Carpal Tunnel Syndrome Due to Hydroxyapatite Crystal Deposition Disease

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Received: 4 July 2012 / Accepted: 31 August 2012 / Published online: 11 September 2012
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Keywords Hand · Carpal tunnel syndrome · Calcific tendinitis · Median nerve

Introduction

The most commonly encountered entrapment neuropathy is carpal tunnel syndrome (CTS). Carpal tunnel syndrome could be due to increase in the contents of the tunnel or a decrease in size of the tunnel. Unilateral carpal tunnel syndrome has been described following carpal bone injuries, distal radius fractures and metacarpal fractures [1]. Space occupying lesions of carpal tunnel may be caused by tumors, gouty tophi, pseudogout [2], sequeae of distal radius fractures, and post traumatic osteophytes [3]. Hydroxyapatite crystal, the most abundant form of calcium in the human skeleton, may get deposited in the soft tissues around the wrist, and when deposited in the carpal tunnel may lead to carpal tunnel syndrome [4–6].

Case Report

62-year-old lady presented in the orthopedic clinic with numbness of the left hand over the median nerve distribution of 03 months duration. Her range of movements of the wrist and fingers were normal. She had full motor power in the hand, and had no wasting of the thenar muscles. There were no signs of inflammation, and she was not in pain. Plain films of the wrist showed evidence of previous distal radius fracture with an ulnar styloid fracture which was not united.

A carpal tunnel view showed a calcified mass in the carpal tunnel, volar to the proximal part of the capitate (Fig. 1).

Her hematological studies including full blood count, uric acid, thyroid function tests, calcium and serum phosphate were normal and she was negative for rheumatoid factor.

Nerve conduction study showed features of moderate carpal tunnel syndrome on the left and a normal conduction velocity on the right side.

Sagittal ultrasound images showed a calcified mass anterior to the carpal bones, causing anterior displacement of the flexor tendons and compression of the median nerve in the carpal tunnel. Axial images also showed compression of the median nerve in the carpal tunnel. There was crowding of the flexor tendons with anterior displacement by a calcified mass anterior to the carpal bones (Fig. 2a and b).

High resolution axial CT images showed a mass 8×6 mm, anterior to the capitate but separate from it. This homogenous mass had cloud like area of high density [HU 880] suggestive of calcified fragment. Volume rendered images showed the fragment anterior to the capitate (Figs. 3 and 4).

Surgery was done by conventional open carpal tunnel release. There was no evidence of inflammation of the flexor tendons, and the median nerve appeared normal.

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Fig. 1 Carpal tunnel view showing a radio-opaque shadow over the capitate in the carpal tunnel

At surgery a chalky white mass measuring 10×7 mm was removed, which was friable. The mass was not attached to the flexor tendon or its sheath, but appeared as if arising from the synovium (Fig. 5).

Histopathology of the specimen revealed features of hydroxyapatite crystal deposition disease. On decalcified tissue the deposited crystals stained pale eosinophilic or basophilic and they produced a laminated psammomatous appearance focally. These crystal aggregates were not refractile and did not exhibit birefringence (Figs. 6 and 7).

Discussion

Carpal tunnel syndrome, one of the commonest entrapment neuropathies of the extremity is caused by either an increase in the contents of the carpal tunnel or a decrease in the volume of the tunnel. Common causes of unilateral carpal tunnel syndrome are fractures of the distal radius, followed by carpal injuries. However non traumatic causes like gout, tenosynovitis, and hemorrhage into the carpal tunnel may also result in

Fig. 3 High resolution CT image showing a mass 8×6 mm size, the mass had a homogenous cloud like area of high density [880 HU] suggestive of a calcified lesion

carpal tunnel syndrome [7]. Systemic causes like pregnancy, rheumatoid arthritis and amyloidosis has also been reported as other causes [4, 8, 9]. Various crystal deposition diseases like calcium pyrophosphate dihydrate deposition disease [CPDD, or pseudogout], gout, and calcium hydroxyapatite deposition disease (HADD) of the wrist and hand are known to result in carpal tunnel syndrome [10]. In a study of 11 patients with space occupying lesions producing carpal tunnel syndrome by Kang et al., three were due to a calcified mass [3].

Most of the cases of CTS when presented with unilateral symptoms will have abnormal nerve conduction studies on the contralateral side, and if symptoms are restricted to one side, reasons other than idiopathic has to be sought for [3]. Kang et al. suggests special imaging procedures like CT or MRI in cases of unilateral CTS with a mass over the wrist or tenderness over the volar crease area [3].

Crystal deposition in the wrist may produce mass effects which bulge into the carpal tunnel producing features of carpal tunnel syndrome [10]. Classic features of CPDD [pseudogout] are calcification of the triangular fibro cartilage and isolated

Fig. 2 **a** Sagittal ultrasound image showing the calcified mass [star] anterior to the carpal bones causing anterior displacement of the flexor tendons [double arrows] and compression of the median nerve suggested by waist like depression [arrow head]. **b** Axial ultrasound image showing compression of median nerve within carpal tunnel. Crowding of flexor tendons with anterior displacement by the calcified mass [Star], anterior to the carpal bones

Fig. 4 Sagittal CT image showing a mass anterior to the capitate, and separate from the carpal bones

scapho-trapezial-trapezoidal joint disease [10]. Crystal deposition disease becomes painful when the deposit ruptures into the soft tissues initiating an inflammatory response.

