CASE REPORT

MULTIPLE INJURIES OF THE RADIAL NERVE ALONG WITH THE DISTAL RADIUS FRACTURE: A CASE REPORT WITH 9-MONTH FOLLOW UP

Abstract

Traumatic radial nerve injuries are common in the upper extremity. Injuries due to humeral fractures are also very common. However, multi-trauma cases are rare, and in some of these cases, combined nerve injuries are reported. To our knowledge, no case of injury in different regions of the radial nerve along with distal radius fracture has been reported. In this study, a rare and unusual traumatic radial nerve injury with a distal radius fracture caused by a work accident is presented. Conservative treatment procedures performed in radial nerve injuries are not compatible with distal radius fracture treatment and complex processes may occur during the rehabilitation process. An inappropriate immobilization procedure would disrupt the treatment. Accordingly, it should be aimed to manage immobilization protocols correctly and to provide compensation in conservative treatment with fast track rehabilitation.

Key Words: Radial nerve injury; distal radius fracture, multiple injury

OLGU SUNUMU

DİSTAL RADİUS KIRIĞI İLE BİRLİKTE ÇOKLU RADYAL SİNİR YARALANMASI: 9 AYLIK TAKİPLİ BİR OLGU SUNUMU

Özet

Travmatik radyal sinir yaralanmaları üst ekstremitede yaygındır. Humerus kırıklarına bağlı yaralanmalar da çok yaygındır. Bununla birlikte, çoklu travma vakaları nadirdir ve bu vakaların bazılarında kombine sinir yaralanmaları bildirilmiştir. Bildiğimiz kadarıyla, distal radius kırığı ile birlikte radyal sinirin farklı bölgelerinde herhangi bir yaralanma olgusu bildirilmemiştir. Bu çalışmada, bir iş kazasının neden olduğu distal radius kırığı ile birlikte nadir ve olağandışı bir travmatik radyal sinir hasarı olgusu sunuldu. Radyal sinir yaralanmalarında yapılan konservatif tedavi prosedürleri, distal radius kırığı tedavisi ile uyumlu değildir ve rehabilitasyon sürecinde karmaşık süreçler ortaya çıkabilir. Uygunsuz bir immobilizasyon prosedürü tedaviyi bozabilir. Buna göre, immobilizasyon protokollerinin doğru bir şekilde yönetilmesi ve hızlı rehabilitasyon ile konservatif tedavide kompansasyon sağlanması amaçlanmalıdır.

Anahtar Kelimeler: Radyal sinir yaralanması; distal radius kırığı, çoklu yaralanma

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1. Introduction

Radial nerve injuries are common in the upper extremity (1). The incidence was reported to be 11.8% (2). Due to the anatomical relationship between the humerus and radial nerve, humerus fractures or direct trauma can cause radial nerve injury (1, 3). Contusion after a high-intensity trauma can lead to paralysis (4). These high-energy traumas also can cause multiple injuries, in particular (5). It was reported that the radial nerve was injured in combination with the ulnar or median nerve after humerus fractures (6).

Multiple injuries are rarely seen in different parts of the same extremity. In addition to a high-intensity trauma to the humeral region, the distal radius fracture, which can lead to injuries in the deep branch of the radial nerve, could cause more complex clinical consequences. Although the distal radius fracture does not cause damage to the posterior interosseous nerve, it can prolong the treatment process caused by the radial injury (7).

In addition to the wrist drop caused by paralysis of the extensor muscles in radial nerve injury, the distal radius fracture may negatively affect the treatment results of the patient after surgery because of immobilization procedures (8). The wrist should be immobilized in a neutral position for fracture healing and mildly extension for radial nerve injury (8, 9). This study aimed to present a rare and unusual case of traumatic radial nerve injury combined with a distal radius fracture caused by an occupational accident. Besides, the results of a 9-month follow-up, surgery and conservative treatment were explained.

