Cervical Necrotizing Fasciitis

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Necrotizing fasciitis (NF) is a rapidly progressing soft tissue infection that carries a significant mortality rate despite intensive treatment. Terms such as hospital gangrene, streptococcal gangrene, Meleney gangrene, gangrenous erysipelas, necrotizing erysipelas, and synergistic necrotizing cellulitis have been used as synonyms. More commonly seen in the abdomen, perineum, and lower extremities, the neck, owing to its rich vascular network, is a rare site for this fulminant condition. It is characterized by widespread destruction of the subcutaneous tissues and fasciae and gas formation in anatomic spaces. Overlying skin and muscles are spared initially but may undergo necrosis with disease progression.

Cervical NF is most commonly caused by dental infection, especially from the mandibular molars, followed by trauma.1,2 Less common causes of cervical NF are peritonsillar abscess, insect bites, osteoradionecrosis, and hypodermic needle infection.3 NF can be caused by a single organism but usually occurs as a polymicrobial infection. Among causative bacteria are group A β-hemolytic and other types of streptococci, Staphylococcus aureus, Escherichia coli, Klebsiella spp, and some obligate anaerobes, such as Bacteroides spp and Peptostreptococcus spp.1,4

In this article, three cases of cervical NF are described and the clinical features and management of this fulminant disease are discussed.

Case Presentations

Case 1

A 27-year-old male presented with the main complaints of fever, difficulty in swallowing, and an enlarging neck mass. His sore throat started a week previously, and he was diagnosed with tonsillitis by his family physician and was given oral antibiotics. Despite this treatment, his symptoms worsened, and he was seen at another hospital for this problem. A diagnosis of right peritonsillar abscess was made, incisions in the anterior tonsillar pillar were made, and a copious amount of purulent material was drained. He was admitted and started on intravenous metronidazole and seftrixone therapy. Owing to his worsening general condition, high fever, and an enlarging swelling in the right side of the neck, he was transferred to our hospital.

His physical examination revealed a painful, reddish, and warm swelling in the right side of the neck (Figure 1). No fluctuance or crepitus was elicited. He had severe trismus and could only tolerate liquids. His temperature was 39.5°C. Laboratory tests showed a sedimentation rate of 78 mm/h and a white blood cell count of 23,000, with a neutrophil dominance. Ultrasonography of the neck showed diffuse thickening of the skin with emphysema in the subcutaneous tissues. No abscess formation was observed. Because of these ultrasonographic findings, computed tomography (CT) was ordered to evaluate the extent of the pathology in more detail. Diffuse subcutaneous air-fluid levels were observed on the CT scans (Figure 2).

Cultures were taken from the throat, and the antibiotic therapy was switched to a combination of clindamycin and gentamicin. Given that the swelling increased markedly in size and the overlying skin became more erythematous within a day, the patient was taken to the operating room for neck exploration. A modified hockey stick incision that slightly passed the midline was used. During the operation, a large amount of foul-smelling purulent material was encountered as soon as the skin and subcutaneous layers were passed. Cultures were taken from this material. The superficial and deep cervical fasciae were necrotic, and the external jugular vein was thrombosed. The parapharyngeal and retropharyngeal spaces were involved, but, fortunately, major vessels in the neck vessels were spared. Dead tissues reached as low as the inferior border of the clavicle. All necrotic and infected tissues were removed (Figure 3A). Opened neck spaces were copiously irrigated with antibiotics and antiseptic solutions. Multiple drains were installed, and
the wound was closed in layers. After consultation with the clinical microbiology department, gentamicin was replaced by ciprofloxacin. Skin necrosis along the wound edges were observed in the postoperative period, and local débridement was performed. His fever remained high during the first 3 days following surgery. Cultures taken during the procedure turned out to be negative. Hyperbaric oxygen (HBO) treatment was initiated to accelerate the healing process. The general health condition of the patient and his cervical wound improved significantly after the third day until his discharge on the fifteenth day following the procedure. At the 2-month follow-up, the skin defect was observed to have healed completely with secondary intention (Figure 3B) and a tonsillectomy was performed under general anesthesia.

