

CASE REPORT

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Medicolegal Aspects of Necrotizing Fasciitis of the Neck

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ABSTRACT: Necrotizing fasciitis of the neck (NFN) is a relatively rare, fulminating infectious process of the cervicofacial tissues which may cause sudden and unexpected death. Although often the result of a dental infection, injuries of the soft tissues of the neck may also initiate rampant cellulitis, and recognition of the underlying etiology of such cases is necessary to determine properly the manner of death. Five cases of NFN are presented with a review of the causative factors and usual bacteriology, and specific factors of medicolegal interest are addressed.

KEYWORDS: pathology and biology, fasciitis, death, necrotizing fasciitis of the neck

Investigating an injury and determining possible relationships between such injury and underlying or consequent disease processes comprise a particular area of expertise practiced by the forensic pathologist. Some disease entities, such as diabetes mellitus or coronary artery atherosclerosis, are known to contribute significantly to morbidity and mortality when superimposed upon even minor incidents of trauma. In other instances, death may result months or even years after an injury is sustained. Careful review of the intercedent course is needed to delineate fully a relationship between the initiating traumatic event and the final fatal outcome.

Necrotizing fasciitis of the neck is a rare inflammatory process of the cervicofacial tissues wherein an often seemingly innocuous dental infection or injury of the neck tissues results in a rapidly advancing localized infection, manifesting severe systemic septic toxicity and frequently terminating in death. Although it usually produces externally visible changes in the soft tissues of the face and neck, on occasion there may be virtually no demonstrable gross abnormalities. This condition may be missed, even during the postmortem examination. Cervical fasciitis frequently is associated with injury of the mouth, mandible, or neck, and a careful investigation is necessary to establish firmly the antecedent event and thus determine the manner of death in individuals who die of this septic process.

Herein are reported five cases of necrotizing fasciitis of the neck, encompassing a variety

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of etiologies. These also illustrate instances where this infection was related to a specific injury, or where the development of the soft tissue infection was probably exacerbated by an underlying psychiatric illness.

Case Reports

Case 1

The decedent was an 18-year-old American Indian male with both a long history of glue- and paint-sniffing and a seizure disorder, probably a consequence of such solvent abuse. He had been diagnosed as manifesting an aggressive personality disorder. Although placed on anti-seizure medications, he usually stopped taking these drugs almost immediately upon departing medical supervision. His family situation was unstable, and he had been admitted to the hospital several times for treatment of sequelae of child abuse. On several occasions, he had run away while an inpatient, usually returning to his home after eluding authorities.

On the day of his death, in response to his complaints of a sore throat, his family followed the accepted routine for health care delivery on this particular Indian reservation by calling an ambulance, which was staffed with a crew of emergency medical technicians (EMTs). When the EMTs arrived, he jumped out of a window and ran into the surrounding hills. The ambulance departed shortly thereafter, and he then returned to his home. Three hours later, he began having fits of coughing, accompanied by apparent dyspnea. He lay down upon a mattress in the living room, and suddenly died. The postmortem examination disclosed a well-developed young American Indian male, with no external abnormality or evidence of injury. The neck had no significant swelling or asymmetry (Fig. 1). Internally, the cervical strap musculature and paralaryngeal fascia were somewhat dull in character, in contrast to the usual glistening appearance of these tissues. The epiglottis was unremarkable, and the laryngeal mucosa was shiny, smooth, and without edema or inflammatory exudate. The re-

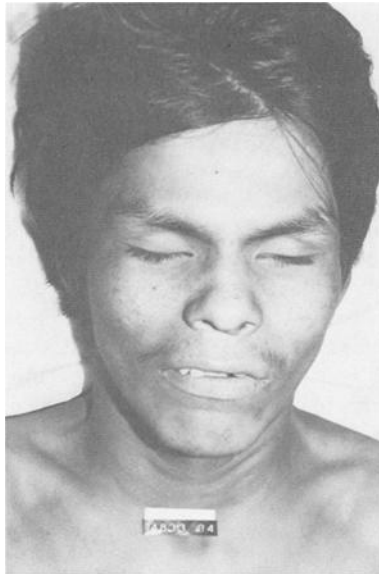


FIG. 1—Case 1: Complete lack of external morphologic inflammatory changes in the cervical tissues, despite a severe deep myositis and fasciitis.

mainder of the gross autopsy examination was not unusual. Postmortem toxicologic studies revealed a therapeutic level of phenobarbital (20.3 mg/L), and a subtherapeutic level of Dilantin® (3 mg/L). No alcohol was detected.

