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Osteosynthesis with Variable Angle Volar Plate in Dorsal Barton Fracture Due to Blunt Trauma: Clinical Case

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ABSTRACT

Distal radius fractures in young adults are associated with high-energy trauma and in elderly people with low-energy falls. One of the distal radius fractures is the Barton Fracture (BF), a radiocarpal fracture-luxation whose production mechanism usually varies, the most common being a fall on an extended and pronated wrist. We present a 27-year-old male patient with distal radius epiphysis injury with radiocarpal dislocation following blunt trauma. Timely osteosynthesis with variable angle volar plate favored the restoration of distal radiocarpal and radioulnar biomechanics.

KEYWORDS: Barton Fracture, volar plate, TASER

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INTRODUCTION

Distal radius fractures account for 16% of acute locomotor injuries treated in trauma centers and 75% of forearm fractures.

CLINICAL CASE

27-year-old male patient with no personal records of illness who consulted a Level I hospital because of blunt trauma to the skull, chest, abdomen, and left forearm caused by resistance in an encounter with the police. He also received electric shock by an unknown model TASER® device (Axon Enterprise, Scottsdale, Arizona) during the police operation. The patient and witnesses deny another mechanism of trauma. In this hospital he presented fasciculations in lower extremities, macroscopic hematuria, and was referred to a higher-level hospital. Physical examination showed normal vital signs: SO2: 96%; Weight: 60 Kg; Size:1.65m; BMI:22.04 Kg/m2.

Ecchymosis, edema, pain on palpation and mobilization were observed in skin, as well as dorsal deformity in the wrist and in the distal third of the left forearm plus functional impotence. Sensitivity and peripheral pulses were normal. Electrocardiogram was requested, and it showed normal tracing. Interdisciplinary assessment was made in the emergency department and simple computed tomography of the skull, blood count, serum electrolytes, glycemia, urea nitrogen, and creatinine were measured, which were normal. Wrist radiography confirmed left distal radius intra-articular fracture with marked dorsal displacement and carpal radius dislocation, radiological criteria compatible with a Dorsal Barton's Fracture (Figure 1).

The chosen treatment was surgery based on the unstable radiological pattern. A marked deformity and instability in the left wrist joint —which impinged on the volar distal forearm— was observed through dissection by planes following Henry's approach until exposing comminuted distal radial epiphyseal fracture with radiocarpal dislocation and the characteristics of a Dorsal Barton's Fracture. Intraoperatively, radiocarpal capsule, distal radioulnar ligament and flexor carpi radialis tendon distension were detected.

Open reduction of dislocation and left radiocarpal fracture and temporary fixation with two Kirschner nails were performed with adequate fluoroscopy-guided reduction, radial height and radial inclination recovery. Subsequently, definitive osteosynthesis was performed with variable angle 7 x 2 H volar plate, fixation with one 14 mm cortical screw and 7 locking screws, removal of Kirschner nails with satisfactory final confirmation in intraoperative fluoroscopy-guided anteroposterior and lateral projections. Surgical treatment was supplemented with capsular repair and tendon tightening (Figures 2 and 3).

The patient presented good anatomical and functional recovery with joint mobility with a flexion of 74 degrees, extension of 69 degrees, radial deviation of 19 degrees, and ulnar deviation of 27 degrees. He is currently discharged and exercising his work activity.

DISCUSSION

BF is a distal radius fracture and occurs near the base of the fifth finger. When carpal displacement occurs, it is called Barton's fracture (1) (2). The mechanism of injury varies according to the population. In pediatric patients and young adults, they are mostly due to sports activities and car accidents. In the elderly, especially in women, less strength is needed due to decreased bone density secondary to osteoporosis (3, 4). BF results from compression injury with marginal shearing fracture of the distal radius. The most common cause is a fall on an extended, pronated wrist. The compressive force goes from the hand and wrist across the articular surface of the radius, thus generating dorsal displacement of a triangular portion of the radius along with the carpus (5). In the clinical case, there was a direct blunt trauma mechanism on the distal third of the left forearm and the stabilizing structures of the radiocarpal joint such as the distal radiocarpal and radioulnar ligaments and joint capsule, which is a poorly described injury mechanism.

Therapeutic success requires a scrupulous reconstruction of the articular surface, considering the importance of stable osteosynthesis that enables articular congruence, alignment, and radial length that entail restoring distal radiocarpal and radioulnar biomechanics (6).

Two different designs of locking plates are currently used for the volar plating of distal radius fractures depending on the screw orientation possibilities: fixed angle and variable angle (polyaxial) plates. In comparative studies of the use of both plates, it was found that the overall functional results —based on the Mayo wrist score, the Quick-DASH *(Disabilities of the Arm, Shoulder and Hand*) score, Range Of Motion (ROM) and prehension force, as well as the radiological parameters— were better in patients treated with variable angle plate (7).

Variable-angle volar plate enabled early functional recovery that optimized the patient's return to work activities. It is indicated in the management of intra-articular and extra-articular fractures in the distal region of the radius; in addition, it allows to fix specific portions of the distal radius such as the styloid process, the lunate facet, and the distal radioulnar joint. Due to its ergonomic design, it does not need to be molded and allows adjustments to be made, so that articular congruence occurs (8, 9). The technique of the plate allows to use Kirschner wires that guarantee an adequate fit.

The comprehensive evaluation of the patient allowed to rule out complications secondary to electric shock. The physiological effect of the TASER® (Thomas A Swift's Electric Rifle) is the stimulation of presynaptic motor neurons leading to tonic-clonic seizures followed by a refractory period, during which the affected person gets paralyzed (10).

CONCLUSION

Distal radius fractures are a frequent cause of consultation in traumatology. The mechanism of the fracture, although it is defined, is not among the most known. The clinical case shows the importance of bringing up other possible mechanisms and of the anatomical correction that allows the recovery of the biomechanics of the joint.

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CONFLICT OF INTEREST

The authors declare no conflict of interest in the publication of this article.

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FIGURE LEGENDS

Figure 1. Radiological image of the left distal radius fracture.

The radioulnar joint separates, the lack of alignment of the articular surfaces of the distal radius and ulna is observed. a) Anteroposterior projection that shows distal radius fracture (white arrow) with fracture involving the index and middle fingers, loss of radial height and inclination. Additionally, the distal ulnar radius joint is affected.

b) Lateral projection of the wrist that confirms the intra-articular traces and the dorsal displacement with radiocarpal dislocation (black arrow).

Figure 2. Osteosynthesis of Barton's Fracture.

The anatomical reduction and permanent containment of the fracture with the volar plate in the distal radius allowed articular congruence, alignment, and radial length that favored the restoration of distal radiocarpal and radioulnar biomechanics.

Figure 3. Immediate postoperative osteosynthesis of Barton's Fracture.

The patient achieved anatomical correction that allowed to recover the biomechanics of the joint.