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Research Article

Complications following open distal radius fractures

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Abstract

Background: Open wrist fractures are rare comprising approximately 2.4 people per 100,000 per year, with little known about their complications. This retrospective study reports on all open wrist fractures presenting to a major trauma centre over a 7-year period.

Methods: From June 2007 to June 2014, all patients attending a major trauma centre with a distal radius fracture were identified. The clinical details were reviewed and the patients with open fractures identified. The radiographs and notes were then reviewed. The injuries were classified using the Gustilo and Anderson classification and the fractures by the Frykman classification system.

Results: There were 34 open wrist fractures. All patients underwent surgical debridement and fixation. Fixation comprised open reduction and internal fixation (27 pts), kirschner wire fixation (3 pts), external fixation with additional kirschner wires (1 pt), and external fixation alone (3 pts). Fixation took place a mean of 13.8 hours (SD: 9.7, range: 2.1 to 46.7) after arrival in hospital. There were 10 complications in 10 patients (29%). Overall 7 patients (21%) required further surgery.

Conclusion: The rate of infection is low; however, the rate of re-operation is high. Patients with open wrist fractures should be made aware, early in their management, of the high risk of further surgery.

Keywords: Wrist, Distal radius, Fracture, Open, Compound

INTRODUCTION

Closed wrist fractures are common, occurring in 100 – 1,000 people per 100,000 population per year, depending on age and gender [1]. Conversely, open wrist fractures are rare comprising approximately 2.4 people per 100,000 per year [2]. Consequently, there are few reports in the literature [3-6]. There has however, been much research on open lower limb fractures, with higher rates of complications seen compared to closed injuries, including delayed union, non-union, and infection [7,8].

This retrospective study reports on all open wrist fractures presenting to a major trauma centre over a 7 year period. We describe the patient demographics, mechanism of injury, and complications.

MATERIALS AND METHODS

General

From June 2007 to June 2014, all patients attending a major trauma centre with a distal radius fracture (fracture within 3cm of the radio-carpal joint) were identified. The clinical details were reviewed and the patients with open fractures identified. The radiographs and notes were then reviewed.

Fractures

The injuries were classified using the Gustilo & Anderson classification [9] and the fractures by the Frykman classification system.

Statistical analysis

Statistical analysis was performed with SPSS version 19.0 (IBM Corporation, New York, United States). The Shapiro-Wilk test was used to test for normality. Comparison between groups was carried out using the t-test for parametric and the Mann Whitney U test, for non-parametric data. A p value of less than 0.05 was considered statistically significant. The study was registered with the hospital Research and Innovation department.

RESULTS

General considerations

Over the 7-year period, there were 34 open wrist fractures. These comprised 24 females and 10 male patients, with a median age of 65.5 years (IQR: 52.5 to 76.8). Follow-up of fractures was for a median 49 days (IQR: 36 to 89). The majority of patients had an early discharge to the hand therapists, while 7 patients were followed-up by the orthopaedic team for more than 90 days. Tourniquet was used in 24 patients, with an additional patient where the tourniquet was applied but failed after 6 minutes and so was discontinued. The mean tourniquet time was 73.6 (SD: 24.3, range: 35 - 120).

Injury

The mechanisms of injury comprised: a fall onto an outstretched hand (22 pts, 64.7%), fall from height (5 pts, 14.7%), fall down stairs (2 pts, 5.9%), road traffic accident, (3 pts, 8.8%), 1 tractor accident from tyre explosion (1 pt, 2.9%), and 1 case where a closed fracture had become an open fracture during cast treatment (1 pt, 2.9%). The higher energy injuries were more prevalent in a younger patient group.

The fracture types, using the Frykman classification were: 3 type I, 6 type II, 5 type IV, 4 type V, 5 type VI, 2 type VII, and 9 type VIII. Using the Gustilo classification there were 21 Gustilo I, 7 Gustilo II, and 6 Gustilo III. Median age of Gustilo type I & type II was 70.5 years (IQR: 60.0-79.5) and median age of Gustilo type III was 49.0 years (IQR: 48.0 to 56.8). This showed a significantly lower age for the higher energy injuries ($p=0.024$).

Fixation

All patients underwent surgical debridement and fixation. Fixation comprised open reduction and internal fixation (27 pts), kirschner wire fixation (3 pts), external fixation with additional kirschner wires (1 pt), and external fixation alone (3 pts). Fixation took place a mean of 13.8 hours (SD: 9.7, range: 2.1 to 46.7) after arrival in hospital (the patient that developed an open fracture during cast treatment of a closed fracture was omitted from this calculation). There were two cases where the patient attended a local hospital prior to transfer to the major trauma centre. It was not possible to identify the time of arrival at the primary hospital, so arrival time at the major trauma centre was used in calculations. It should be noted that neither of these patients developed any complications. All patients received antibiotics on arrival at the hospital, these varied and comprised: Co-Amoxiclav (22 pts), Cefuroxime (3 pts), Cephadrine (1 pt), Flucloxacillin and Gentamicin (7 pts), and Teicoplanin (1 pt).

