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Treating fractures of the carpus

Summary

Background. The objective of this study was to identify the incidence of carpal fractures and the treatment of patients with this fracture at the Orthopaedic Section, Haugesund Hospital, Norway.

Material and method. A total of 320 patients with 331 carpal fractures that had been treated at the section were included in the study. The data were collected through an examination of medical records.

Results. Scaphoid fractures were found in 277 patients, and the final outcome was healing in 96 % of these cases. Appropriate and speedy treatment of 243 scaphoid fractures by means of cast immobilisation or a primary operation resulted in healing in 89 % of the cases. After surgery for non-healing cases, the healing outcome was 99 %. Thirty-four patients received inadequate or delayed primary treatment, and the result after plaster casts, operations for non-healing and one reoperation in this group was healing in only 75 % of the cases. Inappropriate or delayed primary treatment led to a significant increase in the frequency of failure to heal and surgery. All 54 non-scaphoid fractures healed satisfactorily, and only one was operated on. Twenty-seven patients had a fracture of the triquetrum. There were seldom fractures in the six other carpal bones.

Interpretation. The result of plaster casts and primary operations was satisfactory. In general our results agree with those of other reports in relevant literature.

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Scaphoid fractures of the wrist are common and represent by far the most usual fracture of the carpal bone. The carpus contains seven other bones that can also break. Such injuries are rare but should be considered in the event of injury or pain in the wrist. The fractures can show all degrees of dislocation, and they often cause little pain, with the result that the injury can easily be overlooked. As a rule there is no oedema or clinical displacement. There are therefore grounds to presume that this type of fracture is under-diagnosed (1, 2). The injury has a good prognosis if it is detected and treated appropriately, and a poor prognosis if it is overlooked. It is therefore also interesting in the context of compensation.

The injury mechanism is most often a fall on the outstretched arm with dorsal flexion and radial or ulnar deviation in the wrist. Anatomically there are many variants, from small avulsion fractures to fractures through the corpus. The fracture may also be combined with a fracture or dislocation in other carpal bones, or with a fracture in the radius or metacarpal (3). Diagnosis is often uncertain. Applying a cast on the basis of suspicion leads to initial overtreatment in this patient group, and early examination with special imaging is therefore necessary. In most cases this will dispel the suspicion of a scaphoid fracture or reveal a fracture in other carpal bones (1, 4, 5).

As the fracture may be difficult to detect by plain radiography, special imaging such as CT or MR may be required (1, 3, 5, 6), or comparison of the images with those of the healthy hand. These patients may also be candidates for wrist arthroscopy.

If the fracture is non-dislocated, standard treatment is primarily cast immobilisation and, in the event of significant displacement, surgery with repositioning and osteosynthesis. It is important to regain the anatomical position (2, 6). Pinning is often used in operations on non-scaphoid fractures, and small fragments with no joint affection can often be removed.

Inappropriate primary treatment of all types of carpal fracture can cause non-union and subsequent arthrosis of the wrist (2). Correct non-union treatment with screw fixation and bone transplantation if necessary is important to avoid long-term effects such as arthrosis of the wrist.

The goal of this follow-up was to map the incidence and treatment of carpal fractures in our department as part of the quality assurance.

