MONTEGGIA FRACTURE-DISLOCATIONS IN CHILDREN

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Thirty-three Monteggia fracture-dislocations occurring in patients aged 2 to 15 years were reviewed. A follow-up of 2 to 7 years in 25 patients revealed that 88% had good to excellent results and 12% had results which were fair or poor. Closed reduction was successful in 24 of 28 cases and appeared to be very effective. Open reduction was required only for older children or when treatment was begun late.

A mild hyperextension deformity at the elbow noted on follow-up of patients with anterior dislocation of the radial head seemed to support the theory that the injury is caused by hyperextension. A new classification of Monteggia fracture-dislocations in children is proposed.

In 1814 Giovanni Battista Monteggia first described dislocation of the radial head associated with fracture of the ulna in two adults. Since then, most studies have been confined to adults (Speed and Boyd 1940; Smith 1947; Evans 1949; Mullick 1977). The current classification of the adult injury was devised by Bado (1962) and divides the lesions into four types based largely on the position of the radial head: in Type I it is anterior, in Type II posterior, in Type III lateral, and in Type IV there is also an associated fracture of the radius.

Since the literature is almost entirely limited to skeletally mature patients, we decided to review Monteggia injuries in childhood, observing their aetiology, classification, treatment and long-term follow-up.

PATIENTS AND METHODS

Between 1970 and 1982 33 children treated at the Winnipeg Children’s Hospital were diagnosed as having Monteggia fracture-dislocations (Figs 1 to 3). There were 21 boys and 12 girls, aged 2 to 15 years with an average age of 6.4 years at the time of injury. Using the Bado classification, there were 28 Type I injuries, one Type II and four Type III. In 31 patients the injury was caused by a fall, in one by a car accident and in one by a boating accident. Associated injuries included an ipsilateral fracture of the distal radius in a four-year-old and a head injury in the patient injured in a car accident. No vascular complications were encountered, but one patient with a closed Type I injury briefly suffered a posterior interosseous nerve palsy. There were 29 closed injuries and 4 open fractures. All the open injuries occurred in Type I lesions, three patients sustaining the open wound on the anterior aspect of the forearm over the site of the apex of the ulnar fracture.

Treatment. Closed reduction was performed within 48 hours in all but three patients: these three were not definitively treated until one, two and 16 weeks after injury. The delay in treatment was due to lack of recognition in peripheral hospitals of the radial head dislocations.

Closed reduction was attempted in 28 children and was successful in 24; the four failures included the patient who was not treated until one week after injury. In five children, including the other two whose treatment was delayed, a primary open reduction was performed. All nine children who had open reduction also had internal fixation of the ulna, using a rod or a plate. In five of these nine, closed reduction of the radial head was successful; in one child, however, the dislocation recurred, was recognised one week later and required a second closed reduction. The remaining four children required open reduction of the radial head; these included all three in whom the diagnosis was originally missed. In these patients, the annular ligament was reconstructed (Fig. 4) using fascia from the forearm (Bell Tawse 1965; Boyd and Boals 1969) and the radius was pinned to the ulna to ensure reduction until the ligament had healed (Fig. 5). The pins were removed six weeks later. Two children had transient posterior interosseous nerve palsy, both associated with lateral dislocation of the radial head.

Follow-up. Twenty-five of the 33 patients were reviewed at 2 to 7 years after treatment (average 4.1 years). This included a personal interview, clinical examination and radiographic assessment of the elbow.

The assessment used a modified version of a rating system devised by Bruce, Harvey and Wilson (1974) where points were deducted for increasing degrees of pain, deformity and restriction of movement. Sixty
Examples of Monteggia fracture-dislocations. Figure 1—Clinical appearance. Figures 2 and 3—Radiographic appearances of two different patients.

Fig. 4—Reconstruction of the annular ligament using fascia from the forearm (after Boyd and Boals).
Fig. 5—Methods of maintaining reduction of the radial head when there has been prolonged dislocation. On the right is our preferred method: the radius is pinned to the ulna.

points were assigned to movement, 30 to pain and 10 to deformity (Fig. 6). A perfect score of 100 was rated as an excellent result, 95 to 99 was good and 80 to 94 fair: anything below 80 was rated poor. Using these criteria, there were 22 patients with good or excellent results, one was fair and two were poor. The two patients with poor results were those whose Monteggia fractures were not recognised early and who were not definitively treated until two or 16 weeks after injury.

One interesting and unexpected finding in 10 of the 22 patients with a good or excellent result was the presence of mild hyperextension; this was an average of 5° more than the uninjured side. There were no permanent nerve deficits.

