COMPARTMENT SYNDROME AFTER FRACTURE OF THE DISTAL RADIUS

F. DENOLF[1], J. ROOS[2], J. FEYEN[2]

A compartment syndrome of the forearm after a fracture of the distal radius is presented. This rare complication should be considered after high velocity trauma in young people. In this setting, we prefer general anesthesia for fracture reduction. Fracture fixation and avoidance of circular casts are recommended. Repeated evaluation allows early detection of compartment syndrome. Fasciotomy should be done if this syndrome occurs.

Keywords : compartment syndrome ; fasciotomy ; fracture of the wrist.
Mots-clés : syndrome des loges ; fasciotomie ; fracture de l'extrémité inférieure du radius.

Compartment syndrome following fractures of the distal radius has been reported infrequently. The aim of this paper is to present a case and to discuss some features of this condition.

CASE REPORT

In June 1993, a 29-year-old right-handed truck driver presented to the emergency department at St. Dimphna University Hospital in Geel, one hour after he had fallen off a moving truck. He complained of marked pain in the right wrist.

On examination, we found an obvious deformity of the right wrist and marked tenderness accompanied by moderate swelling. The neurovascular status was normal except for a "different" feeling at the tip of the middle finger. X rays showed a fracture of the distal radius with mild comminution and marked displacement (fig. 1).

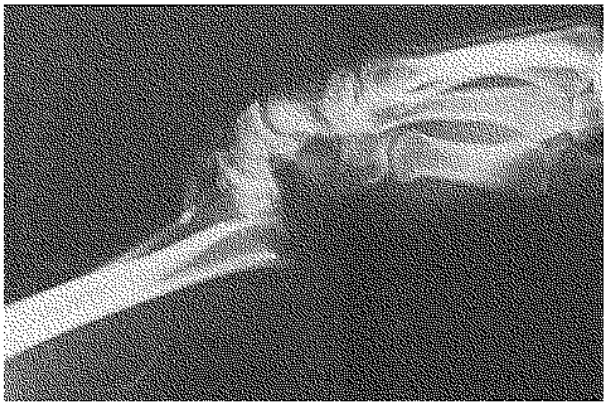

Fig. 1a

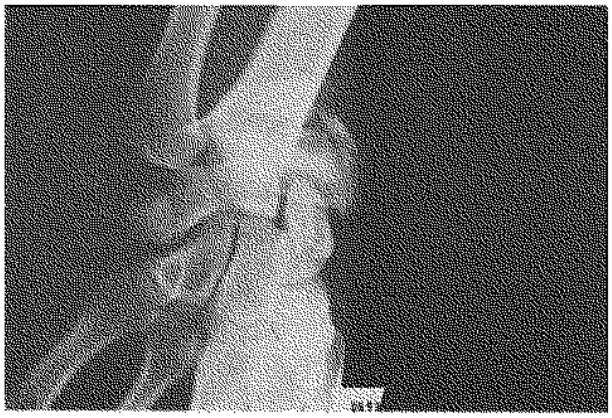

Fig. 1b

Fig. 1. — a) A-P radiograph of the distal radius; b) lateral radiograph of the distal radius.

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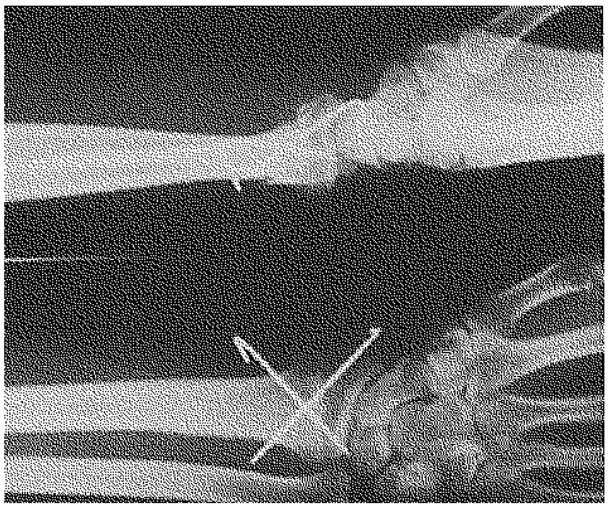

Fig. 2. — Percutaneous K-wire fixation of the distal radius.

The patient was taken to the operating room within one hour and given an axillary block (marcaine). A closed reduction was performed. The fracture was fixed with two crossed percutaneous Kirschner wires (fig. 2). A complete below-elbow cast was applied. Immediately afterwards the cast was split along the whole length of the ulnar border including the cotton wool, and spread by 1 cm. However on review 8 hours later, after the axillary block was cleared, the patient reported paresthesias in the median nerve distribution and intense pain in the forearm. He had painful and diminished active finger movements. Passive extension of the fingers was extremely painful. The cast was completely removed and revealed a tense and swollen forearm. The radial pulse was present. On the basis of these findings the clinical diagnosis of compartment syndrome was made. Two hours later the patient underwent decompression of the forearm and carpal tunnel. Pressures were recorded before the fasciotomy with the aid of the Stryker miniaturized digital fluid pressure monitor according to the recommendations of Mc Dougall (4). Pressures of 45 mm volarly and 39 mm dorsally were obtained (compared to 5 and 6 on the left). Henry's approach was used to decompress both the deep and superficial compartments and the carpal tunnel. The median nerve was explored and found to be normal. There was no apparent muscle necrosis but the muscle bellies were swollen although of good color. Intra-operatively the pressure dropped to 19 mm in the volar compartment and 9 mm dorsally. A dorsal compartment fasciotomy was not performed. The wound was left open and five days later grafted. Postoperatively the pain improved markedly but the patient still had some paresthesias in the middle three fingers. There was also a 4 + paresis of the abductor pollicis brevis and opponens and decreased dorsiflexion mobility of the wrist. Three months postoperatively motor strength had completely recovered. Slight numbness still existed in the middle finger, but the patient was able to resume work.

