A Woman with a Necrotizing Soft-Tissue Infection

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From the Case Records of the Alpert Medical School of Brown University Residency in Emergency Medicine

DR. PAUL COHEN: Our patient is a 62-year-old woman with type 2 diabetes mellitus who presented to the emergency department complaining of lightheadedness, headaches, poor appetite, as well as several days of fever to 102°F. The patient stated that she developed a tender buttocks' "boil" beginning 4-5 days prior to presentation. She was seen by her primary care physician and was prescribed an oral antibiotic but she continued to have pain. Her blood glucose levels rose above 300, and while the wound spontaneously began to drain two days prior to presentation, the pain persisted. She was referred to the emergency department.

Her past medical history includes coronary artery disease (CAD), diabetes mellitus (DM), and hypertension. She currently takes atorvastatin, lisinopril, triamterene-hydrochlorothiazide, glyburide, metformin, and insulin. She does not use tobacco.

Physical exam was significant for an obese woman in no distress. Her temperature was 37.2°C, HR 84, BP 121/64 and oxygen saturation 98% on room air. Her lungs were clear to auscultation, cardiac exam demonstrated a normal s1s2 with regular rate and rhythm, and no murmurs, gallops, or rubs. The patient's abdomen was obese, soft, with no masses or distention. Her skin was erythematous over the left side of her suprapubic region and was tender to palpation from the suprapubic region to the left labia. There was no crepitus. There was a cavitated abscess on the left buttock with an 8 x 5 cm area of necrosis. On genitourinary exam the left labia had an area of necrosis with erythema and induration, and was tender to palpation

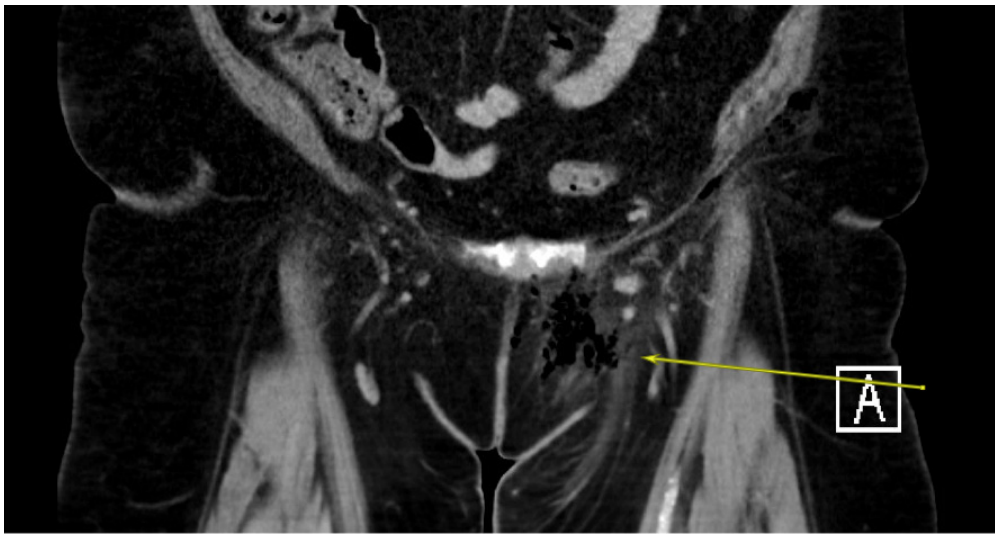
DR. THOMAS GERMANO: What did her laboratory examinations reveal?

DR. COHEN: The patient had a WBC count of 12.2 x 10^9/L with 88% segmented neutrophils and 2% bands. The hemoglobin and hematocrit were 12.4 g/dL and 38.9% respectively. Platelets were normal. The patient's sodium was 121 mEq/L (corrected to 127 mEq/L for a glucose of 573 mg/dl), potassium was 4.6 mEq/L, chloride was 88 mEq/L, CO2 was 17 mEq/L and the anion gap was 16. BUN/Creatinine were 43 mg/dL and 1.3 mg/dL respectively. The patient's CRP was 280 mg/L and the venous pH was 7.22.

