Median Nerve Entrapment Neuropathy in Pediatric Forearm Fracture

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A 10-year-old female patient sustained trauma to her left forearm due to a fall from a bicycle. Radiographic evaluation revealed a closed type of greenstick fracture at proximal third of radius and ulna. The fractures were treated by closed reduction and plaster cast application. Patient was free of any neurological symptoms of the affected forearm immediately after the cast and began experiencing them following cast removal 1 month after injury. Patient developed tingling and numbness of the left-hand index finger and thumb on the volar surface along with weakness of thumb and index finger flexion. In our initial clinical examination, the affected forearm was found to have a radial tilt or bow, a sensory examination showed sensation of pins and needles at the left-hand index finger and thumb on the volar surface, and a motor examination showed restricted forearm rotation, weakness of thumb flexion, and index finger flexion at distal interphalangeal joint. Flexor digitorum superficialis function was present. Patient also showed inability to make the "O" sign (►**Fig. 1**) and weakness of thumb abduction by positive "Pen test." Rest of the hand function was normal. Radiograph of the left forearm on anteroposterior view showed angulation of radius bone and a lateral view showed an osseous tunnel at the callous site of healed fracture of radius bone (►**Fig. 2**). Electrodiagnostic test also confirmed the diagnosis. After 1 month of observation, the median neuropathy progressed on successive clinical examinations from initial tingling numbness to loss of sensation and loss of motor power to FDP of index finger and flexor pollicis longus (FPL) and thenar muscles. The first electromyography (EMG) report said absent sensory nerve action potential (SNAP) and reduced compound motor action potential (CMAP) of abductor pollicis brevis (APB) muscle; this was followed by absent SNAP and absent CMAP of APB muscle in follow-up EMG. Ultrasound examination done also revealed entrapment of median nerve in the osseous tunnel adjacent to healed radius callus. Hence, a decision was taken to explore with consent taken for nerve reconstruction using sural nerve graft and possibility of additional procedure in future such as tendon transfer in case of incomplete or nonrecovery. On exploration, the median nerve was found twisted and entrapped in the osseous tunnel on the shaft of the radius caused by new bone formation in response to the fractures (►**Fig. 3**). Decompression and release of the median nerve from the osseous tunnel were done. Approximately 5 mm diameter of nerve was merely compressed, while a posterolateral fascicle of the nerve was found adherent to radius bone, and it was injured and discontinuous. Intraoperative stimulation after median nerve decompression showed visible flexion of both thumb and index finger and some contractions of thenar muscles were also felt with little visible movement. Probably 40% of the median nerve was damaged functionally. Neurolysis of the compressed portion of the median nerve was done with repair of the injured fascicle by coaptation to intact distal nerve segment by a single microsuture and fibrin glue. Follow-up after 1 month showed absence of sensation of pins and needles at the volar surface of thumb and index finger of left hand. After 5 months of nerve surgery, clinical examination showed complete motor recovery of extrinsic and intrinsic muscles, that is, FDP of IF, FPL, and APB with ability to make "O" sign and complete

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Fig. 1 Inability to make "O" sign on left-hand examination.

Fig. 2 Radiograph showing osseous tunnel (white arrow) at the radius callus site.

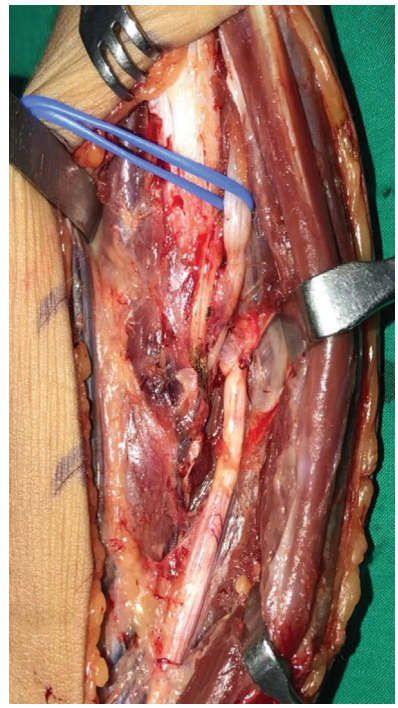

Fig. 3 Intraoperative view showing osseous tunnel at the radial bone shaft with entrapment of median nerve (blue rubber).