2. Case Report

A 32-year-old man, who was injured with an 8-ton stone falling on his upper extremity, presented to the emergency room. There was a 0.5 cm traumatic hole in the area of the triceps muscle. Also, there was post-traumatic edema in the wrist and hand due to fall during the accident. In neuromuscular evaluation, there were signs of radial nerve injury. Extension limitation was evident in all fingers and the wrist of the right extremity. “wrist drop” was observed. There was no fracture in the humerus (Figure 1). In the volar region of the arm and forearm region, there was ecchymosis and edema. There was no suspicion of a fracture in the wrist area and therefore no radiography assessment was performed. A short-arm splint was placed for the post-traumatic edema in the wrist. It was noted that lacerations (2 pieces of 2 cm) in the volar and dorsal surface of the arm were closed with staples. Distal capillary filling was normal in all fingers, and also radial and ulnar pulses were palpable. The patient was referred to the hand surgery clinic.

Figure 1. Radiographs of the humerus (the first day of the trauma)

The following day, the patient's Electromyography (EMG) was recorded (Table 1). Early injury of the motor branch of the radial nerve at the level of the upper arm and hand-wrist was diagnosed. In needle EMG examination, the voluntary activity could not be obtained in the muscles of brachioradialis, extensor digitorum communis, extensor indicis proprius muscles with radial nerve innervation. The sensory and motor transmissions of the right ulnar and median nerves were within normal limits. The patient was hospitalized for nerve repair. There was no chronic disease, drug use, allergy or bleeding diathesis in the patient's history. No abnormality was found in his systemic and physical examination. Ecchymosis was seen in the periphery of the lacerations, and the forearm and hand dorsum were still edematous.

The patient was operated one week later. Peripheral nerves were explored. Motor nerve, extensor tendon repair was performed. Fasciocutaneous flap was used. The patient was placed in a prone position under intratracheal general anesthesia. After cleaning with betadine, sutures on the right side of the arm were removed. The incision was extended distally, proximally and posteriorly, and triangular fasciocutaneous flaps were elevated. In the nerve exploration, the lateral head of the triceps muscle was cut. The contusion was observed in the lateral, posterior and anterior parts of the humerus as a result of foreign body entering. The 1 cm segment of the radial nerve was dark colored and edematous due to contusion. The deep brachial artery was found to be thrombosed. The traumatic part was excised. The nerve was repaired periepineurally under loupe. Triceps muscle was repaired, and a hemovac drain was inserted. The skin flap was returned to its place and the skin was sutured. The splint was placed after the surgery, no early postoperative complications were detected and vital findings were normal.

On the 5th day of surgery, edema was still stable on the 5th day of surgery. In the 3rd week after surgery, the patient applied to the orthopedics and traumatology outpatient clinic for increased wrist pain and control examination. Distal radius fracture was diagnosed on x-ray imaging (Figure 2). Circular plaster was applied to the patient's wrist in the neutral position. Circular plaster was removed approximately 3 weeks later and a radiograph of the wrist was recorded (Figure 2).

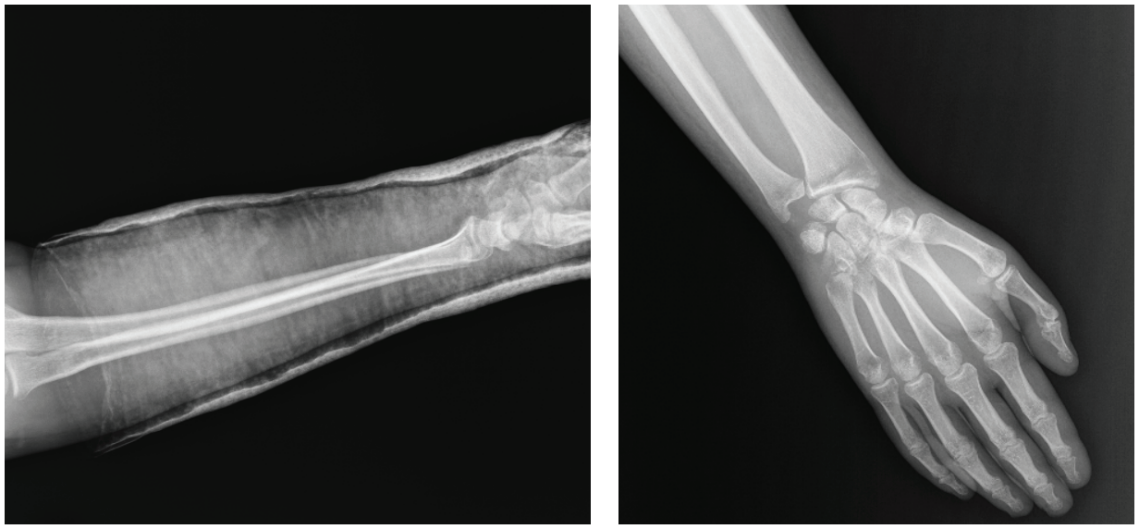

Figure 2. Radiographs of the radius (3rd week after trauma on the left, 6th week on the right)