Microscopic inspection of sections through the cervical strap musculature disclosed an extremely severe acute myositis and fasciitis, with masses of acute inflammatory cells percolating along fascial planes and between bands of skeletal muscle, resulting in broad trabeculae of necrotic tissue interspersed by thin remnants of viable or dying myofibers (Fig. 2). The inflammatory process breached the thyroid capsule, but did not involve the laryngeal wall or respiratory mucosa of the upper airway. A tissue Gram stain (Fig. 3) of the cervical sections revealed multiple Gram positive cocciform bacteria, often in pairs, or clumps of three and four. No cultures had been taken at the time of autopsy.

In the absence of demonstrable evidence of injury in the superficial or deep layers of the neck, it was believed that the source of the septic process was probably an infected tooth, and that the manner of death was natural. Also, it was clear that this individual's psychiatric problem interfered with his ability to seek proper medical care, and this illness contributed to his death.

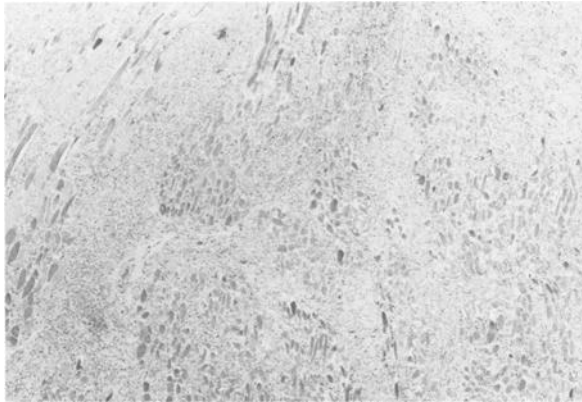


FIG. 2—Case 1: Microscopic section of deep cervical musculature, with extremely severe acute necrotizing inflammation and subtotal effacement of muscular fascicles and intervening fascial layers (hematoxylin and eosin; magnification $\times 35$).

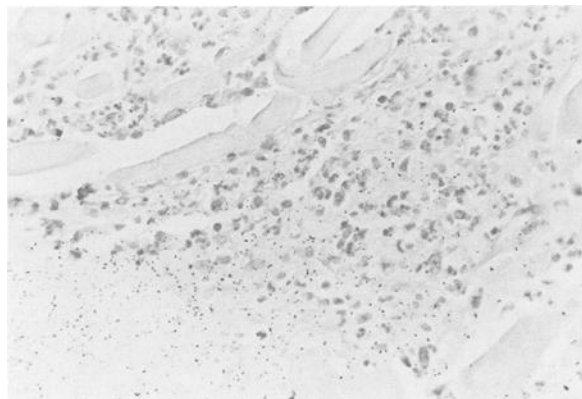


FIG. 3—Case 1: Cocciform Gram positive organisms, often in pairs, within necrotic cervical soft tissues (Brown-Brenn; magnification $\times 350$).

Case 2

A 29-year-old black male, with a long history of undifferentiated schizophrenia, was a veteran, and would often wander about the halls of the local Veteran's Administration Hospital, ostensibly visiting inpatients. On 25 Dec. 1982, he complained of dysphagia, with swelling and pain in the right jaw. Oral examination disclosed an infected wisdom tooth with cellulitis, and penicillin was started. By the next day, he was febrile to 103°F (39.4°C) and confused. He was referred to the Ear, Nose and Throat Clinic, with an appointment two days hence. At this appointment, he was tachycardic (124/min), with stridor and crepitus of the cervical tissues. Incision and drainage of the neck was carried out, with a tracheostomy tube placement. Alpha hemolytic streptococci were grown from wound cultures. The next day, spread of the cellulitis necessitated a wide incision and drainage of the superior chest and subclavicular region. A pneumothorax prompted insertion of chest tubes, and bilateral purulent drainage was obtained. On 30 Dec., he was transferred to another institution for hyperbaric therapy. While undergoing this treatment, he developed ventricular tachycardia and died.

