



Necrotizing soft-tissue infection of the upper extremity following a toothpick injury: Case report and a literature review

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Abstract

NSTIs (Necrotizing soft-tissue tissue infections) are severe surgical infections characterized by rapid spread over the superficial fascia and involve the subcutaneous tissue, fascia, and sometimes muscles. At the same time, the skin may appear intact at the beginning of the disease, which might lead to severe systemic complications that may end fatally for the patient. Early recognition and urgent surgical intervention with appropriate antibiotics and other supportive measures are the most important in treating these infections. The presence of comorbidities complicates treatment. Diabetes and heart diseases are the most common comorbidities in patients with NSTIs. Reminding clinicians about this infection is essential in order to recognize it and provide adequate and timely treatment quickly. To that end, we present a patient with NSTIs of the upper extremity after being pricked by a used toothpick.

Keywords: Soft-tissue; necrotizing soft-tissue infections; LRINEC; surgical exploration; toothpick; soft-tissue pathology

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Introduction

Necrotizing soft tissue infections (NSTIs) are infections characterized by rapid and fulminant progression with life-threatening consequences such as multiorgan failure and a potentially fatal outcome. The main characteristic of these infections, in all anatomic locations, is that due to their rapid spread, which leads to the destruction of epidermal, dermal, subcutaneous, fascial, and sometimes muscle tissue with systemic effects on vital organs [1]. This is a rare disease, but according to different authors, the incidence of NSTIs has increased in recent years and mainly reaches 1–4/100.000 persons per year. There are other data on mortality in the literature, but they have one thing in common: despite the available treatment methods, the mortality rate is high. Earlier studies reported mortality rates up to 70% [2]. The new studies report a mortality rate of up to 35%, an increase if the diagnosis is not made in time and in patients with comorbidities [3]. Diabetes mellitus (DM) is the most frequent comorbidity in patients with NSTIs [1,2]. Herein, we present a patient with NSTIs of the upper right extremity after contact with a wooden toothpick previously used by the patient.

Case report

A 45-year-old previously healthy man was admitted to the Department of General Surgery, the General Hospital Novi Pazar, Serbia, after being treated by a physiatrist for pain, swelling, redness, and limited movement in his right hand. His symptoms appeared three days after accidentally puncturing himself with a used toothpick. He sought medical attention from a physiatrist, where he was treated for two days. On the 6th day, after a toothpick stab, a progressive worsening of symptoms led him to our outpatient clinic with a pronounced clinical picture of NSTIs.

Upon admission, the patient had swelling and pain throughout his right arm, from the hand to the shoulder, exhibiting a typical type of pain upon palpation, accompanied by redness and eschar. His movements were severely limited, almost impossible, and he experienced pain even at rest. In addition to local

findings, the patient had a high fever. Blood pressure and oxygen saturation were within the normal limits.

Afterward, the patient was hospitalized, and a diagnostic workup was initiated, yielding the following laboratory findings [Table 1]. Based on the clinical findings and the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score outcomes (10), immediate surgical and conservative therapy was initiated with empirical broad-spectrum antibiotics (Ceftriaxone, Ciprofloxacin, and Metronidazole) until swab culture and sensitivity results were available, fluid replacement and other supportive therapy. The involvement of the skin, subcutaneous fat tissue, muscle fascia, and muscles was verified, and a cloudy fluid was observed seeping from the affected tissue after the skin incision (Figure 1). The patient underwent detailed surgical wound treatment under general anesthesia (Incision, debridement, drainage of contents, and establishing communication between affected tissue parts with the placement of sterile gauze soaked in antiseptics were performed). Of note, the *Enterococcus spp* was isolated from the wound swab on the 2nd day of hospitalization, and the antibiotherapy was altered based on its sensitivity to the Imipenem and Ciprofloxacin. On the 3rd day of hospitalization, a slight decrease in leukocytes and CRP was observed (Table 1). Although local infection symptoms persisted, laboratory findings showed initial improvement. The wound was dressed in antiseptics daily.