The case was referred to the physical therapy and rehabilitation outpatient clinic. The case was re-evaluated at the physical therapy outpatient clinic for 1.5 months after trauma. There were still "wrist drop" deformity and reflex sympathetic dystrophy was observed. The surgical incision image of the patient is presented in Figure 3.

Figure 3. The incision site for the third week after surgery

In physiotherapy unit, dynamic extension splint was placed. Accordingly, it was aimed to prevent possible flexion and extension contracture in metacarpophalangeal joints. The patient was asked to use the splint during the first two months of the rehabilitation process. First, edema control was obtained with manual lymph drainage and kinesiotaping (fan-cut method) for about 2 months (Figure 4). After the edema of the patient was under control, a hot-pack was applied to the wrist. Neuromuscular electrical stimulation was applied after galvanic stimulation for the first 3 weeks. Electrical stimulation applications were gradually reduced in 6 months (from 5 days a week to 1 day). Active strengthening exercises were performed to increase the range of motion for the shoulder joint. Shoulder range of motion (ROM) was trained using the Proprioceptive Neuromuscular Fasciculation (PNF) technique (flexion/abduction/external rotation) with "post isometric-relaxation" and "rhythmic stabilization" methods. In addition, ROM was increased by scapular mobilization. Active and active-assistive ROM was performed in the elbow joint. Passive and active assistive ROM was performed in the wrist and joint mobilization was performed on the wrist and phalanges. The intensity of the exercises was gradually increased over a 9-month period. In the EMG recorded 7 months after the trauma, findings were still consistent with the total lesion of the radial nerve, proximal to the triceps muscle (Table 1).

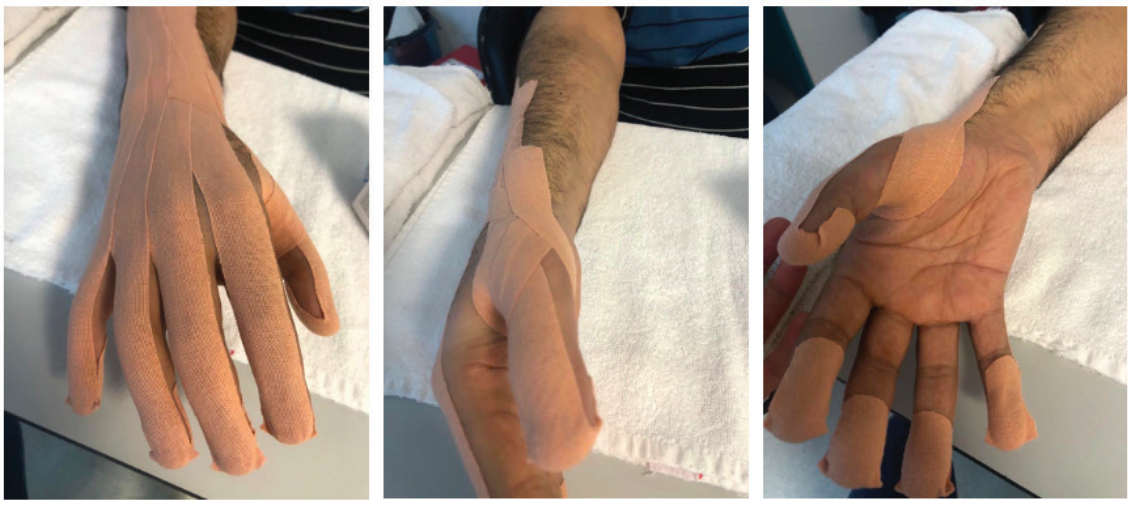

Figure 4. Kinesiotape application (fan-cut method)