Autopsy examination revealed subcutaneous emphysema over the entirety of the chest wall and neck. The anterior mediastinum was filled with purulent material. The perilaryngeal musculature and fascia was indurated, and had innumerable areas of necrosis. Empyemas involved both pleural cavities. Microscopically, myositis and fasciitis spread through the entirety of the neck, with breach of the thyroid capsule, and extension into the retropharyngeal space. Alpha hemolytic *Streptococci* and *Bacteroides fragilis* were grown from the wound and blood cultures.

Case 3

This was a 25-year-old Hispanic male who developed pain in his left mandible on 10 March 1983. He was started on penicillin. Over the next several days, the area became more swollen, extending inferiorly to involve the lateral neck, and he developed trismus and inability to swallow even water. He was febrile and tachycardic. On 15 March, he was admitted to the hospital and started on intravenous antibiotics. A periapical abscess was detected with X-rays of the left lower first molar. A chest X-ray revealed bibasilar pneumonic infiltrates. Over the next two days he appeared to be improving slightly. However, on 17 March, he was found unresponsive, and died despite aggressive resuscitative measures.

The postmortem examination revealed diffuse cervical edema, with a small amount of crepitation. Upon reflection of the skin of the anterior neck, copious amounts of yellow-white purulent exudate were exposed, in conjunction with massive soft tissue necrosis extending into the left supraclavicular region. The local lymph nodes were enlarged, boggy, and focally necrotic. Indurated necrosis involved the entirety of the mediastinum, surrounding the pulmonary veins, and with focal purulent exudate on the pericardium. The right pleural cavity had a 720-mL pink-yellow empyema. Microscopically, the soft tissue of the neck and mediastinum exhibited subtotal necrosis, with only occasional recognizable skeletal muscle fragments, and focal acute vasculitis, with necrosis of major arteries and veins. A dense, acute pneumonia was present, with scattered microabscesses. Postmortem blood cultures grew nonhemolytic *Streptococcus*; lung and pleural fluid cultures had a mixed growth, predominantly *Streptococcus* and *Bacteroides* species.

Case 4

This was a 32-year-old American Indian male, who was allegedly beaten and dragged by a chain around his neck on 8 Oct. 1980. Four days later he presented to a health clinic, complaining of neck swelling and weakness. At that time, he was hypotensive (blood pressure

70/40 mm/Hg), tachycardic (136/min), and tachypneic (56/min). He was given fluids for several hours, and then transferred in an ambulance to another hospital. During the trip, he suddenly arrested, and died despite aggressive resuscitation.

At the autopsy examination, he was found to have severe circumferential swelling and cellulitis of the neck, with multiple draining abscesses laterally (Fig. 4). A few small, relatively innocuous contusions were on the face, chest, left buttock, and right arm. These were not associated with any internal injuries. No injuries were detected in the neck. The laryngeal mucosa was markedly edematous, and airway obstruction was believed to be the cause of death. An advanced micronodular cirrhosis, chronic pyelonephritis, and an old, healed left frontal cortical contusion of the brain were also detected, and these findings confirmed his history of chronic alcoholism. No cultures were taken.

Despite attempts at investigating the alleged injuries, no confirmatory evidence was ever obtained. As a consequence, the manner of death was certified as undetermined.

Case 5

This was a 47-year-old American Indian male with a long history of alcoholism, complicated by chronic pancreatitis and subsequent diabetes mellitus. On 25 Dec. 1985, he was involved in an altercation, during which he was beaten, and sustained a fracture of the right mandible. This fracture went undetected, as he refused medical care, but went home and took to bed. His family cared for him and, after a period of nearly 3 weeks, noted that he was becoming lethargic and obtunded. He was brought to the hospital on 12 Jan. 1986, and was found to be in florid diabetic ketoacidosis. His right neck and jaw were swollen and indurated, with fluctuance below the anterolateral course of the mandibular ramus (Fig. 5). Pneumonia was detected in a chest X-ray. He was believed to be septic. Incision and drainage was carried out in the fluctuant area below the mandible, and this was packed. Within a few hours, the margins of the surgical incision became gangrenous (Fig. 6). Despite intensive therapy, he deteriorated and died on 15 Jan. Cultures of the wound grew alpha hemolytic *Streptococcus*; sputum cultures were positive for *Enterobacter*.

