

in 34 patients at an average follow-up of 5 years. No avascular necrosis or chondrolysis occurred.

We believe, like Hurley et al. (1996), that slipped capital femoral epiphysis is not a unilateral disease but a disease of both hips. Our case demonstrates 2 complications that resulted from non-optimal operative therapy. First, the implants were removed too early, at the age of 10 years. A short time after this operation, a unilateral new slipping occurred. Prophylactic pinning of the contralateral side was not performed, because the parents refused this operation, although we recommended it. Within 6 months, a further slippage of the non-stabilized hip was detected, which would have been obviated by simultaneous pinning.

We use threaded wires, because we have seen few complications with this technique. An outgrowing of these wires from the physeal plate occurs very seldom, so the risk of restabilization is low. This is important, because too-early removal of the implants and outgrowing seem to be the same functionally.

Canale S T. Problems and complications of slipped capital femoral epiphysis. In: American Academy of Orthopaedic Surgeons, Instructional Course Lectures, XXXVIII (Ed. Barr J S) CV Mosby, St. Louis 1989: 281-90.

Crawford A H. Slipped capital femoral epiphysis. *J Bone Joint Surg (Am)* 1988; 70: 1422-7.

Engelhardt P. Spontanverlauf der Epiphyseolysis capitis femoris. *Orthopäde* 1994; 23: 195-9.

Hägglund G. The contralateral hip in slipped capital femoral epiphysis. *J Pediatr Orthop (Part B)* 1996; 5: 158-61.

Hägglund G, Hansson L I, Ordeberg G, Sandström S. Bilaterality in slipped upper femoral epiphysis. *J Bone Joint Surg (Br)* 1988; 70: 179-81.

Hurley J M, Betz R R, Loder R T, Davidson R S, Alburger P D, Steel H H. Slipped capital femoral epiphysis—The prevalence of late contralateral slip. *J Bone Joint Surg (Am)* 1996; 78: 226-9.

Imhäuser G. Spontane Epiphysenlösung am koxalen Femurende. In: *Orthopädie in Praxis und Klinik*, Band VII, Spezielle Orthopädie (Eds. Witt A N, Rettig H, Schlegel K F). Georg Thieme Verlag, Stuttgart-New York 1987: 2115-48.

Jerre R, Billing L, Hansson G, Wallin J. The contralateral hip in patients primarily treated for unilateral slipped femoral epiphysis—long-term follow-up of 61 hips. *J Bone Joint Surg (Br)* 1994; 76: 563-7.

Jerre R, Billing L, Hansson G, Karlsson J, Wallin J. Bilaterality in slipped capital femoral epiphysis: importance of a reliable radiographic method. *J Pediatr Orthop (Part B)* 1996; 5: 80-4.

Kumm D A, Schmidt J, Eisenburger S-H, Rütt J, Hackenbroch M H. Prophylactic dynamic screw fixation of the asymptomatic hip in slipped capital femoral epiphysis. *J Pediatr Orthop* 1996; 16: 249-53.

Southwick W O. Osteotomy through the lesser trochanter for slipped capital femoral epiphysis. *J Bone Joint Surg (Am)* 1967; 49: 807-35.

Irreducible fracture-separation of the distal ulnar epiphysis in the Galeazzi equivalent fracture—a case report

Juan Castellanos, Carlos Ramírez-Ezquerro, Lidia de Sena and José M Cavanilles-Walker

Department of Orthopaedic Surgery and Traumatology, Hospital Universitari Germans Trias i Pujol, Spain. Correspondence: Dr. Juan Castellanos, Department of Orthopaedic Surgery and Traumatology (3^a planta), Hospital Universitari Germans Trias i Pujol, Ctra. del Canyet, s/n. 08916 Badalona, ES-Barcelona, Spain. Tel +34 93 497-8927. Fax -8843. Submitted 99-03-06. Accepted 99-08-19

An 11-year-old girl was admitted to the emergency room after sustaining an extension injury to her outstretched left hand, presenting pain, tenderness and swelling of the wrist. The neuromuscular examination was normal. Radiographs showed a distal radial shaft fracture and a type II Salter-Harris fracture of the distal ulna with dorsal displacement of the proximal fragment (Figure 1).

