Ulnar nerve palsy is a rare complication of closed midshaft forearm fractures; only 8 cases have been reported. This article describes a case of ulnar nerve palsy associated with a midshaft forearm fracture.

A 12-year-old girl sustained a right midshaft forearm fracture. Whether she had a peripheral nerve injury was unknown due to strong pain. She underwent emergency manual reduction and intramedullary pinning. However, ulnar nerve palsy was remarkable postoperatively and gradually worsened. Therefore, neurolysis was performed 9 weeks later. The nerve had adhered to surrounding scar tissue. Six months after a second surgery, she had no motor dysfunction. The pathogenesis of ulnar nerve palsy complicated with midshaft forearm fractures varies and may be the result of direct contusion, direct damage by a bony spike, bony entrapment after closed reduction, and entrapment by a scar. In the current case, the patient was uncooperative at initial examination. Therefore, it is unknown whether she presented with immediate ulnar nerve palsy after the fracture. However, the ulnar nerve was not entrapped at the fracture site, and the surrounding muscle was intact but adhered to the surrounding scar tissue. The etiology of this case was considered to be entrapment by scar formation. According to a literature search, the authors recommend exploring the nerve approximately 8 to 10 weeks after primary surgery, after which neurological symptoms do not tend to improve.

Seigo Suganuma, MD; Kaoru Tada, MD; Hiroyuki Hayashi, MD; Takeshi Segawa, MD; Hiroyuki Tsuchiya, MD

Abstract

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A 12-year-old girl sustained a right midshaft forearm fracture. Whether she had a peripheral nerve injury was unknown due to strong pain. She underwent emergency manual reduction and intramedullary pinning. However, ulnar nerve palsy was remarkable postoperatively and gradually worsened. Therefore, neurolysis was performed 9 weeks later. The nerve had adhered to surrounding scar tissue. Six months after a second surgery, she had no motor dysfunction. The pathogenesis of ulnar nerve palsy complicated with midshaft forearm fractures varies and may be the result of direct contusion, direct damage by a bony spike, bony entrapment after closed reduction, and entrapment by a scar. In the current case, the patient was uncooperative at initial examination. Therefore, it is unknown whether she presented with immediate ulnar nerve palsy after the fracture. However, the ulnar nerve was not entrapped at the fracture site, and the surrounding muscle was intact but adhered to the surrounding scar tissue. The etiology of this case was considered to be entrapment by scar formation. According to a literature search, the authors recommend exploring the nerve approximately 8 to 10 weeks after primary surgery, after which neurological symptoms do not tend to improve.

Drs Suganuma, Tada, Segawa, and Tsuchiya are from the Department of Orthopaedic Surgery, Graduate School of Medical Science, Kanazawa University, and Dr Hayashi is from the Department of Orthopaedic Surgery, Kanazawa Red Cross Hospital, Kanazawa, Japan.

Drs Suganuma, Tada, Hayashi, Segawa, and Tsuchiya have no relevant financial relationships to disclose.

Correspondence should be addressed to: Seigo Suganuma, MD, Department of Orthopaedic Surgery, Graduate School of Medical Science, Kanazawa University, 13-1 Takara-machi, Kanazawa, Japan (suganumaseigo1978@yahoo.co.jp).

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Figure: Intraoperative photographs showing the ulnar nerve before (A) and after (B) neurolysis. The ulnar nerve was entrapped in scar tissue, and neurolysis was conducted using a microscope.
Ulnar nerve palsy is a rare complication of closed midshaft forearm fractures. This article describes a case of ulnar nerve palsy complicated by a closed midshaft forearm fracture in a pediatric patient.

**Case Report**

A 12-year-old girl presented to a nearby hospital after a fall. She was diagnosed with a midshaft forearm fracture (Figure 1). Whether she had a peripheral nerve injury was unknown due to strong pain. She underwent emergency manual reduction and intramedullary pinning using Kirschner wire. Sub Cast fixation was subsequently performed. However, ulnar nerve palsy became remarkable postoperatively and gradually worsened.

She presented to the current authors’ institution 6 weeks after the primary surgery. Bony union was almost complete (Figure 1). The authors followed her symptoms for 3 weeks, but no sign existed of improvement (Figure 2). Therefore, the authors performed a second surgery under general anesthesia 9 weeks after the primary surgery. Intraoperatively, it was revealed that the ulnar nerve was strongly adhered to surrounding scar tissue (Figure 3). The nerve was not entrapped at the fracture site, and the surrounding muscle was intact. The authors later removed the metal and carefully performed neurolysis using a microscope (Figure 3). Six months after her second surgery, she had no motor dysfunction (Figure 2).

**Discussion**

Many peripheral nerve injuries complicated by fractures and dislocations are neurapraxia or axonotmesis. These injuries accompany specific fractures and dislocations: brachial plexus palsy with clavicle fractures, axillary nerve palsy with shoulder joint dislocation, radial nerve palsy with humeral shaft fractures, median and anterior interosseous nerve palsy with supracondylar humerus fractures, posterior interosseous nerve palsy with Monteggia fractures, median nerve palsy with distal radius fractures, sciatic nerve palsy with hip and pelvic fractures, and peroneal nerve palsy with knee joint dislocation. However, ulnar nerve palsy is a rare complication of closed midshaft forearm fractures, and to the authors’ knowledge, 8 cases have been reported (Table). Anatomic studies by Clarke and Spencer reported that the ulnar nerve is more mobile in the forearm, which accounts for its infrequent injury associated with fractures.