The autopsy revealed an extensive cellulitis and fasciitis, involving the right neck, and to a lesser extent the left neck, with complete denudation of the mandibular periosteum. The fracture was posteriorly located, at the angle of the mandible. A severe pneumonia was present. The pancreas was shrunken and densely fibrotic. Microscopically, the cervical mus-



FIG. 4—Case 4: Severe swelling and induration of the neck and upper anterolateral thorax, with multiple draining abscesses.



FIG. 5—Case 5: Asymmetrical swelling of right neck and mandibular soft tissues. Note the necrotic area over the right mandibular ramus, and sutured sites of surgical drainage on the lower neck.

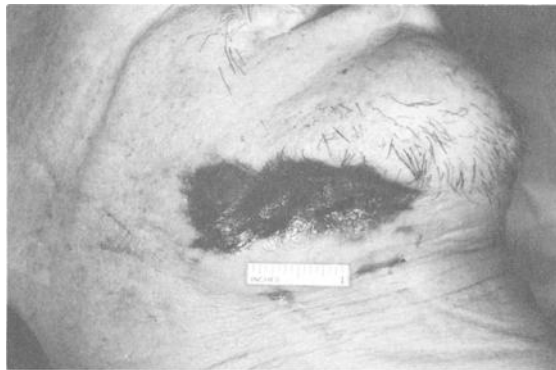


FIG. 6—Case 5: Closeup view of cutaneous necrosis, which followed surgical incision and drainage (note incision along anterior-inferior border immediately inside of necrotic area). The well-delineated margins mimic a patterned blunt injury.

culature and soft tissues were severely necrotic, with masses of acute inflammatory cells percolating through the remnants of myofibers. Microabscesses were ubiquitous. A diffuse, acute bronchopneumonia was demonstrated, and diabetic glomerulopathy was apparent in kidney sections.

As his underlying injury was a direct consequence of a beating, the manner of death was classified as a homicide.

Discussion

Necrotizing fasciitis is a fortunately uncommon condition that is quite familiar to surgeons, obstetricians, and gynecologists. The most common presentation follows abdominal, pelvic, or perineal injury or surgery, wherein a rapidly spreading infection permeates the tissues around or near the damaged area or operative site, spreading along the fascial planes. A significant occurrence of fasciitis of the extremities is related to drug abuse. The early clinical findings are innocuous, reflecting the insidious nature of the condition. After a short period of time, the overlying skin and subcutaneous tissues become erythematous and indurated, and begin to slough. Even then, the true extent of the infection is not obvious, as the process infiltrates the fascial spaces beyond the grossly apparent limits of the infection. Therapy for this rapidly advancing necrotizing inflammation requires massive debridement, as well as antibiotic and fluid support. It is not uncommon for a patient with this condition to require several episodes of debridement, and frozen section diagnosis at the time of the surgery has been advocated as a tool to aid the surgeon in carrying out the necessary amount of tissue removal [1]. A prolonged convalescence, with extensive skin grafting, is often the course if the patient survives the initial period. The mortality rate for necrotizing fasciitis of the body is about 25 to 30%; however, mortality increases to 50% over the age of 50 [2].

Necrotizing fasciitis of the neck (NFN) is a much less common condition than fasciitis of the abdomen, perineum, or extremities. A recent review by Spankus et al. [3] found 29 cases reported in the world literature, and added 3 new cases. In many ways, NFN is similar to fasciitis in other areas of the body because it is rather insidious in onset, yet rapid in its course. The mortality rate in Spankus' series was 22%, with a definite increase in the death rate of males over 40 years of age. Of the 5 cases reviewed here, all were male, and the ages ranged from 18 to 47, with an average age of 30.2 years. Other studies have found a predominance in whites; the fact that 3 of the 5 cases delineated here were American Indian may reflect the distinctive racial mix of New Mexico.