Closed reduction under general anesthesia was tried but the ulnar fracture could not be reduced. Open reduction was performed through a dorso-ulnar approach over the distal radioulnar joint. Intraoperative examination revealed that the ulnar metaphyseal fragment was dislocated into a capsular buttonhole (Figure 2), leaving the epiphysis of the distal end of the ulna with its metaphyseal flake in its normal location at the distal radioulnar



Figure 1. Galeazzi-equivalent fracture showing radial fracture with volar displacement and a Salter-Harris type II ulnar epiphysiolysis with dorsal displacement of the ulnar metaphysis.

joint. The metaphyseal fragment prevented the reduction maneuver and made it necessary to enlarge the buttonhole and unblock the metaphyseal fragment. Then the fracture could be reduced and the forearm placed in complete supination. In this position, reduction was stable. Percutaneous fixation of the radial fracture was performed using a Kirschner wire. The capsular tear was closed and a brachial cast was applied with the forearm in complete supination. Postoperative radiographs revealed correct reduction.

The cast and Kirschner wire were removed 6 weeks later. Active exercises of the wrist and el-

bow were started immediately. Hand motion and strength were normal at the 4- and 9-month follow-up examination and the patient had no pain.

Comparative radiographs of both wrists at the last control revealed no physal disturbance and the ulnar variance was symmetrical.

Discussion

Galeazzi fracture-dislocations consist of a fracture of the radial shaft, usually at the union of the mid third and the distal third of the shaft, together with a dislocation or subluxation involving the distal radioulnar joint (Mikic 1975, Reckling 1982, Mohan et al. 1988). In children, there is a variation of this lesion consisting in a radial fracture associated with a distal ulnar epiphysiolysis instead of distal radioulnar joint dislocation (Mikic 1975, Reckling 1982, Landfried et al. 1991). This occurs because the physal plate offers less resistance to injury in hyperpronation than does the triangular fibrocartilage complex (Landfried et al. 1991).

Galeazzi fracture-dislocation and Galeazzi equivalent-fracture are extremely rare injuries in children (Mikic 1975, Reckling 1982, Walsh et al. 1987, Maculé Beneyto et al. 1994).

As opposed to adults, in whom the common treatment is open reduction with rigid fixation of the radius with a plate (Chambers et al. 1996), in children, the treatment consists of closed reduction and application of a brachial cast with the

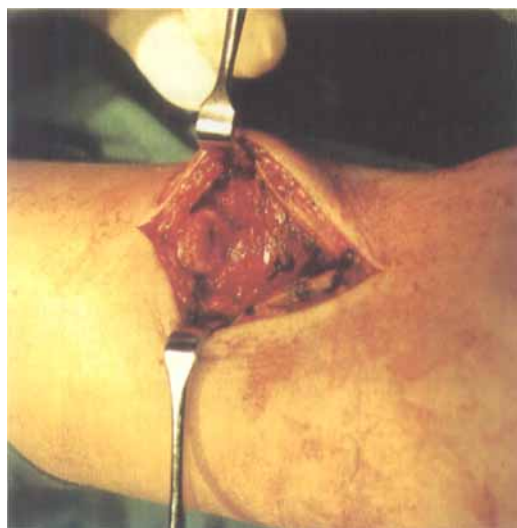


Figure 2. Intraoperative photo. Note the ulnar metaphysis introduced in the capsular buttonhole.

wrist in complete supination (Mikic 1975, Reckling 1982, Walsh et al. 1987, Letts and Rowhani 1993).

In children, open reduction may be necessary if reduction of the radius is not correct (Campbell 1990) or if dislocation of the radioulnar distal joint or the ulnar physeal fracture cannot be reduced, usually due to interposition of the extensor tendons (Karlsson and Appelqvist 1987, Hanel and Scheid 1988, Biyani and Bhan 1989, Landfried et al. 1991, Letts and Rowhani 1993) or the periosteum (Landfried et al. 1991).

