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Case Report

Management of necrotizing fasciitis due to a human bite: case report

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ABSTRACT

Human bites, often underestimated, present significant risks of infection, with necrotizing soft tissue infections (NSTIs) posing a severe threat due to their rapid progression. We present a case of a 72-year-old diabetic male with a human bite on his forearm, leading to NSTI. Despite initially superficial symptoms, including fever and localized pain, the condition rapidly deteriorated, necessitating surgical intervention. The patient underwent multiple debridement procedures and antibiotic therapy, resulting in wound healing. Human bites predominantly affect young males and can occur in various anatomical regions. Microbial flora in the oral cavity increases infection risk, with diabetic individuals being particularly vulnerable due to compromised immunity and delayed wound healing. Prompt diagnosis, antibiotic therapy, and surgical intervention are crucial in managing NSTIs, emphasizing the importance of early medical attention and vigilance in human bite injuries to prevent adverse outcomes like sepsis and mortality.

Keywords: Necrotizing fasciitis, Human bite, Case report, Skin graft, Debridement

INTRODUCTION

Human bites rank third among common bite injuries, trailing behind dog and cat bites. Victims of human bites typically fall within the 20 to 30-year-old age bracket, with males being more frequently affected than females.

These injuries can occur in almost any anatomical region, spanning from the head, face, upper and lower extremities, to sensitive areas like the breasts, lips and genitalia. Infections resulting from human bites vary in incidence, ranging from 4% for facial injuries to a staggering 50% for hand bites inducing ravaging consequences such as necrotizing soft tissue infections (NSTIs).[1]

Although uncommon, NSTIs pose an alarming threat due to their rapid progression and potential fatality. These bacterial infections have the capacity to cause devastating damage through multiple layers of the body, destroying the epidermis, dermis, subcutaneous tissues, fascia, and even the muscles.

Individuals at extremes of age or with underlying health conditions such as diabetes mellitus and immunosuppression are more prone to developing NSTIs.[2]

NSTIs remain linked with considerable mortality rates. Early identification of signs and symptoms, precise diagnostic assessments, and prompt medical treatment combined with surgical intervention are imperative to prevent adverse patient outcomes, such as sepsis, limb amputation, and fatalities.

CASE REPORT

A 72-year-old man with a medical history of an uncontrolled diabetes mellitus was admitted to the emergency department with a superficial, roughly 6-cm right.

forearm bite delivered by his 22-year-old daughter with mental disorders 48 hours earlier. the patient reported a fever with chills and rigors prior to the time of consultation, combined with a swollen, painful limb. he

then reported a gradual worsening of the swelling and pain of the limb, and systemic symptoms including weakness, palpitation, and cold sweats that pushed the patient towards the ED 96 hours after the injury.

At the time of the injury, the lesion was neither washed nor disinfected.

At the time of presentation, the patient had a temperature of 38.2°C, a heart rate of 102 beats per minute (bpm), and a blood pressure of 110/70 in his right arm read from a sitting position.

Locally, a diffuse swelling and cyanotic distal right upper extremity, along with foul smelling discharge from the bite wound, painful to palpation, with increased skin tension around the involved area, associated with reduction of hand and wrist movement, there was also tenderness and local warmth. In addition, necrotic tissue was observed on the hand dorsum. Laboratory parameters revealed severe inflammation with a highly elevated white blood cell count 24G/ and 90% neutrophils, also a highly elevated C-reactive protein of 390 mg/l. This patient also had an unbalanced diabetes mellitus with a glycated hemoglobin level of 10% and a hyponatremia of 128 mmol/l the rest of his complete blood work was unremarkable HIV 1 and 2 tests were negative, Hbs Ag-non reactive, hepatitis C virus non-reactive.

The radiological screening showed hyperechogenicity of the hypodermic tissue crossed by thin hypoechogenous bands dissociating the fatty lobules.

Furthermore, there were no signs of fractures, osteomyelitis, septic arthritis and gas shadows.

NF was thought of as a differential diagnosis, and the plastic surgery team's opinion was requested. The patient was urgently transferred to the operating room for surgical exploration of the affected area. An amputation of the index finger was deemed a necessary course of action; and subsequently, the surgical procedure was performed by the orthopedic team.

Aggressive debridement was crucial to aim at controlling this fulminant infection and halt its progression. Preventive surgical decompression was performed in order to avoid any aggravating complications.

