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Chronic Pain Management after Necrotizing Soft Tissue Infection (NSTI): A Case Report

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Abstract

Background: Necrotizing soft tissue infections (NSTIs) are potentially life threatening medical emergencies associated with devastating and rapidly spreading destruction of soft tissues. Atypical presentations and delayed early diagnosis can be significant challenges in managing NSTIs. The infectious process can start at any part of the body with rapid progression leading to limb amputation and high mortality rate. We present a case of a patient with NSTI, the sequelae and management of the chronic pain that developed. **Aim:** This case report looks to shed light on the importance of a plan for management of subacute and chronic pain in treating patients who present with Necrotizing soft tissue infection. **Case presentation:** A 53-year-old female who presented with septicemia and was subsequently admitted and treated for NSTI in 2014 resulting in amputation of her distal foot, toe digits, and now with ongoing chronic wound of the lower extremities along with chronic pain. **Conclusion:** Chronic pain as part of the sequelae of Necrotizing soft tissue infections needs to be anticipated by the health care management team in order to optimize patient care post operatively.

Keywords

Necrotizing Soft Tissue Infections (NSTIs), Chronic Pain, Sequelae

1. Introduction

Necrotizing soft tissue infections are uncommon but aggressive infections with potential for high morbidity and mortality. The basic pathology involves invasion and rapid spread of microbial pathogens into the subcutaneous tissue where the

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bacteria release enzymes and toxins that cause tissue ischemia and necrosis. Concomitant stimulation of production of cytokines promotes systemic toxicity, shock and multisystem organ failure. Early aggressive treatment to reduce complications and improve survival rate, is required [1].

Prompt diagnosis and rapid care, including immediate use of appropriate antibiotic therapy and extensive surgical treatment can improve the outcome. Wong *et al.* [1] analyzed factors correlated to adverse outcomes. Three factors were found to affect survival: advanced age, presence or two or more associated comorbidities, and delay from admission to operation of more than 24 hours.

Etiology is commonly trauma or underlying soft tissue invasion by either aerobic and anaerobic bacterial pathogens. In most cases, the infection is polymicrobial. Most common pathogens are *streptococcus* and *staphylococcus* species others include *Vibrio vulnificus* from sea water exposure; *Aeromonas hydrophilia* from fresh water exposure. Risk factors include injectable drug use, alcohol abuse, obesity, diabetes mellitus, peripheral vascular disease, immunosuppression, malignancy and increased age.

Early signs and symptoms of NSTI are identical to those seen with cellulitis or abscesses potentially making the correct diagnosis difficult.

Wang *et al.* [1] proposed three clinical stages of NF. In the early stage, skin at the infection site is swollen, warm, and severely painful; the pain is out of proportion to the other signs. In the intermediate stage, the affected skin develops severe ischemia, thrombosis of blood vessels supplying the fascia, and blisters with serous fluid. In the late stage, the infected skin becomes necrotic, gray, and dark. In addition, blood vessels supplying the fascia are blocked, there is sensory loss (particularly to pain and touch sensations) and there is gas production from the tissues, which produces a "twisting sound" on palpation.

The clinical presentation will vary depending on the microbiologic pathogen responsible, as well as the anatomical region and depth of infection. In general, erythema, pain beyond the margins of obvious infection, swelling, and fever are the most common findings on physical examination. NSTI presentations occur late in the course of the disease; bullae, skin ecchymosis preceding skin necrosis, presence of gas in the tissues by examination or radiographic evaluation, cutaneous anesthesia.

Other clinical signs that are often seen in NSTI, but are less specific, include pain out of proportion to examination, edema extending beyond the skin erythema, systemic toxicity, and progression of infection despite antibiotic therapy. One of the most important pieces of evidence to support the diagnosis of NSTI is the chronology of disease ascertained on history. The symptoms and signs of NSTI usually progress very rapidly. This makes early diagnosis critical and becomes vitally important to clinicians making treatment decisions. Patients who present with signs and symptoms of systemic toxicity or shock already have very advanced disease, and appropriate surgical evaluation must happen quickly.

Complications: Multi organ failure, septic shock with cardiovascular collapse,

scarring with cosmetic deformity. Limb loss, sepsis, chronic pain and metastatic cutaneous plaques.

We present the case of a 53-year-old female who was admitted with septicemia and NSTI of the right upper extremity with subsequent sequelae with development of chronic pain. Informed consent was obtained from the patient for this case report.

