

Ulnar Nerve and Ulnar Artery Injury Caused by Comminuted Distal Radius Fracture

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Learning Point of the Article:

The physician should remember that the ulnar neurovascular bundle may be vulnerable to tension caused by severely displaced distal radius fracture.

Abstract

Introduction: Distal radius fractures are one of the most frequent traumas encountered in daily orthopedic practice. With this case report, we would like to emphasize the significance of an unexpected associated ulnar nerve and artery injury with distal radius fracture to physicians.

Case Report: A 56-year-old male patient was evaluated in the emergency room after a motorcycle accident. The left wrist had a deformity and swelling, and about 3 × 1.5 cm of superficial skin abrasion was found in the volar surface of the wrist. It was noted that distal pulses were palpable, no neurological damage was found except hypoesthesia in the 5th finger. Radiologic examination revealed that the right shoulder was dislocated, and there was a displaced comminuted distal radius fracture in the left wrist with a non-displaced fracture of the ulnar styloid. The fracture was treated with open reduction and internal fixation using volar anatomic plate through the volar approach. After the surgery, pre-operative numbness did not resolve and opposing that expected; it increases with associated pain on the ulnar nerve innervated area within 30 days. The electromyographic analysis revealed severe partial ulnar nerve injury. The surgical exploration of the nerve was decided. The ulnar nerve was found to be trapped in scar tissue, and intimal injury and consequent thrombosis were observed at the ulnar artery.

Conclusion: Distal radius fractures are well-known fractures among the orthopedic surgeons; median nerve compression with a fracture is also within the expectation of the physician. However, the injury of the ulnar nerve and artery is unexpected. With this case report, we would like to emphasize the awareness of the diagnosis and treatment of this kind of associated unexpected ulnar nerve and artery injuries.

Keywords: Distal radius fracture, ulnar nerve injury, Guyon's canal, ulnar artery injury.

Introduction

Distal radius fractures are one of the most frequent traumas encountered in daily orthopedic practice. Approximately one-sixth of the fractures seen at the emergency rooms is distal radius fractures [1].

Although the most frequent neurological injury caused by these fractures is median nerve neuropathy, it has been reported in the literature that such fractures might cause ulnar nerve and artery injury.

This study aims to share the case of the ulnar nerve and ulnar artery injury following a closed distal radius fracture due to high energy trauma and our approach to this patient.

Case Report

A 56-year-old male patient was evaluated in the emergency room after a motorcycle accident.

In the patient's physical examination, it was found that the right shoulder had an epaulet sign, the right arm was in external rotation and abduction, and the humeral head could be felt by deep palpation in the anterior part of the glenoid.

The left wrist had a deformity and swelling, and about 3 × 1.5 cm of superficial skin abrasion was found in the wrist's volar surface.

It was noted that distal pulses were palpable, no neurological damage was found except hypoesthesia in the 5th finger.

Radiologic examination revealed that the right shoulder was

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Author's Photo Gallery



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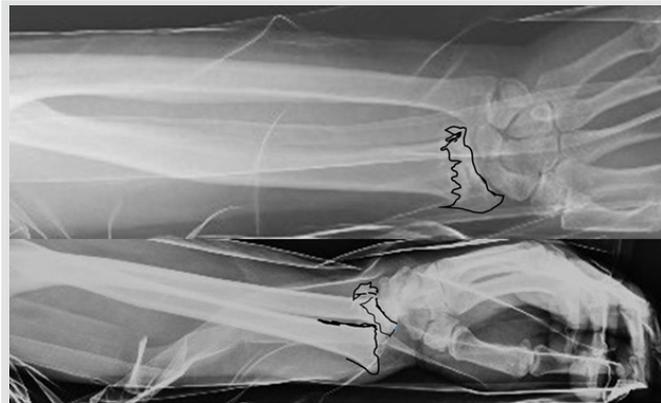


Figure 1: Notice the displacement on lateral radiograph.

