



Posterior Interosseous Radial Nerve Neuropathy at the Arcade of Frohse

Ishikawa, Hitoshi ; Hirata, Souichirou ; Saura, Ryuichi ; Andoh, Yoshihiro ; Ishikawa, Makoto ; Mizuno, Kosaku

(Citation)

Bulletin of allied medical sciences Kobe : BAMS (Kobe), 12:157-162

(Issue Date)

1997-01-24

(Resource Type)

departmental bulletin paper

(Version)

Version of Record

(URL)

<https://hdl.handle.net/20.500.14094/00188152>



Posterior Interosseous Radial Nerve Neuropathy at the Arcade of Frohse

Hitoshi Ishikawa¹, Souichirou Hirata¹, Ryuichi Saura¹, Yoshihiro Andoh², Makoto Ishikawa², and Kosaku Mizuno

The posterior interosseous nerve has direct and important relations in its course with bone, joint, bursa and muscle at the entrance of spinator arcade and each point may be the source of pathology which deforms the nerve.

In the present study, we describe ten cases of posterior interosseous nerve syndrome from patients with rheumatoid and non-rheumatoid arthritis. Differential diagnosis of posterior interosseous nerve syndrome from other pathologic conditions such as wrist drop, tendon rupture is essential to establish the diagnosis. In the present study, the deep radial nerve was directly compressed by an antecubital cyst in six rheumatoid patients, and four non-rheumatoid patients had ganglion at the antecubital region which was caused secondarily by movements of repetitive pronation-supination as a causative factor. In patients with a persistent nerve compression syndrome, decompression of the nerve is recommended to diminish the possibility of recurrence.

Key Words

Posterior interosseous nerve,
Antecubital cyst,
Ganglion,
Nerve Paralysis,
Surgical treatment.

INTRODUCTION

Before and after entering the supinator muscle the radial nerve has a number of anatomical relations which are of particular clinical significance. On the dorsum of the forearm the posterior interosseous nerve divides in a variable manner to innervate the ex-

tensor digitorum extensor carpi ulnaris, extensor pollicis longus and brevis, abductor pollicis longus, extensor indicis and extensor digiti minimi. The posterior interosseous nerve has direct and important relations in its course with bone, joint, bursa and muscle at the entrance of spinator arcade and each may be source of pathology which deforms the nerve¹⁻⁵⁾. In addition, entrapment of the radial nerve in the radial tunnel can produce radial tunnel syndrome. It is important at the onset to note the proximity of the radial tunnel and the more distal supinator canal with the arcade of Frohse, which in fact overlap in some cases but have different symptoms and signs. We have recently reported three cases of posterior interosseous nerve syndrome associated with rheumatoid synovial cysts of the elbow joint⁶⁾, and in a

Faculty of Health Science, Kobe University School of Medicine¹, Ishikawa Hospital, Himeji², and Department of Orthopaedic Surgery, Kobe University School of Medicine, Kobe, Japan.

Table 1. Characteristics of Posterior Interosseous Nerve Syndrome in Ten Patients

Case	Sex	Age	Cause of Neuropathy	Surgical Procedure
1	F	48	Rheumatoid synovial cyst	Radial nerve decompression with elbow synovectomy
2	F	51	Rheumatoid synovial cyst	Radial nerve decompression with elbow synovectomy
3	F	35	Rheumatoid synovial cyst	Wrist exploration
4	M	62	Rheumatoid synovial cyst	Radial nerve decompression with elbow synovectomy
5	F	60	Rheumatoid synovial cyst	None
6	M	68	Rheumatoid synovial cyst	Radial nerve decompression with elbow synovectomy
7	M	17	Ganglion	Radial nerve decompression with resection of ganglion
8	M	16	Ganglion	Radial nerve decompression with resection of ganglion
9	M	44	Ganglion	Radial nerve decompression with resection of ganglion
10	M	47	Ganglion	Radial nerve decompression with resection of ganglion

M: male, F: Female

baseball pitcher⁷⁾. In the present paper, we have summarized ten cases of interosseous nerve syndrome which we have experienced in the past 15 years, including the cases which have already been reported⁶⁻⁷⁾. These conditions are due to pathological entrapment of the posterior interosseous nerve in the elbow region. The cause of these conditions in these regions remained the subject of speculation until the results of exploring the nerve revealed that these areas are potential entrapment sites in the region of the elbow.

