Bilateral Proximal Radial Shaft Fracture Dislocations Resulting from 2 Separate Injuries with the Same Mechanism, Each Associated with Median Nerve Entrapment: A Case Report in a Gymnast Performing Back Hand Springs

Bony Entrapment of Median Nerve at Proximal Radius

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Abstract We report a rare case of entrapment of the median nerve following a closed fracture of the proximal one-fourth of the radius in an adolescent in failure of back hand spring. We proposed that the forearm pronation and the wrist extension in, “the Back Handspring position” made the median nerve close to the radius at one-fourth proximal radius, played an important role in this complication.

Keywords Proximal one-fourth radius fracture · Median nerve bony entrapment · Back handspring

Introduction

Entrapment of the median nerve in shaft fractures of the forearm is rare and only 4 cases have been reported in the English

literature [1–5]. Of note is that only Geissler’s report occurred in the proximal radius, but others occurred in distal radius. Our case happened in bilateral forearm, by the same mechanism of injury, failure of back handspring, at the same level of radius, proximal one-fourth, with median nerve entrapment.

This paper reports the uncommon bony entrapment of the median nerve following a closed one-fourth proximal radius fracture. We also discuss the anatomic and pathologic causes for this uncommon nerve compression syndrome.

Case Report

A 14-year-old boy failed in landing on ground in back handspring during gymnastics and sustained right closed proximal one-fourth radius fracture, subluxation of radial head and medial collateral ligament (MCL) injury from medial epicondyle of humerus (Fig. 1). Six months after the bone union by closed reduction and percutaneous intramedullary pinning (Fig. 2a, b), he was referred to our institution and was found to have only protective sensation and finger pulp atrophy in the thumb, index and middle fingers with thenar muscle atrophy and a weak abductor pollicis brevis muscle. The anterior inter-osseous nerve was intact without weakness of the pincer movement of the thumb and index finger. Hoffmann-Tinel sign was present on both the fracture site of radius (Fig. 2a) and 3 cm proximal of the wrist crease. A nerve conduction study showed no signal of the median nerve conduction velocity both in the elbow and across the carpal

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Fig. 1 Initial radiograph of the right forearm at the local orthopedic clinic after injury

tunnel. The patient underwent exploration of the median nerve in the proximal one-fourth where the Tinel sign was appreciated through an anterior approach. The fracture site was united firmly. The median nerve went into anterior aspect of the

Fig. 3 Operating findings of the right forearm with supinated position. Exploration of the median nerve through anterior approach of the right forearm. Bony entrapment of median nerve. (white arrow: median nerve, black arrow: radius)

fracture site of the radius and out from medial aspect of the fractured site of the radius at forearm supination (Fig. 3). After recognizing the bony entrapment, the X-rays were retrospectively reviewed and a radiological sign of this entrapment was found. A well-defined bony canal was found in the anterior aspect of the radius where we appreciated the Tinel sign (Fig. 2a, b). Bony canal at the fracture site was reported to be important evidence of bony entrapment of the nerve, which we should be aware and familiar with [6, 7]. One year later, he sustained the left closed proximal one-fourth fracture of radius, opposite side, in failure of back handspring (Fig. 4). Since he complained of the median nerve palsy, he referred to our

Fig. 2 Radiograph and 3-D Computer Tomography (CT) at six months after the initial injury. **a** Radiograph showing localization of Tinel sign (white arrow head), bony canal (white arrow), and calcification of the MCL (open triangle). **b** 3-D CT showing bony canal (black arrow)

Fig. 4 Initial radiograph of the left forearm after injury

institute 1 day after the injury. He complained hypesthesia in the median nerve distribution and could not flex his thumb interphalangeal joint and index finger distal interphalangeal joint. We performed the exploration of the median nerve through an anterior approach. The median nerve was entrapped at fracture site under tendinous arch of the flexor digitorum superficialis muscle (Fig. 5a). We performed release of the median nerve and the reduction and internal fixation of the radius fracture (Fig. 5b). At 4 years after the initial surgery, the neurological deficit was recovered completely at the left

side but diminished sensation was observed at the right side at the final follow up record as follows. Although the patient's right hand showed slight atrophy of the abductor pollicis brevis muscle, he could oppose thumb and the sensory deficit had almost resolved (SW test: thumb and index, blue, 3.61, diminished light touch; long, purple, 4.31, diminished protective sensation).

Discussion

In the back handspring in gymnastics, landing of the palm was performed at extension of the elbow, pronation of the forearm, maximum dorsiflexion of the wrist and extension of the fingers (Fig. 6a). In our cases, the failure of back handspring resulted in the MCL injury in the elbow, one-fourth proximal radius fracture and subluxation of radial head. From the operation findings of right side case, median nerve went into anterior aspect of the fracture site of the radius and out from medial aspect of the fractured site of the radius at forearm supination, it is strong possibility that this patient suffered the fracture at forearm pronation position, ulna and median nerve overlapped radius at proximal 1/4 forearm. The displaced radius fracture was complicated with the median nerve entrapment. In proximal one-fourth forearm fracture of radius, the proximal bone fragment displaced toward ulna shaft tethered by biceps tendon and distal bone fragment displaced toward ulna shaft tethered by flexor digitorum superficialis (FDS) tendinous arch insertion (Fig. 6b). Although it has been recognized that the median nerve lay quite far from the proximal radius, these rare cases lead us to recognize the possibility of

Fig. 5 Operating findings of the left forearm with supinated position. **a** Before and **b** After release of the median nerve. (white arrow: median nerve, black arrow: radius)

Fig. 6 **a** Schematic drawing of Back Handspring position (Forearm: pronation, Fingers: extension, Elbow: extension, Wrist: dorsiflexion). **b** Schematic drawing of one-fourth proximal radius fracture at Back Handspring position showing the anatomic and pathologic causes for this uncommon median nerve compression. In a proximal one-fourth forearm fracture of the radius, the proximal bone fragment is displaced flexor side

tethered by the tense biceps tendon, and the distal bone fragment is also displaced toward the flexor side tethered by the tense flexor digitorum. Forearm pronation decrease distance between radius and median nerve anatomically. In addition, the tense FDS tendinous arch compresses the median nerve on the radius. These complex anatomical factors may increase the involvement of the bony entrapment of median nerve

entrapment of median nerve even in closed minimally displaced fractures of proximal radius. In this case also, early decompression of median nerve on the left side had led to be better recovery than that on the right side.

We recommend that the attention for median nerve injury should be paid for the one-fourth proximal radius fracture of back handspring in gymnastics.

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