DISCUSSION

Mubarak defined compartment syndrome as "a condition in which high pressure within a closed fascial space reduces capillary blood perfusion below the level necessary for tissue viability" (5). Numerous causes were reported, but all are related to either decreased size of the compartment or increased compartment contents (5). The prevalence of compartment syndrome seems to be less than 1%, with only a few cases reported.

Five cases have been reported in adolescents. Matthews (3) and Younge (10) described a case each after a Salter II fracture of the distal radius, Hernandez (2) after a Salter I. All three were given a hematoma block which possibly increased the compartment pressure sufficiently to develop the syndrome. Santoro and Mara (7) reported a compartment syndrome in a 17-year-old boy also with a Salter II fracture, following the application of skeletal traction and elevation, thereby reducing compartment size. Naito and Ogata (6) also believed that the combination of elevation and traction was responsible for the compartment syndrome in a 17-year-old boy with a comminuted fracture of the distal radius and a concomitant scapholunate dissociation. In adults, Cooney *et al.* (1) found 4 cases of Volkmann's ischemic contracture. Three patients had a constricting cast that was retained despite persistent pain. One of

the 3 patients had an undisplaced fracture. Shall *et al.* (8) reported 2 cases : neither of the 2 fractures resulted from great energy, but both were given a hematoma block for reduction. Stockley *et al.* (9) added another 5 cases. All cases reported occurred in male patients below the age of 50 years. A large force is usually responsible for a distal radius fracture with extensive soft tissue damage in a young person. It is unlikely that a single mechanism is the cause in all patients. The final outcome is however similar with elevated intracompartmental pressure and resultant interstitial edema. Pressures exceed those of the microcirculation and lead to ischemia.

The diagnosis of compartment syndrome after fractures of the distal radius remains a clinical one. The most reliable physical signs are paresthesias or reduced hand sensitivity in the median nerve distribution and marked pain on passive digital extension. Pain out of proportion to the primary injury, despite reduction of the fracture, immobilization and analgesics and a tense compartment complete the picture. Distal pulses are usually present.

Different techniques for direct measurement of intracompartmental pressure have been developed and found to be accurate and reliable. Pressure measurements are useful adjuncts in patients with equivocal physical findings or comatose patients. The precise pressure and time thresholds for irreversible nerve and muscle damage however have not been established with certainty (5). Therefore the decision for surgical intervention is essentially clinical.

Therapeutic measures involve : reduction of fractures or dislocations, removal of constricting bandages and fasciotomy. Fasciotomy should involve the whole volar compartment, starting with the lacertus fibrosis in the antecubital fossa and extending into the palm to allow carpal tunnel release. The dorsal compartment rarely needs to be decompressed since the volar, dorsal and the compartment containing the muscles of the mobile wad are interconnected. Pressure measurement can be helpful to decide on the need for dorsal decompression.

CONCLUSIONS

1. Compartment syndromes do occur after wrist fractures in young persons after violent trauma.
2. Hematoma block anesthesia for reduction should be avoided. An axillary block delays detection of a possible compartment syndrome. A general anesthetic is preferred in order to allow for repeated examinations.
3. Prompt clinical diagnosis and extended palmar fasciotomy is the recommended management.
4. A full recovery can be expected after a fasciotomy done correctly and in time. Residual deficits are usually due to intrinsic nerve damage. The residual sensory disturbance in our case is probably due to axonal damage at the time of the fracture.

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SAMENVATTING

F. DENOLF, J. ROOS, J. FEYEN. Compartiment-syndroom van de voorarm na distale radiusfractuur : een gevalstudie.

Een compartiment-syndroom van de voorarm na een distale radiusfractuur wordt beschreven. Deze zeldzame complicatie moet in gedachten gehouden worden na high-velocity trauma bij jonge mensen.
In deze context verkiezen wij een algemene narcose voor fraktuurreductie. Fixatie van de fraktuur en vermijden van circulaire gipsen wordt aangeraden. Herhaald en oplettend volgen van de patiënt laat vroege detectie toe. Een fasciotomie moet zo vlug mogelijk uitgevoerd worden indien deze complicatie zich voordoet.

RÉSUMÉ

F. DENOLF, J. ROOS, J. FEYEN. Syndrome des loges de l'avant-bras après fracture de l'extrémité inférieure du radius distal.

Les auteurs présentent un cas de syndrome des loges après fracture de l'extrémité inférieure du radius.
Cette complication peu courante doit être présente à l'esprit lors d'un traumatisme violent chez l'adulte jeune.
Dans ces cas, nous préférons une anesthésie générale pour réduire la fracture. Une stabilisation de la fracture est à conseiller ; d'autre part il faut éviter d'appliquer un plâtre circulaire. Une surveillance stricte du patient permet un diagnostic rapide. Une fasciotomie doit être pratiquée aussi rapidement que possible si cette complication se présente.