NEW BADO TYPE IV MONTEGGIA FRACTURE DISLOCATION VARIANT OCCURRING IN A CHILD: A CASE REPORT

A. Younus, FC Orthopedics (SA), **N. Ncobela**, MBChB (SA), Helen Joseph Hospital, Johannesburg, South Africa and **A. Kelly**, FC Neurosurgery (SA), Dr George Mukhari Academic Hospital, Pretoria, South Africa

Correspondence to: Dr. Adrian Kelly, P.O. Box Medunsa, Pretoria, South Africa. Email: adriankelly1000@yahoo.co.uk

ABSTRACT

Bado Type 4 Monteggia fractures are defined as fractures of the proximal or middle third of the ulna occurring together with a fracture of the proximal radius with anterior radial dislocation. These lesions are rare comprising approximately 1% of Monteggia fracture subtypes. We report a previously non-classified further subtype of the Bado Type 4 Monteggia fracture namely, a fracture of the proximal ulna occurring together with a Salter-Harris Type II fracture dislocation of the radial head with anterior radial dislocation occurring in a child. The acute presentation enabled the radial head to be reduced and both the radial and ulnar fractures were held with Kirschner wires. At 6 weeks post-operatively the Kirschner wires were removed and the patient demonstrated a normal range of motion.

Key words: Bado Type IV Monteggia fracture dislocation, Salter-Harris II radial head, Paediatric Monteggia fracture dislocation

INTRODUCTION

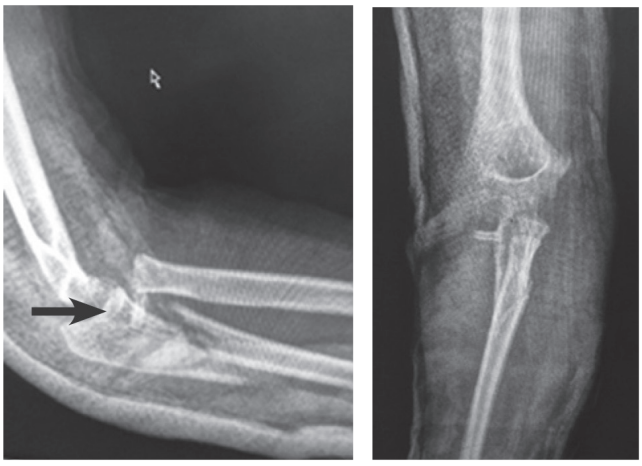
In 1914 Giovanni Battista Monteggia first described a Monteggia fracture which he defined as a proximal ulnar fracture occurring together with dislocation of the radial head (1). In 1967 Jose Louis Bado developed a four-tier sub-classification based on the anatomical variation of the fracture dislocation. In this sub-classification Type 1 refers to a proximal diaphyseal ulnar fracture with anterior dislocation of the radial head; Type II refers to a proximal diaphyseal ulnar fracture with posterior or posterolateral dislocation of the radial head; Type III refers to a proximal metaphyseal ulnar fracture with lateral or anterolateral dislocation of the radial head; and Type IV refers to a proximal diaphyseal ulnar fracture with anterior dislocation of the radial head occurring together with a concomitant proximal diaphyseal radial fracture (2). While applicable and relevant to the adult population few case reports exist specifically considering the Bado Monteggia classification in the paediatric population (3-8). A further challenge when considering specifically the Bado IV Monteggia fracture dislocation is its rarity comprising between 1% and 10% of cases in several large series (9-13). The importance of aptly managing these lesions is that delayed diagnosis commonly results in ulnar mal-union with anterior bowing and an irreducible radial head (14). According to our review of the English literature this is the first report of this fracture pattern being described.

CASE REPORT

A nine year old female patient presented to our unit after an innocuous fall from a bed complaining of severe pain, swelling and deformity of the right forearm. Clinical examination revealed a closed injury with no neurovascular deficit being demonstrated. X-rays of the right forearm were performed which demonstrated a Bado Type IV Monteggia fracture dislocation variant, namely a proximal ulnar metaphyseal fracture occurring together with a Salter-Harris II fracture dislocation of the radial head with anterior radial dislocation (Figure 1).