recovered thumb abduction (►**Figs. 4** and **5**). The electrodiagnostic test showed ongoing reinnervation with mild axonal loss and a comparable motor amplitude in both FPL and APB that correlated with clinical examination showing recovery. Patient also had a good recovery of sensation at 1 year. The nerve probably was in a state of progressive compression induced block due to compression by a bony bar. Following decompression of the nerve, the axoplasmic flow was restored in a few days leading to improvement of its function. In the longer term, the nerve repair also has helped.

Closed greenstick forearm fractures in pediatric age group at shaft level are common; majority of the fractures

Fig. 4 Postoperative patient showing "Pen test," successful abduction at carpometacarpal joint.

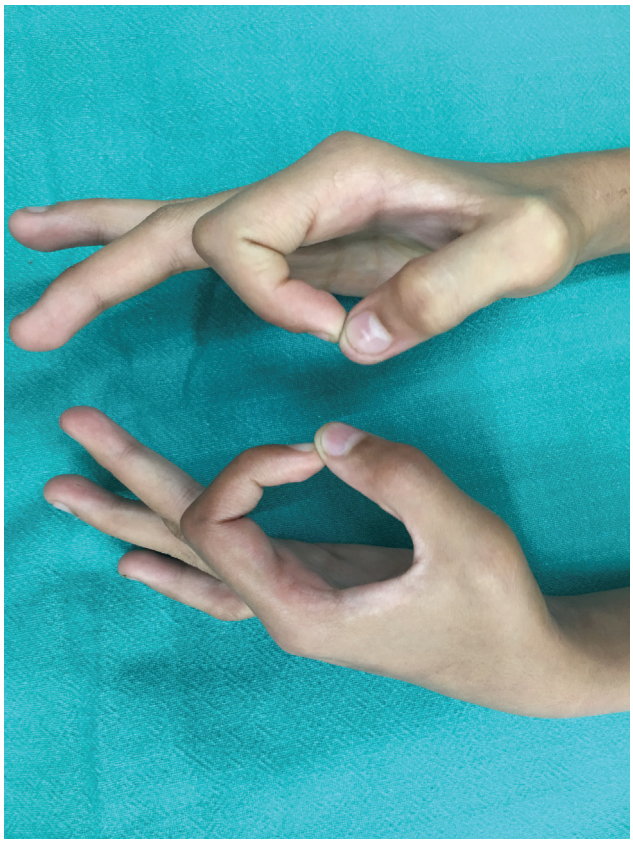

Fig. 5 Postoperative patient is able to do "O" sign on left-hand examination.

are within the accepted range of angulation; malrotation and displacement are treated by closed reduction manipulation owing to remodeling potential in pediatric age group; and remaining are treated by open reduction and plating or intramedullary nailing.[1,2] Association of median nerve injury in pediatric forearm fractures is rare.[3,4] In our case, a progressive median nerve dysfunction developed over a period of time due to malunion and angulation at the fracture site as well as the wound biology (exuberant callus engulfing the nerve progressively). Our case highlights that even in a closed greenstick fracture, a rigid fixation using intramedullary nail or plate osteosynthesis would be a better option as compared with conservative approach in a diaphyseal fracture in preadolescence age group fulfilling the criteria for fixation. The criteria are, for age <10 years, angulation up to 20 degrees and age >10 years, and angulation less than 20 degrees is acceptable for closed treatment.[2] The rigid fixation of the fracture with implant may have prevented the radial angulation deformity and excess callus formation and its sequelae leading to progressive neuropathy. In cases of suspected neuropathy, a serial hand examination and electrodiagnostic studies help in assessing the recovery of a nerve. In case of nonrecovery, preoperative radiograph[5] and ultrasound can help in localizing the site of entrapment of nerve. After nerve recovery, we plan to correct radius bone angulation to regain forearm rotation if advised by our orthopaedic colleagues.

Conflict of Interest
None.

References

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