Case 2

A 74-year-old woman was referred to our department from the emergency unit for high fever, left-sided neck swelling, and difficulty in swallowing. The symptoms had begun 2 weeks previously after she manually tried to remove a food remnant from the back of her throat, and she was receiving oral antibiotic treatment, without any benefit. Her past medical history was positive for hypertension and ischemic heart disease. The initial head and neck examination revealed a diffuse left neck swelling with overlying skin erythema that was very tender on palpation. The oral examination was normal, but flexible endoscopy showed diffuse edema and pooling of saliva in the hypopharynx. The vocal cords were mobile. Purulent material was recovered from fine-needle aspiration of the neck swelling, which was sent for culture. Laboratory tests showed a severe leukocytosis, a very high sedimentation rate, anemia, and impaired renal and liver function tests. Blood cultures were taken, and gentamicin and clindamycin were started after consulting with the infectious diseases department. On the neck CT, diffuse air was seen in the parapharyngeal, retropharyngeal, prevertebral, and masticatory spaces on the left side.

Figure 1. A, Anterior view of the patient showing an erythematous right-sided neck mass. B, Close-up view of the patient with oozing pus and skin discoloration owing to thrombosed dermal vessels.

Figure 2. A, Computed tomography of the patient showing asymmetry of the pharyngeal air column and diffuse air in the parapharyngeal space. B, Note that the diffuse emphysema reaches the left side of the neck at the hyoid level.
With the diagnosis of cervical NF, the patient was taken to the operating room the next day for débridement. A modified hockey stick incision similar to the one used in case 1 was used. Similarly, a large volume of pus started to ooze from the subcutaneous tissues as soon as the incision was made. This was sent for culture as well. The sternocleidomastoid muscle fascia and some parts of the muscle were observed to have undergone necrosis. Pus-filled spaces were found deeper to this muscle, in the parapharyngeal and retropharyngeal regions. The facial vein was thrombosed by the infectious process and was ligated and removed. At the end of the operation, a skin strip about 6 cm wide, just superior to the incision line, had to be removed because it lost its viability while removing the deep necrotic tissues. The wound was irrigated with antibiotics, and antiseptic solutions and drains were placed. Several sutures to bring the upper and lower edges of the incision were placed. The surgery was completed with direct laryngoscopy and esophagoscopy to look for any pathologies that could have been overlooked during the initial examination, which was negative.

Cultures taken intraoperatively showed a growth of *Streptococcus anginosus*, which was sensitive to ampicillin, cefotaxime, clindamycin, vancomycin, and ofloxacin. In the early postoperative period, the patient experienced severe medical problems, including high blood pressure and low oxygen saturations. In the second day following the débridement, the urinary output of the patient started to decrease, eventually leading to anuria. Her red blood cells and platelets showed a steady decline despite appropriate transfusions. On the tenth postoperative day, the patient experienced cardiac arrest, and after resuscitation, she was transferred to the intensive care unit. Two days later, brain death occurred.

**Case 3**

A 43-year-old male patient underwent total laryngectomy and bilateral functional neck dissection for a T4N2c squamous cell larynx carcinoma. He was receiving cefazolin as routine prophylaxis. On the fifth postoperative day, he developed a high fever, and an erythematous swelling on the right side of the neck, shoulder, and pectoral area was observed. Crepitation could be elicited in the involved areas on examination. Foul-smelling pus started oozing from these areas, with loss of skin within hours. We consulted with the infectious diseases department, and a combination of ampicillin + sulbactam and gentamicin was initiated. Blood and wound cultures were taken. On the following day, he underwent a wide débridement. The apron flap used for the primary operation was elevated. The incision was extended to the right pectoral area. Necrotic tissues were observed in the right anterior and posterior triangles of the neck, in the right pectoral area, and around the reconstructed pharynx. Some necrotic tissue surrounded the right spinal accessory nerve, which was removed without sacrificing the nerve. The wound was copiously irrigated with antiseptic solutions. Two drains for the cervical area and the pectoral area were placed. His general condition and his wound improved gradually within 2 weeks, and a procedure to repair his skin defect involving the right infraclavicular area was performed. The defect was repaired with a combination of primary closure and skin grafting. Heavy
growth of *Streptococcus mitis*, sensitive to vancomycin, was demonstrated on both the wound and the blood cultures. The patient was sent to our oncology department for radiotherapy 2 weeks following wound closure.