A superficial sample of the wound drainage was acquired upon admission, while the subsequent debridement involved collecting numerous specimens for culture.

The affected area was thoroughly irrigated, and the patient was managed in an intensive care unit where he was closely monitored. The patient was then initiated on empirical antibiotics, with adjustments made following the results of the antibiogram. Insulin was also administered to achieve optimal glycemic control. A series of surgical debridement procedures were maintained until tissue necrosis ceased and the growth of fresh viable tissue was observed. Our patient benefited from a total of 7 debridements resulting in a large raw wound.

The patient's wound progressed positively, displaying healthy granulation tissue, with no signs of infection. The wound closure was then performed by skin grafting to address the exposed area.

An effective follow-up protocol was then established for this patient in order to ensure adequate care and wound healing.

Figure 1: Right upper extremity after 3rd debridment (7th day of admission).

Figure 2: Right upper extremity after 10th debridement (post-amputation).

Figure 3: Right upper extremity after the excision of the extensor tendons.

Figure 4: Right upper extremity after the skin graft.

Figure 5: Right upper extremity 3 weeks post skin graft.

DISCUSSION

Human bites are acknowledged for their propensity to induce significant wounds and their increased susceptibility to infection. They are ranked as the third most common cause of bite injuries; trailing behind only dog and cat bites.[3]

It is important to note that the true prevalence and incidence of human bites are challenging to ascertain and likely underestimated. This is primarily due to cases where patients with minor injuries opt for self-treatment without consulting a healthcare provider.

Human bite injuries can occur on any part of the body. The nuanced dynamics of injury circumstances, alongside demographic variables such as age and sex of the victim significantly influence the location of bites.[4]

In a study involving 388 patients with human bites, over half of the patients presented with bites on the hands or fingers (50.3%), Meanwhile, 17.8% of the reported bites were located on the head or neck.[5]

Human bite victims are typically found within the age bracket of 20 to 30 years, and males are much more commonly affected than females.

Based on the circumstances surrounding their occurrence, bite marks can be categorized as accidental or intentional. The intentional type can be further subcategorized by distinguishing between offensive and defensive subtypes.

Human bites can also be classified based on the mechanism of injury into occlusion bites and clenched fist bites, also known as fight bites.[6,7]

The microbial ecosystem within the oral cavity is complex and represents a rich biological setting, characterized by distinctive niches, which provides a favorable environment for the growth and colonization of various microorganisms. In fact, the analysis of human saliva has uncovered over 600 identified bacterial species.[8]

According to a study made by Talan et al, the most common isolated bacterial species were *Streptococcus* (84%), followed by *Staphylococcus* species (52%).

Eikenella corrodens was also frequently isolated (34%).[9]

The high level of infectivity linked to human bites is often attributed to the combination of virulence factors from various bacteria. Infections resulting solely from anaerobic or gram-negative bacteria are uncommon.[10,11]

HIV, HBV, and HCV can potentially be transmitted through human bites, but this exceptionally occurs. Salivary inhibitors typically lessen the infectious potential of the HIV virus and render it inactive; thereby reducing the transmission risk from saliva alone to practically negligible levels.

The presence of blood significantly increases the transmission risk from 0.1 to 0.3%.[12,13]

Clostridium tetani is rarely detected in bite wounds, however, *Clostridium* spores are ubiquitous and because of its potential fatality, tetanus remains a serious concern.[14]

Because of the unique anatomy of the hand and the inoculation with polymicrobial oral flora, bite wounds exhibiting a deceivingly small appearance may lead to infectious spread along superficial structures with relatively low vascularity such as tendons, bones, cartilage and ligaments.

Following a bite injury, there is a potential for the development of many conditions, including but not limited to cellulitis, abscess, tenosynovitis, septic arthritis, osteomyelitis, and even necrotizing fasciitis can develop, predisposing the hand to long-term morbidity.[15]

In the case of an infected human bite wound, the selection of antibiotics is crucial to effectively target the diverse range of potential pathogens introduced into the wound. Empirical antibiotic therapy is often initiated based on the likely organisms involved. A commonly recommended choice is amoxicillin-clavulanate, a broad-spectrum

antibiotic that covers both aerobic and anaerobic bacteria commonly found in the oral cavity. This combination helps address the polymicrobial nature of human bite infections. In more severe cases or if the patient is allergic to penicillin, alternatives such as doxycycline or ciprofloxacin, along with clindamycin, may be considered. However, the choice of antibiotics should be guided by the specific characteristics of the wound, the patient's medical history, and any prevailing local antibiotic resistance patterns. It is crucial for individuals with human bite wounds to seek prompt medical attention for a thorough assessment and appropriate antibiotic treatment to prevent the development of complications and ensure a successful recovery.[16,17]

Necrotizing fasciitis is categorized based on its microbiological profile (either polymicrobial or monomicrobial), the anatomical location involved, and the depth of the infection.

