



Fracture of the ulnar styloid process negatively influences the outcome of paediatric fractures of the distal radius

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In paediatric patients with fractures of the distal radius, the consequences of associated ulnar styloid fractures are often underestimated. These may include persisting pain or functional deficits. The aim of the present study was to report the outcome of these fractures using a modified DASH-Score.

All children with distal radius fractures treated in a two years period were analysed ; only patients with a concomitant fracture of the ulnar styloid were included in the study. In addition, children with a non-union of the styloid at cast removal were asked to complete a postal questionnaire ; the data were compared to those in a group of patients with isolated distal radius fractures. Patients reporting problems and those with a modified DASH score over 0.5 were invited for a long-term follow-up clinical and radiological examination.

A concomitant fracture of the ulnar styloid was present in 11% of all distal radius fractures. At the time of cast removal 46 patients (89%) showed a delayed union of the ulnar styloid. The modified DASH Score of these patients at an average of 31 months (range : 24-40 months) was significantly worse (3.8 ; range : 0-24.2) compared to 0.7 (range 0-27.7) in the patients with isolated radius fractures after a mean of 27 months (range : 21-42 months). At follow-up, 7 patients showed a non-union of the ulnar styloid. Fractures of the base of the styloid process were more likely to develop non-union compared to fractures of its tip.

The presence of an ulnar styloid fracture negatively influences the outcome of distal radius fractures. Patients with lesions of the ulnar styloid should be

followed until union is observed and/or they are asymptomatic.

Keywords : distal radius fractures ; ulnar styloid ; outcome ; DASH score.

INTRODUCTION

Fractures of the distal radius are amongst the most common skeletal injuries of childhood and adolescence (5,16). In adults, up to 70% of distal radius fractures are associated with an ulnar styloid fracture (6,13,14).

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Non union is a common finding in fractures of the base of the styloid (3). The base of the styloid process serves as an anchor for the triangular fibrocartilaginous complex (TFCC) and therefore non-union of the styloid process following fractures may jeopardize the outcome of otherwise correctly treated distal radius fractures. However, ulnar styloid fractures and their outcomes have been studied in adult populations with rather heterogeneous results. In some reports non-union is associated with chronic ulnar wrist pain and pathologies of the TFCC (13). Moreover, ulnar styloid fractures in adults have been shown to be a predictive factor of worse functional outcome for distal radius fractures (2). In contrary, other authors have reported identical functional outcomes in isolated distal radius fractures when compared to distal radius fractures associated with ulnar styloid fractures (2,10,12,14). Thus, the need for a separate operative treatment of ulnar styloid fractures is still not precisely determined.

In children and adolescents the association of distal radius fractures with ulnar styloid fractures seems to be less frequent (15). As there is scarce information describing the outcome of ulnar styloid fractures in children and adolescents, the aims of the present study were (5) to report about the prevalence of ulnar styloid fractures in distal radius fractures in children and (16) to assess their long term functional outcome using a modified DASH-Score.

PATIENTS AND METHODS

All children treated for distal radius fractures at our Department in a two year period (January 2006 to December 2007) were identified. Radiographs were reviewed and only patients with an associated fracture of the ulnar styloid process were included in the study (Fig. 1).

The medical records were analyzed retrospectively for sex, age at time of injury, type of distal radius fracture, mode of treatment and anatomical location of the ulnar styloid fracture (tip or base).

Children and adolescents with a non-union of the styloid process at cast removal were asked to complete a postal questionnaire to assess function and symptoms using a modified DASH score. The same questionnaire

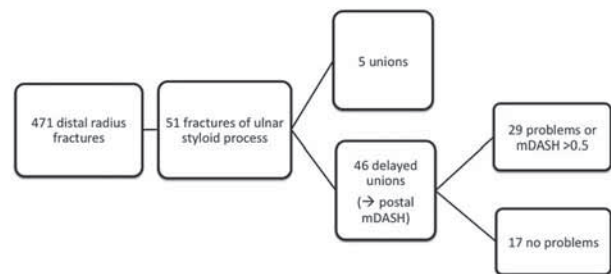


Fig. 1. — Flow chart depicting the patients with concomitant fractures of the ulnar styloid process included in the present study.

was sent to a control group of patients with isolated distal radius fractures.

Patients in the delayed union group who reported problems such as pain or restriction of movement and all those with a modified DASH score over 0.5 were invited for a long-term follow-up clinical and radiological examination.

