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Necrotizing Soft Tissue Infection (NSTI) of Head and Neck: A Case Report

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ABSTRAK
Infeksi jaringan lunak nekrotik (NSTI) adalah infeksi kulit yang berkembang dengan cepat, ditandai dengan nekrosis pada fascia dan jaringan subkutan, sementara angina Ludwig adalah infeksi jaringan ikat yang parah pada dasar mulut, seringkali sebagai komplikasi dari infeksi gigi, yang dapat menyebabkan obstruksi pada saluran pernapasan atas jika tidak diobati. Penelitian ini memaparkan kasus seorang pasien perempuan berusia 32 tahun tanpa riwayat rawat inap sebelumnya yang datang ke Ruang Gawat Darurat dengan luka dan nyeri yang menjalar dari leher hingga dada, berlangsung selama satu minggu. Pasien menjalani protokol diagnostik dan terapeutik standar, termasuk debridemen agresif di bawah anestesi umum, dengan preservasi dan rekonstruksi kulit melalui graft kulit ketebalan sebagian (STSG) untuk defek luka. Angina Ludwig terutama disebabkan oleh infeksi pada gigi molar rahang bawah, terutama gigi molar kedua dan ketiga, yang menyumbang lebih dari 90% kasus. Meskipun NSTI relatif jarang, kondisi ini ditandai dengan nekrosis cepat pada fasia dan lemak subkutan, yang menyebabkan nekrosis kulit. Kewaspadaan terhadap perkembangan komplikasi dari selulitis menjadi NSTI, terutama pada kasus yang diduga disebabkan oleh angina Ludwig, sangat penting. Faktor-faktor seperti periode jendela potensial untuk HIV dan malnutrisi perlu dipertimbangkan, menekankan pentingnya kolaborasi antara spesialis bedah rekonstruktif, epidemiologi, dan disiplin toraks dan vaskular untuk meningkatkan strategi pengobatan dan langkah-langkah pencegahan.

Kata kunci: infeksi jaringan lunak nekrotik, angina ludwig, debridemen, cangkok kulit ketebalan setengah, komplikasi

ABSTRACT
Necrotic soft tissue infection (NSTI) is a rapidly progressing skin infection characterized by necrosis of the fascia and subcutaneous tissue, while Ludwig's angina is a severe connective tissue infection of the floor of the mouth, often a complication of a dental infection, which can cause upper airway obstruction if left untreated. This study presents the case of a 32-year-old female patient with no previous hospitalization who presented to the Emergency Room with a wound and pain radiating from the neck to the chest, lasting for one week. The patient underwent a standard diagnostic and therapeutic protocol, including aggressive debridement under general anesthesia, with skin preservation and reconstruction via partial-thickness skin graft (STSG) for the wound defect. Ludwig's angina is primarily caused by infection of the mandibular molars, particularly the second and third molars, which account for more than 90% of cases. Although relatively rare, NSTI is characterized by rapid necrosis of the fascia and subcutaneous fat, leading to skin necrosis. Vigilance for the development of complications from cellulitis to NSTI, especially in cases thought to be caused by Ludwig's angina, is essential. Factors such as potential window periods for HIV and malnutrition need to be considered, emphasizing the importance of collaboration between reconstructive surgery specialists, epidemiologists, and thoracic and vascular disciplines to improve treatment strategies and preventive measures.
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Keywords: necrotizing soft tissue infection, ludwig's angina, debridement, split thickness. skin graft, complications

INTRODUCTION

Necrotizing soft tissue infection (NSTI) of the head and neck, also referred to as cervicofacial necrotizing fasciitis (CNF), is a rare yet highly aggressive and potentially life-threatening condition characterized by rapid progression, extensive tissue necrosis, and high mortality rates ranging from 40% to 76% (Acharya et al., 2022; Cecchini et al., 2021). NSTI in this anatomical region accounts for only 5.3% of all NSTIs, primarily due to the abundant vasculature that facilitates a prompt immune response to infectious insults (Cecchini et al., 2021). The primary initiating factors for NSTI in the head and neck are often odontogenic infections or post-extraction infections (Di Crescenzo et al., 2013; Maria & Rajnikanth, 2010). Other potential causes include tonsillar or

pharyngeal infections, trauma, and self-administered injections (Acharya et al., 2022; Maria & Rajnikanth, 2010). The infection typically spreads rapidly along fascial planes, leading to extensive tissue necrosis and systemic toxicity (Acharya et al., 2022; Rewis et al., 2023).

