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Hardware Failure and Non-union Due to Chronic *Propionibacterium acnes* Osteomyelitis of the Clavicle: A Case Report

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Introduction

Propionibacterium acnes is a low-virulence, anaerobic, gram positive organism that is part of normal skin flora. It is an opportunistic pathogen associated with surgically-associated infections including shoulder prostheses and arthroscopy, cerebrovascular shunt placement, and cardiovascular devices [1-5]. It is also the pathogen associated with acne vulgaris.

While there is extensive discussion of *P. acnes* infection associated with procedures involving the shoulder, there is a paucity of data suggesting a further association with clavicle surgeries. A single case report has been published about osteolysis in the distal clavicle associated with *P. acnes* [6]. We report a unique case of hardware failure and nonunion of a middle-third clavicle fracture caused by chronic *P. acnes* infection.

Case Report

A 42-year-old female presented to clinic with a history of post-traumatic clavicle fracture treated non-operatively 4 years previously. She complains of decreased range of motion in her left shoulder and an inability to perform normal daily activities due to pain. Her original injury was treated at a different institution. A left clavicle X-ray at this initial visit showed a complete fracture in the middle third of the clavicle with a 3.7 cm displacement and superior angulation of the proximal fragment (**Figure 1**).

She was scheduled for surgery, which was delayed twice per the patient's request.

Ten months after her initial presentation, open reduction and internal fixation was performed. Prophylactic clindamycin was given preoperatively. The fracture was reduced under direct visualization with excellent bony apposition. A narrow clavicle plate was placed superiorly and secured with six locking screws. Intraoperative X-ray, seen in **Figure 2**, showed successful reduction and fixation.



Figure 1 Initial X-ray shows a complete fracture through the middle third of the clavicle with a 3.7 cm displacement between the fragments due to superior angulation of the proximal fragment.

At her two-week follow-up, the patient presented with a complaint of a popping sensation and severe, constant pain with motion of her shoulder. The symptoms began 1 day prior to the visit after the patient slept without her sling and woke up with pain. Physical exam revealed a clean, dry, and intact incision with sutures in place. There were no open areas or erythema present, and the patient was afebrile. Repeat X-rays (**Figure 3**) were taken and revealed failure of the medial plate with a loose screw. She was scheduled for hardware removal and repeat ORIF of her left clavicle.

Several days after this visit, the patient presented with formation of a blister near the middle of the incision. She said the blister opened and was draining greenish-brown, foul-smelling fluid. On exam, supraclavicular lymphadenopathy was noted, as well as a 1cm x 2cm bullous, fluctuant blister on the incision. She was scheduled for emergent hardware removal and left clavicle irrigation and debridement.

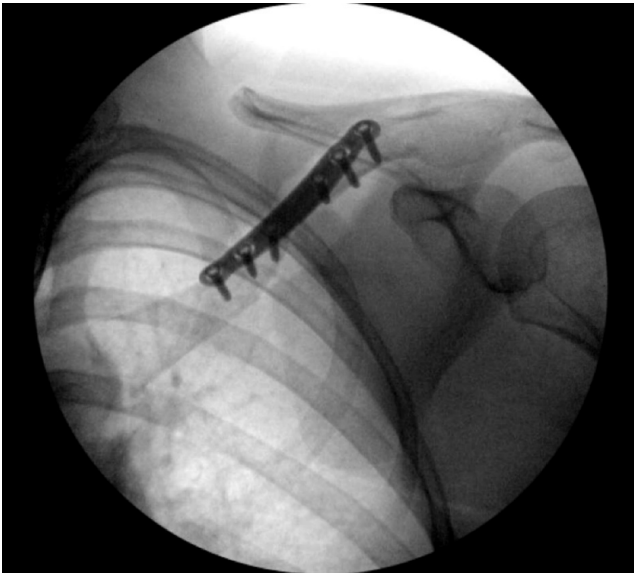


Figure 2 Intraoperative X-rays during initial ORIF show successful reduction of the clavicle fragments and placement of a plate with six screws.



Figure 3 X-rays taken 2 weeks after initial fixation show lucency around the most medial screw as well as separation of the plate from the medial end of the clavicle, indicating hardware failure and non-union.