**Discussion**

NF was first described by Joseph Jones, a Confederate army surgeon, in 1871, which he observed in wounded soldiers during the American Civil War. He used the term *hospital gangrene* for this disease and referenced more than 2600 cases.\(^5\) In 1924, Meleney reported on 20 cases of superficial fascial necrosis in China as a consequence of minor trauma or insect bites and isolated β-hemolytic streptococcus from these cases.\(^6\) He named the pathology "hemolytic streptococcus gangrene." In 1952, Wilson was the first person to use the current term "necrotizing fascitis." He reported on 22 cases of severe infection and necrosis of superficial and subcutaneous tissues following wounds, lacerations, abrasions, and insect bites. This term is the most accurate description of this clinical entity since it emphasizes the propensity to involve and spread along fascial planes and the nonspecific microbiologic nature of the disease.

NF can occur in all age groups but is more frequent in adults than children.\(^1\)\(^7\) There is no gender or racial predilection. Among the predisposing factors for NF are alcoholism, diabetes mellitus, arteriosclerosis, chronic renal failure, intravenous drug abuse, malignancy, immunosuppression, obesity, and local factors (eg, minor trauma, dental problems, surgery, acne lesions, herpes infection, chronic tonsillitis). However, in the pediatric age group, NF mostly affects healthy children.\(^7\)

Poor prognostic factors affecting survival in cervical NF are old age, uncontrolled diabetes, female sex, anemia, coexistent pulmonary disease, late referral, and delayed surgical intervention.\(^8\) Descending infection leading to thoracic involvement also negatively affects the ultimate outcome. The second case in our study carried several of the above-mentioned unfavourable conditions (old age, late referral, ischemic heart disease, and female sex), which eventually led to her death owing to sepsis-associated multiorgan dysfunction. Although the disease in case 1 was more extensive, he showed a pronounced recovery after the initial surgical intervention. This is mainly due to his young age and the lack of any other associated health issues. The third case, who was in his early forties, also fared well after the débridement.

Reported mortality rates for cervical NF show great variation. The overall mortality rate in cervical NF without mediastinal involvement is reported to be between 0 and 32% in different studies.\(^9\) If there is mediastinal involvement, the mortality rate is reported to exceed 50%.\(^10\) Especially during the preantibiotic era, descending NF was associated with mortality rates over 50%.\(^11\) Despite the availability of broad-spectrum antibiotics, the disease still carries a high mortality rate. If left untreated, NF is associated with a mortality rate between 22 and 100%.\(^8\)

The differential diagnosis of cervical NF includes gas gangrene, myositis, pyoderma gangrenosum, and thyroditis. Especially in its early stage, NF may be misdiagnosed as cellulitis or erysipelas. The similar initial presenting signs of warm erythematous and edematous skin, swelling, and pain often lead to this confusion.

Among some of the major complications of cervical NF are pneumonia, septic shock, lung abscess, mediastinitis, pleural effusion, pericarditis, internal jugular vein thrombosis, and arterial erosion.

The role of CT in the diagnosis of cervical NF cannot be overemphasized. Although ultrasonography can yield valuable information, CT shows the extent of the disease precisely and thus is valuable in early diagnosis and monitoring the course of the infectious process. The extent of surgical débridement and the decision to repeat wound exploration can be based on CT findings. The most common findings seen on the CT scans of patients with NF are thickening of subcutaneous tissues, fluid collection in multiple neck spaces, and diffuse enhancement and thickening of the cervical fasciae, platysma, and neck muscles.\(^12\) The deep tissue involvement seen on CT scans always extends beyond the overlying skin necrosis. Subcutaneous air, which is one of the cardinal signs of NF, can be demonstrated on only 60% of CT scans. Magnetic resonance imaging is also an alternative, but it is more expensive and takes more time to complete than CT.

