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Case Report

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Posterior Interosseous Nerve Injury After a Fracture of Ulna and Radius: A Case Report

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ABSTRACT

The aim of this study is present a case of isolated injury to the branch of posterior interosseous nerve.

A 27-year-old gentleman was presented with an inability to extend the ulnar three fingers of his left hand after sustaining closed fractures of the left ulna and radius after a motorbicycle accident. The patient recovered partially over the course of 3 months but continues to be functionally compromised by the persistent radial deviation of his left wrist and incomplete mobility of the ulnar 3 fingers upon extension. On second exploration, we found the denervated muscles supplied by the recurrent branch of posterior interosseous nerve. Tendon transfer was performed with good clinical outcome at 12 months.

This is a rare case of isolated injury to branch of posterior interosseous nerve. This generates the suspicion of possibility of PIN or its branch injury even in closed fractures of the forearm. In addition, this highlights the importance of interval generation during the fracture fixation to prevent the possibility of iatrogenic injury to branches of PIN.

KEYWORDS: Posterior interosseous nerve, Peripheral nerve palsy, Ulna fracture, Radius fracture

ABBREVIATION: PIN: Posterior interosseous nerve

INTRODUCTION

Posterior interosseous nerve (PIN) palsy has been described in several reports due to traumatic causes such as Monteggia fractures, radial head fractures, posterior elbow dislocation, bullet wounds, lacerations and penetrating injuries. Only one previous case exists describing PIN palsy after closed fracture of ulna and radius (9).

The posterior interosseous nerve is the distal motor branch of the radial nerve that is susceptible to injury as a result of trauma (fractures, compressions or contusions), neoplasms and other pathologies (2,4,8,9). It arises from the radial nerve along the lateral epicondyle of the humerus before emerging through the two heads of the supinator muscle at the arcade of Frohse. The PIN then divides into the lateral and medial branch approximately eight centimeters below the elbow. Spinner even compares it to the *cauda equina* as most of the motor branches leave the main trunk at the same time (8).

The basic pattern of the division of the posterior interosseous nerve after it emerges from the supinator consists of two major branches: the recurrent branches supplying the superficial layer of muscles (extensor digitorum communis, extensor digiti quinti and extensor carpi ulnaris) and the descending branches which supplies the deeper muscles (abductor pollicis longus, extensor pollicis longus and brevis and extensor indicis proprius) (1,6). Preparation between extensor digitorum quinti and extensor digitorum communis is highly discouraged as it may lead to iatrogenic injury to the recurrent branches.

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The PIN is relatively well protected in comparison to the median and ulnar nerves due its deep anatomical course. Injury distal to the division of the PIN is uncommon and most often due to a penetrating injury (3,6). Traumatic PIN palsy has been categorized by Suematsu and Hirayama into three types, with a fourth further described by Horton (Table I) (5).

Here, we describe a patient with a both bone forearm fracture and the resulting isolated injury of the recurrent branch of PIN. Even though there have been some reports of trauma resulting in PIN palsy in the literature, (3-7) an isolated injury to either the superficial or deep branches of the PIN due to this type of fracture has not been described to our knowledge.

CASE REPORT

A 27-year-old gentleman presented with an inability to extend the ulnar three fingers of his left hand eight months after a motorbicycle accident. He sustained a closed fracture of the proximal third of the shaft of the radius and midshaft of the ulna (Figure 1). He was unable to extend the wrist and all five fingers immediately after the injury. He was evaluated and managed by an orthopedic surgeon at another center. The proximal radius fracture was fixed with dynamic compression plate through a dorsal Thompson approach between extensor carpi radialis and extensor digitorum communis (Figure 2). The ulna was fixed through the ulnar approach between flexor carpi ulnaris and extensor carpi ulnaris. The clinical presentation of wrist and finger drop at the time was determined to be neuropraxia and thus likely to recover.

Table I: Modified Suematsu and Hirayama Classification of PIN Injuries (5)

Type I	Complete PIN palsy
Type II	Injury to the recurrent branch
Type III	Injury to the descending branch
Type IV	Isolated paralysis of extenosr pollocis longus

As expected, the patient's ability to extend the wrist, thumb and index finger showed gradual improvement on follow up at three months following surgery (Figure 3). However, the persistent drop of the left ulnar three fingers with radial deviation of the wrist upon extension remained. The patient was again evaluated at 18 months post-injury.