Complications

There were 10 complications in 10 patients (29%). These comprised: 2 suspected wound infections treated with antibiotics, 1 extensor pollicis longus tendon ruptures, 1 failure of fixation requiring re-fixation, 3 removal of metalwork, 1 ulna shortening for abutment due to fixation being short, 1 compartment syndrome requiring fasciotomy (tourniquet time was 80 minutes at 250 mmHg), and 1 ulnar nerve deficit. Overall 7 patients (21%) required further surgery. Of the 6 high energy injuries, there was one complication, that of the ulnar nerve deficit.

Only 8 patients underwent surgery within 6 hours, 1 of which subsequently underwent ulna shortening for abutment. Of the 15 patients undergoing surgery within 12 hours, in addition to the patient who underwent ulna shortening, there was also 1 patient who required plate removal, 1 patient who underwent fasciotomies for compartment syndrome and 1 ulnar nerve deficit and 1 superficial infection treated with antibiotics. There was no difference in complication rate between patients undergoing surgery before or after 12 hours.

DISCUSSION

Open wrist fractures are rare, occurring in approximately 2.4 people per 100,000 per year [2]. In our study, over a 7-year period, 32 open wrist fractures presented directly to our hospital, with an additional two who referred in from elsewhere. Our hospital covers a population of 500,000 people which would give an approximate figure of 0.9 people per 100,000 population a figure which is about a third of that of Court-Brown [2], who reported 2.4 per 100,000. However, it is difficult to identify the exact population served, especially as two of the patients were transferred from elsewhere in the region.

Most research on open radius and/or ulna fractures does not differentiate shaft from distal (wrist) fractures [3,10-13]. However, while no studies have directly compared distal fractures to either proximal or mid-shaft fractures, the frequency and types of complications differ between closed proximal/diaphyseal radius fractures and distal radius fractures [11,14,15]. Differences in outcome also differ depending on the mode of treatment [16,17]. We discuss the current study in the context of previous studies on distal radius fractures, although given the paucity of publications we also review the outcomes of open forearm diaphyseal fractures.

The majority of fractures (71%) in the current study resulted from a low energy injury, which is slightly lower than previous studies of open distal radius fractures who reported from 93% to 98% low energy injuries [3,4,18], but similar to the study by Duncan et al. [19] on open diaphyseal fractures, where there were 78% low

energy injuries. The higher energy injuries in the current study were present in a younger patient group.

While there was a high rate of complications, the majority were related to the fixation itself, and may be because of the more complex injuries often seen with open fractures. Patients should be made aware of not only the severity of injury, but also the high likelihood of further surgery being required. Luhmann et al. [3] reported on 65 open paediatric forearm fractures. There were 11 patients (17%) with complications. Jones [20] reported 1 re-operation for non-union, 1 deep infection, 1 delayed amputation following failed replantation, in 18 patients with high energy open diaphyseal forearm fractures.

Infection in this study was low (6%) with no deep infection. This is in accord with Kurylo et al. [4] who reported no infections in their 10 patients going to surgery within 6 hours or in their 22 patients going to surgery after 6 hours. Glueck et al. [5] also had a low infection rate of 3 in 42 patients. This contrasts to Rozental et al. [6] who reported 8 infections in 18 patients with open wrist fractures. Follow-up in the current study was on average only up 49 days, so late infections may have been missed, indeed Zumsteg et al.

[13] reported 7 deep infections after 90 days from initial fixation (10 deep infections overall), although their study comprised all 'radius and/or ulna fractures', rather than wrist fractures. While in the current study patients were not directly contacted, any re-attendance to hospital would have been identified, although we cannot completely exclude late infections as the patients may have attended elsewhere.

CONCLUSION

While this study has small numbers, making comparison between subgroups difficult, it is one of the largest studies on open distal radius fractures. In keeping with previous studies, the rate of infection is low, however the rate of re-operation is high, and this is something which patients should be made aware of early in their management.

COMPLIANCE WITH ETHICAL STANDARDS

Ewan Bigsby, Jonathan Manara, John Jackson, Owain Davies, William Harries declare that they have no conflicts of interest. The study was registered with the hospital review board with specific ethical approval not being required.

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