DR. HALE SEASON: What was your main concern for this patient?

DR. NICK MUSISCA: Our main concern for this patient was whether she had a necrotizing soft-tissue infection (NSTI) leading to sepsis and significant metabolic abnormalities. NSTIs are fairly rare with only about 1000–2500 cases occurring annually in the US. Incidence is likely increasing, however, although the reasons are obscure—it may be due to increasing virulence of bacterial organisms, better reporting, or increasing resistance to antimicrobials. (1, 2) Patients with an NSTI can have signs and symptoms similar to other, less severe soft-tissue infections, such as cellulitis or an abscess. Clinical findings that should raise suspicion include

Figure 1. Patient's CT scan showing subcutaneous emphysema and stranding in the perineal region (arrow).



pain that is out of proportion to the examination, clinical progression despite antibiotics, systemic toxicity, as well as bullae and skin ecchymosis. Subcutaneous emphysema, a classic finding in an NSTI, is less commonly noted. (1, 3)

DR. JAY BARUCH: This patient was a diabetic. Is there an increased risk for an NSTI in this population?

DR. WILLIAM BINDER: There appear to be certain populations with a higher incidence of NSTIs. Patients who are immunocompromised, drink alcohol heavily, have diabetes, obesity, or peripheral vascular disease, tend to have an NSTI more frequently than young and healthy patients. However, NSTIs do occur in the population without predisposing risk factors. Additionally, there have been some reports in the literature suggesting an association between non-steroidal anti-inflammatory medications and NSTIs, but there is no definitive relationship established at this point. (1)

NSTIs have been recognized for centuries, and Hippocrates described the disorder in the 5th century BC. (4) Initially, NSTIs were classified according to their anatomical location. Fournier, for instance, initially described the necrotizing skin infection that bears his name in the late 19th century. (5) In the modern era, NSTIs are now classified as Type I, Type II, and Type III infections. (6) Type I infections are the most frequent and account for over 70% of NSTIs. (7) These infections are polymicrobial, with gram + cocci, gram - rods, and anaerobes, and are frequently associated with comorbidities, but are not usually preceded by trauma. (1) Type II infections are monomicrobial and typically are due to Group A Streptococcus, although Staphylococcus aureus, Aeromonas hydrophilia, and other organisms have been implicated in these infections. (7) These infections often have an inciting event such as a puncture wound or intravenous drug use. (8) Type III infections are often due to seafood ingestion or warm seawater contamination and are caused by gram negative marine organisms, particularly Vibrio Vulnificans, and have a 30% – 40% mortality. They are more common in Asia. (7) A type IV infection caused by fungal organisms has been described, but these are rare. (8) Interestingly, there is significant heterogeneity in both anatomic location and microbial causation in NSTIs reported by various medical centers. This is likely due to different microbial patterns and environmental factors as well as population characteristics in different sections of the US and globally. (2,9,10)

DR. ANDREW NATHANSON: How is the diagnosis of an NSTI made? Is there a role for imaging? Surgical consultation is usually the most important intervention in these cases.

DR. MUSISCA: Historically, NSTIs were associated with a mortality rate of 30%–40%. Early diagnosis and treatment, rapid and aggressive surgical intervention, and advancements in critical care medicine have lowered the mortality rate in recent years to 10%–20%. (11,12,13) A high index of suspicion is usually necessary to make the diagnosis as common presenting features such as swelling, pain, and erythema, are non-specific. (14) Laboratory tests have contributed to early diagnosis, but they are not definitive. The laboratory risk indicator for necrotizing fasciitis (LRINEC), a risk stratification score, has not been validated in a multicenter prospective trial. (7,15,16) If the extent of disease on exam is equivocal, bedside exploration can facilitate early diagnosis and can be performed under local anesthesia.

