



(RESEARCH ARTICLE)



## ACUTE SCAPHOID FRACTURES: RESULTS OF PERCUTANEOUS AND OPEN SURGICAL TREATMENT IN 44 PATIENTS

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### ABSTRACT

**Introduction:** Scaphoid fractures account for about 75% of carpal fractures and mainly affect young adults. They are often missed and expose patients to nonunion and avascular necrosis. This study reports our department's experience with their surgical treatment.

**Materials and methods:** We retrospectively reviewed 44 acute scaphoid fractures operated on between 2019 and 2024. Fractures were classified according to Schernberg. Treatment was percutaneous or open, with screw or Kirschner-wire fixation. Union was assessed on radiographs and functional outcome with the QuickDASH score.

**Results:** Mean age was 32 years (range 17–48), and 95% of patients were men. The mechanism was indirect in 95% of cases. Fractures involved the proximal pole in 22 cases, the upper waist in 16 cases and the tuberosity in 6 cases. Treatment was percutaneous in 36 cases (81.8%) and open in 8 cases (18.2%). Union was achieved in 39 cases (88.6%) after a mean of 6 weeks, at a mean follow-up of 24 months. Complications included 5 nonunions, 4 cases of avascular necrosis, 3 cases of osteoarthritis and 1 malunion.

**Conclusion:** Surgical fixation, especially percutaneous, provides a high union rate. Early diagnosis remains essential: any wrist injury should be considered a scaphoid fracture until proven otherwise.

**Keywords:** Scaphoid; Fracture; Percutaneous Screw Fixation; Herbert Screw; Nonunion; QuickDASH.

## 1 INTRODUCTION

Scaphoid fractures are the most common carpal fractures, accounting for about 75% of them [1,2]. They mainly affect young, active men after a fall on the outstretched hand or a sports injury. Their severity is related to the particular shape of the bone and to its retrograde blood supply, which exposes the proximal pole to necrosis [3].

These fractures are often missed. Clinical signs may be mild, and initial radiographs may appear normal. Delayed diagnosis increases the risk of nonunion, avascular necrosis and, in the long term, wrist osteoarthritis [2,4]. Associated ligament injuries are frequent and worsen the prognosis.

The management of acute fractures has evolved. Cast treatment remains an option for stable, undisplaced fractures, but surgical fixation, especially percutaneous, has become widespread [5,6]. It allows faster union and an earlier return to activity. The aim of this study was to report our department's experience with the surgical treatment of these fractures.

## 2 MATERIALS AND METHODS

### 2.1 Study design and population

This retrospective study included 44 patients operated on for a scaphoid fracture in the Department of Orthopaedic and Trauma Surgery A of Hassan II University Hospital, Fez, over a five-year period (2019–2024). Data were collected from medical records, operative reports and outpatient registers.

We included patients older than 16 years with an acute scaphoid fracture. We excluded patients with associated wrist injuries requiring an extensive approach, fractures neglected for more than one month and fractures treated conservatively.

### 2.2 Imaging

All patients had posteroanterior and lateral radiographs of the wrist and dedicated scaphoid views. Computed tomography was performed in case of diagnostic doubt or to assess the fracture line and displacement (Figure 1). Fractures were classified according to Schernberg, who describes fractures according to the level of the fracture line, from the proximal pole to the tuberosity [7].



**Figure 1: Radiograph (left) and coronal CT slice (right) showing a scaphoid fracture.**

### 2.3 Treatment

Surgery was performed under regional anaesthesia in 28 patients (63.6%) and under general anaesthesia in 16 patients (36.4%). Treatment was percutaneous or open. Fixation used a Herbert-type compression screw [8] or Kirschner wires. The approach depended on the level of the fracture line. Distal fractures (Schernberg types III to V) were approached volarly, with distal-to-proximal screw insertion. Proximal and upper waist fractures (types I and II) were approached dorsally, with proximal-to-distal screw insertion [9] (Figures 2 and 3).

The wrist was immobilised in a splint for three weeks after surgery. Rehabilitation started from the third postoperative week.



**Figure 2: Scaphoid fracture before (left) and after (right) compression screw fixation.**



**Figure 3: Radiographic control after Kirschner-wire fixation of a scaphoid fracture.**

## 2.4 Assessment

Union was assessed on follow-up radiographs. Functional outcome was assessed with the QuickDASH score, ranging from 0 (no disability) to 100 (maximum disability) [10]. Complications were recorded. Mean follow-up was 24 months. The analysis was descriptive.

# 3 RESULTS

## 3.1 Demographic and clinical data

Mean age was 32 years (range 17–48). There were 42 men (95%) and 2 women (5%). The mechanism was indirect, by a fall on the hyperextended wrist, in 42 cases (95%), and direct in 2 cases (5%).

## 3.2 Radiological data

According to the Schernberg classification, fractures involved the proximal pole in 22 cases (50%), the upper waist in 16 cases (36.4%) and the tuberosity in 6 cases (13.6%) (Table 1).

