

# Proximal Neuropathy in Colles' Fracture

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**ABSTRACT: Background:** Peripheral nerve injury at the wrist following Colles' fracture is rare and usually located in the region of the fracture. Mononeuropathies in the proximal forearm have not been reported. **Method:** We present two patients with Colles' fracture with proximal forearm neuropathies. **Results:** Both cases were associated with mononeuropathies in the forearm as proximal as the elbow, involving the median, ulnar and radial nerves in one, and the median and ulnar nerves in the other. **Conclusion:** Following Colles' fracture proximal nerve involvement may occur and, with increased awareness, this lesion may be identified more frequently.

**RÉSUMÉ: Neuropathie proximale dans la fracture de Colles. Introduction:** La lésion d'un nerf périphérique suite à une fracture de Colles est rare et généralement située dans la région de la fracture. Des mononeuropathies au niveau de l'avant-bras n'ont jamais été rapportées. **Méthode:** Nous présentons deux cas de fracture de Colles avec neuropathie de l'avant-bras proximal. **Resultats:** Deux cas de fracture de Colles, tores deux associés à des mononeuropathies de l'avant-bras aussi hautes que le coude, impliquant les nerfs médian, cubital et radial chez un et médian et cubital chez l'autre. **Conclusion:** Une atteinte nerveuse proximale peut survenir suite à une fracture de Colles et, avec plus de vigilance, cette lésion pourrait être identifiée plus souvent.

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Peripheral nerve injury at the wrist following Colles' fracture is rare, occurring in approximately 6% of such fractures.<sup>1</sup> The neuropathy is distal, in the region of the fracture, unless it follows improper casting or other iatrogenic cause such as brachial plexus block or poor positioning during general anesthesia,<sup>1</sup> and it may involve the median, ulnar, or radial nerve. Mononeuropathies in the proximal forearm directly consequent to Colles' fracture have not been reported. We present two such cases of Colles' fracture, both of which were associated with mononeuropathies in the forearm as proximal as the elbow, involving the median, ulnar and radial nerves in one, and the median and ulnar nerves in the other.

## CASE REPORTS

### Patient 1

A 33-year-old man fell several feet off a ladder, on his outstretched arms, and sustained a closed comminuted fracture of the distal right radius (Colles' fracture). There were no other injuries. Under general anesthesia he underwent closed reduction and application of an Agee external wrist fixator. Subsequently, he complained of right median nerve distribution numbness. Examination revealed normal muscle bulk and strength and numbness in the distribution of the right median nerve. Ulnar and radial nerve distribution weakness was not evident. Nerve conduction studies (NCS) and electromyography (EMG) were performed 3 weeks post trauma.

### Patient 2

A 42-year-old woman tripped on the sidewalk and sustained a left comminuted radial fracture without other injury. She underwent casting of the distal forearm and proximal hand at another hospital. Swelling and numbness of the hand developed and the cast was removed. Examination revealed numbness and moderate (MRC grade 4/5) weakness in the distribution of the median and ulnar nerves. NCS and EMG were performed 6 weeks post trauma at which time the neurological examination was unchanged although the swelling had significantly improved.

## MATERIALS AND METHODS

Nerve conduction studies of the median, ulnar, and radial nerves were performed using standard technique.<sup>2</sup> Results were compared to the laboratory normal values. EMG was performed using a monopolar needle electrode using standard technique.<sup>3</sup> Axonal injury to nerves was considered to be present when fibrillation potentials were found. Other neurogenic parameters (size, polyphasicity, interference patterns) were not used due to the subjective nature of the interpretation of these findings.<sup>3a</sup>

## RESULTS

Electrophysiologic results are shown in Table 1. Findings in Patient 1 revealed: 1) median neuropathy above the branch to pronator teres (pronator teres syndrome), 2) radial neuropathy above the branch to brachioradialis but below triceps, and 3) ulnar neuropathy above the branch to flexor carpi ulnaris (Table 1). Findings in Patient 2 were limited due to patient discomfort and refusal to undergo complete needle EMG study but revealed: 1) left median neuropathy above the branch to flexor digitorum superficialis, and 2) left ulnar neuropathy above the wrist (Table 1). In both patients, the presence of fibrillation potentials in all abnormal muscles was graded as 2+ or 3+.

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**Table 1:** Results of Electrodiagnostic Studies.