On evaluation, we initially assumed that this was due to scar adhesions of extensor digitorum communis to the ulnar three

Figure 1: Radiographs (anteroposterior and lateral view) of the left forearm with fracture of forearm with proximal third radius and mid shaft ulna and distal radius fracture.

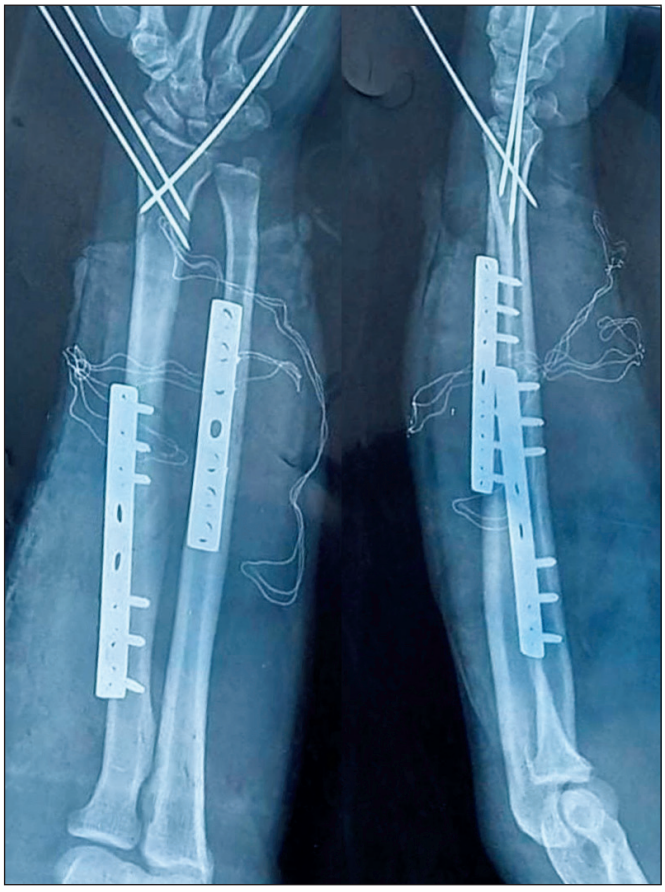

Figure 2: Post-operative radiographs (anteroposterior and lateral view) of the left forearm after fracture fixation.

fingers as he was able to extend the wrist, thumb and index finger. The removal of the implant and adhesiolysis of the tendons was thus planned. Intra-operatively, his left extensor digitorum communis, extensor digiti minimi and extensor carpi ulnaris showed signs of extensive denervation (Figure 4A, B). We explored the posterior interosseous nerve at its emergence from the supinator muscle and found it to be intact. We did not opt for exploration distally as it was already 18 months of the injury and planned for tendon transfer. Standard tendon transfer of his flexor carpi radialis tendon to his extensor digitorum communis was performed to restore finger extension. He showed good extension of wrist and fingers on follow up after 12 months (30 months post-injury) (Figure 5A, B).

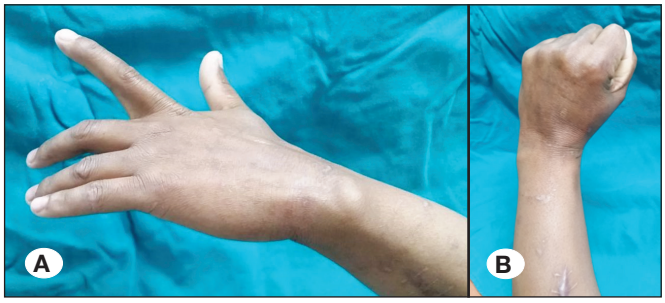

Figure 3: A) Lateral view of his left hand and wrist with notable weakness of middle, ring and little finger active extension. Note the normal extension of the wrist, thumb and index finger is without any problem. **B)** Wrist is deviated in radial direction during wrist extension.