Figure 1

Pre-operative radiograph of the right forearm showing Bado Type IV Monteggia variant: Ulnar metaphyseal fracture occurring with Salter-Harris II fracture dislocation of the radial head with anterior radial dislocation (Black arrow)



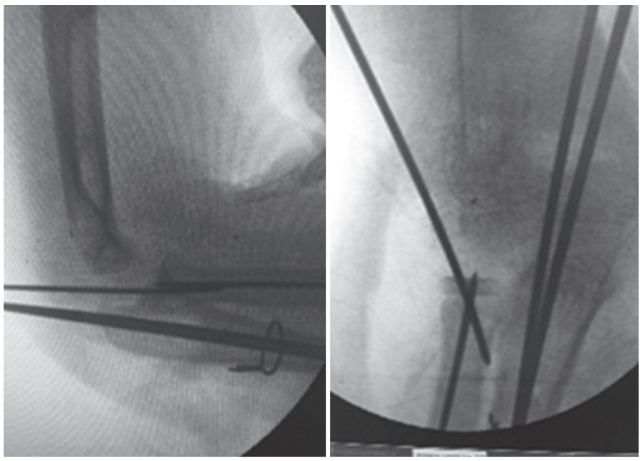
Under general anaesthesia utilizing fluoroscopic imaging, a closed reduction was initially attempted using Patterson's manipulative technique (15) together with the Israeli flexion-pronation reduction technique (16), however both were unsuccessful. Due to failure of closed reduction we proceeded to open reduction using the Boyd surgical approach (17-19).

The intra-operative findings confirmed a displaced proximal metaphyseal fracture of the ulna and a Salter-Harris II fracture dislocation of the radial head which was dislocated anteriorly outside of an intact annular ligament. After reduction the radial head remained unstable recurrently dislocating anteriorly from the annular ligament. Due to the inherent instability of the radial head within the annular ligament the ulnar fracture was addressed first utilizing a single antegrade 1.8mm intra-medullary Kirschner wire to reduce and provide some stabilization of the ulnar fracture. Thereafter while holding the radial head within the annular ligament as well as reducing the Salter-Harris II fracture of the radial metaphysis, a single retrograde 1.8mm Kirschner wire was inserted to maintain the radial head within the annular ligament as well as fixate the Salter-Harris II fracture of the radial head. Stability of the radius was increased with a single 1.8mm Kirschner wire being passed obliquely through the radial epiphysis, physis, and radial neck, in that sequence.

After radial fixation the ulnar fracture, at this point held only with a single anterograde Kirschner wire, angulated posteriorly and while being held in a reduced position, a second antegrade Kirschner wire was inserted in an attempt to maintain the reduction. This was however unsuccessful as the posterior ulnar angulation partially recurred. To maintain the ulnar reduction a cerclage wire was passed around the ulnar fracture fragments which successfully reduced the fracture and completely corrected the posterior ulnar angulation. Intra-operative X-rays confirmed successful anatomical reduction of the fracture of ulna the radius (Figure 2) and visual confirmation confirmed the radial head to be reduced within the annular ligament. The wound was closed in layers and an above elbow back slab was applied at ninety degrees of flexion and neutral rotation.

Figure 2

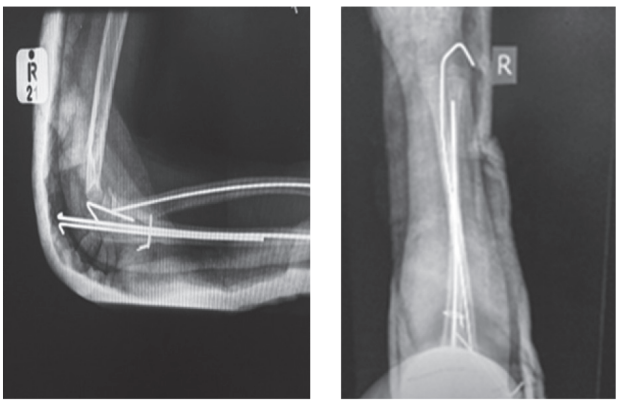
Intra-operative X-ray of the right forearm: showing two antegrade 1.8mm intramedullary ulnar Kirschner wires and a cerclage wire around the fracture fragments of the ulna. One retrograde 1.8mm Kirschner wire and an obliquely inserted 1.8mm Kirschner wire were used to maintain the Salter-Harris II radial fracture dislocation



