Compression of the Deep Palmar Branch of the Ulnar Nerve by a Ganglion

A Case Report

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Abstract A ganglion originating from the pisotriquetral joint is the most common cause of distal ulnar nerve compression. Midpalmar ganglions causing ulnar nerve compression are rare. This case describes a ganglion arising from the third carpometacarpal joint causing compression of the deep motor branch of the ulnar nerve.

Keywords Distal ulnar nerve compression

Introduction

Nerve compression is a pathological process in which there is neurapraxia with or without axonotmesis. In this process, neural fibers are damaged to varying degrees. The etiology of compression at Guyon's canal includes repetitive trauma, tumors such as ganglions and lipomas, pisiform instability, and pisotriquetral arthritis to name a few. The most common cause of distal ulnar nerve compression is a ganglion originating from the pisotriquetral joint. Midpalmar ganglions causing ulnar nerve compression are rare.

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Their clinical presentation, classification, and operative management are well known. Interestingly, the anatomic origins of midpalmar ganglia have previously only been speculated upon.

We report a unique case of a complex ganglion originating from the volar and ulnar aspect of the third carpometacarpal joint causing compression of the deep motor branch of the ulnar nerve. Magnetic resonance imaging (MRI) was used to locate the ganglion and plan surgery. Postoperatively, the patient's motor recovery was complete at 2 years. For midpalmar ganglia causing distal ulnar nerve compression, preoperative MRI can be used to identify the anatomic origin, thereby facilitating surgical planning and complete excision.

Case Report

A 20-year-old male, right-hand dominant, packaging employee presented with a 2-month history of increasing weakness and decreasing right-hand function. He had noticed a gradual weakening in grip and pinch. He had no previous history of hand trauma and his past medical history was unremarkable.

On examination, the right hand revealed marked atrophy of the first dorsal interosseous muscle. There was no hypothenar atrophy. No abnormality or mass lesion was noted on inspection or palpation. Froment's sign was positive. The patient was unable to abduct and adduct his fingers. He showed normal strength of the abductor digiti minimi but no function of the interossei or adductor pollicis. The flexor digitorum profundus to the fourth and fifth digits and the flexor carpi ulnaris were normal. Grip strength measured 30 kg on the right and 36 kg on the left. Key pinch measured 4.8 kg on the right and 7.5 kg on the

left. Dynamic two-point discrimination measured 4 mm in the ulnar nerve distribution. Tinel's sign was not elicited along the course of the ulnar nerve.

X-rays of the hand were normal. The electromyography nerve conduction studies indicated normal ulnar nerve motor conduction to the abductor digiti minimi and normal ulnar sensory conduction. However, ulnar nerve motor conduction to the first dorsal interosseous showed a very low amplitude delay and polyphasic response, which suggested focal palsy consistent with a lesion of the deep palmar branch of the ulnar nerve. Median nerve function was normal. An MRI was performed to rule out a midpalmar mass lesion. Magnetic resonance imaging of the hand showed a deep, large, fluid-filled, and multilobulated mass consistent with a deep ganglion, distal to the ulnar tunnel and arising from the volar and ulnar aspect of the third carpometacarpal joint (Figs. 1 and 2).

The patient was taken to the operating room and the ulnar nerve was exposed through an incision over Guyon's canal. The ulnar nerve and artery were identified proximal to the wrist. Dissection was carried distally through an unroofed Guyon's canal, allowing exposure of both the deep motor and superficial sensory branches. The transverse retinaculum was released to gain better exposure of the deep volar ganglion. The flexor tendons were radially retracted, exposing the volar ganglion originating from the carpus. The superficial palmar arch was identified. Both the deep branch of the ulnar nerve and the deep palmar arch were invested by the multilobulated ganglion as they entered the palm (Fig. 3). The deep motor branch of the ulnar nerve and the deep palmar arch were then dissected free of the ganglion and the origin of the ganglion was traced back to the base of the third carpometacarpal joint. The ganglion with its origin was excised. The median nerve

was not compressed at any point. The transverse retinaculum was repaired, the wound was closed, and the hand was splinted with the wrist neutral.

