

Case Report Clinical Pathology

Necrotizing soft tissue infection following routine third molar extraction: report of two cases and review of the literature

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Abstract. Necrotizing cellulitis, necrotizing fasciitis, and necrotizing myositis are a constellation of severe soft tissue infections characterized by rapid progression, dusky soft tissue changes, and edema and induration expanding beyond the clinical wound edges. The cases of two female patients with type II necrotizing soft tissue infections occurring after routine third molar extraction are reported here. The patients were treated for the infections at the University of North Carolina Hospitals in 2016. Both were previously healthy. Of particular interest, recent inoculation of group A *Streptococcus* appears to have contributed to the infection in both cases.

Key words: infection; necrotizing; fasciitis; mediastinitis.

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Necrotizing cellulitis, necrotizing fasciitis, and necrotizing myositis are a constellation of severe soft tissue infections characterized by rapid progression, dusky soft tissue changes, and edema and induration expanding beyond the clinical wound edges. Surgical exploration is considered the only way to definitively establish the diagnosis.

Two types of necrotizing soft tissue infection (NSTI) are generally recognized. Type I is defined as a polymicrobial infection, while type II is a monomicrobial or polymicrobial infection associated with group A *Streptococcus* (GAS). The cases of two patients with type II NSTIs that arose after routine third molar extraction

in otherwise healthy female patients are presented here. The patients were treated for the infections at the University of North Carolina Hospitals in 2016. Both cases were associated with recent exposure to group A *Streptococcus*.

Case reports

Case 1

An 18-year-old female with a history of anxiety presented to the emergency department 1 day after routine wisdom tooth removal at an outside facility, complaining of severe, intractable jaw pain and left submandibular edema. She

quickly deteriorated in the emergency department, becoming hypotensive, tachycardic, febrile to 39.3 °C, and hypoxemic, requiring 4-l nasal cannula supplementation to maintain oxygen saturation >90%. She received significant fluid resuscitation and was started on broad-spectrum antibiotics (vancomycin, clindamycin, and ceftriaxone), placed on vasopressor support (epinephrine and norepinephrine), and transferred to the pediatric intensive care unit (PICU). Laboratory evaluation on presentation showed a white blood cell count (WBC) of $28.8 \times 10^9/l$, C-reactive protein (CRP) of >45 mg/dl, and an arterial lactate peak of 5.5 mmol/l.



Fig. 1. Case 1: Coronal contrast CT image of the maxillofacial region taken on hospital day 3, demonstrating the presence of developing submandibular fluid collections in the setting of clinical soft tissue necrosis.

Examination was remarkable only for maximum inter-incisal opening of 20 mm, bilateral neck tenderness, and mild left submandibular edema, consistent with her postoperative status. Computed tomography (CT) imaging revealed fullness overlying the left platysma and an otherwise expected postoperative appearance of third molar sites. Upon discussion with the patient's family, it was learned that the patient had experienced throat pain, oropharyngeal erythema, and odynophagia in the days prior to third molar extraction.

On hospital day 3 the patient began to develop worsening fullness in the left buccal space with desquamation of the left cheek. This progressed to induration and erythema to the left buccal and submandibular regions, despite broad-spectrum antibiotic coverage. Clinical examination and a repeat CT scan were consistent with developing abscess (*Fig. 1*), and the patient was taken to the operating room for incision and drainage. Over the next 2 weeks the patient continued to show evidence of progressive soft tissue erythema, induration, and frank



Fig. 2. Case 1: Appearance at the time of initial debridement, with notable edema, erythema, and frank tissue necrosis of the inferior cheek and superior neck soft tissues.

necrosis of the inferior cheek (*Fig. 2*), requiring multiple debridements consisting of aggressive irrigation with normal saline, clindamycin, and quarter-strength Dakin's solution. Findings during all further procedures were consistent with thin, gray, 'dishwater' fluid drainage with thin, friable skin and subcutaneous tissues that began to fall apart with minimal manipulation. Surgical specimens sent to pathology were reported as "entirely necrotic soft tissue with scant neutrophils". Given the patient's presentation consistent with a type II NSTI, nucleic acid amplification testing was performed on aspirates from her original blood culture and surgical specimens, both of which were positive for GAS.

The patient's soft tissue wound continued to improve with debridement and wound packing. She was well enough to be discharged from the hospital on hospital day 39, in good condition. Her left facial wounds continued to heal well. She was most recently seen 8 months following her initial presentation and showed acceptable scarring, no pain, and maximum inter-incisal opening of 47 mm.

Case 2

A 15-year-old female with a history of obesity presented to the University of North Carolina Hospitals 1 day after routine wisdom tooth extraction at an outside facility, complaining of extreme facial swelling, pain, and difficulty breathing. She was hypotensive, tachycardic, and in acute respiratory distress, requiring emergent intubation in the emergency department. She received significant fluid resuscitation and was started on broad-spectrum antibiotics (vancomycin and piperacillin-tazobactam), placed on vasopressor support (norepinephrine and dopamine), and transferred to the PICU. Laboratory evaluation on presentation was notable for a WBC of $30.2 \times 10^9/l$, CRP of 38.2 mg/dl, and an arterial lactate peak of 4.2 mmol/l. CT scans revealed extensive edema involving the left-greater-than-right facial, parapharyngeal, retropharyngeal, and mediastinal spaces (*Fig. 3*).

