Operative management of nonunion scaphoid fracture in children: a case report and literature review

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Abstract Scaphoid fractures are uncommon in children, but if maltreated, they can result in nonunion. The authors report a case of left scaphoid nonunion in an 11-year-old boy. The operative management of this pseudarthrosis was performed (K-wire fixation and bone grafting of scaphoid). After a 10-month follow-up period, the left wrist regained a full range of motion with no impairment. The roentgenograms showed union of the scaphoid. Surgical management of scaphoid nonunion fractures in children offers successful fusion, with very low nonunion rate and patient’s satisfaction.

Keywords Scaphoid · Nonunion · Surgery · Children

Introduction

Fractures of the scaphoid are rare lesions in children accounting for nearly 0.4% of all paediatric fractures [1, 2]. Most of them are successfully managed with standard cast immobilization. However, nonunion of this carpal fracture in children is extremely rare and is generally attributed to diagnosis delay or failure. Acute scaphoid fractures correctly treated by prompt immobilization have a very low (0.8%) nonunion rate [3]. Nonunion can be classified into two groups: children whose fractures go unrecognized and therefore untreated, and those whose fractures are diagnosed, appropriately treated, but still do not unite. We present a case of nonunion scaphoid fracture in an 11-year-old boy, which was successfully treated by bone grafting and Kirschner-wire fixation.

Case report

An 11-year-old boy was examined after sustaining a fall on his outstretched left hand during sports activities. The patient complained of pain in the wrist without deformity. The clinical examination revealed a light swelling of the dorsal wrist. The neurovascular states were normal. The X-ray’s appearance of the left wrist was normal. His wrist was placed in plaster cast for 3 weeks, after which he was pain free. Fifteen months later, he re-injured his left wrist. The roentgenograms showed nonunion of scaphoid fracture (Fig. 1). He was surgically treated through the following steps:

- Anterior approach of the scaphoid.
- Cancellous bone grafting of the scaphoid. The bone graft was taken from the iliac crest.
- Kirschner-wire fixation (Fig. 2).

In the postoperative management, a thumb-spica cast was applied for 8 weeks. The plaster and the k-wires were removed at the same time, with no postoperative complications.

After a 10-month follow-up period, the left wrist regained full range of motion with no impairment. X-rays showed union of the scaphoid in good position (Fig. 3).

Discussion

The low incidence of scaphoid fractures in children has been attributed to the cartilaginous state of the bone [4]. The ligamentous and cartilaginous structures of the
children’s wrist offer relative resistance, the impact force being delivered to the distal radius which is more prone to injury.

These fractures are uncommon, accounting for only 0.45% of all fractures in the upper limb and 2.9% of all fractures of the hand and wrist in children [1]. The peak

Fig. 1 Initial anteroposterior (a) and lateral (b) radiographics of the left wrist show a nonunion scaphoid fracture

Fig. 2 a and b Postoperative X-ray film showing the bone grafting of the scaphoid and K-wire fixation
incidence of the scaphoid fracture is between the ages of 12–15 years [5].

Unlike scaphoid fractures in adults, paediatric scaphoid fractures involve the distal pole in 59–87% of cases, the middle pole in 12–36% and the proximal pole in 0–2% [2].

Most scaphoid fractures in children can be successfully treated with cast immobilization, with a very low (0.8%) nonunion rate [3].


Nonunion of scaphoid fractures in children is attributed to a delay or failure in diagnosis. When nonunion of scaphoid fractures is diagnosed, the treatment principles to be applied are similar to those used on adults [7]. Various procedures have successfully been used including bone grafting [8], K-wire fixation [7] as well as screw fixation (standard AO or Herbert) with or without bone grafting [4].

Although bone grafting through the anterior approach has been advocated as the treatment of choice [8], we agree with Maxted [4] that fixation of the graft bone by Kirschner wires until complete union is an important addition to the procedure. Open reduction and internal fixation with a Herbert screw using bone graft is a reliable option that yields excellent results [9].

Screw fixation and bone grafting was the most performed procedure in the study of Henderson and Letts [10]. They reported similar results with other procedures (K-wire fixation without bone grafting, bone grafting without fixation). The question is whether the use of screws will disturb the normal growth of the scaphoid or not. Mintzer and Waters [11] reported that the smaller size of Herbert screw can be accommodated by the small paediatric scaphoid and provide rigid internal fixation without complication. The treatment is often surgical, all series showed successful results with operative management of scaphoid fracture nonunion in children. Because a child’s scaphoid has a more favourable healing capacity than that of an adults, Weber et al. [12] proposed prolonged treatment with cast immobilisation for nonunion scaphoid fractures in children. In their study, about six children with ununited scaphoid fractures treated conservatively, the mean period of immobilisation was 5.3 months (3–7), and they had a union of the fracture and an excellent Modified Wrist Score in all patients. With prolonged immobilisation in children, stiffness and osteoporosis do not seem to be an issue, and full motion of the wrist will be obtained.

The correction of the DISI intraoperatively may lower the risk of degenerative changes. The persistent postoperative DISI pattern has been asymptomatic with otherwise normal radiographs [11]. The growing scaphoid and remodelling capacity enable the correction of minor degrees of malunion.
Conclusion

Surgical treatment of nonunited scaphoid fractures in children offers successful fusion, with very low rates of nonunion and a high rate of patient satisfaction.

Conflict of interest None.

References