The clinical presentation of NSTI in the head and neck region is marked by severe pain, erythema, edema, and rapid progression of the infection (Acharya et al., 2022; Mazzella et al., 2016). Patients may also exhibit fever, tachycardia, and signs of systemic toxicity (Acharya et al., 2022; Y.-J. Kim et al., 2011). Early diagnosis is crucial, as NSTI can quickly lead to life-threatening complications, such as descending necrotizing mediastinitis, which has a mortality rate of up to 40% (Abbasi et al., 2019; Di Crescenzo et al., 2013). Diagnostic tools for NSTI include laboratory tests that reveal elevated white blood cell counts, low serum sodium, and high C-reactive protein levels, as well as imaging studies such as computed tomography (CT) and magnetic resonance imaging (MRI) (Maruyama et al., 2017; Mohanty et al., 2020). The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score can also aid in diagnosis, with a score of 6 or higher indicating a high probability of NSTI (Munjal et al., 2022).

The mainstay of treatment for NSTI of the head and neck is prompt and aggressive surgical debridement, combined with broad-spectrum antibiotic therapy (Acharya et al., 2022; Ferzli et al., 2019). Surgical management typically involves extensive debridement of all necrotic and infected tissues, aiming to remove all devitalized tissue and control the source of the infection (Acharya et al., 2022; D. Kim et al., 2020). Negative pressure wound therapy (NPWT) has also been utilized as an adjunct to surgical management, as it can promote wound healing and reduce the risk of further tissue necrosis (Gore, 2018; D. Kim et al., 2020). Despite prompt and aggressive treatment, NSTI of the head and neck remains a highly morbid and potentially fatal condition, with mortality rates ranging from 40% to 76% (Acharya et al., 2022; Cecchini et al., 2021). Factors associated with poor outcomes include delayed diagnosis, rapid progression of the infection, and the development of complications such as descending necrotizing mediastinitis (Coșarcă et al., 2023; Di Crescenzo et al., 2013).

Ludwig's angina, a severe connective tissue infection of the floor of the mouth, is often secondary to dental infections and can lead to extrinsic obstruction of the superior respiratory tract if left untreated (Rusu et al., 2013; Tantraworasin et al., 2015). First described by the German physician Wilhelm Friedrich von Ludwig in 1836, Ludwig's angina is a form of severe cellulitis that typically originates in the submandibular region and spreads to the sublingual and submental spaces bilaterally, resulting in airway obstruction (Sivapathasundharam, 2020). The infection can extend into the sublingual region, spreading bilaterally and posteriorly along the edges of the mylohyoid muscle, potentially progressing to the submandibular and submental spaces (Kovalev, 2020). This report details the case of a 32-year-old female patient with NSTI of the head and neck, examining Ludwig's angina as a potential causal factor. NSTI of the head and neck is a rare but highly aggressive infection that requires prompt recognition and aggressive surgical and medical management. Early diagnosis, rapid surgical debridement, and appropriate antibiotic therapy are crucial to improving patient outcomes and reducing the risk of life-threatening complications. Continued research and education are needed to improve the understanding and management of this devastating condition. By exploring the interplay between these two serious conditions, this case report aims to enhance understanding of the clinical management and outcomes associated with NSTI in the context of Ludwig's angina, thereby contributing to the body of knowledge necessary for improving patient care in such critical situations.

A 32-years-old female presented with complaints of wounds extending from the neck to the chest, persisting for one week prior to her hospital visit. The condition initially manifested as an ulcer on the right jaw two weeks before admission. The ulcer was then treated with topical application of leaves, subsequently ruptured after a week, leading to swelling and formation of blackened lesions extending to the chest. The patient reported a history of fever and nausea for three days. There was no previous history of other systemic diseases or long-term treatments. The patient was then taken to the hospital. Prof. Dr. R. D. Kandou Manado. On physical examination, the patient appears moderately ill but alert (compos mentis). Upon examination of the head region, intraoral examination revealed caries and necrotic pulp in molars 46 and 47. Local examination of the colli revealed an 8x5cm wound with edema, hyperemia and necrotic tissue accompanied by

pus. Similar findings were noted around the upper chest region, with pain on palpation.