2. Case Presentation

In 2014, the patient at that time aged 48 was taken to the ED due to sudden onset armpit pain, lethargy, weakness, vomiting and diarrhea starting 24 hours prior. Patient states she was on vacation in a cabin in the mountains in North Carolina with family. She noticed a painful "raspberry red" blister with a black spot on her left hand fifth digit one evening. She does not recall any specific precipitating events, but does remember feeling a "prick-like" pain in the finger earlier in the day. She washed her hands with running tap water and continued on her usual activities. Over the course of the evening she began to feel lethargic and nauseous. Over the course of the night she describes vomiting copious amounts of non bloody non bilious vomitus and having watery diarrhea. She did not take any medications. The following morning, family members found her difficult to arouse but responsive. Patient states she felt weak and felt like "she was hit by a truck". There was also new-onset sharp left-sided armpit-shoulder pain. She was rushed to the emergency department. The last thing she recalls is being prepped for a vaginal exam on speculation of toxic shock syndrome. After that she lost consciousness and the next week's events were described to her by family in latter days. She states she was transferred to a nearby facility for higher level care.

Hospital course: The patient was in a critical state in the ICU for an extended period with multiple debridement procedures of the left axillary area including some bedside as she was too critical at times to be taken to the operating room. She was on CVVHD at one point, was on a ventilator for respiratory failure and eventually required a tracheostomy for respiratory management.

She later required amputation of her left lower extremity digits and her right metatarsals. From the ICU she was moved to step down and was in the step down unit for one month prior to being moved to a rehabilitative nursing facility for another month.

Her total duration of stay in the hospital and nursing facility was 4 months.

Prior to this hospitalization, her medical history was significant for a myocardial infarction (MI) in 2012 for which she had a stent placed, right foot metatarsal fracture that was fixed without surgery and chronic osteodegenerative back pain. She had smoked one pack a day for 27 years and had quit following her MI. At the time of the NSTI, the only medication she was taking was a nasal decongestant for seasonal allergies.

Sequelae:

Upon discharge from rehab she had ongoing challenges. She has had chronic

non-healing wounds on both feet. She had a pseudomonas non-necrotic infection that affected her bilateral ankles. Subsequent years brought additional surgeries to manage the wounds in her feet. She went on to have outpatient debridement and wound dressing of the bilateral feet done which healed with a lot of scarring limiting her already impaired mobility. In 2018, she underwent "bone shaving of her right foot at the site of her prior amputation.

She had recurrent osteomyelitis at the base of her left big toe in November 2019 and March 2020, with two rounds of IV antibiotics and finally improving following hyperbaric oxygen treatment.

Lower extremity exam:

On presentation to our clinic, exam revealed midfoot amputation distal right foot with an open area at the bottom of right foot the size of a quarter (Figure 1).

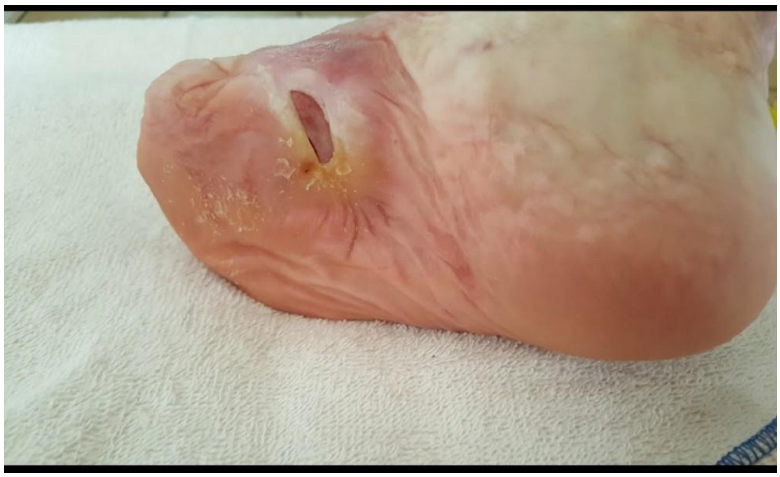

Figure 1. Right foot at presentation to the clinic.

Left food exam revealed left foot amputation of toes: left foot had a distal wound distal at the bottom of foot (Figure 2).