<b>Patient 1</b>			
<b>Nerve Conduction Studies</b>			
<b>Motor Nerve</b>	<b>Amplitude(mV)</b>	<b>Latency (ms)</b>	<b>Velocity(m/s)</b>
median (wrist)	*0.2 (>5) <sup>^</sup>	3.8 (<4.4)	
(elbow)	*0.2	11.4	53 (>49)
ulnar (wrist)	8 (>5)	3.2 (<3.4)	
(elbow)	7	9.8	54 (>50)
<b>Sensory Nerve</b>			
<b>Amplitude (μV)</b>	<b>Latency (ms)</b>	<b>Velocity (m/s)</b>	
median	*No response		
ulnar	*4 (>6)	3.0	47 (>50)
dorsal ulnar	*4 (>6)	1.8	58 (>50)
radial	13 (>10)	1.7	65 (>50)
<b>Patient 2</b>			
<b>Nerve Conduction Studies</b>			
<b>Motor Nerve</b>	<b>Amplitude (mV)</b>	<b>Latency (ms)</b>	<b>Velocity (m/s)</b>
median	*No response		
ulnar (wrist)	*0.1 (>5.0)	6.0 (<3.4)	
(elbow)	*0.1	8.6	*40 (>50)
<b>Sensory</b>			
<b>Amplitude (μV)</b>	<b>Latency (ms)</b>	<b>Velocity (m/s)</b>	
median	*No response		
ulnar	*No response		
dorsal ulnar	*No response		
radial	21 (>10)	2.0	60 (>50)
<b>Electromyography</b>			
<b>Patient 1</b>		<b>Patient 2</b>	
<b>Fibrillation Potentials</b>	<b>Normal</b>	<b>Fibrillation potentials</b>	
Brachioradialis	Biceps brachii	First dorsal interosseus	
Extensor carpi radialis	Deltoides	Abductor digiti minimi	
Extensor digitorum communis	Infraspinatus	Abductor pollicis brevis	
Extensor indicis proprius	Teres major	Flexor pollicis longus	
Pronator teres	Latissimus dorsi	Flexor digitorum superficialis	
Flexor digitorum superficialis	Triceps		
Flexor pollicis longus	Serratus anterior	Refused further EMG study.	
Abductor pollicis brevis	Pectoralis major		
Flexor carpi ulnaris	Pectoralis minor		
Flexor digitorum profundus 4, 5	Paraspinals C5-T1		

<sup>^</sup> normal values are bracketed. \* denotes abnormal finding.

## DISCUSSION

In two patients, multiple proximal mononeuropathies complicated Colles' fracture. Although each patient underwent a medical procedure prior to the documentation of the neuropathies, we do not believe that they were responsible for the lesions. We base this on the fact that the localization of the neuropathies in each case

was well proximal to the site of external fixation in the former and casting in the latter. In the first patient there were no ecchymoses, swelling, or other evidence of widespread forearm trauma, and the placement of the pins in the distal third of the radius would be unable to cause injury to more proximal muscles. In the second case, hand swelling developed and the cast was removed, and the study was performed long after the swelling subsided. Although the hand swelling within the cast could conceivably have caused compression of the dorsal ulnar sensory nerve and thus explain its absence, it cannot explain the median nerve innervated EMG abnormalities as proximal as the flexor digitorum superficialis. They would thus be unlikely to have contributed to the neuropathy.

In the largest series of Colles' fracture, carpal tunnel syndrome was seen in 0.2%.<sup>4</sup> Ulnar neuropathy at the wrist has been reported only in isolated case reports.<sup>5-7</sup> Radial nerve injury has not been reported to our knowledge and proximal neuropathy of any nerve has not been reported as a direct consequence of the fracture. Our two patients demonstrate that neuropathies involving the median, ulnar or radial nerves may occur as a direct consequence of Colles' fracture and may occur as proximal as the elbow.

The mechanism of injury is unclear. We suspect that the involved nerves may undergo proximal stretch injury caused by hyperangulation of the hand and distal bone fragment, compounded by the proximal tethering of these nerves in the cubital tunnel, ulnar groove, and pronator teres or sublimis bridge. With regards to the radial nerve, sudden violent contraction of the triceps has been reported to result in neuropathy and this might also contribute to the first patient's radial neuropathy above the elbow but distal to the triceps.<sup>8</sup> The sudden contraction occurs when the patient cushions the fall on outstretched arms, the self-same posture which results in the Colles' fracture.

Following Colles' fracture proximal nerve involvement may occur and with increased awareness this lesion may be identified more frequently and its pathogenesis better elucidated.

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