We performed the irrigation and debridement the following day. Incision was made over the previous incision site. The fluctuant area was decompressed and the extravasated fluid was submitted for culture. The bone and nonunion site were thoroughly curetted and extensive excisional debridement was performed of necrotic bone and soft tissue. The wound was thoroughly irrigated and appeared clean. At this time, the wound was closed in layers using PDS suture and the skin was closed. The patient was discharged on post-operative day four on Bactrim after cultures came back negative. On post-operative day 7, the anaerobic culture results came back positive for *P. acnes*.

The patient did not return for follow-up until 6 months later, at which point her course of Bactrim had long since been completed. X-rays at this time are shown in **Figure 4**.



Figure 4 At 6-month follow-up after hardware removal, X-rays showed re-displacement of the medial clavicular fragment superiorly and complete nonunion.

They showed the left clavicle after hardware removal, with a midline fracture and approximately 3 cm of bone loss. However, at this time, the patient reported no symptoms and we chose to continue without intervention as long as she remained stable. Shortly thereafter, she returned to clinic with complaints of weakness and discomfort in her left shoulder and an inability to perform normal activities of daily life. After extensive discussion, a plan was put into place to begin staged ORIF and nonunion takedown with possible iliac crest bone graft after a bone biopsy.

We performed a bone biopsy, which revealed extensive fibrous tissue and scarring but no purulent or necrotic tissue. However, anaerobic cultures from the biopsy again grew *P. acnes* and the infectious disease team was consulted. As per their recommendations, the patient was started on a 6 month long course of rifampin and minocycline and was told to delay surgical intervention until the completion of her antibiotic course. Currently, she is being managed non-operatively and is managing her shoulder pain with NSAIDs.

Discussion

Perioperative infections are amongst the most devastating complications of orthopedic procedures, resulting in a variety of problems ranging from hardware failure and nonunion to prolonged hospitalization, increased costs, and systemic complications [7]. *P. acnes* is a low-virulence, anaerobic gram positive organism most widely known for its role in acne vulgaris [8]. However, it has also been noted as a cause of infection of a variety of implants, including cardiac devices and intracranial shunts [2,9]. In the scope of orthopedic surgery, *P. acnes* is most well-known as a cause of infection during shoulder procedures [1].

In the past, *P. acnes* was often considered a contaminant of intraoperative cultures; however, more recent literature has shown that it is an organism capable of colonizing the shoulder joint and causing complications in the perioperative period [9]. Although it has an indolent course, it can result in failure of surgery [1]. It is hypothesized that despite skin preparation and prophylactic antibiotics, viable *P. acnes* persists deeper in the dermis and incision of the skin can cause seeding of the wound with the bacterium [4]. Mook et al. looked at 117

patients undergoing a deltopectoral approach to open shoulder surgery to determine the incidence of *P. acnes* seeding of the wound. They found that 39 (17%) of pericapsular soft tissue samples taken for culture were positive for *P. acnes* [5].

Other studies have identified the incidence of *P. acnes* in specific shoulder procedures. Chuang et al. identified 19.6% of patients of 51 undergoing shoulder arthroscopy culture-positive for deep inoculation of *P. acnes* despite skin preparation with 4% chlorhexidine scrub and 2% chlorhexidine gluconate/70% isopropyl alcohol prep [10]. Multiple studies have shown that *P. acnes* is the most prevalent cause of joint infection after shoulder arthroplasty [11-13].

In conclusion, despite the growing volume of literature linking *P. acnes* with shoulder implants, there are no reports of hardware complications associated with clavicle repair as a result of *P. acnes*. There is a single report describing *P. acnes* mediated distal clavicular osteolysis, but no hardware or surgery was involved [6]. To our knowledge, our case is the first reported case of hardware failure and nonunion in the middle third of the clavicle as a result of chronic *P. acnes* infection. We suggest that clinical suspicion should be high for *P. acnes* infection in patients with an indolent disease course and evidence of hardware failure or osteomyelitis after clavicle procedures.

We obtained the patient's written informed consent for print and electronic publication of this report and for reprinting in foreign editions of the journal. No author has a potential conflict of interest regarding this work.

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