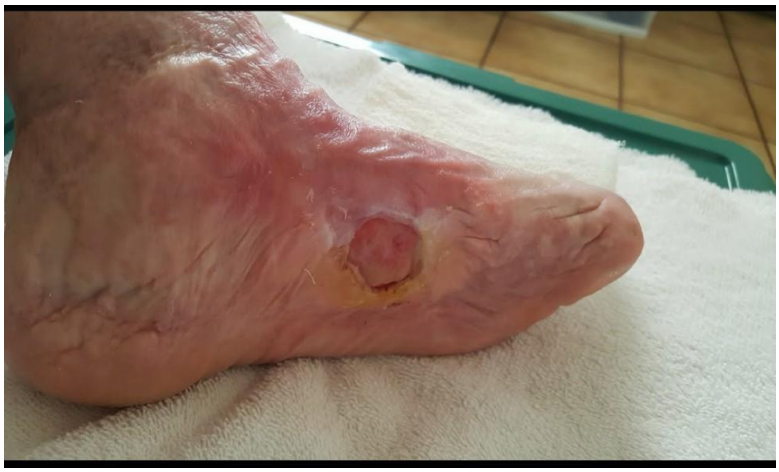

Figure 2. Left foot at presentation to the clinic.

3. Discussion

Our patient's presentation was pathognomonic for necrotizing soft tissue infection with evolution from a dermohypodermal infections *i.e.* erysipelas to cellulitis and onto deeper infection; necrotizing fasciitis. The presentations are characterized by soft tissue erosions. These conditions are a rare entity in the day to day clinical practice thus warranting a keen clinical acumen to diagnose and treat early to avert their devastating fast spread and long term morbid outcomes.

Inflammatory response following superficial dermohypodermal infection by the causative organisms result in venous micro-thrombosis, arterial vasculitis, local hemorrhage with secondary skin infarcts. The resulting edema is as a consequence of the release of pathogen virulent factors and toxins. Liquefactive necrosis of tissues results in foul smelling thin watery fluid clinically referred to as "dishwater pus".

Spread of infection to deeper underlying tissues resulting in fasciitis and myonecrosis causes bullae to develop as infection progresses, if in case of clostridium species gas production can be observed. Rapid extension of the lesions is evidenced by systemic manifestations of septic shock as the organisms disseminate into the bloodstream, Fat necrosis can result in severe hypocalcaemia [2]. There is high mortality with some others placing it at 76% [3] and 30% in the elderly [3].

Treatment modalities include aggressive surgical debridement, broad-spectrum antibiotics, hemodynamic support and general cardiorespiratory supportive care to maintain vital organ functions. Surgery is the first choice treatment of NF including early debridement of all necrotic tissues and drainage of involved fascia planes by fasciotomy. Prompt surgery has been associated with improved survival, compared to delayed intervention [4]**.** Surgery should be performed within 24 hours of presentation as the mortality rate significantly increases beyond this period [5].

The cooperation of different medical specialties including intensivists, surgeons and infectious disease specialists is crucial for optimal post-operative care, Adequate nutritional support improves survival [3] [6]. With persistent inflammation and intravascular coagulation, patients are at high risk of thrombosis. As thrombo-embolic complications are the second cause of mortality [7], appropriate anticoagulation therapy is needed.

Very few studies have been done to describe the chronicity of pain in these patients and the need for effective pain control. In addition to the supportive post-operative care from other specialties Wang *et al.* **[1]** proposed that in the last stage of NF, the blood vessels supplying the fascia get blocked, resulting in sensory loss (particularly for pain and touch sensations) which may be a contributor to the chronic pain. The choice of analgesia should be correctly considered to achieve chronic pain control with minimal side effects.

Current pain management

Our patient presented to our clinic in November 2019 with ongoing high levels

of pain. She reported a pain score of 10 on the numerical pain rating scale NRS [8]. She was frustrated and tearful when discussing her case as she was especially dismayed at the high levels of ongoing pain and reduced mobility due to the pain in her feet.

Prior to seeing us, her pain was being managed mainly by her podiatrist who asked her to seek care with a pain clinic for more comprehensive management. She was on a high dosage of opioid medication (oxycodone 20 mg 6x/day) but still with ongoing high levels of pain.

We had a discussion on multimodal care with the patient. Due to current and ongoing infections, injection therapy was not an option for the patient. The patient had a fitted orthotic boot to allow her to ambulate better secondary to her amputation.

The patient was interested in the use of medical marijuana under the state's compassionate care act. The patient was started on medical cannabis regimen and subsequently the following medications were added, which allowed us to titrate and lower her opioid dosage to lower than 50mg Morphine equivalent per 24 hours.