The risk of development of NFN is exacerbated by the presence of underlying disease. Approximately 50% of the cases have one or more predisposing conditions, including (in descending order of frequency) diabetes mellitus, atherosclerotic coronary vascular disease, and alcoholism. Two of the five cases here were chronic alcoholics, and one was diabetic as well.

The development of NFN most often follows a dental infection, usually with abscess formation. Of importance to forensic pathologists is the fact that the second most common source of infection is trauma, which may be extremely minor in nature. One previously reported case [4], that of a 43-year-old alcoholic man, illustrates that even such everyday minor injuries as facial ecchymoses, abrasions, and lip lacerations may lead to a fatal infectious process. Other conditions which have been known to result in NFN are peritonsillar abscess [5] and osteoradionecrosis [6].

The bacteriology of NFN is relatively constant. In nearly every case, a Gram positive coccus, generally hemolytic *Streptococcus*, is a predominant organism. Anaerobic organisms are often present (as in the cases reviewed here), and Gram negative bacteria may also be cultured. These findings are in keeping with the bacteriologic results in necrotizing fasciitis of all bodily sites [7]. These types of organisms are in contrast to the fusospirochetes found in Vincent's angina, an exudative infection of the oropharynx that may be confused with NFN.

The medicolegal implications, as illustrated by several of the cases reported here, are relatively self-evident. In deaths that result as a consequence of NFN, documenting the presence of any former or predisposing injury is vital in establishing the manner of death, especially where the manner is a homicide. As with many other situations, it is not always clear to the clinical physician that a relationship between injury and later sequelae may be important, and the forensic pathologist must investigate the etiology of cases of fasciitis that come to

autopsy. There are also pitfalls in the interpretation of injuries in NFN; in Case 5 of this series, the large gangrenous area surrounding the surgical drainage site was initially misinterpreted as a patterned injury from a blow by a blunt object (Fig. 6). Only after consultation with the admitting physicians and surgeons was it clear that the cutaneous necrosis had followed the surgical intervention and was not related to the primary injury. As death may occur days to weeks after the initial trauma occurred, the passage of time, with concomitant changes of healing, may significantly alter or obscure the contours of the original injury, making meaningful interpretation difficult.

Another problem of forensic science interest which has not been addressed in any previous description of NFN is the role that a psychiatric illness may play in the development and course of this illness. Two of the five cases described here involved individuals who had significant mental illness. In Case 1, the personality disorder, complicated by a fear of physicians, caused the young man consciously to avoid medical treatment, and thus contributed to his death. In Case 2, the chronic schizophrenia probably interfered with adequate care. It is well known that underlying mental illness can cause a patient to avoid medical care, and thus exacerbate even innocuous medical conditions [8]. As a consequence of the tremendous social upheaval of the past decade, wherein innumerable formerly institutionalized mental patients have been turned out into the community to fend for themselves, deaths in this population are often unattended, and thus fall under the jurisdiction of local medical examiners. Therefore, it is not unlikely that NFN might be discovered in the careful autopsy of a patient with some sort of psychiatric illness who died alone, on the street, or in a transient-type hotel. Awareness of this condition will prevent missing NFN as a cause of death, even where gross morphologic changes are minimal (as in Case 1 of this series).

Conclusions

Necrotizing fasciitis of the neck is a rare, rapidly advancing, potentially fatal infection of the soft tissues of the neck, with a relatively characteristic bacteriology. The etiology is most often from a dental infection. However, even a minor injury may be the point of origin of the septic process. Predisposing conditions include diabetes, coronary artery disease, and alcoholism. Although usually producing external morphologic changes, notably edema, induration, and sites of drainage, cervical fasciitis may occasionally present as a sudden unexplained death without any of these changes. Also, this condition may arise in a patient with mental illness, and the prompt diagnosis and therapy needed to halt the fascial spread of the infectious process may be impeded by the underlying psychiatric problem. Finally, cases of necrotizing fasciitis of the neck should be closely investigated to determine if trauma was the inciting event, so as to ascertain correctly the manner of death.

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