We describe a case in which reduction of the ulnar physeal fracture was impossible due to a capsular buttonhole involving the ulnar metaphysis. To our knowledge, this has been described only once in the literature in a case of an isolated Salter-Harris type II epiphysiolysis involving the ulnar distal epiphysis (Engber and Keene 1985).

In the presence of a fracture of the distal third of the radius, the existence of a distal radioulnar joint injury or an ulnar physeal fracture must be ruled out. Clinical examination searching for deformity and/or pain and an extensive radiographic evaluation should be performed since the ulnar component of the lesion is missed very often (Walsh et al. 1987, Mohan et al. 1988, Letts and Rowhani 1993).

In children who sustain a fracture-dislocation or a Galeazzi-equivalent fracture, closed reduction (under general anesthesia) and cast immobilization should be attempted first. In cases where reduction of the ulnar injury is impossible, repeated attempts should be avoided, because they can cause physeal damage (Lee et al. 1984). Open reduction must be performed because of the interposition of various structures, usually tendons or periosteum, but the interposition of a capsular buttonhole should also be considered, as described in this paper.

The child should be followed until growth stops since physiolyse at this level are associated with precocious physical closure in more than half of the cases (Chambers et al. 1996).

- Biyani A, Bhan S. Dual extensor tendon entrapment in Galeazzi fracture-dislocation: a case report. *J Trauma* 1989; 29 (9): 1295-7.
- Campbell R M Jr. Operative treatment of fractures and dislocations of the hand and wrist region in children. *Orthop Clin North Am* 1990; 21 (2): 217-43.
- Chambers H, De la Garza J F, O'Brien E, Price C T, Stanley E, Wilkins K E. Fractures of the radius and ulna. In: *Fractures in children* (Eds. Rockwood C A Jr, Wilkins K E, Beaty J H). Lippincott-Raven Publishers, Philadelphia 1996.
- Engber W, Keene J S. Irreducible fracture-separation of the distal ulnar epiphysis. Report of a case. *J Bone Joint Surg (Am)* 1985; 67 (7): 1130-2.
- Hanel D P, Scheid D K. Irreducible fracture-dislocation of the distal radioulnar joint secondary to entrapment of the extensor carpi ulnaris tendon. *Clin Orthop* 1988; 234: 56-60.
- Karlsson J, Appelqvist R. Irreducible fracture of the wrist in a child. Entrapment of the extensor tendons. *Acta Orthop Scand* 1987; 58 (6): 280-1.
- Landfried M J, Stenclik M, Susi J G. Variant of Galeazzi fracture-dislocation in children. *J Pediatr Orthop* 1991; 11 (3): 332-5.
- Lee B S, Esterhai J L, Das M. Fracture of the distal radial epiphysis. Characteristics and surgical treatment of premature posttraumatic epiphyseal closure. *Clin Orthop* 1984; 185: 90-6.
- Letts M, Rowhani N. Galeazzi-equivalent injuries of the wrist in children. *J Pediatr Orthop* 1993; 13 (5): 561-6.
- Maculé Beneyto F, Arandes Renú J M, Ferreres Claramunt A, Ramón Soler R. Treatment of Galeazzi fracture-dislocations. *J Trauma* 1994; 36 (3): 352-5.
- Mikic Z D. Galeazzi fracture-dislocations. *J Bone Joint Surg (Am)* 1975; 57 (8): 1071-80.
- Mohan K, Gupta A K, Sharma J, Singh A K, Jain A K. Internal fixation in 50 cases of Galeazzi fracture. *Acta Orthop Scand* 1988; 59 (3): 318-20.
- Reckling F W. Unstable fracture-dislocations of the forearm (Monteggia and Galeazzi lesions). *J Bone Joint Surg (Am)* 1982; 64 (6): 857-63.
- Walsh H P J, McLaren C A N, Owen R. Galeazzi fractures in children. *J Bone Joint Surg (Br)* 1987; 69 (5): 730-3.