Injury, Int. J. Care Injured 43 (2012) 908–911

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Displaced paediatric distal radius fractures—When should we use percutaneous wires?

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ARTICLE INFO

Article history:
Accepted 6 January 2012

Keywords:
Paediatric
Radius
Fracture
Closed reduction
Displacement
K-wiring

ABSTRACT

Purpose: To establish the intra-operative radiographic parameters that predict the need for percutaneous wire fixation to prevent redisplacement following manipulation for displaced paediatric distal radius fractures.

Materials and methods: A retrospective study of 105 children, assessing pre-, intra- and post-operative radiographs. Optimal reduction was defined as less than 10% residual translation and less than 5° of angulation on anteroposterior and lateral radiographs. Redisplacement was defined as more than 20° angulation or 50% translation on either view.

Results: No fracture that was optimally reduced redisplaced. 40% of fractures with suboptimal reduction redisplaced. Initial translation was significantly associated with redisplacement.

Conclusions: If our criteria for optimal reduction are met, closed reduction and casting can be confidently employed. If not, percutaneous wires should be employed to avoid redisplacement, especially in cases with a high grade of initial translation.

Introduction

Forearm fractures are amongst the commonest skeletal injuries in childhood.[1] The majority (75–84%) occur in the distal third, with the remainder in the middle (15–18%) and proximal thirds of the forearm (1–7%).[2] There has been much debate regarding the amount of angulation and displacement that is acceptable before operative intervention becomes necessary. In general, the younger the child, the more distal the fracture, and the lesser the angulation, the better the result without intervention.[3,4]

For displaced fractures, closed reduction and cast immobilisation has been the mainstay of treatment in this population but rates of redisplacement of 25–39% have been reported.[5,6] Numerous studies from large centres have identified risk factors for redisplacement, with an initially 'off-ended' fracture[7–9] and imperfect reduction[5,7,10] shown to have a high redisplacement rate. However, no study has clearly defined what represents an acceptable reduction. The use of percutaneous Kirschner wires (K-wires) has been shown to reduce the risk of redisplacement[11,12] and their use at initial surgery has been advocated in the presence of these proven risk factors.[7,13] In practice however, the general orthopaedic trauma surgeon may be unwilling to use K-wires on a child, especially when an apparently satisfactory closed reduction has been achieved.

The aim of this study was to establish the quality of reduction necessary to avoid redisplacement and therefore define the intra-operative radiographic parameters that, if not achieved, necessitate fracture stabilisation with K-wires. The secondary aim was to determine the rate of redisplacement if wires were not used in cases of imperfect reduction.

Materials and methods

A retrospective analysis was carried out between September 2010 and 2011 of all children under the age of 16 years old who underwent operative intervention for a distal third radius fracture in a District General Hospital in the United Kingdom. Open fractures, cases with associated dislocations and epiphyseal injuries were excluded from the study. The decision to operate and the treatment received were made in each case by the on-call consultant in charge of the patient's care.

The study was registered locally and demographic data was collected from electronic records. Pre-operative radiographs were reviewed and initial translation was measured and graded according to the loss of bony contact, using the system proposed by Mani et al., where grade I has no loss of contact, grade II <50%, grade III >50%, and grade IV is complete displacement .[8] When no internal fixation was employed, intra-operative radiographs were scrutinised to assess the success of closed reduction, with optimal reduction defined as less than 10% residual translation and less

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doi:10.1016/j.injury.2012.01.006

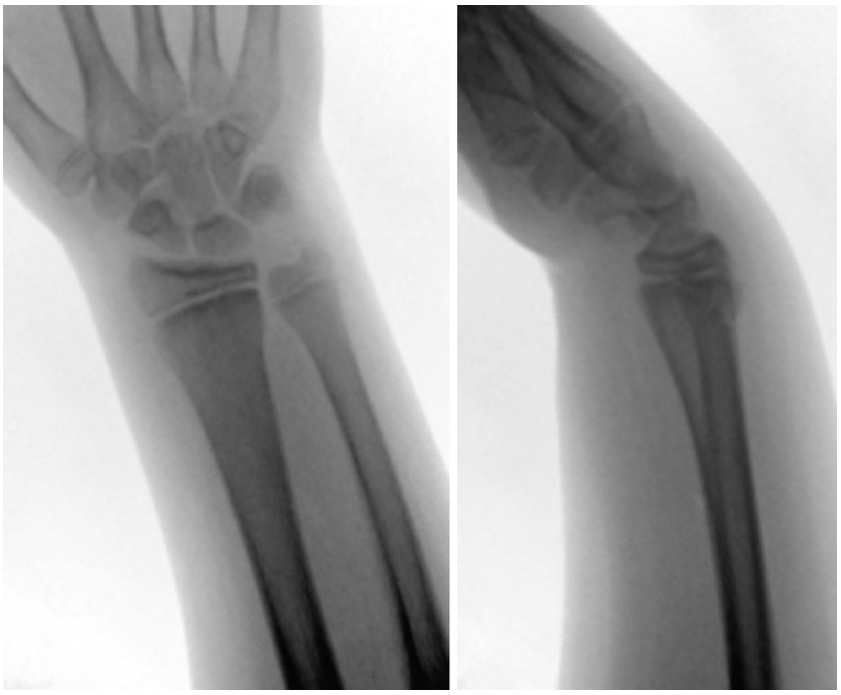

Fig. 1. Optimal reduction of distal radius fracture with initial grade IV translation.

than five degrees of angulation in the sagittal or coronal plane. Examples of optimal and suboptimal reduction are given in Figs. 1 and 2. Clinic records and post-operative radiographs were reviewed to identify any redisplacement, reintervention or complications. As in previous studies, redisplacement was defined as more than 20° of angulation or less than 50% of bony contact.[9,13]

Risk factors for redisplacement were evaluated. The *t*-test for independent samples was used to assess the effect of age and distance of the fracture from the physis. The Fisher exact test was used for sex, associated ulna fracture and success of reduction. The one-way ANOVA test was used for the grade of translation. Statistical analysis was performed using IBS SPSS Statistics 19.0.

Results

During the study period 105 patients underwent operative intervention for distal radial fractures with 83 fitting the inclusion criteria. Of those cases excluded there were 20 epiphyseal injuries,

Fig. 2. Suboptimal reduction of distal radius fracture with initial grade III translation.