DISCUSSION

We have described a case of an isolated Type II PIN palsy in a 27-year old male with a closed ulna and radius fracture, later presenting with the associated clinical signs of superficial forearm compartment muscle denervation. This case highlights the difficulty of assessing such injuries and the need for careful assessment of PIN branches. Careful preparation of the recurrent branch and special care during the placement of the plate is needed as both may result in iatrogenic injury.

One previous case of PIN palsy after radius and ulna fracture exists. Steinmann's pin was used without PIN assessment. Full recovery occurred after 3 months. Similar case describing PIN palsy after the posterior elbow dislocation, which did not result in spontaneous recovery and during exploration after

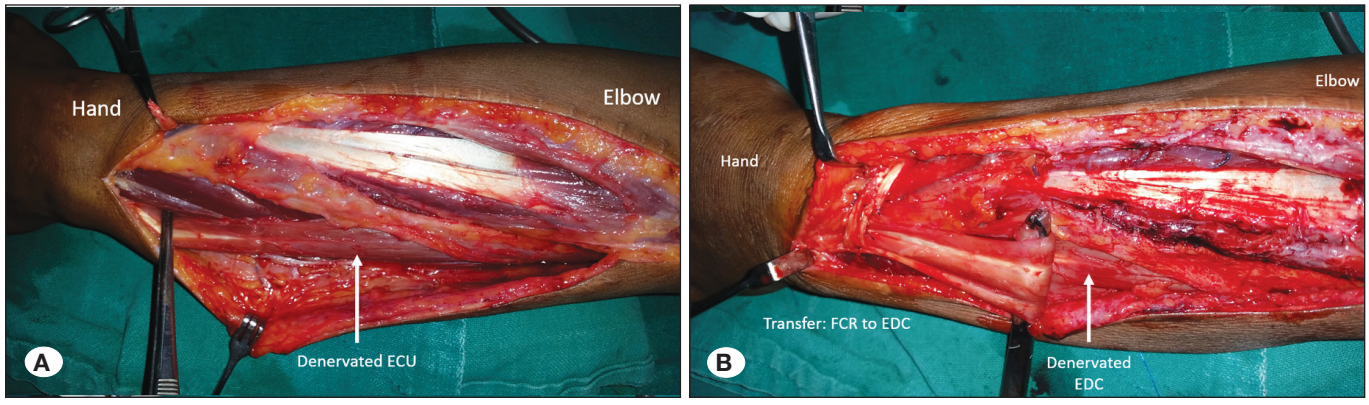

Figure 4: Intra-operative picture showing **A)** Denervated extensor digitorum comminus and extensor carpi ulnaris **B)** Tendon transfer from flexor carpi radialis to extensor digitorum comminus.

Figure 5: Follow up picture of the patient showing **A)** Good extension of the ulnar 3 fingers
B) Neutralization of wrist extension to straight line.

12 weeks thrombosed vessels were crossing and constricting the nerve (9).

Whilst easily missed, early identification of PIN palsy has been linked to significantly better outcomes relative to other nerve injuries (6,10). One likely reason is the largely homogenous motor fiber composition of the PIN, which tends to regenerate more completely following epineural suturing and early mobilization of the volar and dorsal musculature when compared to primarily mixed- or sensory nerve fibres (4). Therefore, timely diagnosis of PIN palsy and intervention is likely to result in complete functional recovery for the patient.

We describe a unique case of PIN neuropraxia after closed ulna and radius fracture with persistent damage to PIN recurrent branch. This case demonstrates the possibility of injury to the PIN or its branches following trauma or inadvertently during surgery. It is therefore prudent to maintain a low index of suspicion and consider further evaluation of similar presentations with other neurological tests, such as nerve conduction studies and electromyography. Clinical signs of radial deviation and drop of the left three ulnar fingers should raise suspicion of isolated damage to the distal recurrent branch of the PIN. In such cases the recurrent branch of radial nerve should be thoroughly assessed at its emergence from supinator muscle between the interval of extensor carpi radialis brevis and extensor digitorum communis. This case report clearly illustrates the uncertainty of further injury if this is omitted.

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