The DASH-score is a valid score to evaluate the results of treatment of upper extremity injuries in adults. However, there is no similar outcome score for the use in children and adolescents. In this study the DASH score was therefore modified. The question about the sexual activity was removed and the formula was accordingly adapted (8).

The study was reviewed and approved by the local ethical committee (EK20-140EX08/09).

Independent samples t-tests were used to compare values of the DASH score in the isolated radius fracture group and the group with a concomitant styloid fracture. P-values of less than 0.05 were considered statistically significant. (SPSS Inc., Chicago, IL, USA, Version 16.0 for Mac). Furthermore, descriptive statistics were applied for the outcomes. A two tailed Fischer's exact test was used to show the association between fracture position and non-union rate.

RESULTS

Among 471 patients with distal radius fractures, we identified 51 (11%) patients with an associated fracture of the ulnar styloid process. Forty-two (82%) of these were male with a mean age of 13 years (range : 8 to 17) and 9 (18%) were female with a mean age of 10.4 years (range : 7 to 17) at the

time of injury The fracture occurred on the right side in 26 cases and on the left side in 25.

Fractures of the ulnar styloid were associated with a displaced (bayonet) metaphyseal distal radius fracture in 18 cases (35%), with an undisplaced Salter Harris II fracture in 15 cases (30%) and with an undisplaced metaphyseal distal radius fracture in 7 cases (14%). The remaining 11 (21%) ulnar styloid fractures were observed in combination with green stick fractures.

The styloid fractures were localized at the tip in 36 patients (71%) and at the base of the styloid process in 15 (29%).

Forty-six fractures (91%) were treated with plaster cast immobilisation for 4 to 6 weeks. Four fractures (7%) required open reduction and internal plate fixation of the radius. One fracture (2%) was fixed with K-wires. The patients with plate fixation were older than 15 years of age and their distal radial physes were near closure.

At the time of cast removal 5 patients (11%) demonstrated bony union of the ulnar styloid. The remaining 46 patients (89%) showed a delayed union of the ulnar styloid and were sent a postal questionnaire.

Modified DASH score

The modified DASH-Score of patients with delayed union of the styloid process was assessed at an average of 31 months (SD : 7.4, range : 24 to 40) after the injury. The mean score was 3.8 (SD : 6.2 ; range 0 to 24.2). Seventeen patients (37%) were free of symptoms, eight patients (17%) reported occasional discomfort or pain at rest, and nine (20%) reported occasional pain in terminal movements. Twelve patients (26%) reported pain when carrying heavy loads or performing overhead activities.

In the isolated radius fracture group (n = 60, mean age 12.3 years, range : 7-18) which served as a control, the modified DASH Score was recorded after a mean of 27 months (SD : 6.4, range 21 to 42). It was significantly lower (p = 0.046) compared to the group with delayed union of the ulnar styloid (mean 0.7 ; SD : 0.4, range : 0-27.7). Main problems in this group were occasional pain while carrying heavy loads and during overhead activities.

Clinical Follow-up and radiographs

Among the 46 patients with delayed union of the styloid process, the 29 patients reporting problems and/or having a modified DASH score higher than 0.5 were invited for clinical and radiological follow-up. Twenty of them had suffered a fracture at the tip of the styloid, and 9 a fracture at the base of the styloid process.

Twenty seven patients (93%) had a good functional outcome with a full range of motion of the injured wrist. Two (6%) patients – both treated with open reduction and internal fixation – had a slight limitation in dorso- and palmar-flexion compared to the contralateral side. Of these two, one child also had restriction in pronation and supination and discomfort in the terminal range of movement.

Radiographs at follow-up showed that the ulnar styloid had healed in an anatomical position in 21 patients (72%) ; one patient (4%) showed an ulnar side translation while 7 (24%) patients showed a non-union. Interestingly, only two of the 20 fractures of the tip (10%) showed a non-union, whereas five of nine fractures of the base of the styloid (56%) were not united (Fig. 2 & 3). A two tailed Fischer's exact test showed a significant association between fracture location and non-union rate (p = 0.02), with a tendency of base fractures of the styloid to develop non-union.

All patients with non-unions at the base furthermore showed instability of the distal radio-ulnar joint. These patients complained of intermittent wrist pain, specifically associated with lifting heavy objects or over head activities. An MRI of the wrist revealed a partial rupture of the TFCC. Instability of the distal radio-ulnar joint was present in none of the patients with non-unions of the tip of the ulnar styloid.