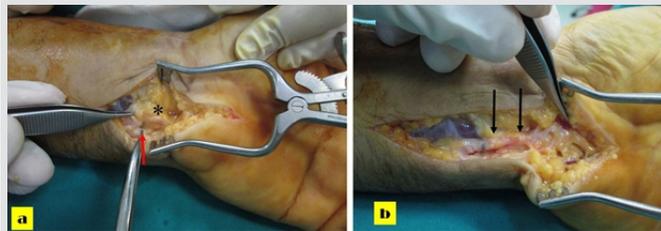


Figure 3: (a) The black arrow shows the starting point of compression on the ulnar artery and nerve, the asterisk shows stenotic segment of the artery and the red arrow shows the ulnar nerve over the scar tissue. (b) Two black arrows demonstrate the thrombosis and undulation on the ulnar artery.

dislocated, and there was a dorsally displaced severely comminuted distal radius fracture in the left wrist with a non-displaced fracture of the ulnar styloid (Fig. 1). The dislocated right shoulder was reduced under sedoanalgesia. The patient was operated electively 1 day after the injury.

Under infraclavicular blockage anesthesia, with a pneumatic tourniquet inflated, approximately 10 cm skin incision was made on the volar aspect of the left wrist. The radial artery was explored and protected. After the fracture was reduced, it was temporarily fixed with 3 K-wires. Then, permanent fixation was achieved using a distal radius volar anatomic plate and screws (Fig. 2).

The patient had symptoms of paresthesia and severe pain on the 4th and 5th fingers at 10th-day follow-up after the procedure.

He was closely monitored, as current symptoms did not improve, and electromyographic examination was obtained at the 4th week postoperatively. The electromyographic analysis revealed severe partial ulnar nerve injury. The surgical exploration of the nerve was decided.

Approximately 10 cm incision was made on the ulnar aspect of



Figure 4: Asterisk demonstrates the thrombosis and discoloration on the artery and yellow arrow shows the stenotic segment, notice the red coloration on the surface of the artery.



Figure 5: The yellow arrow shows the excised thrombotic segment of the ulnar artery.



Figure 2: Post-operative anterior-posterior and lateral radiographs. Notice the smooth reduction.

the wrist's volar part. The ulnar nerve and the ulnar artery were found trapped inside the scar tissue (Fig. 3).

The compressed ulnar nerve was released. Intimal injury and consequent thrombosis were observed at the ulnar artery. The thrombosed segment was excised till to the edge of the healthy vascular intimal layer (Fig. 4).

As the defect was approximately 5 cm, an anastomosis was planned with a vein graft from the forearm. About 8 cm of skin incision was made on the forearm's volar side, 10 cm below the elbow joint, and 6 cm of vein graft was harvested from the basilic vein, reversed, and the defect was repaired with the graft (Fig. 5-7).

The ulnar artery was also decompressed against the probability of further compression. Four weeks after the second operation, finger hypoesthesia started to improve, and clinically, the pain diminished, and wrist and hand functions became better (in complete comparison).

The patient had full functionality and pain-free wrist without any neurovascular impairment; after the 8 months from the second surgery (Fig. 8-10).

Discussion

There have been the case reports and series regarding isolated ulnar nerve and ulnar artery injuries associated with distal radius fracture in the literature; however, and two authors have reported both artery and nerve injury. Regarding treatment and intraoperative findings, our report is unique in the literature.

While distal radius fractures are rarely associated with neurological injuries, the median nerve is most commonly affected by this type of fracture.



Figure 6: (a) Exposure of the basilic vein, the yellow arrow shows the vein. (b) The harvested vein graft reversed and ready for anastomosis.

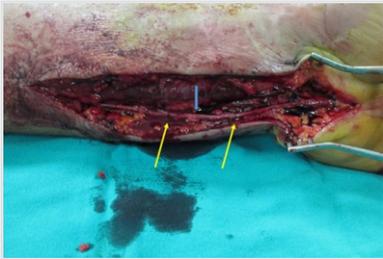


Figure 7: The yellow arrows show the proximal and the distal side of the anastomosis. The blue arrow shows the body of the vein graft, which filled with blood, the evidence that the anastomosis is actively working.