The patient became gravely unstable, requiring near code-dose epinephrine rescue in addition to baseline vasopressor support. Physical examination revealed severe bilateral facial and neck edema, left facial skin desquamation, weeping, and eschar formation, and left buccal mucosal ecchymosis and vesiculobullous appearance (*Fig. 4*). The oral and maxillofacial, thoracic surgery, and extracorporeal membrane oxygenation (ECMO) teams immediately took the patient to



Fig. 3. Case 2: Coronal contrast CT image of the maxillofacial region taken at the time of arrival, demonstrating massive left-sided facial and cervical cellulitis with progression to the contralateral soft tissues.

the operating room for median sternotomy, central cannulation for venoarterial ECMO, and incision and drainage of bilateral facial and deep neck spaces as well as the mediastinum. Upon discussion with the patient's family, it was learned that a family member was recovering from streptococcal pharyngitis.

The patient showed slow improvement in cardiovascular status, and she was able to be decannulated from ECMO with sternotomy closure on hospital day 4. The patient continued to show evidence of progressive soft tissue erythema, induration, and frank necrosis requiring multiple debridements consisting of aggressive irrigation with normal

saline, clindamycin, and quarter-strength Dakin's solution. Findings during all further procedures were consistent with thin, gray, 'dishwater' fluid drainage with thin, friable skin and subcutaneous tissues that began to fall apart with minimal manipulation. Surgical specimens obtained throughout the patient's debridements and sent to pathology were reported as "almost entirely necrotic soft tissue, rare viable fascia, and fat necrosis with bacterial colonies (cocci) present". Microbiological cultures repeatedly grew oropharyngeal flora as well as *Streptococcus pyogenes* (GAS). The patient was eventually extubated and progressed well thereafter.

The patient's soft tissue wound continued to improve with debridement and wound packing. She was well enough to be discharged from the hospital to outpatient rehabilitation on hospital day 34, in good condition. Her left facial wounds continued to heal well while in outpatient rehab. She was most recently seen 5 months following her initial presentation and showed acceptable scarring, no pain, and maximum inter-incisal opening of 45 mm.

Discussion

NSTIs are characterized by rapid clinical progression of edema and induration expanding beyond the clinical wound edges, with patients often describing initial pain out of proportion to examination. Type II NSTIs are more likely to occur in patients without traditional risk factors for developing infectious complications.

In both cases presented here, healthy patients developed NSTIs following routine, non-infected dental extractions. There was absolutely no evidence of pre-operative odontogenic pain or infection. A review of cases of documented cervicofacial NSTI specifically following routine, non-infected tooth extractions, published in the English language literature over the past 10 years, is presented in Table 1¹⁻¹⁰.

Although the review in Table 1 includes only a small number of cases, some considerations can be gleaned. The first is that severe, impressive NSTIs can occur within 48 hours after an otherwise seemingly innocuous procedure in healthy patients without odontogenic signs and symptoms. This was also the case in both of the patients reported here, who presented within 24 hours to an emergency department in septic shock. Second, the distinction between type I and type II NSTIs is often impossible; however, treatment in



Fig. 4. Case 2: Appearance at the time of presentation to the University of North Carolina Hospitals, with notable edema, frank tissue necrosis, eschar, and mucosal ulceration.

Table 1. Cervicofacial necrotizing soft tissue infections following routine, non-infected extraction published in the English literature since 2008.

