Case Report

Acute Carpal Tunnel Syndrome After Canine Bite

Abstract
Acute carpal tunnel syndrome (ACTS) from an infected source is rare because most cases result from trauma. There are cases of ACTS occurring after feline bites, but none in the reported literature after canine bites. The following is a case report of a 58-year-old woman who presented to the emergency department with progressive median nerve symptoms after a canine bite. In the operating room, a significant mass effect was found within the contents of the carpal tunnel secondary to an abundance of purulence. The patient was treated urgently with irrigation and débridement of the wrist with an extended open carpal tunnel release and flexor tenosynovectomy and discharged with peripheral venous access for long-term antibiotics. At 1-month follow-up, the healed wound showed no signs of infection. A mild sensory deficit remained in the median nerve distribution.

Case Report
A 58-year-old right-hand-dominant woman presented to the emergency department complaining of progressively worsening right wrist pain, weakness, and numbness in the median nerve distribution after having sustained a dog bite to the wrist 4 days previously. Earlier that week, she was seen at an urgent care center, where she was evaluated and prescribed clindamycin and metronidazole. However, her pain and weakness continued to worsen, leading to her to present to the emergency department, with evaluation by an orthopaedic hand surgeon.

On examination, she was found to have healing puncture wounds on the volar and dorsal wrist. The wrist and carpal tunnel were tight and full on palpation. The wrist was resting in a flexed position. She had pain with passive extension of wrist and digits. Neurologic examination was significant for a positive Tinel sign of the median nerve. Phalen and Durken tests were equivocal. Her overall finger range of motion was limited secondary
to pain and swelling. There was decreased sensation over the median nerve distribution. The sensation was intact to light touch within the ulnar and radial nerve distributions.

Radiographs were negative for fracture or foreign body. Wrist MRI revealed a large fluid collection within the carpal tunnel and within the flexor tendon sheaths (Figure 1).

She was urgently taken to the operating room for irrigation and débridement of the wrist, with an extended open carpal tunnel release and flexor tenosynovectomy. Intraoperatively, abundant turbid fluid was found within the volar wrist above the pronator quadratus and within the carpal tunnel, where there was obvious strangulation of the carpal tunnel contents (Figure 2). There was also extensive flexor tenosynovitis involving the flexor digitorum superficialis, flexor digitorum profundus, and flexor pollicis longus, all of which were débrided with tenosynovectomy. Multiple tissue swabs and samples from within the carpal tunnel were sent for culture. The median nerve appeared hyperemic but was adequately decompressed with release of the transverse carpal ligament.

During the patient’s postoperative hospitalization, she described decreased pain and improved paresthesias and numbness. She acknowledged some, albeit abnormal, sensation within the median nerve distribution. The patient also demonstrated the ability to perform a small amount of thumb interphalangeal joint flexion and index finger distal interphalangeal joint flexion. Vancomycin and piperacillin-tazobactam were administered for empiric organism coverage while monitoring cultures. The patient was also evaluated by an infectious disease specialist during her hospitalization, who recommended intravenous ertapenem for a 6-week duration in light of cultures that showed no growth after 48 hours. She was discharged on postoperative day 3 with peripheral venous access for long-term antibiotics.

At the 1-week follow-up visit, she noted that mild tingling in the median nerve distribution was much improved. Physical examination showed an appropriately healing wound, mild swelling, reasonable finger motion to all flexors, and sensation intact in all nerve distributions, with mild deficit in median nerve distribution. A gentle range-of-motion exercise was initiated.

At the 1-month follow-up visit, the patient stated that her numbness had significantly improved, but was not yet normal. She complained of grip weakness and mild stiffness. Physical examination demonstrated a healed wound without signs of infection, and finger motion was much improved. A mild sensory deficit remained in the median nerve.

Figure 1

Sagittal (A) and axial (B) images reveal a large fluid collection extending from the carpal tunnel to the Parona space, with reactive inflammation within the involved flexor tendons.
distribution. She continued to follow up with the infectious disease specialist. The patient also began occupational therapy at that time.

**Discussion**

Dog bites are the most common form of animal bite to the hand and represent 1 in 200 emergency department visits.\(^3,4\) Bites to the hand are more likely to become infected compared with the arm, leg, and face because of the numerous small compartments and thin soft-tissue coverage.\(^4\) Overall, one fifth of dog bites result in infection; however, 36% of dog bites to the hand become infected.\(^5\) The most common organism obtained in the isolate from an infected canine bite is *Pasteurella canis*.\(^4\) Infected dog and cat bites usually include *Pasteurella* species, which are aggressive gram-negative pathogens but can include many other organisms not routinely identified by clinical microbiology laboratories and not previously recognized as bite-wound pathogens.\(^5,6\) No organisms were obtained from the cultures in this case, which is probably due to the antibiotics administered before surgical cultures having decreased the yield.

General management of dog bites should not use erythromycin alone because of resistance from *Pasteurella* species.\(^5\) One study showed that 70% of patients with *Pasteurella multocida* had received inadequate or incorrect antibiotics before hospitalization.\(^5,7\) This study also showed that infected wounds that present in under 12 hours from dog bites typically are from *Pasteurella*, while those that present after more than 12 hours are more likely to be infected with *Staphylococcus* or anaerobes, due to the high virulence of *Pasteurella*.\(^5\) In addition to antibiotics, the most important aspect of treatment is an adequate débridement of deep penetrating wounds. Wounds should also be left open for continued drainage.\(^5\)

Inpatient antibiotic treatment for dog bite wounds must cover not only *Pasteurella* but also anaerobes and staphylococci.\(^5,6\) Morgan and Palmere\(^5\) recommend empiric use of imipenem intravenously for severe infections, which is similar to the antibiotic this patient received after surgical intervention. For patients with allergies to penicillin, another option is ciprofloxacin plus metronidazole.\(^5\)

ACTS is defined by progressive median nerve symptoms resulting from a pressure threshold of 20 to 30 mm Hg within the carpal tunnel, which compromises the epineural blood flow of the median nerve.\(^8\) Although there are many different causes of ACTS, they all have the same pathophysiology in common, which is a decrease in epineural blood flow, leading to dysfunction of the median nerve and thus to the need for urgent surgical decompression.\(^1\) If carpal tunnel release is performed early, the nerve often fully recovers; however, the longer the delay, the higher the risk of permanent nerve injury.\(^1\) Although most of this patient’s function did return, she had yet to regain her full function even 1 month after surgery.

In conclusion, the patient in this case report incurred a deep puncture wound from a canine bite, which resulted in a significant amount of purulence within the carpal tunnel and surrounding flexor tendons. Although she was started on appropriate antibiotics, she most likely did not undergo a thorough irrigation and débridement of her deep tissues in the emergency department on her initial presentation. This likely led to...
the inoculation of bacteria within the carpal tunnel that continued to develop into ACTS.

References

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