A negative mean difference was obtained when the injured shoulder had a higher value than the other side

	Shoulder with clavicular fracture	Contralateral shoulder	Difference mean	CI [a]
All patients (n 85)				
Length of clavicle	206	211	5.7	4.1–7.4
Muscle strength of abduction	8.0	8.1	0.1	–0.2–0.5
Muscle strength of flexion	8.7	8.5	–0.2	–0.7–0.1
Constant score	89	89	0.6	–0.2–1.3
Midclavicular fractures in patients <15 years old (n 42)				
Length of clavicle	190	191	1.8	0.4–3.1
Muscle strength of abduction	5.9	6.0	0.1	–0.2–0.5
Muscle strength of flexion	6.7	6.8	0.9	0.4–1.4
Constant score	86	86	0.6	–0.1–1.3
Midclavicular fractures in patients >15 years (n 29)				
Length of clavicle	220	231	11.1	8.2–14.0
Muscle strength of abduction	10.6	11.1	0.4	–0.2–1.1
Muscle strength of flexion	11.1	10.8	–0.3	–0.9–0.4
Constant score	93	93	1.0	–0.6–2.7
Lateral clavicle fractures (n 14)				
Length of clavicle	222	228	6.8	2.3–11.3
Muscle strength of abduction	8.9	8.2	–0.6	–1.7– 0.4
Muscle strength of flexion	9.7	8.5	–1.2	–2.8– 0.3
Constant score	89	89	–0.6	–3.4– 2.3

[a] Confidence interval for the mean

Table 3. The length of the clavicle (mm) and the muscle strength of abduction and flexion (pounds) in 16 patients with >15 mm shortening of the injured clavicle

	Shoulder with clavicular fracture	Contralateral shoulder	Difference mean	CI [a]
Length of clavicle	217	235	18.4	16.5–20.4
Muscle strengh of abduction	10.0	10.1	0.6	–0.5–1.6
Muscle strengh of flexion	9.8	9.6	–0.2	–1.3–0.8
Constant score	93	94	0.5	–1.8–2.8

[a] Confidence interval for the mean

Results

At the follow-up, 28/71 mid-clavicular fractures and 7/14 lateral fractures had healed with persistent functional shortening of the clavicle of 5 mm or more, compared with the uninjured shoulder. Since children (< 15) are known to differ in their fracture healing capacity they were analyzed separately. The shortening was commonest after displaced mid-clavicle fractures in adults (Table 2).

There were no statistically significant differences in abduction and flexion strength , active range of motion or Constant score between the injured and the uninjured shoulder. There was no correlation between the degree of shortening and shoulder mobility (Tables 2 and 3). In a stepwise regression analysis with the range of abduction and flexion, the power of abduction and flexion, and Constant score as dependents and the fracture site, age, sex, dominant hand, persisting nonunion, malunion or healing with shortening of the clavicle as independent variables, no statistically significant influence was found.

Radiographs showed 12 malunions and 5 nonunions (Table 4). Clavicle shortening was found in 14 of these cases.

Discussion

The function of the clavicle is to form a strut to hold the glenohumeral joint in the parasagittal plane, thus increasing the range of motion in the shoulder joint

Table 4. The results of the radiographic evaluation of 83 clavicular fractures

	Normal union	Malunion	Nonunion
Midclavicular fractures, patient age at trauma			
<15 yrs old	40	0	0
>15 yrs old	18	11	0
Lateral fractures	8	1	5
All fractures	66	12	5

and the strength of the arm-trunk mechanism (Moseley 1968). Consequently, a decrease in the functional distance between the axial skeleton and the glenohumeral joint would impair shoulder function. Eskola et al. (1986) found that patients with clavicle fractures, primarily displaced by more than 15 mm or with radiologically observable shortening of the clavicle, had significantly more pain and less abduction strength than patients without these findings at the 2-year follow-up examination. In our study, the patients' age and gender distribution were similar to those of Eskola et al. (1986); 67% men compared with 78%, average age 25 years compared with 26 years. The number of midclavicle fractures was higher in our study. In Eskola's report, 88% of the fractures were displaced 1–25 mm, but no data on how often the displacement was severe—more than one bone width—were presented. The main difference between Eskola's and our studies seems to be the duration of follow-up, suggesting that the outcome will improve as time goes by. In our study, nearly half of the clavicles had 5 mm shortening or more at the 5-year follow-up and there was a correlation between early fragment displacement and late clavicle shortening. However, shoulders with shortening of the clavicle had no disability of importance or loss of motion or strength. This may be due to the fact that the functional shortening after clavicle fractures is usually moderate. This is in accordance with the findings of Abbott and Lucas (1954). They proposed that the clavicle was a surplus part which could be partially or even totally excised without disturbance of shoulder function.

In fractures of the clavicle, fragment displacement and comminution imply a risk of painful and disabling exuberant bone and scar formation during healing. Several authors (Neer 1963, Neviaser 1963, Zenni et al. 1981, Jäger and Breitner 1984, Eskola et al. 1986, Post 1989, Schwartz and Höcker 1992, Faithful and Lam 1993, Simpson and Jupiter 1996) have reported an increased incidence of persistent shoulder disability after closed treatment of displaced clavicle fractures in adults. Our findings, however, indicate that closed treatment of such fractures, including those with fragment displacement, in most cases results in normal, painfree function, despite functional shortening in nearly half of the cases.

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