DISCUSSION

In patients with fractures of the distal radius, the consequences of associated ulnar styloid fractures are often underestimated. In the present study we were able to show that the modified DASH-Score of patients with delayed union of the styloid process is significantly worse compared to patients with

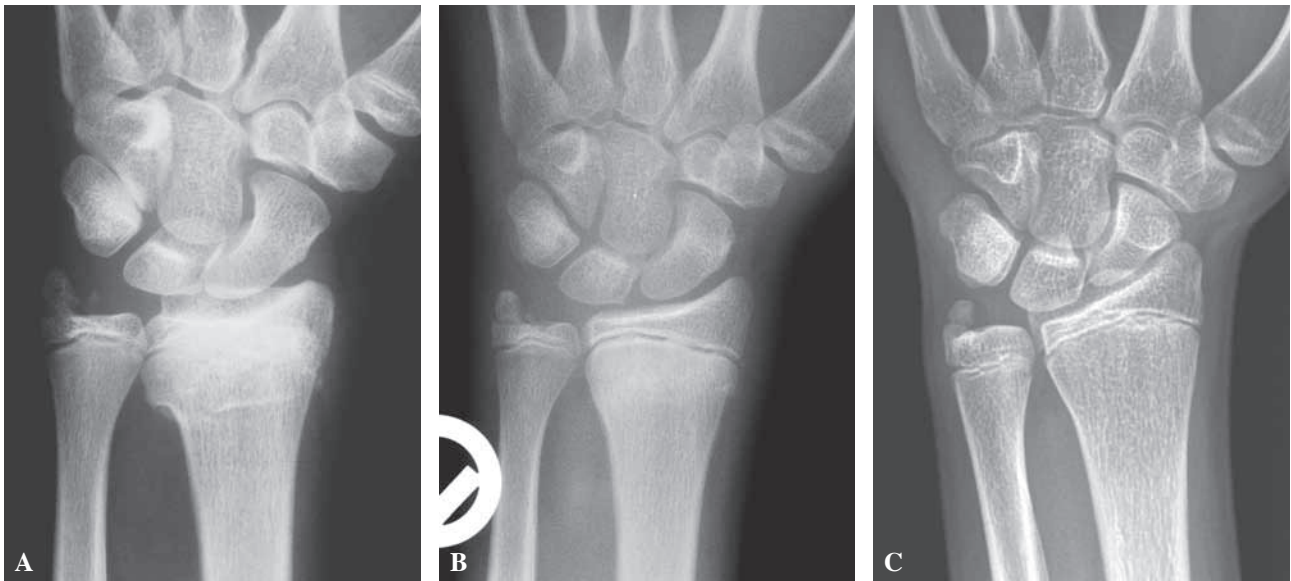


Fig. 2. — A) 12-year-old boy, distal radius fracture with fracture at the base of the ulnar styloid process ; B) 4 weeks post trauma after cast removal ; C) long-term follow-up after 31 months.

