American Journal of Surgery Case Reports

Case Report

Neuropathic Arthropathy of the Distal Phalanx: A Case Report

Jocelyn Compton[1], Ignacio Garcia Fleury[2], Michael Willey[2] and Joseph Buckwalter V[2#]*

[1]*Orthopedic and Fracture Specialists, USA*

[2]*Department of Orthopedic Surgery and Rehabilitation, University of Iowa Hospitals and Clinics, USA*

[#]*Authors Equally Contributed*

Abstract

Neuropathic arthropathy, or Charcot arthropathy, is a destructive joint degenerative process associated with neurologic dysfunction. Although neuropathic arthropathy most commonly affects the weight-bearing lower extremity, literature has sparsely cited cases of neuropathic arthropathy of the shoulder, elbow, and wrist. The pathophysiology of upper extremity neuropathic arthropathy can vary from diabetes, nerve injury and syringomyelia to infectious causes. This case report aims to describe a rare case of digital neuropathic arthropathy, with a unique presentation and management plan. Only 5 previous case reports have described similar joint pathology affecting the joints of the fingers.

Keywords: Charcot joint; Distal interphalangeal joint; Neuropathic arthropathy

Introduction

Neuropathic arthropathy, or Charcot arthropathy, is a chronic, progressive, and destructive process of the involved joint due to neurologic dysfunction. First descriptions of this pathological condition date back to the early 1700's, when William Musgrave reported a case of "arthralgia caused by venereal disease." Yet it was the French neurologist Jean-Martin Charcot who would later give his name to the condition in the late 1800's, reporting spontaneous fractures in a French soldier suffering from tabes dorsalis as a result of nerve degeneration and bone atrophy [1].

Although the exact pathophysiology is uncertain, two theories have been proposed to explain the mechanism of joint destruction: the neurovascular theory and the neurotraumatic theory [2]. The neurovascular theory suggests that the associated neuropathy leads to smooth muscle tone dysregulation that prevents appropriate vasomotor control and subsequent decreased blood flow to the bone. The neurotraumatic theory proposes that the associated neuropathy leads to decreased sensory and proprioceptive innervation, leaving innervated joints prone to progressive destruction with repetitive instability/microtrauma. Now, as research has advanced, both of these theories have shown to play some part in the grand scheme of this condition.

Neuropathic arthropathy of the lower extremities has been thoroughly examined in the literature with information from natural history to management strategies; however fewer cases of neuropathic arthropathy affecting the upper extremities have been reported. When affecting the upper extremity, the most commonly affected region is the glenohumeral joint of the shoulder, often associated with syringomyelia. Although several cases have been reported of shoulder, elbow, and wrist neuropathic arthropathy, only 5 cases have been reported of neuropathic arthropathy affecting the Distal Interphalangeal (DIP), Proximal Interphalangeal (PIP), or Metacarpal Phalangeal (MCP) joints [3-6]. Here, we present a case of neurogenic arthropathy affecting the DIP joint of the right index finger following median nerve injury.

Case Presentation

A 78-year-old, right-hand dominant male presented to clinic with a chief complaint of right index finger instability and dysfunction. Specifically, he reported difficulty with writing and buttoning shirts. His history was notable for an accident in 1953, when at the age of 13; he was pushed into a train window sustaining a right-sided wrist laceration with complete loss of median nerve sensory and motor function. Initial treatment consisted of direct repair of the median nerve and affected tendons of the wrist. Over the course of the next year, he developed a painful neuroma and subsequently underwent neuroma excision and FDS opponensplasty. His median nerve function and pain improved dramatically, and he reports no specific dysfunction or pain for decades.

Sixty-five years after the index injury, his physical exam demonstrated well-healed surgical scars in the distal volar wrist and intact extrinsic flexor and extensor tendons and no range of motion deficits. The DIP of the right index finger was grossly unstable in flexion extension and ulnar and radial deviation. There was no pain with passive or active movement or palpation. His opponens strength was 4+ out of 5. Grip strength was 56 lbs (contralateral 62 lbs) and pinch

Citation: Compton J, Fleury IG, Willey M, Joseph Buckwalter V. Neuropathic Arthropathy of the Distal Phalanx: A Case Report. Am J Surg Case Rep. 2023;4(8):1088.