DR. FRANCES SULLIVAN: Misdiagnosis and delayed diagnosis may have significant consequences in NSTIs. In one review of over 1400 patients with NSTIs, there was a 71% mean rate of misdiagnosis because physicians diagnosed cellulitis, abscess, or soft-tissue trauma. (14) Such delay can lead to further soft tissue destruction, systemic illness and a higher mortality. Plain films are not sensitive in detecting evidence of an NSTI, but a recent study demonstrated that CT has excellent sensitivity (97%) in identifying characteristics of an NSTI, such as thickened and enhanced skin and fascia, deep abscesses, and fluid collections. (17) Subcutaneous gas was noted in only about 70% of cases. (17) Consequently, we obtained a CT scan which revealed extensive subcutaneous inflammatory stranding and subcutaneous emphysema extending from the left buttock to the perineal region and superiorly to the ventral abdominal wall and adjacent to the iliac crest laterally. (**See Image 1.**) A surgical consultation was obtained.

DR. ANGELA JARMAN: Is there a role for medical treatment?

DR. MUSISCA: Antibiotics are a component of early treatment and should cover gram positive skin flora including MRSA, as well as gram negative organisms and anaerobes. Clindamycin is unique because it mitigates toxin production and the Surgical Infection Society and the Infectious Disease Society of America (IDSA) both recommend combination therapy with a beta-lactam antibiotic and clindamycin in group A Streptococcus infections. Given that the causative agent for an NSTI is usually not initially known, it is reasonable to utilize combination therapy as an initial treatment in the emergency department. (7, 18) However, antibiotics are limited in their ability to penetrate infected necrotic tissue, and ultimately, surgical debridement is imperative in NSTIs.

DR. MATIN SHAH: Are there additional therapeutic interventions for patients with an NSTI? What was the outcome for this patient?

DR. COHEN: Medical therapies such as intravenous immunoglobulin (IVIG) and hyperbaric oxygen (HBO) have been used but data are limited. Studies of IVIG therapy for patients with necrotizing fasciitis show minimal or no benefit. (19, 20) Hyperbaric oxygen therapy inhibits anaerobic

bacteria growth, potentiates antibiotic bactericidal activity, and limits clostridium toxin release in animal and human studies. (1) However, HBO use in polymicrobial NSTIs has had mixed results. Given the unique resources needed, and its mixed efficacy in humans, its use is generally institution specific and should not delay operative intervention. (1, 21)

The patient received two liters of 0.9% saline and was started on an insulin drip and intravenous vancomycin, piperacillin-tazobactam, and clindamycin. She was subsequently taken to the operating room overnight for extensive surgical debridement. Wide tissue incisions were made along the abdominal wall, buttocks, and perineal region. Surgical findings included significant induration, numerous small, septated abscesses, necrotic tissue, purulent discharge, and non-adherent fascia that was easily dissected. The excisions were extended to healthy, bleeding tissue to encompass the entirety of the infection. The wounds were packed and the patient was admitted to the surgical intensive care unit, where she was kept intubated for anticipated further surgical debridement. It is very common for surgery to take a "second look" in these cases.

After her arrival to the surgical intensive care unit, she became hypotensive and oliguric, requiring vasopressors and continued fluid resuscitation. Over the ensuing day her hemodynamic status improved but an area of erythema was noted to persist in her lower abdomen. She was taken to the operating room a second time where she was noted to have an additional abscess which organized despite the original debridement, as well as necrotic skin edges along the abdominal and perineal wounds. These were drained and packed, and the wounds were excised. After a 15-day hospital course, she was discharged to a skilled nursing facility with twice daily dressing changes.

Patient's recovering from NSTIs have significant morbidity with high rates of depression and PTSD and inability to return to previous employment. Additionally, they have a higher rate of premature death from infectious causes. (22, 23) Consequently, while our patient has improved, she will require close follow-up with both her primary care physician and her surgeons.

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