Table 1: Baseline and second EMG (motor nerve conductions study) results

	Baseline (1st day of the trauma)		Second (7th month of the trauma)	
	Latency (ms)	**Amplitude (mV)**	**Latency (ms)**	**Amplitude (mV)**
Median				
Wrist	3.55	4.10	3.24	17.53
Axilla	10.80	2.70	8.04	16.52
Ulnar				
Wrist	2.10	5.80	3.09	16.27
Axilla	10.25	5.00	8.16	14.01
Radial				
Forearm	2.60	1.10	2.44	11.87

ms: milliseconds, **mV:** millivolts

Assessments of active range of motion (ROM) and muscle strength during the 9-month follow-up period are presented in Table 2. Pictures showing the patient's joint movement are presented in figures 5 and 6. Clinical findings and EMG record results were not related. Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Figure 5. Active flexion and extension manual muscle strength assessment of the wrist

Figure 6. Extension and abduction ROM of the fingers

Table 2: Active ROM and MMT results performed at 9 months follow-up

	45th day		4th month		6th month		9th month	
	ROM	**MMT**	**ROM**	**MMT**	**ROM**	**MMT**	**ROM**	**MMT**
Shoulder Flex.	100°	3^+	160°	4	160°	4^+	170°	4^+
Shoulder Abd.	90°	3^+	140°	4	150°	4	170°	4^+
Elbow Flex.	100°	3^+	120°	4	130°	4^+	140°	4^+
Elbow Ext.	-35°	0	-20°	3	0°	3^+	0°	3^+
Forearm Sup.	-80°	0	-40°	1	0°	2	10°	2
Forearm Pron.	90°	3	90°	4	90°	4	90°	4
Wrist Flex.	70°	2	70°	3^+	80°	4	80°	4
Wrist Ext.	-70°	0	-50°	1	0°	2	10°	3
1st CMC Flex.	20°	1	20°	3	40°	3^+	50°	3^+
1st CMC Ext.	0°	0	0°	1	0°	1	5°	2
1st CMC Abd.	0°	0	0°	1	0°	1	5°	1^+
2-5th MCP Flex.	20°	1	30°	3	30°	3^+	50°	4
2-5th MCP Ext.	-20°	0	-20°	1	-10°	1	5°	2
2-5th PIP Flex.	20°	1	20°	3	40°	3^+	50°	4
2-5th DIP Flex.	10°	1	10°	3	20°	3^+	20°	3^+

ROM: Range of Motion, **MMT:** Manual Muscle Test, **Flex:** Flexion Scale, **Ext:** Extension, **Abd:** Abduction, **Sup:** Supination, **Pron:** Pronation, **Opp:** Opposition, **CMC:** Carpometacarpal, **MCP:** Metacarpophalangeal, **PIP:** Proximal Interphalangeal, **DIP:** Distal Interphalangeal

3. Discussion

A clinical case report of multi-traumatic involvement of a radial nerve injury and distal radial fracture was reported in this case report. To the best of our knowledge, this is the first documented case report of multi-traumatic radial nerve injury along with fracture. The unusual feature of our case is the demonstration of the effect of immobilization on clinical evaluation results, which was performed compulsorily and was not suitable for post-radial nerve repair. The patient was placed in dynamic extension splints as early as possible, but the effectiveness of surgical and conservative treatment was observed to progress slowly compared to the normal treatment protocol. We think that it may be important to position the patient in a slight extension while applying the circular plaster. Although it is a complex situation, it was observed that the clinical findings of the patient improved significantly in a 9-month period with a fast track physiotherapy and rehabilitation program.

Rohilla et at. described a case of combined radial and median nerve injury in diaphyseal fracture of humerus. They explained the clinical results of the patient they followed conservatively. Another case was reported 4-part proximal humerus fracture with delayed radial nerve injury (10). However, no case report has been encountered in which multi-trauma caused injury on the same nerve. We emphasize the importance of patient follow-up and evaluation in order to maximize the functionality associated with clinical symptoms.

4. Conclusion

According to the result of our case report, the importance of immobilization procedure in the wrist fracture accompanying radial nerve injury was emphasized. Accelerated rehabilitation protocol with dynamic extensor splinting from early period will contribute to the patient gaining functionality. It should be stated that post-op strengthening, mobilization and ROM exercises are important with the results of this rare clinical condition.

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