One of the critical risks associated with necrotizing fasciitis is its ability to spread rapidly, causing widespread tissue necrosis and systemic complications. If left untreated or if there is a delay in diagnosis, the infection can result in sepsis, organ failure, and, ultimately, a high mortality rate. Timely medical intervention is imperative, typically involving aggressive surgical debridement to remove necrotic tissue, along with broad-spectrum antibiotics to target the causative bacteria. The urgency of recognizing and effectively managing necrotizing fasciitis underscores the importance of vigilance and immediate medical attention in suspected cases.[18]

Individuals with peripheral vascular disease or a history of recent surgical procedures may have compromised blood flow and reduced tissue oxygenation, creating an environment conducive to the rapid proliferation of bacteria. Chronic skin conditions, such as eczema or psoriasis, can also serve as potential entry points for the causative bacteria. The presence of comorbidities not only heightens the risk of developing necrotizing fasciitis but also complicates the diagnostic process. These patients may exhibit atypical or masked symptoms, leading to delays in identification and intervention. The intricate interplay between necrotizing fasciitis and underlying health conditions emphasizes the critical need for healthcare providers to maintain a high index of suspicion in individuals with comorbidities, enabling early detection and aggressive management to improve outcomes in this vulnerable population.[19]

Diabetes-related factors heighten infection susceptibility and impair wound healing. Thus, causing an impaired immune response, with a low effectiveness against infections.

Hyperglycemia not only hampers immune cell function, including neutrophils, macrophages, and T-cells crucial for bacterial defense, but also causes poor circulation inducing vascular complications and leading to inadequate blood circulation.

Neuropathy is another common diabetes complication that leads to sensory deficits, delaying injury detection and allowing unchecked infection progression. Motor neuropathy may affect muscles crucial for wound healing.

High glucose levels fosters an environment conducive to bacterial growth, providing constant nutrients for pathogen proliferation.

Diabetic patients are more susceptible to severe infections, especially NF, due to compromised immunity, circulation, neuropathy, and delayed healing, emphasizing the need for vigilant wound care and prompt medical intervention.[20,21]

We believe that the cornerstone of management of necrotizing fasciitis lies in prompt diagnosis, proper antimicrobial therapy and surgical debridement.

As per Talan et al, initial empiric antimicrobial therapy ought to target *S. anginosus*, *S. aureus*, *E. corrodens*, and oral anaerobic organisms. Following analysis, the antimicrobial susceptibility of the sampled isolates aligned with prior investigations regarding antibiotic efficacy against a diverse collection of isolates retrieved from human wounds.

Penicillin G is commonly employed as the initial antimicrobial agent in addressing odontogenic infections. It is advisable to employ a combination of antibiotics, including penicillin along with a 2nd or 3rd generation cephalosporin.

In certain cases, where the infection had already reached the stage of NF, additional measures should be taken. The recommended antimicrobial therapy includes the association of Imipenem, daptomycin, and clindamycin, or piperacillin/tazobactam, daptomycin, and clindamycin, it is crucial to emphasize that surgery is the primary treatment for necrotizing fasciitis, and there should be no delay in seeking a surgical consultation.[11]

Early implementation of emergency incision and drainage associated with aggressive debridement is crucial for the effective treatment of necrotizing fasciitis. A previous study demonstrated that delays in surgical intervention and insufficient initial debridement of NF result in a significantly higher mortality rate. Additional specific measures include resuscitation with intravenous fluids, and meticulous hemodynamic monitoring in an ICU setting combined with nutritional support of these patients.[21]

CONCLUSION

Human bite injuries are particularly susceptible to developing various infectious conditions, including necrotizing fasciitis, which although rare, is potentially

lethal. While the paucity of early pathognomonic signs complicates the diagnosis of NF, emergency physicians should still be well acquainted with the assessment and effective management of human bites.

Early diagnosis, administration of appropriate antibiotics, and prompt surgical debridement, including fasciotomy when necessary, constitute the cornerstones of effective treatment.

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