Author	Year	Patient age/sex Past medical history	Tooth ^a	Initial presentation	Organism	Treatment	Outcome
Bilbault et al. ¹	2008	44 years/M OSA	#1	Postop. day 0 Right face/neck swelling; crepitus	<i>Escherichia coli</i> , <i>Staphylococcus</i> <i>epidermidis</i> , <i>Propionibacterium</i>	IV cefotaxime, gentamicin, metronidazole; OD; SD; HBO	Discharged
Muller et al. ²	2008	47 years/M Healthy	FMX	Postop. day 14+ Fever 38.4 °C; left face swelling	CoNS, <i>Bacteroides</i> , group H streptococci	IV amoxicillin– clavulanate, gentamicin, clindamycin; I&D; OD; orbital exenteration; SD; NPWT	Discharged
Deganello et al. ³	2009	74 years/M Diabetes, cirrhosis, AMI	#15	Postop. day 6 Fever 38 °C; left oropharyngeal/oral/ neck swelling; mediastinitis	<i>Streptococcus sanguinis</i>	IV clindamycin, ceftriaxone; OD; H ₂ O ₂ washout	Died
Perez Araya et al. ⁴	2011	17 years/M Hyperthyroid	Third molars	Postop. day 4 Left neck swelling	“Mixed flora of bacteria with high resistance”	IV “antibiotics”, OD	Discharged
Gonzalez-Garcia et al. ⁵	2011	28 years/F Unspecified medical history	#32	Postop. day 7 Submandibular swelling	None specified	IV imipenem, cefepodoxime; OD; H ₂ O ₂ washout; SD	Discharged
Gonzalez-Garcia et al. ⁵	2011	49 years/M Unspecified medial history	#1	Postop. day 10 Fever >39 °C; submandibular swelling	None specified	No antibiotics mentioned; OD; H ₂ O ₂ washout	Discharged
Antunes et al. ⁶	2013	45 years/F Diabetes, obesity	#32	Postop. day 2 Fever 39 °C; submandibular erythema; eschar	Group A β-hemolytic streptococci	IV penicillin, piperacillin– tazobactam, clindamycin, metronidazole; OD	Died
Goldberg et al. ⁷	2015	6 years/M Mother recently had strep pharyngitis	Unspecified	Unspecified	Group A β-hemolytic streptococci	IV ampicillin– sulbactam, clindamycin; OD; SD	Discharged
Goldberg et al. ⁷	2015	14 years/F Patient recently had strep pharyngitis	Third molars	Postop. day 4	Group A β-hemolytic streptococci	IV vancomycin, ampicillin–sulbactam, clindamycin; OD	Discharged
Lin et al. ⁸	2016	56 years/M Diabetes	Unspecified	Postop. day 1 Left face/neck swelling; crepitus; eschar	<i>Prevotella</i> spp, <i>Serratia</i> <i>marcescens</i> , <i>Stenotrophomonas</i> <i>maltoiphilia</i>	IV imipenem; OD; SD;	Died
Arruda et al. ⁹	2016	73 years/F Healthy	#26	Postop. day 6 Submental edema; eschar	None specified	IV ceftriaxone, metronidazole, meropenem; OD; SD	Discharged
Abe et al. ¹⁰	2017	32 years/M Healthy	#32	Postop. day 2 Fever 40 °C; submandibular swelling; mediastinitis	<i>Streptococcus milleri</i> , <i>Peptostreptococcus</i> <i>asaccharolyticus</i> , <i>Fusobacterium nucleatum</i> , <i>Bacteroides</i> spp, <i>Neisseria</i> spp, α-hemolytic streptococci	IV ampicillin– sulbactam, clindamycin; OD; SD	Discharged

Present case report	2019	18 years/F Anxiety; patient had presumed strep pharyngitis	Third molars	Postop. day 1 Fever 39.3 °C; left submandibular swelling; sepsis	Group A β -hemolytic streptococci (via NAAT)	IV vancomycin, ceftriaxone, clindamycin; I&D; OD; SD; Dakin's washout	Discharged
Present case report	2019	15 years/F Obesity; family member recently had strep pharyngitis	Third molars	Postop. day 1 Left face/neck/chest swelling; eschar; mediastinitis; sepsis	Group A β -hemolytic streptococci (<i>Streptococcus pyogenes</i>)	IV vancomycin; piperacillin-tazobactam; OD; SD; Dakin's washout	Discharged

AMI, acute myocardial infarction; CoNS, coagulase-negative *Staphylococcus*; F, female; FMX, full mouth extraction; H₂O₂, hydrogen peroxide; HBO, hyperbaric oxygen therapy; I&D, incision and drainage; IV, intravenous; M, male; NAAT, nucleic acid amplification test; NPWT, negative pressure wound therapy; OD, open debridement; OSA, obstructive sleep apnea; Postop., postoperative; SD, serial debridement.

^a American System (Universal Numbering System).

any case of NSTI begins with broad antibiotic coverage and early, aggressive, and serial surgical debridement. Although both of the patient cases reported here were confirmed to be caused by group A β -hemolytic streptococcal infections, case 1 was only confirmed after performing nucleic acid amplification testing, again highlighting the difficulty in distinguishing type I and type II cases. Third, beyond the two cases reported here, only two other reported cases (the two by Goldberg et al.⁷) specifically commented on patient or family history of streptococcal pharyngitis infection in the weeks prior to the NSTI, even when the causative organism was found to be group A β -hemolytic *Streptococcus*. Lastly, the review shows that although NSTIs appear to be more common following posterior dental extractions, even more minor procedures—such as the extraction of an asymptomatic mandibular incisor—have been documented to result in NSTIs.

Furthermore, it should be noted that type II cervicofacial NSTIs have also been documented in healthy, non-infected pediatric patients following minor facial trauma, including sporting or recreational accidents. In the report by Goldberg et al. mentioned above, five healthy patients between the ages of 5 and 14 years presented with necrotizing group A β -hemolytic streptococcal infections. Two of these patients presented after routine dental extraction and are documented in Table 1. The remaining three patients experienced minor facial or dental trauma during play, with two of the three children having had documented streptococcal pharyngitis within 1 week prior to the accident⁷. Thus, rapid progression of a cervicofacial infection shortly after any head and neck procedure or minor head and neck trauma should immediately alert the provider to the possibility of NSTI, particularly in the setting of recent streptococcal pharyngitis.

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Competing interests

None.

Ethical approval

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Patient consent

Patient consent not required for the photographs provided.

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