DISCUSSION

Monteggia fracture-dislocations in children have largely been compared to those in adults (Smith 1947; Reckling 1982). Few reviews have specifically addressed the problem of injury in childhood (Ramsey and Pedersen 1962; Peiró, Andres and Fernandez-Esteve 1977; Fahmy 1980; Fowles, Sliman and Kassab 1983). The very good

POINTS

RANGE OF MOVEMENT (60)

(ROM) 60 · (% Impairment · 0.6)

PAIN (30)

30 PAIN

25 MINIMAL AFTER HEAVY USE

20 MODERATE TO SEVERE AFTER HEAVY USE

10 MINIMAL AFTER ANY USE

0 MODERATE TO SEVERE AFTER ANY USE

DEFORMITY (10)

2 HYPEREXTENSION 5

2 LOSS OF CARRYING ANGLE 5

2 APPEARANCE—PATIENT'S PERCEPTION

2 OBJECTIVE ASSESSMENT OF APPEARANCE

2 RADIOLOGICAL UNION

Fig. 6

Criteria for elbow assessment based on Bruce, Harvey and Wilson (1974). For range of movement, the American Medical Association's percentage impairment values were multiplied by 0.6, giving a measure of disability which was then subtracted from the 60 points arbitrarily assigned for movement.
results in our study indicate that the vast majority of Monteggia injuries in children can be treated by closed reduction: it is only for those children with unrecognised lesions and delayed treatment, or for teenagers, that an open reduction of the ulna, and sometimes of the radial head, is necessary. Recently Fowles et al. (1983) suggested that an oblique or comminuted fracture of the ulnar shaft should also be stabilised with an intramedullary rod to avoid recurrence of the deformity. We found, as did Peiró et al. (1977), that in patients less than 13 years old treated by initial closed reduction the long-term results were excellent. Open reductions should be reserved for the teenager in whom a closed reduction has failed or for those in whom the injury has been missed.

The missed Monteggia fracture-dislocation is of serious concern since the end result is frequently less than satisfactory; persistent radial head dislocation may be one result (Fig. 7). It should be possible to draw, on the radiograph, a straight line through the radial shaft intersecting the capitellum in all views; this is especially important in those patients with an isolated fracture of the ulna and is a valuable diagnostic sign. When the diagnosis is delayed, the annular ligament impedes accurate reduction of the radial head. At open reduction it may then be necessary to reconstruct the annular ligament using the fascia from the anterior part of the forearm, as described by Boyd and Boals (1969). In immobilising the radial head a pin should not be passed through the capitellum into the radial head, since it may break, even though the elbow is in plaster. We recommend instead that the radius be held in position by a K-wire passed through the radius into the ulna.

The child with a Monteggia fracture-dislocation, especially with a lateral radial head dislocation, should be examined carefully for nerve injury. In particular, one should examine the posterior interosseous nerve which may be stretched by the displaced proximal radius (Spinner, Freundlich and Teicher 1968; Stein, Grabias and Deffer 1971; Spar 1977).
There has been much controversy about the mechanism whereby the ulnar shaft fractures in conjunction with an anterior dislocation of the radial head. Originally Speed and Boyd (1940) suggested that the injury was due to a direct blow on the posterior aspect of the forearm. Tompkins (1971) postulated that a fall on the outstretched hand with the elbow hyperextended was responsible, producing a violent reflex contracture of the biceps which dislocated the radial head anteriorly with subsequent fracture of the ulna. However, one of the most widely accepted theories is that the injury is caused by hyperpronation (Evans 1949). Our finding of mild hyperextension in patients with previous Monteggia lesions lends support to Tompkins’ theory of hyperextension.

Bado’s (1962) classification of Monteggia fracture-dislocations into four types based on the position of the radial head has been widely accepted as standard for adult lesions. It does not, however, refer to the similar lesions found in childhood (Fahmy 1980). Because immature bones can bend, Monteggia fracture-dislocations occur more frequently in children than is often appreciated, presenting as a so-called “Monteggia equivalent” (Fahey 1960). In this equivalent lesion, there may be no fracture of the ulna at all but rather a bend sufficient to permit the radial head to dislocate (Fig. 8). Most isolated traumatic dislocations of the radial head are probably Monteggia equivalents where the ulna has simply bent or has sustained a greenstick fracture (Figs 9 and 10). We therefore propose a new classification of Monteggia fracture-dislocations in children which takes equivalent lesions into consideration (Fig. 11).

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REFERENCES