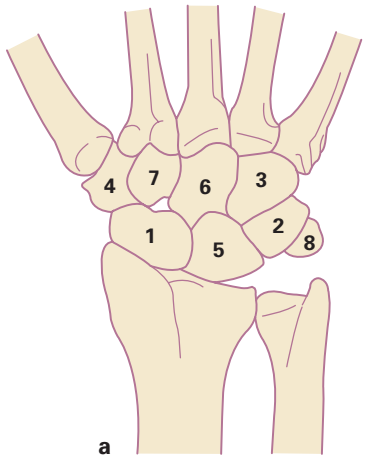
Material and method

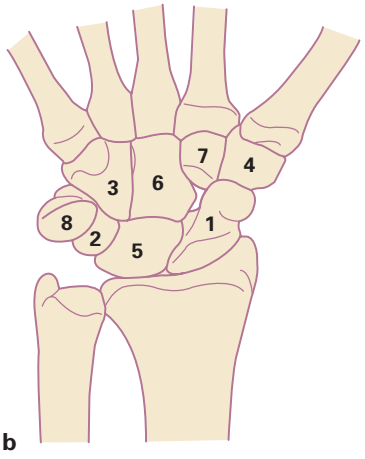
The material consists of 320 patients with 331 carpal fractures, all of whom were treated in the Orthopaedic Section of Haugesund Hospital from 1987 up to and including 2007. A total of 73 % were men, and 27 % were women. The average age at the time of the injury was 36.3 (variation 10.1–95.9). A total of 48 % had the fracture on the right, and 52 % on the left, and 80 % had a fall as the mechanism of injury while the remainder had suffered various types of crushing injuries or traffic accidents. The incidence of falls as the mechanism of injury was significantly higher for women than men (90 % compared with 76 %, $p = 0.008$). There was a gender difference in our material: the men were significantly younger than the women (33.0 compared with 44.8; $p < 0.00\ 1$), they more often had the fracture on the right, and had to be operated on more frequently. Seven patients had fractures in two carpal bones, and two patients in three. Sixteen patients had supplementary pathological conditions, including ten with fractures of the radius, five with metacarpal fractures, and two with lunate luxation.

Plaster casts that included the basal phalanx of the thumb were used as primary treatment for scaphoid fractures in all cases except those operated on almost immedi-

Main points

- Carpal fractures are often overlooked, both clinically and in radiographic evaluation
- Approximately 80 % of carpal fractures are scaphoid
- Delayed treatment of scaphoid fractures often causes non-union
- Triquetral fractures constitute approximately 50 % of non-scaphoid fractures, and fractures of the other six carpal bones are uncommon





Bone	Number	Percentage
1. Os scaphoideum	277	83.7
2. Os triquetrum	27	8.2
3. Os hamatum	8	2.4
4. Os trapezium	7	2.1
5. Os lunatum	7	2.1
6 Os capitatum	4	1.2
7. Os trapezoideum	1	0.3
8. Os pisiforme	0	0.0

Figure 1 *Distribution of 331 fractures in carpal bones: a) the carpus seen from the back of the hand, b) seen from the under side*

ately due to considerable displacement. The surgical method was open repositioning and screw fixation, with bone transplantation in addition for non-union. All non-dislocated non-scaphoid fractures were usually treated for from four to six weeks by cast immobilisation. For displacement of more than 1 mm, except for dislocated triquetral fragments, the treatment consisted of open repositioning, pinning and a cast.

Information was gathered by examining medical records, and was statistically processed using the software package Statistica for Windows (7). $p < 0.05$ is statistically significant for both t-test and cross-tables.

Results

The distribution of fracture localisation is shown in Figure 1. A total of 277 patients, or approximately 87 %, had a fracture of the scaphoideum. A total of 243 patients received adequate treatment, 229 of these with immobilisation alone and 14 by primary operation due to the extent of the displacement. The treatment resulted in primary healing in 89 % of this group. After 22 operations and three reoperations, the outcome in this group was healing in 98.7 % of the cases. Thirty-four other patients with scaphoid fractures received delayed treatment, either because the patient ignored the injury or because the injury was initially wrongly assessed by others. In some cases several years passed with no treatment. After 21 operations and one reoperation for poor healing, the healing outcome was significantly worse for this group (75 % compared with 99 %, $p < 0.001$). Five patients (2 %) with a scaphoid fracture were shown to have radiocarpal arthrosis as a long-term effect. The group who were subject to delayed treatment were also shown to have significantly more frequent radiocarpal arthrosis (9 % compared with 1 %, $p = 0.001$).

All non-scaphoid fractures were treated with casts except for one hamate fracture that was operated with setting and pinning. All non-scaphoid fractures healed satisfactorily. Poor healing of one triquetral fragment was accepted as satisfactory. No radiocarpal arthrosis was shown in this group.

