Outcome of surgical treatment in posterior interosseous nerve syndrome

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Isolated paralysis of muscles innervated by the posterior interosseous nerve (PIN) is rare. Nine such cases of PIN palsy were reviewed over a period of seven years. Apart from one case with a traumatic etiology, the remaining cases did not have a significant clinical history identifying the cause of their neuropathy. Seven cases underwent surgical decompression, five of which improved dramatically. The remaining two patients required tendon transfers, resulting in a fully functional recovery.

Key Words: *Posterior interosseous nerve syndrome*

Chirurgie pour le syndrome du nerf interosseux postérieur : résultats

RÉSUMÉ : La paralysie isolée des muscles innervés par le nerf interosseux postérieur est une affection rare. Neuf cas de ce type de paralysie ont été examinés sur une période de sept ans. Exception faite de l'un d'entre eux où il y avait une étiologie traumatique, les autres cas ne présentaient pas d'antécédents cliniques clairs permettant de discerner la cause de la neuropathie. Une décompression chirurgicale du nerf a été pratiquée chez sept patients, et l'intervention a donné d'excellents résultats chez cinq d'entre eux. Les deux autres ont subi une transposition tendineuse, qui a permis un rétablissement tout à fait fonctionnel.

Posterior interosseous nerve (PIN) palsy, or syndrome, results in the inability to extend the metacarpophalangeal joints of the fingers and the inability to abduct or extend the thumb. However, wrist extension is preserved because the radial nerve innervates the extensor carpi radialis longus before dividing into the PIN and radial sensory branches (1). Although this nerve has predominantly motor innervation, it carries a small amount of sensory

fibres that innervate the ligaments of the intercarpal and wrist joints, which explains the associated pain occasionally seen in this condition. This is in contrast to radial tunnel syndrome, which is associated with pain over the proximal forearm but without muscle palsy. Among the various etiological factors cited, the most common cause is compressive neuropathy by one of the anatomical structures surrounding the nerve: the Arcade of Frohse, the extensor

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carpi radialis brevis muscle, the supinator muscle and the vascular leash of Henry (2-12).

Other reported causes include benign tumours (13-26), unreduced fractures of the radial head, especially Monteggia fractures (27-30), rheumatoid synovitis (31-33), amyloid neuropathy (34), pseudogout (35), vascular malformations (36-38) and iatrogenic injury (39-44).

The purpose of the present study was to review our experience with PIN syndrome and surgical management of this uncommon condition.

MATERIALS AND METHODS

Nine cases from 1987 to 2000 were identified by retrospective chart review of the files of the senior author. Six men and three women ranging from 22 to 76 years of age were identified. The diagnosis was made clinically and confirmed with electromyography and nerve conduction studies (Figure 1). All cases were idiopathic with progressive onset of neuropathy, with the exception of one patient with a history of a radial head fracture. The duration of disability varied from three months to 10 years. Seven patients underwent surgical decompression (eight nerves in total), whereas two patients were managed conservatively. These two patients were managed without surgery because of spontaneous improvement before the authors' consultation in one case and the absence of muscle weakness in the other.

Preoperative evaluation included clinical examination, serial electrophysiological studies (electromyogram, nerve conduction velocity) and x-rays of the elbow and forearm. Muscle power was evaluated by the Medical Research

Figure 1) (Case 3) Elderly patient with the inability to extend the thumb or fingers, contrasted with his other hand

Council (MRC) Scale (45) on a scale of five to zero (5=normal, 0=complete deficit) to compare postoperative results with preoperative evaluation.

RESULTS

The series of nine cases included six men and three women, ranging in age from 22 to 76 years (mean: 43.6 years). Follow-up ranged from six months to two-and-a-half years (mean: 28.4 months). An overview of these patients is shown in Table 1. Bilateral PIN syndrome was seen in one patient.

TABLE 1
Summary of surgically managed cases of posterior interosseous nerve palsy