Postoperatively, the hand was immobilized for 1 week. Hand therapy was then started and included passive and active range of motion of the digits and wrist. The patient was fitted with a protective wrist splint. After 6 weeks, he had full range of motion of all digits and the first dorsal interosseous muscle had near-normal motor muscle strength. After 10 weeks, grip strength measured 28 kg on the right and 48 kg on the left. The patient continued to improve, and after 15 weeks, all ulnar intrinsic muscles, including the first dorsal interosseous muscle, had regained normal motor strength. Two years later, the patient had a full motor recovery. His grip strength measured 52 kg on the right and 50 kg on the left. Key pinch measured 10 kg on the right and 10.5 kg on the left.

Discussion

Compression of the deep motor branch of the ulnar nerve was first described by Hunt in 1908 [2]. In 1952, Seddon presented a case in which a ganglion arising from the pisohamate joint caused compression of the deep ulnar nerve distal to the hypothenar muscle innervation [3]. Since then, numerous lesions causing distal ulnar nerve compression in the hand have been identified [6, 10]. Guyon's canal (distal ulnar tunnel) is a well-known region of the wrist where the ulnar nerve is vulnerable to compression [3, 4, 7]. The most common cause of distal ulnar nerve compression, however, is a ganglion originating from the pisotriquetral joint [2, 6]. Midpalmar ganglions causing ulnar nerve compression are rare [3, 7, 8].

Figure 1 Coronal T₂-weighted fast-spin echo with fat suppression (TE/TR, 48/3100) demonstrates a multilobulated cystic structure arising from the ulnar aspect of the third carpometacarpal joint. It is tracking distally along the volar aspect of the third metacarpal joint.

Figure 2 Coronal T₂-weighted fast-spin echo with fat suppression (TE/TR, 60/3500) demonstrates a multilobulated cystic structure lying on the volar aspect of the diaphysis of the third metacarpal and deep to the flexor tendons. This is in the region of the deep branch of the ulnar nerve.

Ulnar nerve compression syndromes have been classified according to clinical findings and location. One such classification system has been proposed by Shea and McClain [10]. Type I syndrome involves motor weakness of all ulnar innervated muscles of the hand and a sensory deficit of the volar surface of the hypothenar eminence to the ulnar two digits. The condition is caused by ulnar nerve compression just proximal to or within Guyon's canal. Type II syndrome also involves motor weakness in the ulnar innervated muscles of the hand but is caused by pressure on the nerve where it leaves Guyon's canal in the region of the hook of hamate. The site of compression along the deep branch determines the number of muscles affected. The superficial sensory branch is unaffected. Type III syndrome involves sensory deficit over the volar surface of the hypothenar eminence and the ulnar two digits [6]. It is caused by a compressed or traumatized superficial ulnar nerve branch just where it exits Guyon's canal with deep motor branch sparing.

Another system of classification describes ulnar nerve compression according to location [4]. In Gross and Gelberman's system, zone 1 involves compression in the ulnar tunnel proximal to the bifurcation of the nerve. Zone 2 involves compression of the deep motor branch distal to the bifurcation. Zone 3 compression involves the superficial sensory branch distal to the bifurcation.

In a refinement of this description of ulnar nerve compressions according to location, Feldman et al. [3] proposed a subclassification of zone 2 lesions. They stressed the importance of distinguishing, first, between those compressions proximal to the innervation of the hypothenar muscles and those distal to it, and, second, between lesions within the ulnar tunnel and those distal to it. Thus, zone 2-A involves isolated compression of the deep motor branch proximal to the innervation of the

hypothenar muscles within the ulnar tunnel. Zone 2-B involves isolated compression of the deep motor branch distal to the innervation of the hypothenar muscles but still within the ulnar tunnel. Finally, there is zone 2-C, which involves an isolated compression of the deep motor branch distal to the ulnar tunnel. Zone 2-C lesions do not affect hypothenar innervation. The present case is a zone 2-C lesion according to this classification.

In patients with compression of the deep motor branch of the ulnar nerve (zone 2-C), the onset of symptoms is often gradual but frequently well developed at the time of diagnosis, as shown in this case. Typically, the extrinsic hand muscles function normally and sensation in the hand is also normal. However, the interossei and adductor pollicis muscles are adversely affected. The associated motor deficit may go unnoticed, unless, as in the case of our patient, some type of manual dexterity is regularly required in the patient's occupation [6].