On the 5th day of hospitalization, the wound underwent a third surgical procedure (Figure 2). Subsequently, on the 7th day, the swelling and pain significantly regressed, and the patient became more mobile, with minimal discharge from the wound. Furthermore, a wound swab was repeated on the 12th day of hospitalization when *Klebsiella spp* was isolated, which led to antibiotic adjustment based on Colistin, Vancomycin, and Metronidazole findings for the next 10 days. In addition, daily dressing changes were done until complete healing was achieved. Moreover, on the 30 days of hospitalization, he was discharged in favorable general condition; his swelling and pain had significantly decreased, and hand mobility was almost

fully restored. The control wound swab was sterile. The patient was treated on an outpatient basis for another seven days, after which he was referred for physical

therapy and scheduled for follow-up with a surgeon as needed.

Table 1. Laboratory findings.

	1 st day of hospitalization	3 rd day of hospitalization	7 th day of hospitalization
WBC(/L)	21.3x10 ⁹	16	12
CRP (mg/L)	321	251	101
Glycemia (mmol/L)	10.8	8	7
Creatinin (μ mol/L)	169	153	123
Na ⁺ (mmol/L)	142	141	140
Procalcitonin (ng/mL)	4.2	3	0,5
Hb (g/L)	100	110	123

*WBC: white blood cell; CRP: C reactive protein; Hb: Hemoglobin



Figure 1. A) Initial surgical treatment of the affected region; B) The cloudy liquid that oozes from the affected tissue.



Figure 2. The affected region after the 3rd surgical debridement.

Discussion

Hand injuries caused by used toothpicks contaminated with human saliva can be equally serious as human bites [4]. According to literature data, toothpick-related injuries are estimated to be 3.6 per 100,000 persons and are believed to be underreported [5]. Several studies have stated that the majority of injuries caused by toothpicks involve ingestion [6]. Soft tissue infections remain crucial, like the tumoral conditions of these vital organ tissues of human beings, to date [7,8]. The result of the one-year survey in the USA showed that 76% of all toothpick injuries involved extremities and trunks [6]. The penetrating wound from a toothpick is tiny, and initial symptoms are subtle.

Moreover, the seemingly harmless tiny puncture wound is frequently overlooked by patients or missed during physical examination, making an accurate assessment of the severity of such an injury extremely challenging [4,5]. In the present work, our case with NSTIs of his upper right extremity after contact with a wooden toothpick previously utilized by himself. It is clear that in such situations, the wound may be insufficiently taken seriously and overlooked. Due to minor symptoms at the onset and delayed medical attention, an increase in the window between the injury and the first visit to the surgeon significantly provides time for the initial infection to develop into NSTIs.

NSTIs represent an aggressive surgical infection of the skin and soft tissues, which spreads along the fascia. In contrast, the tissue above it initially appears healthy, often leading to postponement of diagnosis and surgical intervention. It is frequently a life-threatening infection that requires urgent medical treatment, usually by a multidisciplinary team. The global incidence of NSTIs is reported as 0,4/100000 per year [1]. Despite an improvement in medical care, mortality was still reported very high [9]. Bodansky et al. [10] reported a recent increase in the incidence of NSTIs.

The most common sites of NSTIs are the anogenital region, lower limbs, and anterior abdominal wall, but

they can occur on any body part [9]. The present case admitted us with an infection that affected his entire right upper extremity, with propagation to the back of the right shoulder. As such, health providers need to diagnose NSTIs promptly because these infections, besides antimicrobial therapy, necessitate surgical intervention. In addition to local warmth, the presence of erythema and ecchymosis, and tissue swelling, patients with NSTIs also experience a specific type of pain (disproportionate to palpation). Of note, it is also crucial to emphasize that in NSTIs, general symptoms such as elevated body temperature (fever) and hemodynamic instability in later stages are commonly present [1-5], which infections might lead to shock and sepsis with multiorgan failure and a potentially fatal outcome [1]. The presented case revealed no difficulties in diagnosing NSTIs, as he was admitted to the outpatient clinic with a complete clinical picture of NSTIs, given that some time had already passed since the injury.