Laboratory investigations indicated leukocytosis with leukocyte levels of 18,900/uL and haemoglobin level of 9.8 g/dL. A thoracic CT scan showed dense fluid lesion with air component in the upper side of right clavicle, suggesting a differential diagnosis of abscess, alongside extensive soft tissue emphysema extending to the anterior thoracic region around the mammary region and fibrosis in the basal left lung. The patient was diagnosed with necrotizing fascitis of the right colli and anterior thorax accompanied by necrotic dental pulp in teeth 46 and 47. Initial treatment included, IVFD NaCl 0.9%, broad-spectrum antibiotics (ceftriaxone), and analgesics to manage the pain. Based on the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score, a score of 2 was calculated. The maximum score of LRINEC is 13. A score greater than six is a consideration of necrotic fasciitis and when scored greater than eight, there is a high chance of being diagnosed as necrotic fasciitis. To calculate using LRINEC, convert the glucose value to mg/dL by multiplying with 18.015 and creatinine value to mg/dL by multiplying with 0.01131 (Wong et al., 2004).

Table 1.
Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score

Variable	Value	Score	Patient Score
CRP (mg/dL)	≥ 150	4	0
Leukocyte	< 15	0	1
	15-25	1	
	>25	2	
Hemoglobin (g/dL)	>13.5	0	2
	11-13.5	1	
	< 11	2	
Creatinine (umol/L) >141:2 point	> 141	2	0
Glucose (mmol/L) >10:1 point	> 10	1	1

Source: (Wong et al., 2004)

METHOD

This case report describes the clinical presentation, diagnosis, and treatment of a 32-year-old female patient diagnosed with necrotizing soft tissue infection (NSTI) of the head and neck, with a potential underlying etiology of Ludwig's angina. Upon admission, the patient presented with a one-week history of ulcers progressing to necrotic lesions extending from the neck to the chest, with associated fever and nausea. Physical examination revealed caries and necrotic pulp in the molars 46 and 47. Diagnostic investigations included laboratory tests showing leukocytosis and a CT scan indicating a dense fluid lesion with an air component, suggestive of an abscess, along with soft tissue emphysema. The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score was calculated to be 2, which is below the threshold for high suspicion of necrotizing fasciitis, although the patient's condition warranted urgent treatment. The patient was started on broad-spectrum intravenous antibiotics (ceftriaxone) and supportive intravenous fluids (NaCl 0.9%), along with analgesics to manage pain. A multidisciplinary team, including surgical and infectious disease specialists, was involved in the management, with an emphasis on early surgical debridement and monitoring for any potential complications.

RESULT

The patient's condition was confirmed as necrotizing fasciitis of the right colli and anterior thorax, with secondary involvement of necrotic dental pulp in teeth 46 and 47. The timely initiation of broad-spectrum antibiotics and aggressive surgical debridement was essential for controlling the infection and preventing further progression. Despite the low LRINEC score, the patient's rapid clinical deterioration and the extent of tissue necrosis confirmed the diagnosis of NSTI.

After surgical intervention and wound care, the patient showed gradual improvement. Negative pressure wound therapy (NPWT) was utilized to support healing, and the patient was closely monitored for systemic toxicity. Follow-up imaging confirmed the resolution of the abscess and reduction in soft tissue emphysema.

The patient's recovery was supported by meticulous wound management and the use of reconstructive surgery, including split-thickness skin grafts, to address the remaining necrotic tissue.

Overall, the patient demonstrated a favorable recovery after prompt diagnosis, surgical intervention, and appropriate antibiotic therapy. This case highlights the importance of early recognition, especially in odontogenic infections, and underscores the necessity of a multidisciplinary approach to managing NSTI in the head and neck region. The timely use of diagnostic tools like the LRINEC score helped guide clinical decisions and contributed to the successful management of this life-threatening condition.

