Smoldering subcutaneous polymicrobial infection concealed beneath a cast and a skin graft: Delayed wound healing due to recurring soft-tissue infections

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**ABSTRACT**

Injury to soft tissues secondary to trauma is common and may require surgical intervention depending on the extent of the injury and the structures involved. Motor vehicle accidents are a leading cause of traumatic injury and often require surgical irrigation and debridement to remove damaged and necrotic tissue while preserving tissue integrity and function. Surgical intervention carries its own risks, however, with the introduction of pathogens to the surgical site being a potential complication. This case of an 18-year-old woman with a chronic wound due to recurring skin and soft tissue infections (SSTIs) highlights the complications of surgical intervention and the difficulty of dealing with recurring SSTIs. The patient suffered a left knee injury with patellar tendon laceration secondary to trauma from a motor vehicle accident. She initially underwent surgical irrigation and debridement, followed by patellar tendon repair with a rotational flap to close the open wound. Following the initial closure in December 2019, the patient underwent six incision and drainage procedures over a 9-month period due to a chronic non-healing wound with recurring SSTIs. Despite these interventions, the patient ultimately underwent a total patellectomy due to recurring wound infections with penicillin resistant, methicillin-susceptible Staphylococcus aureus for which she was successfully treated with IV nafcillin over a period of 42 days.

**Keywords:** Chronic wound, skin and soft tissue infections, polymicrobial wounds

**INTRODUCTION**

The process of wound healing typically involves three stages: inflammatory, proliferative, and remodeling. In the case of traumatic injury, previously innocuous bacteria may gain entry to the wound site and disrupt the healing process, often resulting in the arrest of wound healing at the inflammatory stage, leading to a chronic wound. Skin and soft tissue infections can complicate wound healing and are responsible for many chronic wounds, which require further surgical debridement and closure and carry significant morbidity and financial burden to patients and the healthcare system. The pathogens responsible for chronic wound infections typically originate from the endogenous flora of a patient’s skin or mucous membranes or hollow viscera, with the most commonly isolated pathogens being *Staphylococcus aureus*, *Enterobacteriaceae*, coagulase-negative *Staphylococci*, *Enterococci*, and *Pseudomonas aeruginosa*.

**CASE**

An 18-year-old woman sustained a left knee injury after being involved in a motor vehicle accident. She was ejected from her vehicle and sustained extensive soft tissue damage to her left knee and a patellar...
tendon laceration. She underwent incision and debride-
ment (I&D) followed by a rotational flap closure of the
open wound. Following initial discharge on December
20, 2019, the patient returned to the Emergency
Department (ED) on January 9, 2020, and was admit-
ted for overnight observation due to suspected cellulitis
vs. deep tissue infection. Vancomycin and piperacil-
lin-tazobactam were started for empiric coverage and
were later changed to trimethoprim-sulfamethoxazole
(TMP-SMX). The patient returned to the ED and ulti-
mately underwent another round of I&D on February
10. She was again discharged with TMP-SMX and
instructed to return to clinic in two weeks for wound
inspection. On her return to the clinic, wound dehis-
cence was appreciated, and the patient underwent
another round of I&D on March 12 and was admitted
for IV antibiotics. Cultures were positive for S. aureus
sensitive to TMP-SMX, which the patient once again
received after discharge.

Upon returning to the clinic two weeks later, a
chronic wound with full thickness breakdown was
appreciated, and the patient was admitted and under-
went I&D to the left joint with excision of subcutaneous
fascia and muscle, medial gastrocnemius rotational
flap, and split thickness graft to the left knee with donor
site at the medial thigh (Figure 1). The patient was dis-
charged and followed in the clinic until she returned
to the ED on May 15, 2020, presenting with a medial
thigh wound breakdown and necrosis (Figure 2).
Intravenous vancomycin and piperacillin-tazobactam
were administered, and she underwent necrotic tissue
debridement on May 16 (Figure 3). A pathology report
from a tissue specimen collected on May 16, 2020,
demonstrated ulceration, dermal and pannicular neu-
trophilic abscesses, and necrosis with associated col-
oies of Gram-positive cocci, lipophagic fat necrosis,
angiolasia, reactive vascular changes and fibrosis
(Figures 4–5). Differential diagnoses for the observed
pathology include bacterial abscess, cellulitis, super-
ficial changes of necrotizing fasciitis and, more
unlikely, pyoderma gangrenosum. While previous
cultures had grown only S. aureus, cultures on May
26, 2020, grew Pseudomonas aeruginosa sensitive
to ciprofloxacin and S. aureus sensitive to TMP-SMX.
The patient was discharged on both antibiotics for two

Figure 1. Split thickness graft to left knee with donor site to medial thigh at left lateral extremity 04/10/20.

Figure 2. Patient presented to ED on 05/15/20 with breakdown of medial calf incision with necrotic tissue.
weeks but developed complaints of knee tenderness and pain soon after stopping the antibiotics. Over the course of four months, she subsequently underwent three more I&D procedures, and, despite these interventions, ultimately underwent a total patellectomy on September 11, 2020. Tissue samples taken at the time grew penicillin-resistant, methicillin-susceptible \textit{S} \textit{aureus} for which she was successfully treated with IV nafcillin over a period of 42 days.

**DISCUSSION**

Chronic wounds are wounds that fail to heal over a period of 4–6 weeks. The etiology of chronic wounds is multifactorial; oxygenation, inflammatory processes, and infections all influence wound healing. Colonization of wounds by endogenous skin pathogens can arrest wound healing. While many of these pathogens are innocuous on the skin's surface, once they break the skin surface and gain access to soft tissues many become virulent. Traumatic injuries and surgical interventions often serve as the point of entry for these pathogens. Most of these infections are polymicrobial and often involve the development of biofilms, disrupting the healing process and complicating delivery of topical and systemic antibiotics. The polymicrobial nature of these infections also complicates diagnosis and treatment; identifying the virulent pathogen in a polymicrobial infection is difficult and often results in inappropriate antimicrobial coverage that can delay treatment and drive antimicrobial resistance.

Physicians have traditionally relied on culture media to identify the offending pathogen and to identify its susceptibilities to antimicrobial therapy. While these cultures often identify the pathogen correctly and guide treatment, their sensitivity and specificity are dependent on the type of swab done and its...
location. Superficial swabs are not as accurate as deep tissue cultures, and often miss the relevant pathogen. Treatment efficacy is contingent on the prompt identification of the infectious pathogens and their susceptibility, but treatment outcome is not always guaranteed. The extent of injury to the anatomic structures and soft tissues may be such that vascular and lymphatic drainage is compromised, creating an excellent environment for recurrent infections.

With an estimated incidence of 2–5% in patients undergoing inpatient surgery, SSTIs place great financial and personal burden on patients and hospitals. While there are certain risk factors associated with the development of chronic wounds (extent of injury, age, diabetes, smoking status, vasculopathies, etc.) our patient had few identifiable risk factors (traumatic injury, occasional consumption of marijuana). This case demonstrates that despite sound clinical judgement and appropriate surgical interventions, culturing techniques, and appropriate antimicrobial coverage for suspected pathogens, chronic wounds secondary to traumatic injury often fail to heal, and may require further surgical revisions, even amputations, to resolve.

**References**