Case	Sex	Age (years)	Tender at foramen of Frohse	Preoperative strength: EDC, EPL, ECRB (MRC scale)	Duration of disability	Postoperative strength: EDC, EPL, ECRB (MRC scale)	Improvement after decompression	Surgical findings	Tendon transfers
1	F	22	No	3/5, 3/5, 3/5	26 months	4/5, 4/5, 4/5	6 months	Prominent arcade of Frohse	
2	M	34	Yes	3/5, 3/5, 4/5	3 months	4/5, 4/5, 4/5	6 months	None	
3*	M	77	Yes	0/5, 0/5, 0/5	2 years	5/5, 5/5, -: tendon transfers done	NA	Prominent arcade of Frohse	FCR to EDC, PL to EPL
4	M	68	Yes	3/5, 3/5, 4/5	3 years	4/5, 4/5, 4/5	1 month	Prominent arcade of Frohse	
5	F	46	Yes	3/5, 0/5, 3/5	1 year	5/5, 5/5, 5/5	1 month	Prominent arcade of Frohse	
6*	F	62	Yes	0/5, 0/5, 0/5	1 year	5/5, 5/5, -: tendon transfers done	NA	Iatrogenic transection PIN	FCR to EDC, PL to EPL
7(left)	M	28	Yes	4/5, 4/5, 4/5	4 months	5/5, 5/5, 5/5	1 month	Prominent arcade of Frohse	
7(right)	M	28	Yes	4/5, 4/5, 4/5	5 months	5/5, 5/5, 5/5	1 month	Prominent arcade of Frohse and leash of Henry	

*Tendon transfers. ECRB Extensor carpi radialis brevis; EDC Extensor digitorum communis; EPL Extensor pollicis longus; FCR Flexor carpi radialis; F Female; M Male; MRC Medical Research Council; PIN Posterior interosseous nerve; PL Palmaris longus; NA not applicable

Figure 2) Surgical exposure markings

Figure 3) Asterisk (*) showing the superficial sensory branch of the radial nerve; Arrow indicating the 'hourglass' constriction of the posterior interosseous nerve at the level of the Arcade of Frohse

One patient (case 6) displayed a remote, 12-month history of a radial head fracture with iatrogenic injury to the PIN following open reduction and internal plate fixation. The remaining patients had no clinical history of identifiable etiological factors. Two patients were involved in occupations that involved repetitive pronation and supination (cases 4 and 7).

Operative findings

In all cases but one that underwent surgical exploration (Figure 2), a thick tendinous Arcade of Frohse was identified. A significant operative finding in cases 3 and 4 was an 'hourglass' deformity at the site of entrapment with a near autoamputation of the PIN in case 3 (Figure 3). The vascular leash of Henry appeared prominent in association with the Arcade of Frohse in one case. No visible anatomical compression could be ascertained in one patient.

Postoperative evaluation

Seven nerves improved dramatically with decompression alone, as shown by the recovery of muscle power following surgery. Recovery of muscle function was remarkable after

Figure 4) The same patient (case 3) after tendon transfers showing extension of the thumb and fingers

decompression, as shown in Table 1. Case 6 underwent immediate tendon transfers at initial exploration due to a transection of the PIN secondary to iatrogenic injury. Case 3 presented with a severe hourglass deformity at initial exploration. After no recovery was observed one year after decompression, tendon transfers were performed (Figure 4). In both cases, tendon transfers were performed in end-to-side fashion to preserve muscle function in the event of functional nerve regeneration. Functional recovery was considered excellent following tendon transfers (Table 1).

DISCUSSION

Our experience confirms that the most common cause of PIN palsy is a compression of the PIN at the Arcade of Frohse. Decompression of this tendinous arcade is indicated in cases of PIN palsy. Tendon transfers are probably indicated when decompression alone is not likely to result in nerve recovery, such as in cases of longstanding compression, in cases with evidence of muscle atrophy or in elderly patients who would not be willing to undergo another surgery.

In our review of the English medical literature, a total of 140 such cases have been reported, 80 of which were explored. Thirty-seven cases were found to have a thick, tendinous Arcade of Frohse and 33 cases were found to have other causes such as lipoma (14), ganglionic cysts (6), neuroma (3), neurofibroma (5), bursitis (5) and rheumatoid synovitis (7). In the remaining cases, which were not explored, most recovered spontaneously.

Spontaneous paralysis of PIN is a rare clinical entity (1). Only 37 cases to date have been diagnosed as compressive neuropathy, the cause being mostly the Arcade of Frohse, which is said to be present only in 30% of the population (12).

Contrary to the belief that repetitive actions of pronation and supination (3-7) accentuate such entrapments, only two of our cases displayed a history of an occupation associated with such repetitive movements.

CONCLUSIONS

Based on our experience and review of the literature, we believe that surgical exploration is beneficial in cases of

PIN palsy. Exploration is both diagnostic and therapeutic. In our series, the shorter period of recovery of function after decompression with a shorter duration of symptoms exemplifies this point. Lastly, we believe a decision to perform concomitant tendon transfers could be made on visualization of the nerve intraoperatively. In the patient with a severe hourglass compression of the PIN, where recovery is doubtful, immediate end-to-side tendon transfers may be

advisable. Additional factors that should be taken into consideration are atrophy of the PIN innervated muscles and the patient's age.

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