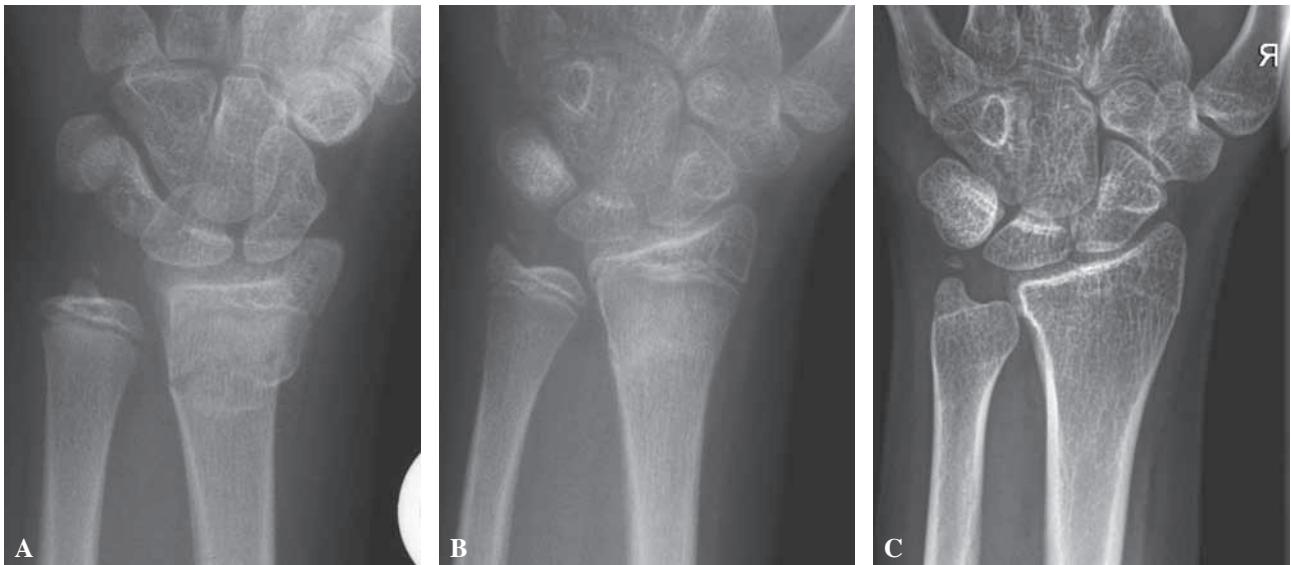


Fig. 3. — A) 11-year-old girl, distal radius fracture with fracture of the tip of the ulnar styloid process ; B) 5 weeks post trauma after cast removal ; C) long-term follow-up after 42 months.

isolated radius fractures. Additionally, fractures of the base of the styloid tend to develop non-unions when compared to fractures at the tip of the styloid process.

We noted an association of an ulnar styloid fracture with distal radius fractures in about one tenth of our patients. This is much lower than the proportion reported by Stansberry *et al* who found that out of

222 wrist fractures, 45 children (33%) had an associated fracture of the ulnar styloid (10). In contrast, 40-70% of distal radius fractures in adults are associated with an ulnar styloid fracture (6,13,14). The seemingly lower prevalence of ulnar styloid process fractures in children may be due to the fact that the ulnar styloid ossifies at the age of 7 years in girls and 9 years in boys (11). Thus, a certain number of fractures occurring prior to the appearance of the ossification centre may be missed and therefore lead to an underestimation of the true incidence. Abid *et al* in their study of 46 paediatric ulnar styloid fractures reported two such examples (1).

We found ulnar styloid fractures to be associated with all types of distal radius fractures with no specific pattern. This mirrors the findings of Abid *et al* (1) while other studies do not mention the types of distal radius fractures occurring in combination with ulnar styloid process fractures (11,15). Similar to other reports in the literature (1) we found that the majority of ulnar styloid fractures were located at the base. Additionally, we were able to demonstrate a significant association of styloid base fractures and symptomatic non-union. Fractures at the ulnar styloid base were found to increase the risk of distal radioulnar joint instability (13). This is not surprising since the base of the ulnar styloid process serves as the major attachment for the TFCC. In contrary, in patients with a non-union located at the tip of the ulnar styloid process, the TFCC should remain unharmed (7). However, other series describing tears of the TFCC in both tip and base fractures do not confirm our observation (1).

There is scarce information in literature reporting objective long-term outcome of non-unions of the ulnar styloid process in children. Our study shows that paediatric patients with delayed union of the styloid process have a worse modified DASH score when compared to a control group of patients with isolated distal radius fractures. Several other studies also have addressed symptomatic ulnar styloid non-unions and these indicate that ulnar styloid non-union usually has a negative impact on injured wrists (4,7). In contrary, Kim *et al* found no significant differences after a follow-up study between adult patients with union and non-union of ulnar styloid fractures respectively (9). Moreover, Buijze

and Ring performed a comparison of the clinical impact of united versus non-united fractures of the proximal half of the styloid process following volar plate fixation of the distal radius (3). They found that non-union of the ulnar styloid had no effect on wrist function, pain or DASH score. However, their conclusions were based on a relatively short follow-up period of 6 months. Due to these conflicting results there is no consensus in the literature concerning treatment of fractures of the ulnar styloid. Abid *et al* suggest that a displaced ulnar styloid fracture should be reduced by positioning the wrist in an ulnar inclination maintained by the cast (1). Although this seems to be a reasonable manoeuvre, no data is provided supporting this technique.

This study has some limitations: the DASH score was developed and is validated for adults. However, no valid score for measuring the outcome of children sustaining injuries of the upper limb is available. We therefore modified the DASH score as described above, in order to more accurately reflect the activities of children and adolescents.

In children and adolescents sustaining a distal radius fracture in combination with a fracture of the ulnar styloid process, we suggest to treat the distal radial fracture and to follow the patients until union of the radius and ulnar styloid process is observed and/or the patient is asymptomatic.

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