Figure 8: Notice the appearance of the wrist and hand with full function, 8 months after the second surgery.

Its frequency has been reported in the literature ranging from 0.2% to 20% [2, 3, 4, 5, 6, 7, 8, 9]. In large series, ulnar nerve injury has been reported much less than the median nerve [2, 4, 6]. Isolated ulnar nerve injuries that reported in the literature mostly case reports (Table 1) [10, 11, 12, 13, 14, 15, 16, 17, 18, 19].

Zoëga (1966) observed ulnar nerve palsy in three patients after a closed distal radius fracture; he emphasized that the abnormal dorsoradial displacement of the fracture can cause tension due to the contact pressure of the proximal fragment [10].

Vance and Gelberman (1978) reported ulnar neuropathy in three cases following a distal fracture in the radius. Compared to the common era of distal radius fractures, all cases sustained high-energy injuries, and all of the fractures had a more marked dorsal displacement than standard Colles' fracture [11].

In their anatomical study, they found that the ulnar nerve was approximately 2 mm close to the fragments in a dorsally displaced distal radius fracture, and they emphasized that in an isolated distal radius fracture, ulnar nerve damage might occur as contusion or being tethered by intact distal ulna [11]. Furthermore, ulnar sided-hematoma may compress the nerve in Guyon's canal [11].

If a distal radius fracture is paired with a distal ulna fracture, the likelihood of ulnar nerve damage is higher [11].

They suggested that the ulnar nerve in Guyon's canal was less exposed to pressure than the median nerve did in the carpal tunnel [11].

They also suggested that if there is ulnar nerve deficit due to a distal radius fracture, immediate the closed or open reduction should be performed, and later if the neurological deficit does not improve in 24–36 h, and surgical decompression will be

mandatory [11].

In an anatomical analysis, Clarke and Spencer (1991) found that the ulnar nerve had more mobility and extensibility than the median nerve; thus, the ulnar nerve was possibly less damaged than the median nerve after distal radius fractures [20].

Soong and Ring (2007) found that median nerve entrapment and ulnar nerve injury due to distal radius fracture were associated with high energy. We also justified this hypothesis in our case. Comparing

with median nerve compression, ulnar nerve compression was less commonly encountered [16].

Furthermore, they postulated that the secondary ulnar nerve injury was not correlated with the pressure phenomenon, in contrast with the median nerve.

They disagreed with the idea that a displaced distal radius fracture was not very commonly associated with ulnar nerve injury; they argued that the ulnar nerve was more vulnerable to contusion and stretching than the median nerve due to its fixed position in the Guyon's canal, but that, unlike the median nerve, the ulnar nerve was less affected by pressure-related injuries as it was outside of the carpal tunnel [16].

They recommended exploration of the nerve when there was a coexisting open wound with fracture associated with ulnar nerve injury; otherwise, close follow-up was recommended after the reduction [16].

In our case, the 5th finger had slightly hypoesthesia preoperatively, and we suggested that this was acute neuropraxia that could resolve spontaneously. In the post-operative 1 month follow-up, although the stretching effect of displaced fracture on the nerve resolved and hypoesthetic symptoms on the 4th and 5th fingers progressed. The decision of surgical exploration was made.

The injury of both the ulnar nerve and ulnar artery after distal radius fracture has been reported very rarely in the literature [12, 21].

Poppi et al. (1978) made a surgical exploration while the symptoms of ulnar nerve entrapment that did not resolve after 3 months from the injury in a conservatively treated distal radius fracture; found that the ulnar nerve, artery, and veins were trapped in scar tissue and the ulnar artery was thrombosed. They released the ulnar nerve but did not give additional detail about the ulnar artery in the report [12]. This report seems very similar to ours, but in



Figure 9: Notice the appearance of the wrist and hand with full function, 8 months after the second surgery.

