Reversed reduction of radial neck fractures; a predictable complication of closed manipulation

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Although radial neck fractures account for 5—10% of elbow fractures and 1% of all children’s fractures, they remain a source of controversy as far as management is concerned. Their final outcome depends on the accuracy of reduction in addition to the extent of initial displacement and angulation. The overall incidence of unsatisfactory outcomes is between 15 and 33%, but if only severely displaced fractures were considered; this incidence could be as high as 50%. In this type of fracture, over 90° of angulation of the radial head is an alarming sign of a potential complication that frequently occurs with closed reduction. This is an obscured mal-reduction with a reversal position of the radial head which, if missed, can result in serious consequences. This potential complication was first reported by Jeffery in 1950 when he described two cases out of 450 fractures of the proximal radius in children and recommended open reduction. Since then this fracture has been reported repetitively once every decade in the last half century with a predictable pattern of complication of reversed reduction following a closed manipulation. In spite of these regular reports, this complication is still encountered and occasionally missed.

We are reporting a similar case which was missed on the image intensifier view and we are questioning the wisdom behind the use of routine closed reduction in the management of these fractures with over 90° angulation of the radial head.

Case report

A 9-year-old girl suffered a fall onto her arm and sustained a displaced fracture of the radial neck with 90° angulation (Fig. 1). She was taken to the operating theatre the same day and the fracture was manipulated closely under general anaesthesia and reduced to what was apparent with the image intensifier at the time to be a satisfactory position. The fracture was checked in supination, pronation, valgus, and varus stress and proven to be stable. Standard fluoroscopic image intensification was performed and a copy of the image with reasonable quality was kept in the patient’s file. The patient’s arm was immobilized in a back slab and she was discharged home on the same day.
Nine days later in the outpatient clinic, she was checked clinically and radiologically using plain radiographs. These films revealed reversal position of the radial head, where its articular surface was facing the fracture side (Fig. 2B). The option of performing late open reduction was carefully considered at that time, taking into account the risk of de-vascularising the radial head due to the surgical dissection.

The literature was consulted, and no advice was found on the best treatment of this complication at that point of time. However, following a long discussion with the patient and her family, an open reduction was carried out in order to restore the normal chondral articulation between the radial head and the capitellum, accepting the potential associated risk of avascular necrosis of the radial head.

Kocker's surgical approach was used and the radial head was reversed to normal alignment. The reduction was stable and did not require any internal fixation.

The patient was put into a long arm plaster cast for 3 weeks and then began exercises. Six months later she achieved a range of movement from 20 to 130° flexion, pronation and supination from 60 to 70°. The fracture was united and there was no evidence of avascular necrosis.

Discussion

Jeffery classified Radial neck fractures into two groups; Group 1 mild to moderate lateral tilting of the radial head.

Group 2 is rare and involved a severe tilting of the radial head usually with 90° posterior angulation.

The mechanisms are different in both groups; Group 1 is caused by a fall onto an outstretched hand leading to valgus strain of the elbow thus causing radial head tilting driven by the capitellum.

Group 2 are falls onto the hand causing posterior dislocation of the elbow with spontaneous reduction and during reduction the radial head is broken by the capitellum and stays out of the joint. This makes any trial of closed reduction unfeasible, as the capitillium will resist reducing the proximal fragment; the distal surface of the radial head is easy to slide in joint facing the smooth humeral articular surface in a reversal position of 180° displacement. It is also due to the smooth nature of the articular surface of the radial head, as this has a tendency to slide facing the fracture side with minimal forces during closed manipulation.

Therefore, as the chance of achieving satisfactory reduction is very small, it has been suggested for this type of fracture with over 90° angulation, to proceed primarily with open reduction without closed manipulation. This is in an effort to avoid reversed reduction which can damage the residual attenuated blood supply and destroy the remnant soft tissue attachment to the radial neck.

There are only six reported cases in the literature on such fracture with over 90° angulation. In each case, manipulation was attempted and initially a satisfactory position appeared to be achieved but closer inspection showed that the radial head had completely rotated 180° in reverse direction. All except one case were diagnosed immediately and received open reduction during the same procedure. The only case which was diagnosed late and treated with delayed open reduction (a week later) ended with major complications. Wray et al. reported one patient who had closed reduction with a missed reversed position which was treated a week later with open reduction and resulted...
in non-union and avascular necrosis. However, in spite of these two complications, with that case the authors did not advise for or against the late open reduction. Their case report raised concerns about the benefit of performing any late open reduction. This concern was discussed in detail with our patient and her parents and a delayed (nine days) open reduction was recommended on the bases that bone healing and revascularization of the radial head is still very likely and the expected scenario rather than being an exception.

After 6 months follow up for our patient, full union was achieved and no evidence of avascular necrosis was noted.

Good quality radiographs are essential in the operating room to confirm a satisfactory reduction. However, it may be faster intra-operatively and more convenient to the surgeon to obtain a fluoroscopic picture from the image intensifier to confirm reduction, rather than seeking plain radiographs which could be more time consuming. Therefore, in circumstances where fine anatomical details are crucial for decision making in the operating room, the use of standard film radiographs could not be more emphasized (Figure 2). Our case is an example of what could have made difference in the patient management if we had applied this role.

References