MATERIALS AND CLINICAL RESULTS

The characteristics of posterior interosseous nerve syndrome as noted in ten patients are summarized in Table 1. Nerve involvement in this series includes patients with rheumatoid synovial cyst (case 1-6), and with ganglion (case 7-10). Posterior interosseous nerve paralysis due to rheumatoid synovial cyst are caused by stretch and compression as the result of development of rheumatoid synovial inflammation (Figure 1). In

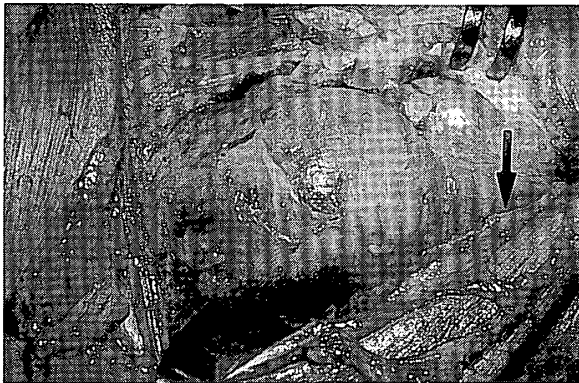


Figure 1. The soft tissue mass (antecubital synovial cyst) protruding between the brachioradialis and spinator muscles. Arrow indicate the posterior interosseous nerve (case 2, from reference number 6).



Figure 2. A large ganglion compressed the posterior interosseous nerve at the arcade of Frohse (case 8), arrow indicating the ganglion arising from joint capsule of elbow joint.

four patients with non-rheumatoid disease, it was confirmed that the nerve was compressed by ganglion at the site of spinator muscle (Figure 2).

Clinical conditions were characterized by tenderness over the antecubital area with painful movements, particularly those of extension and supination in all rheumatoid patients, and progressive weakness of radial abduction and extension of the thumb in five patients (case 2, 7-10). In non-rheumatoid patients there was no history of previous direct injury to the elbow.

There was no wrist drop. Normal cutaneous sensation were perserved in 7 patients; there was hypesthesia over the radio-dorsal aspect of hand in cases 2, 5 and 7. In four rheumatoid patients, the first manifestation of posterior interosseous nerve syndrome was pain located anteriorly over the elbow joint that shot both proximally and distally along the course of the radial nerve. In non-

rheumatoid patients, all had experienced antecubital pain with an inability to completely extend three ulnar fingers. In two patients the elbow had been treated with several local steroid injections around the lateral epicondyle by a physician under the diagnosis of lateral epicondylitis without any recovery of the symptoms.

Routine radiographs showed only moderate to severe joint destruction in all rheumatoid patients, otherwise normal in non-rheumatoid patients. Xerograms and arthrographic examinations were useful in all rheumatoid patients. Arthrography with contrast material injected into the joint showed a distended joint cavity with dissection along the proximal part of the radius (Figure 3). Magnetic resonance images in recent few years were useful in establishing the diagnosis (Figure 4). MR images usually showed soft tissue mass at the antero-lateral aspect of radial which seemed to be originating from joint



Figure 3. Elbow arthrogram showing the antecubital cyst along the proximal radius.



Figure 4. MRI of the elbow joint shows a low to intermediate signal intensity soft tissue mass at the antero-lateral aspect of the elbow joint (arrow) on T2-weighted image.

capsule. MRI appearance of these mass demonstrated low signal intensity on a T1-weighted image and high signal intensity on a T2-weighted image.

Conservative treatment such as the modalities of local rest, medication (NSAIDs) and local intraarticular injection of small amounts of steroids were all given. However, if the condition did not respond promptly to conservative measures, or there was a history of progressively increasing weakness, the posterior interosseous nerve was explored without delay except in case 3 and case 6. Decompression of the radial nerve and synovectomy with radial head resection was carried out in four rheumatoid patients, decompression and local ganglion compressing the nerve were removed in four non-rheumatoid patients. Within one month all patients treated surgically showed return of posterior interosseous function with superficial sensory recovery.

DISCUSSION

In the vast majority of cases the radial nerve divides into its deep (posterior interosseous) and superficial divisions at or just below the level of the lateral humeral epicondyle. In this region, the posterior interosseous nerve is placed directly anterior to the capsule of the radio-humeral joint and head of the radius, with the biceps tendon and bicipital bursa medially and the supinator muscle laterally. Continuing its nerve passes beneath the tendinous free edge of the superficial head of the supinator muscle. Thus in its course the nerve has direct and important relations with bone, joint, bursa and muscle and each may be the source of pathology which deforms the nerve.

Extension and supination of the forearm tenses the free edge of the

muscle and compresses the nerve, while flexion and pronation relaxes opening. Therefore, four non-rheumatoid patients with posterior interosseous nerve syndrome in the present report appeared to demonstrate the repetitive microtrauma due to overuse of the elbow joint. In baseball pitching, there is extraordinary valgus forces and forceful supination placed on the elbow. A carpenter and a golfer also developed this syndrome. The cause of posterior interosseous nerve syndrome was also thought to be due to a combination of supination, dorsiflexion and radial deviation of the wrist. These movement may cause compression neuropathy of the posterior interosseous nerve at the level of Frohse arcade, where the radial nerve passes between the brachioradialis and supinator muscle⁸⁾.