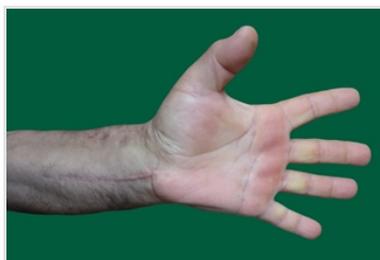


Figure 10: Notice the appearance of the wrist and hand with full function, 8 months after the second surgery.

Table 1						
Author, Year, Journal	Number of cases	Associated injuries				Message from Article
		Median Nerve	Ulnar nerve	Ulnar artery	Radial artery	
Lewis and Miller, 1922, Annals of Surgery	-	1	2	-	-	They reported two cases of ulnar nerve palsy after a distal radius fracture
Bacorn and Kurtzke, 1953, The Journal of Bone and Joint Surgery American Volume	2000	4	1	-	-	They reported single traumatic neuritis of the ulnar nerve amongst 2000 Colles' fractures
Lynch and Lipscomb, 1963, The Journal of the American Medical Association	600	20	-	-	-	Stated that median nerve compression was in a relationship with immobilization in Cotton-Loder position and this position should be avoided
Zoëga, 1966, The Journal of Bone and Joint Surgery British Volume	3	-	3	-	-	When the distal fragment is displaced dorsally and radially, the ulnar nerve is easily stretched by the proximal fragment
Frykmann, 1967, Acta Orthopaedica Scandinavica	430	10	4	-	-	No acute ulnar nerve injury reported; two of them was early, two of them was late
Siegel and Weiden, 1968, The Journal of Trauma	2	2	2	-	-	They presented two cases of combined median and ulnar nerve injury after distal radius and ulna fracture
Rychak and Kalenak, 1977, The Journal of Bone and Joint Surgery	1	+	+	-	-	They stated that the blow from the distal fragment of the radius was main cause of the combined nerve contusion
Vance and Gelberman, 1978, The Journal of Bone and Joint Surgery American Volume	3	-	3	-	-	They emphasized the importance of high energy trauma
Poppi, 1978, The Journal of Trauma	1	-	+	+ (thrombosis)	-	They reported ulnar nerve contusion and ulnar artery thrombosis after Galeazzi's fracture; they performed neurolysis but did not mention about the artery in their article
Fernandez, 1981, The Journal of Hand Surgery American Volume	1	-	+	+	-	Described an irreducible distal radiocarpal fracture-dislocation with entrapment of ulnar neurovascular bundle and flexor profundus tendons 2-5, neither arterial nor neural injury was reported
Bourrel and Ferro, 1982, Annales Chirurgie de la main	6	4	6	-	-	They reported four combined ulnar+median, two isolated ulnar neuropathy in 19 distal radius fractures
Aro et al., 1988, Clinical Orthopaedics and Related Research	166	14	7	-	-	Patients with ulnar nerve compression had either malunion with radial collapse or volar subluxation of the ulnar head in those fractures that healed with dorsal angulation
Kumar, 1990, The Journal of Trauma	1	+	+	-	-	Accused acute angulation of the nerves and volarly displaced fragment for the neurological deficit
Clarke and Spencer, 1991, The Journal of Hand Surgery British Volume	3	-	3	-	-	All three cases were associated with scar tissue around the nerve and surgical decompression was successful. They indicated that the ulnar nerve has more mobility than the median nerve
Hove, 1995, Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery	542	23	5	-	-	four patients' sensory symptoms of the ulnar nerve resolved spontaneously, one patient with a malunion needed a shortening osteotomy of ulna
Pazart et al., 1999, Chirurgie de la main	1	-	+	-	-	Ulnar nerve severed on the proximal fragment after a distal radius fracture
Bienek et al., 2006, The Journal of Hand Surgery British Volume	60	12	-	-	-	In a series of 60 distal radius fractures, 12 carpal tunnel syndrome, no ulnar neuropathy reported