Publisher Name: Medtext Publications LLC

Manuscript compiled: Aug 09th, 2023

***Corresponding author:** Ignacio Garcia Fleury, Department of Orthopedic Surgery and Rehabilitation, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, Iowa City, IA 52242, USA

#Joseph Buckwalter V, Department of Orthopedic Surgery and Rehabilitation, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, Iowa City, IA 52242, USA, Tel: +1-319-356-7160; Fax: +1-319-353-6754

strength was 10 lbs (contralateral 17 lbs). He had 8 mm-10 mm two point discrimination in the median nerve distribution (contralateral 5 mm). Imaging of both hands showed erosive arthritis of the DIP joint of the right index finger and bilateral CMC joint arthritis (Figure 1). His CMC joint arthritis was asymptomatic. Magnetic Resonance Imaging (MRI) of the cervical spine did not show evidence of a syrinx or additional pathology.

After a period of splinting and a discussion of all possible treatment options, the patient elected to proceed with right index finger DIP fusion with a headless compression screw (Figure 2A). The patient was immobilized in a finger splint for 6 weeks, with gradual return to activity. There were no post-operative complications and, at 6 months post-operatively, the patient reported excellent functional with radiographic evidence of solid fusion (Figure 2B).

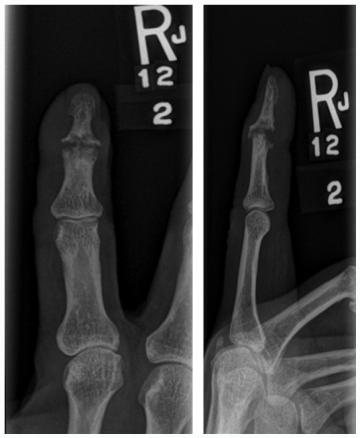

Figure 1: Anteroposterior (AP) and lateral views of the right index finger show destructive changes at the DIP joint.

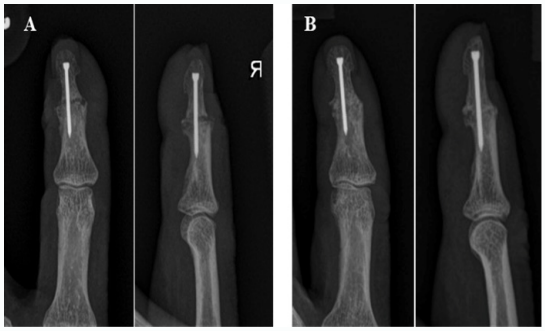

Figure 2: A) AP and Lateral of the right index finger show headless compression screw and fusion of the joint immediately after surgery and (B) At 6 months post-operatively.

Discussion

Neuropathic or Charcot arthropathy of the finger is a rare condition of the upper extremity and, as such, has only been described in 5 previous cases:

- Parker and Froimson [4] reported a case of a 45-year-old right-hand dominant male who presented for swelling of bilateral hand and wrists. His past medical history included multiple neuropathic joints, first presenting in the lower extremities (requiring bilateral above-the-knee amputations) followed by the upper extremities, after bilateral lower extremity amputations required him to weight bear through the upper extremities. In addition, he worked as a dental technician, reporting inability to perceive pain when extreme heat was generated. On presentation, he was seen with painless swelling of bilateral wrists, restricted motion of left thumb MCP and small PIP, as well as a radially subluxated right thumb interphalangeal joint. Treatment consisted of right carpal tunnel release and compression arthrodesis of the right thumb interphalangeal joint for pinch strength. Bilateral orthotic wrist splints were made for stabilization. No report of follow-up is recorded.
- Vanderhooft and Sack [6] reported a 35-year-old male who sustained an amputation of all of his digits on the left hand from a table saw with subsequent replantation of the left long and ring fingers with simultaneous pollicization of the index finger. Two years later, the patient experienced gross instability of the left long finger PIP joint and X-rays showed evidence of Charcot joint. Treatment consisted of an arthrodesis of the left long finger PIP joint, however pseudoarthrosis of the joint progressed and a solid fusion with peg graft was attempted 5 months after the initial arthrodesis. At 4.5 year follow-up, he has maintained solid fusion with functional capability.
- Leung et al. [3] reported a case of a 60-year-old right-hand dominant male with past medical history of diabetes mellitus who presented for painless swelling and deformity of the right small finger. No preceding traumatic event was noted and the deformity was present for several months. Examination showed mild swelling in the small finger localized to the right small finger DIP joint with the distal phlanx in slight flexion and ulnar deviation. Radiographs demonstrated the DIP joint with bone fragmentation and soft-tissue swelling. He was diagnosed with neuropathic arthropathy of the right small finger DIP joint secondary to diabetes mellitus and treated non-operatively with a finger-based splint for which he remains asymptomatic.
- Butala et al. [2] reported a case of a 53-year-old right-hand dominant female who presented with painless stiffness of the left shoulder and thumb for 3 years with paresthesia and weakness for 6 years. Examination of her left hand showed volar subluxation of the first CMC joint of the thumb with decreased range of motion. X-rays showed evidence of arthropathy and cervical spine MRI showed a multi-level cervical syringomyelia. She was treated non-operatively with thumb spica casting and returned at 6 months follow-up with a 60% decreased in symptoms.
- Singh, et al. [5] reported a case of a 68-year-old right-hand dominant female who presented with progressive painless stiffness of the right thumb. She has no major medical history, but was previously assaulted resulting in multiple unnamed injuries. Examination showed a right thumb with pain-free, reduced motion with diffuse tenderness, warmth, and swelling. X-rays showed degenerative processes of the right thumb CMC joint. MRI of the cervical spine revealed an odontoid fracture and hemorrhage into the retropharyngeal space. Treatment was non-operative, with thumb spica splint. At 2-month follow-up, she was noted to have a stable CMC joint with no progression and signs of early union.

The etiology of upper extremity neurogenic arthropathy can vary

widely; a differential diagnosis should be generated and thoroughly investigated at presentation. Consideration should be given not only to direct nerve injury as presented here, but also to diabetic neuropathy, syringomyelia, tabes dorsalis, meningomyelocele, congenital sensory neuropathy, Hansen's disease, peripheral nerve dysfunction, paraplegia, alcoholism, multiple sclerosis, juvenile rheumatoid arthritis, poliomyelitis, familial dysautonomia, septic arthritis, osteomyelitis, osteonecrosis, or malignancy. Work-up should include plain radiographs, laboratory studies, and, importantly, a cervical MRI to rule out the presence of syringomyelia.

Overall, neuropathic arthropathy of the upper extremities is a rare condition, and even more unusual in the joints of the fingers. This case distinguishes itself from previous reports in several ways. First, the mechanism of median nerve transection with subsequent development of neuropathic arthropathy has not been reported. Second, localization to the distal interphalangeal joint of the finger has only been reported once before, and never in the index finger. Finally, operative treatment plan by fusion with a headless compression screw presents a viable treatment strategy for patients with this condition of the distal interphalangeal joint. This report presents yet another management option that has resulted in positive outcomes in line with the patient's goals of care.

References

1. Kassimos DG, Koutsogeorgopoulou LA, Creamer P. Neuropathic arthropathy. Rheumatology. 6th ed. Philadelphia: Mosby Elsevier. 2015:1521-7.
2. Santiesteban L, Mollon B, Zuckerman JD. Neuropathic Arthropathy of the Glenoumeral Joint A Review of the Literature. Bull Hospit Jt Dis (2013). 2018;76(2):88-99.
3. Leung Y, Beredjiklian P, Donthieneni R, Bozentka DJ. Neuropathic arthropathy of the digit: a case report. J Hand Surg Am. 2003;28(2):323-6.
4. Parker RD, Froimson AL. Neurogenic arthropathy of the hand and wrist. J Hand Surg Am. 1986;11(5):706-10.
5. Singh M, Butala RR, Khedekar RG, Tripati M. A rare case of idiopathic thumb CMC joint neuropathic arthropathy complicated by blunt trauma. J Clin Orthop Trauma. 2016;7(Suppl 1):138-41.
6. Vanderhooft E, Sack J. Charcot arthropathy following digital replantation. J Hand Surg Am. 1995;20(4):683-6.