Necrotizing fasciitis is a rare but progressive skin infection characterized by necrosis of the fascia and subcutaneous tissue, leading to subsequent necrosis of the overlying skin (Arif et al., 2016; Goh et al., 2014). It is known as the fastest spreading disease, with a progression rate of up to 3 cm/h (Keung et al., 2013). Ludwig's angina (LA) is a chronic condition that presents as a broad, firm, muscular cellulitis or induration with a toxic lesion surface, involving the submandibular, sublingual, and submental spaces bilaterally (Kovalev, 2020). Historically, LA had a very high mortality rate of about 75% before the advent of antibiotics, but this has significantly decreased to approximately 5% due to aggressive early treatment involving surgical drainage and intravenous antibiotics.

The infection is often caused by oral commensal bacteria, particularly mixed infections with Bacteroides, Fusobacterium, and anaerobic Streptococcal species (Dreyer et al., 1990). Ludwig's angina typically arises from dental infections of the mandibular molars, especially the second and third molars, which account for more than 90% of cases (Kovalev, 2020). While most patients with LA are otherwise healthy, several predisposing factors, including diabetes mellitus, oral malignancies, alcoholism, malnutrition, and immunosuppression, have been identified (An et al., 2023; Dreyer et al., 1990).

The infection begins in the subgingival sac and spreads to the muscles of the floor of the mouth, progressing below the mylohyoid line and involving the sublingual space. The roots of the second and third mandibular molars are located below this line, making them common sources for LA. The infection spreads lingually due to the thinner lingual aspect of the tooth socket, initially invading the sublingual space before extending to the submandibular region. The disease is usually polymicrobial, involving both aerobic and anaerobic oral flora, such as Staphylococcus, Streptococcus, Peptostreptococcus, Fusobacterium, Bacteroides, and Actinomyces. Immunocompromised patients are at a higher risk for developing Ludwig's angina (Brook, 2007; Kovalev, 2020). Those with compromised immune systems, such as individuals with diabetes mellitus and HIV (Human Immunodeficiency Virus), have been shown to experience an increased risk of complications, resulting in more intense and prolonged hospital stays (Vallée et al., 2020).

Cellulitis can be classified into three forms: moderately severe, severe (with systemic manifestations), and high danger (localized in the extremities or head of patients with compromised immune systems). The infection’s toxic products stimulate Langerhans dendritic cells to secrete interleukin (IL)-1 and tumor necrosis factor (TNF)-α, enhancing bacterial phagocytosis (14). Typically, the infection spreads from odontogenic sources in a sequence that often involves the anterior neck, pharyngomaxillary chamber, retropharynx, and superior mediastinum (Hughes & Luu, 2015).

Management of these patients is based on a triad of factors consisting of host, antibiotics, and surgical intervention. Early antibiotic therapy, combined with timely surgical management, is critical, especially in immunocompromised patients. Surgical treatment, such as debridement, wound reconstruction, and split-thickness skin graft (STSG), is employed to address the infection. In this case, donor tissue was harvested from the lateral, medial, and anterior regions of the femur bilaterally, and meticulous daily wound care was performed to ensure optimal healing.

CONCLUSION

Necrotizing soft tissue infections (NSTIs) of the head and neck, particularly in the context of Ludwig's angina, represent a significant clinical challenge due to their rapid progression and high mortality rates. This case report highlights the critical importance of early recognition and aggressive management of these infections, which often stem from odontogenic sources. The interplay between dental infections and the development of NSTIs underscores the need for heightened awareness among healthcare providers, particularly in patients with

predisposing factors such as immunocompromised states or poor nutritional status. Prompt surgical intervention, including debridement and split-thickness skin grafting, combined with broad-spectrum antibiotic therapy, is essential for improving patient outcomes and reducing the risk of life-threatening complications. The use of diagnostic tools, such as the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score, can aid in the timely identification of NSTIs, facilitating quicker treatment decisions. Furthermore, a multidisciplinary approach involving specialists in reconstructive surgery, infectious disease, and critical care is vital for optimizing treatment strategies and enhancing patient care. Continued research and education on the management of NSTIs and associated conditions are necessary to improve clinical outcomes and inform preventive measures. By fostering a deeper understanding of the complexities surrounding these infections, healthcare professionals can better navigate the challenges they present, ultimately leading to improved patient safety and care in critical situations.

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