Author, Year, Journal	Number of cases	Associated injuries				Message from Article
		Median Nerve	Ulnar nerve	Ulnar artery	Radial artery	
Howard, 1961, The Journal of Bone and Joint Surgery	6	-	6	-	-	He presented six cases of carpal and metacarpal fractures with ulnar neuropathy. He stated that this injury might result from severe contusion of the nerve, pressure caused by hemorrhage and edema related to the fracture and intraneural fibrosis in delayed or progressive paralysis
Lu et al., 2007, The Kaohsiung Journal of Medical Sciences	1	-	+	-	-	They presented ulnar neuropathy caused by a Salter-Harris Type two distal radius and ulnar styloid fracture, which resolved spontaneously 16 weeks after closed reduction and percutaneous pinning of the fracture
Soong and Ring, 2007, Journal of Orthopaedic Trauma	5	-	+	-	-	They recommended exploration of ulnar nerve palsy after distal radius fracture if there is open wound or acute carpal tunnel syndrome, otherwise observation without exploration
De Witte et al., 2008, Journal of Orthopaedic Trauma	6	2	2	2 (1 laceration 1 thrombosis)	4 (3 laceration 1 thrombosis)	They suggested that the risk of arterial injury is more common than previously thought, and related with open wound, high energy or concomitant ulnar fracture
Sohal et al., 2009, The Journal of Hand Surgery American Volume	1	-	+	-	-	They reported a case in which the ulnar nerve was found to be in dense scar tissue, dorsal to the styloid of ulna following a distal radius fracture
Ward et al., 2011, Hand (NY)	96	9	-	-	-	They concluded that post-operative nerve dysfunction decreased while surgeon became more experienced with volar plating technique of distal radius fractures
Cho et al., 2010, Clinics in Orthopedic Surgery	2	-	2	-	-	They reported two cases of ulnar nerve palsy after a closed distal radius fracture, which continued after fixation, recovered with decompression and neurolysis
Esenwein et al., 2013, Archives of Orthopaedic and Trauma Surgery	665	22	-	-	-	They reported 22 median nerve compression in 665 cases which were treated by volar plate fixation
Dauzere et al., 2018, Orthopaedics and Traumatology: Surgery and Research	3	3	3	-	-	They advised surgical exploration and release for the patients who have combined median and ulnar nerve injury and have no evidence of recovery within 3 months of injury
Rotman et al., 2019, Archives of Orthopaedic and Trauma Surgery	2	-	2	-	-	They reported two patients who had a pure sensory deficit of dorsal cutaneous branch of the ulnar nerve which resolved after fracture reduction

detail, they did not report any treatment regarding the artery.

De Witte et al. (2008) published a series of six patients with vascular injury after distal radius fracture, which was treated with open reduction and volar plate fixation. In their series, they reported ulnar artery and ulnar nerve injury in two patients. In the first patient with ulnar nerve contusion and ulnar artery laceration, they preferred to perform ligation for the lacerated ulnar artery. The second patient had partial nerve laceration and ulnar artery thrombosis. They performed a repair of the nerve and reconstruction of the artery with a vein graft. They suggested that vascular injuries associated with distal radius fractures were higher than previously published, and the

increased usage of the volar approach in fixation of such fractures was associated with more vascular injuries [21].

In their case, the ulnar nerve has been lacerated while, in our case, the ulnar nerve was trapped in scar tissue. This critical detail distinguishes this case from ours (Table 1).

In our case, we did a surgical exploration and detected that the ulnar nerve was compressed inside the scar tissue, and the ulnar artery was thrombosed with segmental intimal damage. We performed decompression of the ulnar nerve and repaired the thrombosed ulnar artery with segmental resection and vein grafting.

Conclusion

Distal radius fractures are well-known fractures among the orthopedic surgeons; median nerve compression with a fracture is also within the expectation of the physician. However, the injury of the ulnar nerve and artery is unexpected. With this case report, we would like to emphasize the awareness of the diagnosis and treatment of this kind of associated unexpected ulnar nerve and artery injuries.

Clinical Message

Distal radius fractures are well-known fractures among orthopedic surgeons. However, associated injury of ulnar nerve and artery with a fracture is unexpected. The physician should keep in mind that the ulnar neurovascular bundle might be vulnerable to a tension caused by severely displaced distal radius fracture.