**Table 1: Distribution of fractures according to the Schernberg classification**

| Fracture type | Number | Percentage |
|---------------|--------|------------|
| Proximal pole | 22     | 50.0%      |
| Upper waist   | 16     | 36.4%      |
| Tuberosity    | 6      | 13.6%      |
| Total         | 44     | 100%       |

### 3.3 Treatment data

Treatment was percutaneous in 36 patients (81.8%) and open in 8 patients (18.2%). In the percutaneous group, fixation was achieved with a screw in 28 cases (77.8%) and with Kirschner wires in 8 cases (22.2%). In the open group, fixation used Kirschner wires in 6 cases (75%) and a screw in 2 cases (25%) (Table 2).

**Table 2: Treatment methods**

| Technique    | Screw      | Kirschner wires | Total      |
|--------------|------------|-----------------|------------|
| Percutaneous | 28 (77.8%) | 8 (22.2%)       | 36 (81.8%) |
| Open         | 2 (25%)    | 6 (75%)         | 8 (18.2%)  |
| Total        | 30         | 14              | 44         |

### 3.4 Outcome

Union was achieved in 39 patients (88.6%), after a mean of 6 weeks. The mean QuickDASH score at last follow-up was 20.

Thirteen complications were recorded: five nonunions (11.4%), four cases of avascular necrosis (9.1%), three cases of osteoarthritis (6.8%) and one malunion (2.3%) (Table 3). Of the five nonunions, two were revised with bone grafting using the Matti-Russe technique; the other three patients declined further surgery.

**Table 3: Complications**

| Complication       | Number | Percentage |
|--------------------|--------|------------|
| Nonunion           | 5      | 11.4%      |
| Avascular necrosis | 4      | 9.1%       |
| Osteoarthritis     | 3      | 6.8%       |
| Malunion           | 1      | 2.3%       |

## 4 DISCUSSION

### 4.1 Epidemiology and diagnosis

Our series confirms the usual profile of these fractures: a young man injured by a fall on the outstretched hand [1,4]. The mean age of 32 years and the marked male predominance are consistent with the literature. In children and adolescents, these fractures are rarer and their prognosis is generally better [11].

Diagnosis remains difficult. Initial radiographs may be normal, and the fracture is often missed. This led Watson-Jones to recommend that any wrist injury without obvious deformity be considered a scaphoid fracture until proven otherwise [12]. CT, performed in our patients when there was doubt, clarifies the fracture line and displacement and guides treatment [2].

The distribution of our fractures is unusual: proximal pole fractures accounted for half of the cases, whereas the literature reports a clear predominance of waist fractures [2,4]. This difference may be explained by surgical recruitment, as proximal pole fractures are more often operated on because of their high risk of necrosis and nonunion.

## 4.2 Treatment choice

Cast treatment still has a place for undisplaced waist fractures. The SWIFFT trial showed no clear functional benefit of surgery for minimally displaced waist fractures [6]. By contrast, surgical fixation is recommended for displaced, unstable or proximal pole fractures, and when the patient wishes to return quickly to activity [2,5].

Percutaneous fixation, used in 81.8% of our patients, preserves the blood supply and ligaments of the wrist and leads to faster union than casting [5]. Our department has previously reported good results with percutaneous volar screw fixation [13]. The dorsal approach, used for proximal pole fractures, allows the screw to be placed along the central axis of the scaphoid [9].

Biomechanically, Acar et al. showed that a centrally placed volar screw provides better rotational stability for waist fractures, although both approaches remain possible [14]. Atilgan et al. reported similar union rates with percutaneous and open fixation, with faster union after open fixation in the setting of nonunion [15].

## 4.3 Results and complications

Our union rate of 88.6% is close to that of published series, which generally report union rates above 85 to 90% after surgical fixation [2,4]. The high proportion of proximal pole fractures probably explains some of our nonunions and cases of necrosis, as the proximal pole has a poor blood supply [3].

The complications in our series (nonunion, necrosis, osteoarthritis, malunion) are those described in the literature. Two of our five nonunions were revised with a Matti-Russe graft; the other three patients declined revision, reflecting the difficulties of follow-up and treatment adherence in our setting. Their frequency underlines the importance of early diagnosis, anatomical reduction and stable fixation. Kirschner-wire fixation, which is less stable than a compression screw, may also have contributed [8].

## 4.4 Limitations

This study has the limitations of retrospective studies: sometimes incomplete data, no control group and a descriptive analysis. The small number of fractures treated with open surgery does not allow the techniques to be compared. A prospective study with longer follow-up would be useful.

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## 5 CONCLUSION

Scaphoid fractures mainly affect young adults and are often missed. In our series, surgical fixation, mostly percutaneous, achieved union in 88.6% of cases. Complications mainly involved proximal pole fractures. Early diagnosis and stable fixation adapted to the level of the fracture line remain the keys to a good outcome.

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## STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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### *Disclosure of conflict of interest*

The authors declare that they have no conflict of interest.

### *Statement of informed consent*

Informed consent was obtained from the patients for the publication of their clinical images, which have been anonymised.

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