Discussion

The localisation of carpal fractures in our material (Table 1) largely corresponds with that in other reports (2, 5, 8). For scaphoid fractures, the age and gender distribution of the patients in our material corresponds well with data in other studies (9, 10). Our routine treatment consists of including the basal joint of the thumb in the cast. Whether this, or extending the cast to the upper arm, is necessary is controversial (11). The fact that a cast alone produces healing in approximately 90 % of patients with non-dislocated fractures agrees with the results of other studies (4, 12).

In our study, delayed treatment of scaphoid fractures led to multiple cases of poor healing and development of non-union. This also corresponds with other studies (1, 4). The fact that 20–25 % suffer from poor healing or non-union agrees in general with other results (10, 13). Non-union often produces few symptoms, and some individuals are of the view that asymptomatic and randomly detected scaphoid non-union can remain untreated (5), while others advise surgery even for symptom-free non-union to prevent the development of radiocarpal arthrosis (4, 13). For this condition there is often little agreement between radiographic and clinical findings (10).

We have used screw fixation as primary treatment for dislocated scaphoid fractures (over 1 mm diastasis) and casts in addition. Screw fixation can also be conducted with percutaneous techniques (14) or with a combination of percutaneous and endoscopic techniques (15). The operation can be carried out from both the volar and the dorsal side (16).

We found 27 patients with a fracture in the triquetrum, which is also the next most common in other reports (2, 5, 8). Avulsion fractures with no joint affection are the most usual, and a dislocated fragment can be removed if it causes discomfort (2). Corpus fractures are rare, but can also occur in extensive injuries such as lunate dislocation (2, 8). Special imaging is often required to detect such injuries (2). We had one patient with a temporary ulnar injury. The triquetrum is also anatomically close to the pisiforme, and injury can lead to arthrosis in the articular surface between these (2). Eight patients had a hamate fracture, one of whom was operated on. He had a corpus fracture with concurrent injury to the fourth metacarpal. Repositioning, pinning and casting resulted in good healing. It is common for hamate fractures to be combined with damage to the fourth and fifth metacarpals (2). Fractures in the hamatum are uncommon and are often due to the hamulus being broken off (8). This is frequently a sports injury (stress fracture) that does not need setting (2). The torn-off hamulus fragment can affect the ulnar nerve and can be removed if it causes symptoms. The hamatum is anatomically close to both the ulnar and median nerves as well as the flexor ligaments, which can all be injured by a dislocated fragment (2, 5, 8).

Seven patients had a trapezial fracture, which is the third most common in other studies (2, 5, 8). Such injuries can include part of the articular surface against the first metacarpal and can result in arthrosis, a common complication (2, 5, 8). Corpus fractures are rare (5) and may be close to the radial artery, which may also be damaged (2).

Seven patients had a lunate fracture, which is rare (5). These fractures can be difficult to detect by radiography (8) and can

sometimes result in avascular necrosis or lunate malacia due to devascularisation (2, 5). These fractures should therefore be followed up with MR (2, 8).

The capitatum is the largest carpal bone and is well protected inside the wrist. Fractures therefore occur very seldom and are often part of combined injuries such as lunate luxation (2, 5). The injury leads to a risk of non-union, osteonecrosis and arthrosis (2, 5, 8).

The trapezoideum is also anatomically well protected: fractures occur very seldom and are often combined with an injury to the second metacarpal (2, 8). In these cases too it is important to reconstruct the articular surfaces anatomically to avoid arthrosis.

No fractures in the pisiforme were recorded in our material. These fractures are also very rare and are often sports injuries (5, 8). The pisiforme is an easily palpable sesamoid bone that lies close to the flexor carpi ulnaris ligament. The entire pisiforme can be removed if the injury results in permanent pain (2, 5, 8). Removal has little functional effect.

We had no patients under the age of ten, which is consistent with carpal fractures being uncommon in children (5, 17).

Conflicts of interest given: None

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