References

- Jupiter JB. Fractures of the distal end of the radius. *J Bone Joint Surg Am* 1991;73:461-9.
- Bacorn RW, Kurtzke JF. Colles' fracture; a study of two thousand cases from the New York state workmen's compensation board. *J Bone Joint Surg Am* 1953;35:643-58.
- Lynch AC, Lipscomb PR. The carpal tunnel syndrome and colles' fractures. *JAMA* 1963;185:363-6.
- Frykman G. Fracture of the distal radius including sequelae shoulder-handfinger syndrome, disturbance in the distal radio-ulnar joint and impairment of nerve function: A clinical and experimental study. *Acta Orthop Scand* 1967;38:1-61.
- Aro H, Koivunen T, Katevuo K, Nieminen S, Aho AJ. Late compression neuropathies after colles' fractures. *Clin Orthop Relat Res* 1988;233:217-25.
- Hove LM. Nerve entrapment and reflex sympathetic dystrophy after fractures of the distal radius. *Scand J Plast Reconstr Surg Hand Surg* 1995;29:53-8.
- Bienek T, Kusz D, Cielinski L. Peripheral nerve compression neuropathy after fractures of the distal radius. *J Hand Surg Br* 2006;31:256-60.
- Ward CM, Kuhl TL, Adams BD. Early complications of volar plating of distal radius fractures and their relationship to surgeon experience. *Hand (NY)* 2011;6:185-9.
- Esenwein P, Sonderegger J, Gruenert J, Ellenrieder B, Tawfik J, Jakubietz M. Complications following palmar plate fixation of distal radius fractures: A review of 665 cases. *Arch Orthop Trauma Surg* 2013;133:1155-62.
- Zoëga H. Fracture of the lower end of the radius with ulnar nerve palsy. *J Bone Joint Surg Br* 1966;48:514-6.
- Vance RM, Gelberman RH. Acute ulnar neuropathy with fractures at the wrist. *J Bone Joint Surg Am* 1978;60:962-5.
- Poppi M, Padovani R, Martinelli P, Pozzati E. Fracture of the distal radius with ulnar nerve palsy. *J Trauma* 1978;18:278-9.
- Fernandez DL. Irreducible radiocarpal fracture-dislocation and radioulnar dissociation with entrapment of the ulnar nerve, artery and flexor profundus II-V-case report. *J Hand Surg Am* 1981;6:456-61.
- Pazart F, Stindel E, Le Nen D. Fracture of the distal part of the radius associated with severed ulnar nerve. *Chir Main* 1999;18:197-201.
- Lu CC, Chuo CY, Chen SK, Huang YH, Chou PH. Ulnar nerve palsy following fracture of the distal radius in an adolescent: A case report. *Kaohsiung J Med Sci* 2007;23:151-5.
- Soong M, Ring D. Ulnar nerve palsy associated with fracture of the distal radius. *J Orthop Trauma* 2007;21:113-6.
- Sohal JK, Chia B, Catalano LW 3rd. Dorsal displacement of the ulnar nerve after a displaced distal radius fracture: Case report. *J Hand Surg Am* 2009;34:432-5.
- Cho CH, Kang CH, Jung JH. Ulnar nerve palsy following closed fracture of the distal radius: A report of 2 cases. *Clin Orthop Surg* 2010;2:55-8.
- Rotman D, Schermann H, Kadar A. Displaced distal radius fracture presenting with neuropraxia of the dorsal cutaneous branch of the ulnar nerve (DCBUN). *Arch Orthop Trauma Surg* 2019;139:1021-3.
- Clarke AC, Spencer RF. Ulnar nerve palsy following fractures of the distal radius: Clinical and anatomical studies. *J Hand Surg Br* 1991;16:438-40.
- de Witte PB, Lozano-Calderon S, Harness N, Watchmaker G, Green MS, Ring D. Acute vascular injury associated with fracture of the distal radius: A report of 6 cases. *J Orthop Trauma* 2008;22:611-4.

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