Post-operative control X-rays confirmed the fractures to be maintained in a reduced position and the child's wounds healed well (Figure 3).

Figure 3

Post-operative radiograph of the right forearm: showing maintained reduction of the ulnar and radial fractures



At six weeks post operatively radiographs confirmed the fractures to have united and the Kirschner wires were removed (Figure 4).

Figure 4

X-ray right forearm after removal of Kirschner wires: confirmed fracture union and an acceptable reduction had been achieved

After Kirschner wire removal the child commenced physiotherapy and at her three month review demonstrated a normal range of motion (Figure 5).

Figure 5

Three month review: demonstrated a normal range of motion of elbow flexion/extension as well as forearm pronation/ supination

DISCUSSION

The mainstay of diagnosis of the classical Bado IV Monteggia fracture dislocation relies on radiographic confirmation of an ulnar diaphyseal fracture and radial diaphyseal fracture which is relatively straight forward. These two radiographic features must however occur together with anterior radial head dislocation for the definitive diagnosis to be made. Demonstrating this dislocation relies on the radiocapitellar line which refers to a line drawn through the radial head from the radial shaft where radial head dislocation is confirmed when this line does not pass through the capitalism in all views (2).

This Bado Monteggia classification finds limited applicability in our index case which by occurring in a child demonstrated a Bado IV Monteggia variant involving a Salter-Harris Type II fracture of the radial head rather than the classical proximal radial diaphyseal fracture which, according to our review of the English literature, has not been previously described.

The mechanism of injury behind the Bado IV Monteggia fracture pattern, applicable to the classical form as well as our variant, is explained by the hyperextension theory of Thompkins which traditionally describes how the classical Bado IV Monteggia fracture occurs. According to this theory this injury occurs as a result of three steps namely hyperextension of the elbow joint, subsequent radial diaphyseal fracture and radial head dislocation, and finally ulnar diaphyseal fracture (20).

Early recognition and imaging of the elbow is crucial as persistent radial head dislocation can result in loss of forearm rotation, cubitus valgus, elbow instability and chronic pain. Failure to recognize the radial head dislocation is the major complication of this fracture (21-23). Papadrea and Waters (24) reported a very high complication rate with reconstruction of the ulnar and radius in the context of an unreduced radial head. Reduction of the fracture should be performed as soon as possible as the subsequent muscular spasm, soft tissue inflammation, callus organization, and hyper vascularization may make the reduction difficult or even impossible to achieve (25).

In conclusion, we describe a Bado IV Monteggia fracture variant that occurred in a child secondary to unique anatomical considerations that exist in the paediatric age group. According to our English literature review this variant has not been described previously and as such our description is unique. Adherence to standard orthopaedic principles resulted in a good clinical outcome and the child is undergoing out-patient evaluation in our orthopaedic clinic.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of interest

None of the authors have any financial nor personal relationships with other people, or organizations, that could inappropriately influence (bias) their work, all within 3 years of the beginning the work submitted.