The pathogenesis of NF is not clear. It has been hypothesized that the release of several bacterial enzymes and toxins such as hyaluronidase and proteolytic portions of cell membranes contribute to the necrotic process.\(^13\) In the early stages of the disease, infection spreads along natural fascial planes, sparing the skin. As the disease progresses, thrombosis of dermal and subdermal perforators occurs, causing skin necrosis. The avascularity of fascial planes, especially in the presence of anaerobic bacteria, is speculated to help the propagation of the infectious process.

As discussed earlier, the most common causes of cervical NF are odontogenic infection and minor trauma. Less than 10 cases of cervical NF secondary to peritonsillar abscess have been reported.\(^3\) Our literature review revealed only one case of NF following laryngectomy.\(^9\) In that case,
NF occurred 7 months after total laryngectomy, whereas in our case, NF developed as an early complication following the initial surgery. This occurred while case 2 was being treated for NF in our clinic. In some cases, the entrance route of the infection cannot be found since only a minor, insignificant trauma may be the cause. In case 2, manual trauma to the posterior pharyngeal wall was considered to be the most likely source of infection. In cervical NF, the submandibular and carotid triangles are most commonly involved. This is due to the fact that the submandibular triangle is the first lymphatic echelon of the mandibular molars. The submandibular area is contiguous with the parapharyngeal space. From this space, the infection can spread along the carotid sheath or retropharyngeal space to involve other parts of the neck or mediastinum.

To achieve a good outcome in NF, proper treatment is essential. This requires early intervention. The main problem is that these patients lose a lot of valuable time before they are referred to clinics in which their definitive treatment is given. A history of prolonged oral antibiotic treatment on an outpatient basis is common. Given that the infection is usually polymicrobial, an empiric combination of antibiotics effective against the most likely organisms should be started immediately. This treatment can be modified according to culture results. It has been shown that anaerobes account for 30% of the bacteriology, so the combination should definitely cover these microorganisms. The consumption of oxygen by aerobic microorganisms in these infections causes anaerobes to flourish. In our cases, we preferred a combination of clindamycin and gentamicin to cover gram-positive and gram-negative aerobes and anaerobes as the initial antibiotherapy. There was no growth in the tissue and blood cultures of case 1. This may be due to the use of a combination of oral and intravenous antibiotics (metronidazole and ceftriaxone) before the patient was referred to our clinic. In the other cases, we changed our antibiotic regimen after obtaining culture antibiograms.

Along with effective antibiotherapy, surgery constitutes the mainstay of treatment. Early surgical intervention is directly associated with prognosis in these patients. Repeat surgery may be needed in some patients. The surgery should consist of wide exposure of all fascial planes, removing pus and necrotic tissues, opening closed neck spaces to prevent abscess formation, and taking multiple cultures. Placing drains should be part of the procedure as well. The wound can be left open to prevent the growth of anaerobes. This also facilitates local antibiotic irrigations. Frequent dressing changes prevent purulent fluid sequestration. Although there are some controversies in the literature, NF is a good indication for HBO treatment. Not only does it make the cellular environment unfavourable for the anaerobes to grow, but it also accelerates the wound healing process. For patients in whom mobilization would not pose a significant problem, HBO should be an essential part of the treatment. Given that our hospital does not have an HBO treatment unit, it was possible to apply this treatment to only one of our patients, in whom daily transfer from one hospital to another was not a problem because of his relatively better general health.
condition. The use of intravenous immunoglobulin G in NF has been reported in several reports. Although promising results were obtained, the high cost of this treatment may limit its use.

References

Authors Queries

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