The patient was started on a regimen of

- gabapentin 300 mg tid;
- lidocaine 4% patch 1 patch on for 12 hours and off 12 hours (the patient had to buy over the counter patches herself as insurance would not cover the medication);
- tizanidine 4 mg as needed for lower extremity spasms.

We briefly detail the mechanism of action of each of the medications below:

Tizanidine, a centrally acting skeletal muscle relaxant acts by inhibition of the pre-synaptic motor neurons via agonist actions of alpha-2 adrenergic receptor sites reduces spasticity. The inhibition causes reduction in excitatory amino acids e.g., glutamate and aspartate which cause neuronal firing that leads to muscle spasms, with the strongest action being in the spinal polysynaptic pathways [9].

Lidocaine acts on the sodium channels of dysfunctional nociceptors in the dermal layers directly underlying the area of patch application, it binds to the voltage gated sodium channels of dysfunctional nociceptors that also may be abnormally active in the muscles and soft tissues in chronic myofascial pain syndromes, leading to a reversible block of action potential propagation this reduces firing of sodium channels on damaged fibres [10].

Cannabis exerts its action via its two major active components, delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD). The major active ingredient in cannabis, THC, activates cannabinoid receptors type 1 and 2 (CB1 and CB2 receptors). Interestingly, CBD does not seem to act through these receptors. CBD also may reduce unwanted psychotropic effects of THC and potentiate other effects (*i.e.*, anticonvulsant, analgesic, etc.) when given concomitantly, CB1 receptors are most widely expressed in the central and peripheral nervous systems,

while CB2 receptors are mostly expressed in immune cells and therefore in the periphery. As a result, the mechanism of action of cannabis seems to be through THC via neuronal actions (centrally and peripherally). These actions are responsible not only for the analgesic effects of cannabis but also for its psychotropic (*i.e.*, euphoric or "high") effects [11] [12].

Gabapentin, an analog of gamma amino butyric acid GABA is used for the treatment of seizures and post herpetic neuralgia as well as acute and neuropathic pain. Works by depression of presynaptic excitatory input onto dorsal horn neurons through interactions with a2d-1 subunits that are unregulated after injury. They inhibit forward trafficking of a2d-1 from the dorsal root ganglion, their recycling from endosomal compartments, thrombospondin mediated processes and stimulate glutamate uptake Mechanisms not directly related to neurotransmitter release at dorsal horn include inhibition of descending serotonergic facilitation, stimulation of descending inhibition, anti-inflammatory actions and influence on the affective component of pain [13] [14].

Opioid drugs work as analgesics by binding at opioid receptors in the central and peripheral nervous system and the gastrointestinal tract. The major opioid receptor subtypes are mu, delta and kappa. Sigma receptors associated with the N-methyl-D-aspartate ion channel do not meet all the criteria for true opioid receptors, but are capable of providing analgesia. Delta and mu may co-exist in the same cell; kappa does not co-exist with mu or delta. The mechanisms by which they achieve their effect also appear to be different, mu and delta operating through the potassium channel, kappa via the calcium channel [15].

4. Conclusions

With the medication regimen, the patient's pain and her NRS score reduced to a 5 from a previous 10. The pain was tolerable but even more importantly, her level of function improved. She was now able to take seasonal jobs where she was unable to prior.

Suijker *et al.* studied the long-term impact of NSTI on survivors and found long term consequences along the lines of re-infection, altered appearance, traumatic stress symptoms; experiences similar to that of burn survivors [16].

What this case report endeavors to emphasize is the debilitating pain and reduced function that can emanate from NSTI and the importance of a plan and a focus on long-term chronic pain management for these patients. This focus is crucial in providing the patients the ability to function at the highest level they can with reduced pain using a multimodal multispeciality approach. With a multimodal approach, our wonderful patient continues to thrive despite her health challenges and we are encouraged by her positiveness despite her challenges. It is a good reminder that NSTI requires not only acute and subacute management but just as crucial, a plan for chronic pain syndrome that can emanate and can significantly reduce the quality of life of our patients.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Wang, Y., Wong, C. and Tay, Y. (2007) Staging of Necrotizing Fasciitis Based on the Evolving Cutaneous Features. *International Journal of Dermatology*, **46**, 1036-1041. https://doi.org/10.1111/j.1365-4632.2007.03201.x

[2] Canoso, J.J. and Barza, M. (1993) Soft Tissue Infections. *Rheumatic Disease Clinics of North America*, **19**, 293-309. https://doi.org/10.1016/s0889-857x(21)00188-5