REFERENCES

1. Monteggia, G.B. Instituzion Chirurgiche. 1814. Milan.
2. Bado, J.L. The Monteggia lesion. *Clin Orthop Rel Res* 1967; **50**:71-86.
3. Ha, T., Grant, S. and Hurtley, J.S. Monteggia type IV fracture in a child with radial head dislocation irreducible by closed means: a case report. *BMC Res Notes*. 2014; **7**:539-542.
4. Sajjad, M., Ashwood, N., Rao, V. and Galanapoulos, I. Monteggia type 4 fracture –A case report of an unusual presentation of a rare injury. *Ann Clin Case Report.* 2016; **1**:1158-60.
5. Gibson, W.K. and Timperlake, R.W. Operative treatment of a type IV Monteggia fracture-dislocation in a child. *J Bone Joint Surg Br.* 1992; **74**:780-781.
6. Rodgers, W.B. and Smith, B.G. A type IV Monteggia injury with a distal diaphyseal radius fracture in a child. *J Orthop Trauma*. 1993; **7**: 84-86.
7. Bhandari, N. and Jindal, P. Monteggia lesion in a child: variant of a Bado type-IV lesion- A case report. *J Bone Joint Surg Am*. 1996; **78**:1252-55.
8. Garwal, A. Type IV Monteggia fracture in a child. *Can J Surg.* 2008; **51**:E44-45.
9. Beaty, J.H. and Kasser, J.R. Rockwood and Wilkins' fractures in children 5th ed. 2001. Philadelphia: Williams and Wilkins.
10. Olney, B.W. and Menelaus, M.B. Monteggia and equivalent lesions in childhood. *J Pediatr Orthop.* 1989; **9**:219-223.
11. Wiley, J.J. and Galey, J.P. Monteggia injuries in children. *J Bone Joint Surg Br.* 1985; **67**:728-731.
12. Givon, U., Pritsch, M., Levy, O., Yosepovich, A., Amit, Y. and Horoszowski, H. Monteggia and equivalent lesions- A study of 41 cases. *Clin Orthop Relat Res.* 1997; **337**:208-215.
13. Ring, D. and Waters, P.M. Operative fixation of Monteggia fractures in children. *J Bone Joint Surg.* 1996; **78**:734-739.
14. Wada, T., Monji, J., Sato, O. and Yamashita, T. A missed Bado-type IV Monteggia lesion in a child treated with gradual lengthening and angulation of the ulna using Ilizarov technique. *Injury.* 2006; **37**:371-374.
15. Patterson, R.F. Treatment of displaced transverse fractures of the neck of the radius in children. *J Bone Joint Surg*. 1934; **16**:695–698.
16. Kaufman, B., Rinott, M.G. and Tanzman, M. Closed reduction of fractures of the proximal radius in children. *J Bone Joint Surg Br*. 1989; **71**:66–67.
17. Benz, G., Kalliesis, D., Daum, R. and Zachariou, Z. Does lateral bending lead to bowing fracture in an infantile lower arm? *Eur J Pediatr Surg*. 1992; **2**(3):177-179.
18. Boyd, H.B. and Boals, J.C. The Monteggia lesion: A review of 159 cases. *Clin Orthop Relat Res*. 1969; **66**:94–100.
19. Speed, J.S. and Boyd, H.B. Treatment of fractures of ulna with dislocation of head of radius: Monteggia fracture. *JAMA.* 1940; **125**:1699-73.
20. Tompkins, D.G. The anterior Monteggia fracture. *J Bone Joint Surg Am*. 1971; **53**:1109–14.
21. Tawse, A.J. The treatment of malunited anterior Monteggia fractures in children. *J Bone Joint Surg Br*. 1965; **47**:718–723.
22. Lloyd-Roberts, G.C. and Bucknill, T.M. Anterior dislocation of the radial head in children: Aetiology, natural history, and management. *J Bone Joint Surg Br*. 1977; **59**:402–407.
23. Ring, D. and Waters, P.M. Operative fixation of Monteggia fractures in children. *J Bone Joint Surg.* 1996; **78**:734–739.
24. Papandrea, R. and Waters, P.M. Posttraumatic reconstruction of the elbow in the pediatric patient. *Clin Orthop Relat Res*. 2000; **370**:115–126.
25. Brinker, O., Piermattei, D.L. and Flo, G.L. Handbook of small animal orthopaedics and fracture treatment, 2nd ed. 1990. W.B. Saunders, Philadelphia.