The pathogenesis of ulnar nerve palsy complicated by midshaft forearm fractures varies and may include direct con-
tusion, direct damage by a bony spike,10 bony entrapment after closed reduction,11 and entrapment by a scar.10 From an anatomical viewpoint, the ulnar nerve runs parallel to the flexor digitorum profundus muscle under the deep layer of the flexor carpi ulnaris muscle on the forearm and is protected by the surrounding muscle.11 Therefore, this nerve is rarely contused directly by an external force. However, the nerve lies close to the ulna at the middle and distal thirds; therefore, significant angulation and displacement with a spike can directly damage the nerve.10 Torpey et al12 reported an ulnar nerve laceration in a closed forearm fracture. Hirasawa et al11 reported a case of bony entrapment of the ulnar nerve after a closed forearm fracture and reported the characteristics of the injury as follows: motor and sensory impairment of the ulnar nerve was observed at manual reduction, and radiographs showed an absence of callus formation. Matev15 also reported posterior displacement of the median nerve beyond the medial epicondyle of the humerus after posterolateral dislocation of the elbow joint and named the callus-absent image at the fracture site of the humerus. Matev’s sign. In the current case, the patient was uncooperative at initial examination. Therefore, it is unknown whether she presented with immediate ulnar nerve palsy after the fracture. However, the ulnar nerve was not entrapped at the fracture site, and the surrounding muscle was intact but adhered to the surrounding scar tissue as seen intraoperatively. Therefore, the etiology of this case was considered to be entrapment by scar formation.

To determine a treatment plan, the authors recommend that a pathogenic diagnosis be made as soon as possible. A thorough neurological examination is most important because deficits most often occur immediately. However, it is often difficult to conduct a proper examination in pediatric patients because of strong pain. In those instances, repeat examinations are needed.

The current authors propose that a neurologic deficit presenting immediately after a fracture suggests a nerve contusion or direct injury by a bony spike, whereas patients exhibiting a postreduction nerve palsy may result in a nerve caught in the reduced fracture site. The authors also suggest that late nerve palsy is the result of scar formation. In peripheral nerve injuries associated with fractures, the authors generally choose conservative treatment instead of neurotmesis because most injuries resulting in a neurapraxia or axonotmesis resolve spontaneously without neurolysis.16 Omer17 reported that 85% of nerve injuries associated with fracture-dislocation recovered spontaneously when nerves remained connected.

However, the current authors propose that the treatment method and time should be determined by variables such as the severity of palsy, age, the severity of fracture displacement, and the presence of an effective reconstructive method. In cases of sciatic nerve palsy, tibial nerve palsy, and high median or ulnar nerve palsy, exploration of the nerve should be conducted as soon as possible after trauma because it is too long for regeneration. In cases of ulnar nerve palsy associated with midshaft forearm fractures, it is imperative to explore the nerve when a laceration is suspected. Early exploration was performed in 2 of the 8 reported cases. In both cases, ulnar nerves were partially transected.10,12 Ulnar nerve laceration can occur in closed forearm fractures. Neurolysis was performed in 4 of the 6 remaining cases. Neurolysis was performed in 1 case 10 weeks after injury, and the patient was left with a slight weakness of the ulnar innervated intrinsic muscles 1 year later.10 By contrast, although neurolysis was performed 16 weeks after injury in another patient, he recovered fully.10

It is difficult to choose a uniform treatment time because the pathogenesis of each case is different. The current authors propose that exploration of the nerve should be performed by 10 weeks after injury, after which neurological deficits do not typically improve. However, the remaining 2 cases were treated conservatively, and the neurological deficits continued to improve from 8 weeks after injury. At final follow-up, the patients had no residual sensory disturbance or motor dysfunction.13

### Table

<table>
<thead>
<tr>
<th>Author</th>
<th>Patient Age, y</th>
<th>Initial Treatment</th>
<th>Period Until Neurolysis, wk</th>
<th>Pathogenesis</th>
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<tr>
<td>Prosser &amp; Hooper8</td>
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<td>Internal fixation of the radius</td>
<td>10</td>
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<td>Stahl et al10</td>
<td>10</td>
<td>Manual reduction</td>
<td>10</td>
<td>Scar entrapment</td>
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<tr>
<td></td>
<td>15</td>
<td>Manual reduction</td>
<td>16</td>
<td>Scar entrapment</td>
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<tr>
<td></td>
<td>9</td>
<td>Open reduction and nerve repair</td>
<td>N/A</td>
<td>Partial laceration</td>
</tr>
<tr>
<td>Hirasawa et al11</td>
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<tr>
<td></td>
<td>11</td>
<td>Manual reduction</td>
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</table>

Abbreviation: N/A, no answer.
REFERENCES