Carpal tunnel is the initial presentation in 14 % of the cases and if associated with dorsal wrist synovitis, there should be high index of suspicion of CPDD [10]. HADD is characterized by deposition of calcium phosphate crystals in the periarticular soft tissues, most common around the tendons, with predilection for the flexor carpi ulnaris in the hand at the pisiform [4, 11, 12]. But patients present with acutely swollen hand and wrist, with painful restriction of

Fig. 5 Intra-operative photograph showing the calcified mass in the carpal tunnel [blue arrow]

Fig. 6 Low power view showing the pale eosinophilic granular acellular deposits

movements. Presentation is as chronic or recurrent pain or with acute severe pain and tenderness [11–13]. If the mass is sharply marginated it produce less symptoms, as in our case [13]. The diagnosis of gouty tophi as a cause of CTS is supported by elevated serum urate, which was normal in our case. Acute calcific tendinitis in the carpal tunnel resulting in carpal tunnel syndrome has been reported [4–6].

Most of the deposits are ovoid, however this may be linear or triangular also, but the deposits of CPPD are more linear or elongated than HADD [11, 13]. Secondary changes like cystic changes in the small bones, degenerative changes in the adjacent joints, cortical or subcortical erosions and reduction of joint space seen with gout or pseudogout are typically absent in HADD [11]. Stippled calcifications are the feature of gouty tophi, and rarely sheet like appearance [8].

Most common site of HADD is the shoulder, but has been reported in the hand, wrist, elbow, foot, spine and the hip [12–14].

HADD presents with acute onset of pain, extreme tenderness, localized swelling and erythema which was absent in our case. When presenting acutely with pain and signs of

Fig. 7 High power view showing the laminated, psammomatous appearance of the aggregated crystals

inflammation, a diagnosis of infection is made leading to unnecessary surgical intervention. In our patient there were no signs of inflammation, nor was there any restriction of movements. In the case reported resulting in acute carpal tunnel syndrome due to HADD there were symptoms suggestive of an inflammatory response, in the form of acute severe pain, with restriction of range of movements [4, 7].

Space occupying lesions of the carpal tunnel may be easily missed and a carpal tunnel view and ultrasound scanning in suspected cases is mandatory. In our case the routine plain films of the wrist was normal and only after doing a carpal tunnel view was the diagnosis made, which was further confirmed with CT and ultra sound scan. In contrast to other crystal deposition diseases, HADD has a hypoechoic appearance with posterior shadowing which is present even at an early stage of the disease [15].

An extended carpal tunnel release is recommended, so that the floor of the carpal tunnel can be visualized for space occupying lesions.

Conflict of interest Nil

Financial support Nil

References

1. Aslam N, Lo S, McNab I (2005) Acute carpal tunnel syndrome caused by a fragment of bone from metacarpal injury. *Injury Extra* 36:73–76
2. Rate AJ, Parkinson RW, Meadows TH et al (1992) Acute carpal tunnel syndrome due to pseudogout. *J Hand Surg* 17:217–218
3. Kang HJ, Jung SH, Yoon HK et al (2009) Carpal tunnel syndrome caused by space occupying lesions. *Yonsei Med J* 50(2):257–261
4. Din R, Giannikas K, El-Hadidi M (2001) Acute calcifying tendonitis- an unusual cause of carpal tunnel syndrome. *Eur J Emerg Med* 8:65–66
5. Harris AR, McNamara TR, Brault JS et al (2009) An unusual presentation of acute calcific tendonitis in the hand. *Hand* 4:81–83
6. Verfaillie S, DeSmet L, Leemans A et al (1996) Acute carpal tunnel syndrome caused by hydroxyapatite crystals: a case report. *J Hand Surg* 21A:360
7. Pai V, Pain V, Muir R (2009) Periarticular calcification causing acute carpal tunnel syndrome: a case report. *J Orthop Surg* 17(2):234–237
8. Chen CH, Chung CB, Yeh L et al (2000) Carpal tunnel syndrome caused by tophaceous gout: CT and MR imaging features of 20 patients. *A J Roentgenol* 175(655):655–659
9. De Das S (1983) Carpal tunnel syndrome due to a calcareous mass in the carpal tunnel. *Singap Med J* 24(3):175–177
10. Saffar P (2004) Chondrocalcinosis of the wrist. *J Hand Surg* 29B:486–493
11. Dumas C, Vazirani RM, Clifford PD et al (2007) Acute calcific periarthritis of the hand and wrist: a series and review of the literature. *Emerg Radiol* 14:199–203
12. Stahl S, Kaufman T, Schapira D (1998) Calcium hydroxyapatite deposition disease in the hand and wrist: a report of six cases. *Eur J Plast Surg* 21:366–369
13. Hayes CW, Conway WF (1990) Calcium Hydroxyapatite deposition disease. *Radiographics* 10(6):1031–1048
14. Kuroda H, Wada Y, Nishiguchi K et al (2004) A case of probable hydroxyapatite deposition disease [HADD] of the hip. *Magn Reson Med Sci* 3(3):141–144
15. Frediani B, Filippou G, Falsetti P et al (2005) Diagnosis of calcium pyrophosphate dihydrate crystal deposition disease: ultrasonographic criteria proposed. *Ann Rheum Dis* 64:638–640