[3] Childers, B.J., Potyondy, L.D., Nachreiner, R., Rogers, F.R., Childers, E.R., Oberg, K.C., *et al.* (2002) Necrotizing Fasciitis: A Fourteen-Year Retrospective Study of 163 Consecutive Patients. *The American Surgeon*, **68**, 109-116. https://doi.org/10.1177/000313480206800201

[4] McHenry, C.R., Piotrowski, J.J., Petrinic, D. and Malangoni, M.A. (1995) Determinants of Mortality for Necrotizing Soft-Tissue Infections. *Annals of Surgery*, **221**, 558-565. https://doi.org/10.1097/00000658-199505000-00013

[5] Wong, C., Chang, H., Pasupathy, S., Khin, L., Tan, J. and Low, C. (2003) Necrotizing Fasciitis. *The Journal of Bone and Joint Surgery-American Volume*, **85**, 1454-1460. https://doi.org/10.2106/00004623-200308000-00005

[6] Andreasen, T.J., Green, S.D. and Childers, B.J. (2001) Massive Infectious Soft-Tissue Injury: Diagnosis and Management of Necrotizing Fasciitis and Purpura Fulminans. *Plastic and Reconstructive Surgery*, **107**, 1035. https://doi.org/10.1097/00006534-200104010-00020

[7] Bruin-Buisson, C. (2001) Stratégies de prise en charge des fasciites nécrosantes. *Annales de Dermatologie et de Vénéréologie*, **128**, 394-403.

[8] Breivik, H., Borchgrevink, P.C., Allen, S.M., Rosseland, L.A., Romundstad, L., Breivik Hals, E.K., *et al.* (2008) Assessment of Pain. *British Journal of Anaesthesia*, **101**, 17-24. https://doi.org/10.1093/bja/aen103

[9] Fogelholm, R. and Murros, K. (1992) Tizanidine in Chronic Tension-Type Headache: A Placebo Controlled Double-Blind Cross-Over Study. *Headache: The Journal of Head and Face Pain*, **32**, 509-513. https://doi.org/10.1111/j.1526-4610.1992.hed3210509.x

[10] Argoff, C.E. (2000) New Analgesics for Neuropathic Pain: The Lidocaine Patch. *The Clinical Journal of Pain*, **16**, S62-S66. https://doi.org/10.1097/00002508-200006001-00011

[11] Laprairie, R.B., Bagher, A.M., Kelly, M.E.M. and Denovan-Wright, E.M. (2015) Cannabidiol Is a Negative Allosteric Modulator of the Cannabinoid CB_1 Receptor. *British Journal of Pharmacology*, **172**, 4790-4805. https://doi.org/10.1111/bph.13250

[12] Russo, E.B., Burnett, A., Hall, B. and Parker, K.K. (2005) Agonistic Properties of Cannabidiol at 5-HT1a Receptors. *Neurochemical Research*, **30**, 1037-1043. https://doi.org/10.1007/s11064-005-6978-1

[13] Bauer, C.S., Nieto-Rostro, M., Rahman, W., Tran-Van-Minh, A., Ferron, L., Douglas, L., *et al.* (2009) The Increased Trafficking of the Calcium Channel Subunit A2δ-1 to Presynaptic Terminals in Neuropathic Pain Is Inhibited by the A2δ Ligand Pregabalin. *The Journal of Neuroscience*, **29**, 4076-4088. https://doi.org/10.1523/jneurosci.0356-09.2009

[14] Su, T., Lunney, E., Campbell, G. and Oxender, D.L. (1995) Transport of Gabapentin,

a γ-Amino Acid Drug, by System L α-Amino Acid Transporters: A Comparative Study in Astrocytes, Synaptosomes, and CHO Cells. *Journal of Neurochemistry*, **64**, 2125-2131. https://doi.org/10.1046/j.1471-4159.1995.64052125.x

[15] Alan North, R. (1986) Opioid Receptor Types and Membrane Ion Channels. *Trends in Neurosciences*, **9**, 114-117. https://doi.org/10.1016/0166-2236(86)90038-x

[16] Suijker, J., Stoop, M., Meij-de Vries, A., Pijpe, A., Boekelaar, A., Egberts, M., *et al.* (2023) The Impact of Necrotizing Soft Tissue Infections on the Lives of Survivors: A Qualitative Study. *Quality of Life Research*, **32**, 2013-2024. https://doi.org/10.1007/s11136-023-03371-8