Clostridium perfringens infection following carpal tunnel release

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Introduction

Carpal tunnel syndrome is the most common compression neuropathy in the extremities. Surgical decompression or carpal tunnel release is effective in over 90 % of cases. Complications are unusual, and infection is very rare, occurring in less than 0.5 % [2, 3]. When infection occurs, *Staphylococcus aureus* is the most commonly recovered organism [4]. We report a case of postoperative infection caused by *Clostridium perfringens* following carpal tunnel release. To our knowledge, this is the first confirmed *C. perfringens* infection following routine open carpal tunnel release.

Case Report

A 51-year-old T4 paraplegic female underwent an open left carpal tunnel release and ulnar nerve decompression at Guyon's canal for recalcitrant symptoms. The procedure was

performed under sedation with local anesthetic blockade using combined 0.5 % Sensorcaine and 1 % Xylocaine with epinephrine 1:500,000. Chlorhexidine was used as the skin preparation. A forearm tourniquet was inflated to 200 mmHg for 7 min during the carpal tunnel part of the procedure. Total operative time for combined procedures was 22 min. A soft, bulky occlusive dressing was applied. As she lived a great distance away, she was boarded overnight in the Spinal Cord Injury Center. She was not diabetic or immunocompromised but had a suprapubic catheter and a colostomy for her neurogenic bladder and bowel, respectively, with regular bowel movements daily.

On the first postoperative day, she complained of severe wound pain. Exam revealed swelling and erythema, as well as tenderness out of proportion to physical findings. Her white blood cell count was elevated at 32,000. Intravenous piperacillin/tazobactam and vancomycin were initiated per infectious disease service recommendations to cover both Gram-negative and Gram-positive organisms, including methicillin-resistant *S. aureus*. She was returned to the operating room for exploration. At surgery, there was murky fluid in the wound, but pus was not identified. A specimen was sent for Gram stain and culture sensitivity. The incision was extended proximally to allow visualization of the tendons and median nerve. Edema was found, but no pus or additional fluid. The soft tissues were boggy, but no crepitus was present. The wound was irrigated and loosely closed, and a sterile bulky dressing/splint was applied. Postoperatively, the Gram stain showed Gram-positive rods, some of which were intracellular (Fig. 1). Culture grew 4+ beta-lactamase-positive *C. perfringens* within 24 h. Piperacillin/tazobactam and vancomycin were discontinued and replaced by ertapenem per infectious disease recommendations.

Although the wound looked clinically much improved, and pain had largely resolved, the patient returned to the operating

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Fig. 1 **a, b** Gram stain reveals both extracellular and intracellular Gram-positive rods in these two views. The presence of intracellular Gram-positive rods is pathognomonic for *C. perfringens*

room 36 h later for a “second look” incision and drainage. Edema, but no pus or murky fluid, was noted. Skin and soft tissues were viable except for a small amount of necrotic fat and frayed wound edges, which were debrided. The wound was copiously irrigated and closed loosely to maintain drainage. The patient’s clinical course continuously improved. Within 48 h of the incision and drainage, the white blood cell count had been reduced to 15,000. The treatment team considered hyperbaric oxygen treatment but did not utilize this therapy due to the patient’s rapid clinical improvement. Ertapenem was continued for 14 days per infectious disease recommendations. Her wound healed without further problems, and sutures were removed 10 days after the last procedure. She has had excellent relief of her paresthesia and, currently, has no hand problems.

There were four other hand surgeries in the same operating room that day, with no infectious complications. A review of all cultures taken from the operating room 1 month before and after this surgery revealed that none was positive for *C. perfringens*. It was presumed that the source of the *Clostridium* was bowel, but stool cultures, which were taken well after an antibiotic therapy was initiated, did not grow the organism. Cultures of the abdominal skin surrounding the ostomy were not taken.

Discussion

C. perfringens is an anaerobic Gram-positive rod-shaped bacterium formerly referred to as *Clostridium welchii* [6]. Three organisms responsible for gas gangrene were identified in the late nineteenth century when Pasteur, Welch, and Novy described *Clostridium septicum*, *C. perfringens*, and *Clostridium novyi*, respectively [8]. Six *Clostridium* species cause gas gangrene in humans [10], with *C. perfringens* being the most common [6]. *C. perfringens* has five types, A–E, distinguished by their individual toxin [6]. There are at least 12 separate toxins produced by this bacterium, and the alpha-type toxin is the most common cause of human gas gangrene [6]. Factors increasing the risk of clostridial infection include increasing age, diabetes, liver cirrhosis, arterial insufficiency, and disease or treatment causing immunosuppression [5]. Treatment consists of a combination of antibiotics,

aggressive surgical debridement, and hyperbaric oxygen at times.

Infection is a rare complication following carpal tunnel release. Hanssen et al. in 1989 and Harness et al. in 2010 performed large retrospective reviews, each exceeding 3,000 carpal tunnel release cases [2, 3]. They reported the rate of deep infection to be 0.47 and 0.13 %, respectively. According to a study by Houshian et al., *S. aureus* was responsible for 58 % of the hand infections that occurred in patients who previously underwent surgery [4]. The clinical course involving infection by gas-forming bacteria, such as *C. perfringens*, requires at least 12 to 18 h to develop and is associated with systemic symptoms [9]. Our patient reported having fever and chills the day after her carpal tunnel release when her infection was the most severe, as indicated by her white blood cell count. Given the rapid onset and progression of clostridial infections, it is fortunate that she was boarded overnight following her operation.

Clostridial infections most often occur following penetrating injury [5], trauma, or surgical operations involving the gall bladder or bowel [7]. Clostridial bacteria are known to occupy the intestinal and genital tract [6] and have been isolated from feces [1]. A study by Ayliffe et al. investigated four cases of postoperative gas gangrene in three different hospitals, and their findings demonstrated that the bacterial strains isolated from the patients’ wounds and from their feces were identical, providing strong evidence of self-contamination [1]. In his study of 56 cases of postoperative gas gangrene, Parker supported this view [7]. The Ayliffe study documented *C. welchii* that was isolated from various skin sites. In this study, the palm of the hand was one of the most consistently contaminated sites and was more prevalent than the buttocks of the patients. Samples taken from skin sites near the colostomy were also positive for *C. perfringens*. Furthermore, 32 % of female patients demonstrated moderate or heavy skin contamination, while only 10 % of men demonstrated this level of contamination. Lastly, when they analyzed the methods of skin disinfection, soap and water proved to have no effect. Cleaning with 70 % alcohol or using compresses of iodophor povidone-iodine applied for 15 to 30 min both had some useful effects, but complete removal of the bacteria seemed difficult to achieve [1]. In our case, the site of the surgery was the palm of the hand; our patient was female, and she had a colostomy. These facts, combined with the Ayliffe study

information, lead us to speculate that the *C. perfringens* bacteria contaminated the palmar skin due to contact of the skin surrounding the colostomy. Because disinfectants are ineffective against spore formation [5], it is likely that the bacteria entered the wound via the palmar incision of the operation.

Conflict of interest The authors declare that they have no conflicts of interest, commercial associations, or intents of financial gain regarding this report.

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