Although a synovial cyst of the elbow may produce compression neuropathy of the ulnar⁹⁻¹⁰⁾ or posterior interosseous nerve¹¹⁻¹⁵⁾, these are rare entities. In each rheumatoid cases in the present report, weakness of the finger extensors was noted. The separation of posterior interosseous nerve syndrome from other conditions causing inability to extend the finger is often difficult. Millender et al¹⁴⁾, however, noted that in diagnosing the posterior interosseous nerve syndrome, patients often have had rheumatoid involvement of the elbow for a long time. They may first manifest entrapment complication with pain located anteriorly over the elbow joint that shoots both proximally and distally along the course of the radial nerve.

In rheumatoid and non-rheumatoid

patients, all fingers may be affected, but commonly the three ulnar fingers are initially unable to extend, and later the index finger and thumb may have partial or complete involvement. It is important at the onset to note the proximity of the radial tunnel and the more distal supinator canal with the arcade of Frohse²⁾, which in fact overlap in some cases but have different symptoms and signs.

In the present study, the deep radial nerve was directly compressed by an antecubital cyst in six rheumatoid patients, and four non-rheumatoid patients had ganglion at the antecubital region which was caused secondarily by movements of repetitive pronation-supination as a causative factor.

There was no wrist drop in our patients. This is probably due to the fact that the extensor carpi ulnaris is intact, but wrist extension drifts into radial deviation owing to the paralysis of the extensor carpi ulnaris muscle. Tendon rupture also needed to be differentiated from posterior interosseous nerve syndrome. This can usually be done by utilizing the tenodesis effect. The tenodesis effect is maintained in posterior interosseous nerve syndrome, but it is lost in the event of tendon rupture⁵⁾.

Intraarticular injection of steroids was successful in two patients. The other eight cases required surgical decompression of the radial nerve. Temporary relief of symptoms has been reported after injection of steroids into the joint¹⁶⁻¹⁷⁾. However, recurrence may be noted within a few weeks. In patients with a persistent nerve compression syndrome, decompression of the nerve is recommended to diminish the possibility of recur-

rence. Finally, it should be emphasized that although the frequency of posterior interosseous nerve syndrome is relatively rare, the diagnosis must be considered when such nerve compressions are present.

REFERENCES

1. Frohse F, Frankel M. Die Muskeln de Menschlichen Arms. Bardelebens Handbuch der Anatomie den Menschilchen Jena. Fisher, 1908
2. Spinner M. The arcade of Frohse and its relationship to the posterior interosseous nerve paralysis. J Bone Joint Surg 50B: 809-812, 1968
3. Mackinon SE, Dellon AL. Surgery of the peripheral nerve. New York, Thieme Publishers, 1988, ch. 10, pp275-288
4. Roles NV, Maudsley RH. Radial tunnel syndrome: Resistant tennis elbows as a nerve entrapment. J Bone Joint Surg 54B: 499-508, 1972
5. Mosley LH, Kalafut RM, Levinson PD, et al. Cumulative trauma disorders and compression neuropathies of the upper extremities. In Occupational Hand and Upper Extremity Injuries & Diseases, Edited by Kasden MR, Hanley & Belfus Inc. Philadelphia, 1991
6. Ishikawa H, Hirohata K. Posterior interosseous nerve syndrome associated with rheumatoid synovial cyst of the elbow joint. Clin Orthop Rel Res 254: 134-139, 1990
7. Ishikawa H, Hirata S, Matsuda N, et al. Posterior interosseous nerve syndrome in baseball pitcher-a case repot. Bull Allied Med Sci (KOBE) 9: 105-109, 1993
8. Howard FM. Compression neuropathies in the anterior forearm. Hand Clin North Am 2: 743-744, 1986
9. Keret D, Porter KM. Synovial cyst and ulnar entrapment: A case report. Clin Ortop Rel Res 188: 213-215, 1984
10. Jeffert RD, Dorman HO. Antecueital cyst in rheumatoid arthritis-surgical findings. J Bone Joint Surg 54A: 1555-1557, 1972
11. Chang LW, Gowans JDC, Granger CV, et al. Entrapment neuropathy of the posterior interosseous nerve. A complication of rheumatoid arthritis. Arthritis Rheum 15: 350-353, 1972
12. Fernabdes L, Godwill CT, Srivatsa SP. Synovial rupture of rheumatoid elbow causing radial nerve compression. Br Med J 2: 17-18, 1979
13. Marmor L, Lawrence JF, Dubois EL. Posterior interosseou nerve palsy due to rheumatoid arthritis. J Bone Joint Surg 49A: 381-383, 1967
14. Millender LH, Nalebuff EA, Holdsworth D. Posterior interosseous syndrome secondary to rheumatoid synovitis. J Bone Joint Surg 55A: 753-, 1973
15. Popelka S, Vainio K, Tesarek B. Entrapment of oisterior interosseous branch of radial nerve in rheumatoid arthritis. Arch Orthop Scand 45: 370-377, 1974
16. Goode JD. Synovial rupture of the elbow joint. Ann Rheum Dis 27: 604-609, 1968
17. Ehrlich GE. Antecubital cysts in rheumatoid arthritis-A corollary to popliteal (Baker's cyst). J Bone Joint Surg 54A: 165-169, 1972