Based on the microorganisms isolated from wound swabs, NSTI commonly arises from a polymicrobial infection, including aerobic and anaerobic organisms, frequently associated with a breach in mucosal or cutaneous integrity [11,12]. Kim et al. stated that 73.9% had one or more identifiable pathogens [13]. However, some studies report the prevalence of monomicrobial NSTIs at up to 60-80% [9]. As such, in monomicrobial NSTIs, *Staphylococcus aureus* (*S. aureus*) and *Streptococci* seem to be predominant pathogens [13]. Additionally, *Beta-hemolytic streptococcus* of serological group A is one of the most common organisms isolated in cases of NSTIs [9]. Eckmann et al. found methicillin-resistant *S. aureus* (MRSA) as a causative microorganism in 14.6% of complicated skin and soft tissue infections in many European countries [14]. Moreover, we reported that *S. aureus*, *Klebsiella spp.*, and *Pseudomonas aeruginosa* were the most causative agents, with almost the same frequency [1]. Fungal infections are rare and primarily published as case reports [9,15]. According to Peetermans et al., up to 12% of patients with NSTI have a recurrent NSTI [16].

Various risk factors contribute to the progression of necrotizing fasciitis, such as immunosuppression, cancer, vascular disease, DM, alcoholism, obesity, chronic kidney diseases, liver cirrhosis, intravenous drug users, etc [1-9]. DM is the most associated comorbidities with NSTI, with 22%–59% [17] and cardiovascular disease (9%–45%) [16]. The incidence of DM in Tarchouli et al.'s [17] work was 38%, and cardiovascular diseases were 51%, where a higher mortality rate was recorded. Almost 25% of the cases with NSTI have no apparent predisposing factor [16]. Comorbidities can complicate the clinical picture and make treatment difficult [9].

NSTIs rise more frequently in men, accounting for up to 2/3 of all cases [9]. Although NSTIs do not have an age preference, data show that patients over 50 years of age have a worse prognosis [9]. Our case was immunocompetent, with an average body weight (BMI: 26), and without a medical history or clinical findings related to any chronic illness or alcoholism. NSTIs require immediate surgical intervention with antibiotic treatment against the causative pathogen, which increases the probability of a successful cure. Initial empiric pharmacological treatment with broad-spectrum antibiotics is aimed at the most common causative agents until the results of soft tissue Gram staining, culture, and sensitivity are obtained [18]. Due to the increasing uncritical use of antibiotics worldwide, there is a rising number of pathogenic microorganisms resistant to common antibiotics, representing a significant problem [19]. Urgent surgical treatment, which involves extensive removal of necrotic and devitalized tissue, is an essential indicator of favorable treatment outcomes. Initial surgical intervention performed after 24 hours from the onset of symptoms increases mortality. Treatment involves frequent and multiple surgical interventions during the treatment of NSTIs [1-6,9]. Literature data stated that all patients underwent up to 10 radical surgical debridements, averaging 2.5 [2]. The treatment of these infections with

Hyperbaric Oxygen Therapy has not been definitively proven [9]. We followed the same approach in the case of our patient, where Ceftriaxone, Ciprofloxacin, and Metronidazole were initially prescribed, and after isolating the pathogen, targeted antibiotic therapy was included. The first surgical intervention was performed within 24 hours, and three were conducted by the end of the hospitalization.

Different diagnostic procedures (radiological imaging modalities and laboratory tests) are used to diagnose this infection. For precisely this purpose, the LRINEC score was devised to aid clinicians in screening for NSTIs and stratifies patients into low, medium, or high risk of necrotizing fasciitis (NF), and six or higher were considered indicative of NF. To date, the highest sensitivity for the LRINEC of 89.9% was found in the original study. In recent years, the value of this score and its role as a scoring system has been the subject of ongoing controversy in many studies [20]. Regardless of the LRINEC score, surgical exploration is the only way to establish the diagnosis of necrotizing infection. Our patient had an LRINEC score of 10, which fits the high risk for necrotizing soft tissue Infection criteria.

Conclusion

Consequently, the emergency department involves numerous patients who display signs and symptoms of an infection. Clinicians need to differentiate NSTIs, which necessitates surgical intervention promptly. Delays in appropriately addressing can lead to severe consequences, including limb loss, organ damage, and a significantly elevated risk of death. It is a significant challenge for physicians, especially those with limited encounters with this type of condition, to recognize this kind of infection. How to further enhance the early recognition and detection of this potentially fatal condition in the future remains a question. As a matter of fact, this issue merits further investigation.

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