Corrective osteotomy for a malunited proximal radius fracture causing radio-capitellar dislocation in a paediatric patient: A case report

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Abstract

Background: Malunited proximal radius fractures causing dislocation of the radio-capitellar joint are rare. We present a case of a two-year-old female patient with such an injury who was treated with a proximal radius osteotomy with good long-term outcomes.

Method/results: Case study of a single patient with a malunited proximal radius fracture which was identified as causing radio-capitellar dislocation who underwent corrective osteotomy with a good result.

Conclusion: Our opinion is that a corrective osteotomy for a malunited proximal radius fracture causing radio-capitellar dislocation is a sound treatment option and that no supplementary soft tissue reconstruction such as annular ligament exploration/reconstruction is necessary.

Keywords

paediatric, elbow, osteotomy, proximal radius fracture, dislocation

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Introduction

Although paediatric forearm fractures are common, most heal uneventfully. It is well recognised that some malunions can result in lack of full pronation/supination and a clinically relevant disability.^{1,2} However, most do well due to abundant remodelling capacity, even when anatomical reduction has not been achieved.^{3,4} This has been shown to be greatest in the distal radius metaphyseal region.⁵ However, in diaphyseal fractures the potential remodelling capabilities are less⁶ and can lead to disruption of pronation/supination.^{7,8}

Patient and technique

A two-year-old female patient sustained an angulated right proximal radius fracture, with no concomitant injury to the ulna, after falling from a sofa (Figures 1 and 2). She underwent a manipulation under anaesthetic and her fracture was immobilised in an above elbow plaster cast for six weeks. At five months, despite

a good flexion–extension range she had limited pronation. Also, patient's mother had also noticed that having been completely right-hand dominant, she was starting to favour her left hand for manual tasks.

There was no relevant medical history, and the patient had achieved normal developmental milestones throughout.

She was referred to our unit at five months after the original injury due to a lack of pronation. On clinical examination, she had a normal, symmetrical carrying angle with no gross clinical deformity of the forearm. Flexion/extension was pain free and full. However, she had lacked the last 30 degrees of pronation; with a palpable painful click at radio-capitellar/proximal radioulnar joint (PRUJ). Radiographs illustrated a

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Figure 1. Initial injury AP.
Note: No associated ulna fracture.

Figure 2. Initial injury lateral.

well healed, angulated proximal radius fracture with malalignment of the radio-capitellar joint on the antero-posterior (Figures 3 and 4).

In order to assess the dynamic effect of the malalignment on the radio-capitellar joint, the patients was elected for an examination under anaesthetic (EUA) and an arthrogram which took place six months after the original injury.

Figure 3. AP radiograph five months post injury.

The EUA confirmed the lack of observed pronation and a normal radio-capitellar joint congruity in supination (Figure 5), but as the forearm was taken through pronation, the radial head gradually lost alignment with a full dislocation at 70 degrees (Figure 6).

After discussion with the patient and her family, she was elected to undergo a proximal radius corrective osteotomy at 10 months after the initial injury.

The operation was done under general anaesthetic and image intensification. A Henrys' approach was used to expose the malunion site. The posterior interosseous nerve and artery were identified, protected and taken ulnarly whilst the superficial radial nerve was retracted radially and protected. Exposure of the proximal radius was achieved by elevation of pronator teres and a limited release of supinator. This exposure gave good access to the volar aspect of the radius at the site of the deformity. The maximal angulation (30 degrees) and plane of the deformity was noted with use of image intensifier. A 15-degree wedge osteotomy was performed with the use of an oscillating saw and saline irrigation for temperature control. The wedge was then flipped 180 degrees and reinserted in the osteotomy site in order to maintain the overall length of the radius avoiding PRUJ/DRUJ incongruity. The osteotomy was maintained with a 5-hole 2 mm plate with two cortical screws either side of the osteotomy. Intraoperative images confirmed the radial head to be fully congruent through pronation/supination, with the full extent of pronation achievable (Figures 7 and 8).

She was placed into an above elbow backslab in supination for two weeks after which she started mobilising her elbow under supervision of physiotherapists.

Figure 4. Lateral radiograph five months post injury. Note: Radio-capitellar alignment appears abnormal.

Figure 5. Arthrogram in supination showing radio-capitellar joint congruity.

Figure 6. Arthrogram in pronation showing radial head dislocation.

Figure 7. Intraoperative radiograph of osteotomy in supination.

At two months, she had a normal, pain free range of movement, which was equal to the left arm. Six months post-operatively, her plate was removed once the osteotomy was clinically and radiographically perceived to be healed, as this is routine in our paediatric practice.

At final follow-up (four years and five months post-operatively), she was pain free, with a full range of movement of elbow and forearm. Radiographs demonstrated a normal alignment of radius and ulna (Figures 9 and 10).

Figure 8. Intraoperative radiograph of osteotomy in full pronation.
Note: The improvement in radio-capitellar alignment.

Figure 9. AP view of forearm at four years five months post removal of metalwork.

Figure 10. Lateral view of forearm four years five months post removal of metalwork showing normal alignment of radio-capitellar joint.

Discussion

The use of osteotomy in correcting malunited paediatric forearm fractures is well documented.^{9–11} For traumatic radial head dislocations, annular ligament reconstruction has also been shown to be efficacious.^{11–13} However, these cases are related to Monteggia-type injuries and when such a clinical malalignment is faced with, a pure soft tissue procedure would not be appropriate. Hazel and Bindra¹⁴ discussed revising a radial osteotomy intraoperatively owing to radial head subluxation being present after an opening wedge osteotomy was performed; however, this case differs from ours in several ways. Firstly, it is in an adult who suffered the malunited fracture 35 years prior to the operative intervention. Secondly, it demonstrates another example of osteotomies being performed for an injury not only to the radius but also to the ulna. To our knowledge, only one case in English literature has demonstrated a radial osteotomy for radial head dislocation following

an isolated radial shaft fracture.¹⁵ What makes our case unique is that in Yamazaki et al.'s case, the authors needed to supplement their corrective osteotomy with an annular ligament reconstruction in order to keep the radial head reduced. Our opinion remains that should the corrective osteotomy fully addresses the deformity in the appropriate plane of deformity, there would be no need for supplementary soft tissue reconstruction as demonstrated in this case.

Yasutomi et al.⁹ highlighted the mechanism of radial dislocation following malunited forearm fractures. In our case, there was no associated ulna fracture and the radial shaft had a significant malunion forcing the radial head to dislocate as the forearm constraints (interosseous membrane, muscular attachments and DRUJ) were intact.

Of interest, we noted in our case report that the mother became aware of the patient using her left hand more for manual tasks such as voluntary grasping. Although research into hand preference has noted preschool infants can switch from using left and right hands for such tasks, there is evidence to show that preference over being left or right handed emerges very early in an infant's life. This has been shown as early as the gestational period by ultrasound being used to observe intrauterine thumb sucking preference and also measuring neonatal grip strength.¹⁶

The key issue addressing the radial or ulnar malunion is to maintain the relative length in order to prevent the PRUJ or DRUJ malalignment. As illustrated in this case, one way to maintain length and address the angular deformity is to take a wedge, half the angle of deformity, reverse it (in order to 'double' the correction) and insert it back in situ, hence maintaining the length; essentially performing a 15 degree closing and 15 degree opening wedge osteotomy to reconstruct a 30 degree deformity. In our opinion, with this technique, it is unlikely that further soft tissue reconstruction would be required.

Declaration of Conflicting Interests

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