Ganglia usually have well-defined margins and are contiguous with adjacent joint capsules or tendon sheaths [9]. Magnetic resonance imaging clearly localizes the lesion and delineates its relationship to adjacent neurovascular bundles [5]. On MRI T₁-weighted images, the signal intensity of a ganglion is either isointense or slightly hyperintense when compared with muscle. On MRI T₂-weighted images, the signal intensity of a ganglion is typically hyperintense [1]. In the present case, MRI confirmed the rare occurrence of a multilobulated ganglion originating from the volar and ulnar aspect of the third carpometacarpal joint in the region of the deep branch of the ulnar nerve

Figure 3 Both the deep branch of the ulnar nerve and the deep palmar arch were invested by the multilobulated ganglion as they entered the palm. The ganglion originated from the base of the third carpometacarpal joint.

(Figs. 1 and 2). In most cases, a ganglion compressing the ulnar nerve arises from the level of the pisiform–hamate–triquetral complex or slightly distal to it [8].

To our knowledge, this is the first case of a complex, multilobulated midpalmar ganglion originating from the volar and ulnar aspect of the base of the third carpometacarpal joint causing a palsy of the deep branch of the ulnar nerve. McDowell and Henceroth [8] have previously reported a ganglion originating from the middle third of the third metacarpal beneath the origin of the transverse head of the adductor pollicis. In that case, however, MRI was not used to assist in surgical planning and no definite origin of the mass was found. Also, motor recovery following excision was not reported [8].

In another case report, Bowers and Hurst [2] described a dorsal intra-articular ganglion overlying the fourth carpometacarpal joint. This ganglion had an interosseous component that extended into the capitate and fourth metacarpal. Subsequently, an extra-articular volar ganglion measuring 7 mm was found under the ulnar motor nerve at the fourth metacarpal–capitate joint. The authors described a complex ganglion with intra- and extra-articular components originating from the volar carpometacarpal joint without neurologic sequelae. This case differs from ours in that the patient presented only with pain and no motor deficit. Furthermore, an MRI was not performed to localize the ganglion.

Volar ganglions at the third carpometacarpal joint causing compression of the deep motor branch (zone 2-C lesion) are rare [8]. The present case report shows several points in the diagnosis and management of an associated palsy of the deep branch of the ulnar nerve. Electromyography, nerve

conduction studies, and MRI facilitate the accurate location of nerve compression. Magnetic resonance imaging is helpful in identifying the origin of a complex ganglion and its relationship to the deep branch of the ulnar nerve, and in facilitating surgical planning and excision. In this first reported case of ulnar distal motor branch compression by a ganglion with MRI-confirmed origin from the third carpometacarpal joint, motor recovery following excision was complete.

References

1. Bergman AG. Synovial lesions of the hand and wrist. *MRI Clin North Am* 1995;3(2):265–79.
2. Bowers WH, Hurst LC. An intraarticular–intraosseous carpal ganglion. *J Hand Surg* 1979;4(4):375–7.
3. Feldman MD, Rotman MB, Manske PR. Compression of the deep motor branch of the ulnar nerve by a midpalmar ganglion. *Orthopedics* 1995;18(1):65–7.
4. Gross MS, Gelberman RH. The anatomy of the distal ulnar tunnel. *Clin Orthop Relat Res* 1985;196:238–47.
5. Kransdorf MJ, Murphey MD. MR imaging of musculoskeletal tumors of the hand and wrist. *MRI Clin North Am* 1995;3(2):327–44.
6. Kullbom JB, Van Demark RE. Ganglion cyst causing ulnar compression syndrome at the wrist. *SD J Med* 1971;24(1):5–8.
7. Kuschner SH, Gelberman RH, Jennings C. Ulnar nerve compression at the wrist. *J Hand Surg* 1988;13A:577–80.
8. McDowell CL, Henceroth WD. Compression of the ulnar nerve in the hand by a ganglion. *J Bone Jt Surg* 1977;59A:980.
9. Peh WCG, Truong NP, Totty WG, Gilula LA. Pictorial review: magnetic resonance imaging of benign soft tissue masses of the hand and wrist. *Clin Radiol* 1995;50:519–25.
10. Shea JD, McClain EJ. Ulnar-nerve compression syndromes at and below the wrist. *J Bone Jt Surg* 1969;51A(6):1095–103.