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Research Article

# Necrotizing Fasciitis: An Orthopedic Perspective Diagnosis and Management Study

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**Received:** December 16, 2021; **Published:** March 21, 2022

## Abstract

**Background:** Necrotizing fasciitis (NF) is described as an uncommon life-threatening condition characterized by progressive necrosis of subcutaneous tissue and deep fascia planes leading to death if not recognized early and debrided. The main dilemma in the management of Necrotizing fasciitis is its early diagnosis to allow appropriate management.

**Objective:** The objective of this retrospective study was to show results of early diagnosis and debridement of Necrotizing fasciitis and determine mortality outcomes.

**Methods:** Patients with diagnosis of NF in our institution from November 2015 to November 2019 were reviewed retrospective for their clinical presentation, laboratory, risk Indicator of Necrotizing fasciitis leads Score (LRINEC), debridement and mortality.

**Results:** 25 patients with diagnosis of NF, 17 idiopathic (68%), 5 perirectal abscess (20%) and 3 subcutaneous injection of spinal anesthesia in lumbar region (12%).

Common comorbidity were diabetes mellitus (75%), chronic renal disease (66%), peripheral vascular disease (31%).

Clinical presentation pain out of proportion (71%), Erythema (87%), Fever < 38c (82%), skin necrosis bulle (77%).

LRINEC score was < 8 in 19 patients (76%). The infecting organisms were polymicrobial (69%) while (31%) were mono microbial. Average time to operative debridement is 15 hours range (10 - 72) with 4.7 debridement per patient (range 3 - 7). Overall Mortality is 2 patients (8%).

**Conclusion:** Early diagnosis and debridement leads to reduced mortality in necrotizing fasciitis.

***Keywords:*** *LRINEC Score; Necrotizing Fasciitis; Mortality Rate; Risk Factors*

## Introduction

Necrotizing fasciitis (NF) is a subclass of the aggressive skin and soft tissue infections (SSTIs) that results in muscle fascial and subcutaneous tissue necrosis. It is commonly known as flesh-eating disease. This infection is known to travels along fascial planes, which is poor in vascularity [1].

About 0.5 in every 100,000 people per year in the US get NF. It is as common as one in every 100,000 people is some countries. IF not treated, NF can cause mortality in about 100% of cases. Lower extremities are the most common site of NF (57,6%), followed by the abdomen and the perineal region. Upper limbs are rare sites compared to the lower limbs [2].

Trauma is the commonest recognizable etiology. The preponderance of cases has previous slight or major traumas, generally comprising external wounds and surgical wounds [3]. Perforated appendicitis, infection after incarcerated hernia repair, necrotizing cholecystitis, perforated diverticulitis, gastroduodenal perforation, small bowel perforation and obstructive colon cancer with perforation are some the most common complex intra-abdominal infection can lead to NF. Notably, the incidence of NF due to surgical wounds in the chest wall was higher than that observed from similar wounds in the lower abdominal wall. This conditions make the patients at high threat of osteomyelitis and significantly increase the mortality rate of these patients [4].

Scrotal necrotizing fasciitis is prone to skin gangrene (Fournier's gangrene) due to insufficient subcutaneous fat. This is typically the first sign of a necrotizing perineal infection. Fournier's gangrene is often the result of a surgical wound [5]. In addition, this may appear as a consequence of colorectal condition due to ano-rectal infection, sciatic rectal abscess, and colonic perforation. Other causes comprise urethral strictures and trauma from indwelling Foley catheters. In women, it is usually associated with a Bartholin's abscess or an infection of the skin of the vulva [6].

The diagnosis of NF is still chiefly a clinical. Cases of NF typically present with the characteristic triad of symptoms: local pain, edema, and erythema. Tachycardia (> 100 beats/min) and fever are the frequent vital sign deviations, trailed by hypotension (SAP < 100 mmHg) and tachypnea (> 20/min) [7]. These manifestations, in addition to erythema, are helpful in assuring the diagnosis of NF due to other soft tissue infections. At the site of infection presents with pain, sclerosis, skin necrosis, and bleeding bubbles.

Test results for this disease are often nonspecific. However, there are some test results that can help your doctor distinguish NF from other skin diseases, such as a necrotizing soft tissue infection [8]. Precisely, leukocytosis is a mutual characteristic in cases with NF, and white blood cell (WBC) count in leftover of 20,000/L is extremely suspicious. Blood urea nitrogen > 18 mg/dL and serum creatinine > 1.2 mg/dL imitate enduring renal failure, that characteristically found. Numerous laboratory-centered scoring systems have been projected for founding early diagnosis of NF. One of them is the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) [9].

The management of necrotizing fasciitis must be emergency surgery. Better outcome if the surgery is started as early as possible. Surgery requires extensive and extensive excision of the entire necrotic tissue [10]. Early surgery can help minimize tissue loss and eliminate the need to amputate a necrotic limb. For large wounds, the wound should be left open and covered with a damp dressing. Daily change of clothes is mandatory. As long as the necrotic tissue is removed, the patient recovers faster. Excellent surgical evaluation is required when clearly normal tissues are present but without obvious necrosis. In most cases, if there is any doubt about viability, tissues should be removed. In most cases, hemodynamic stability is restored after necrosis and removal of pus [11].

After the operation, patient must be intubated and monitored in the intensive care unit, and may necessitate daily debridement of the surgical wound. Close care is needed to hemostasis and return to the operating room may be needed to remove the necrotic tissue [12].

## Objective of the Study

The objective of this retrospective study was to show results of early diagnosis and debridement of Necrotizing fasciitis and determine if it changes mortality outcomes.

## Materials and Methods

patients admitted in our institute from November 2015 to November 2019, retrospective data collected and medical records were reviewed with diagnosis of necrotizing fasciitis. the data collected were age, gender, anatomic location, comorbidity, intraoperative finding of foul smelling fluid, lack of bleeding and necrotic fascia were also noted. Statistical analysis done with use SPSS software.

## Results

25 patients whose data was collected retrospectives, 13 males and 12 females with average age of 55 (range 35 - 71) from November 2015 to November 2019 in our institute (trauma level 1 unites). 18 patients had diabetes mellitus and chronic renal disease, the parameters included in LRINEC scoring system were done.

25 patients with diagnosis of NF, 17 idiopathic (68%), 5 perirectal abscess (20%) and 3 subcutaneous injection of spinal anesthesia in lumbar region (12%).

Common comorbidities were diabetes mellitus (75%), chronic renal disease (66%), peripheral vascular disease (31%).

Clinical presentation pain out of proportion (71%), erythema (87%), fever < 38c (82%) skin necrosis bulle (77%).

All patients admitted in our hospital had extremity NF in this series, 21 patients (84%), lower limb while 4 patients (16%) lumbar spine region. the data collected included age and gender, anatomic location, LRINEC score, time to surgical debridement, number of debridement and mortality.

LRINEC score was > 8 in 19 patients (76%) and was 6 in 3 patients (4%). the average time to operative room was 15 hours (range 10 - 72).

The organisms cultured are shown in table 3. The most common bacteria were *Strept*. species, found in 13 cases (52%). *Staph. aureus* was found in 9 cases (36%), *Proteus* was found in 6 cases (24%), *Actinobacteria baumannii* was found in 2 cases (8%), same as *Escherichia coli* and *Enterobacter* species. *Klebsiella, Enterococci, Pseudomonas*, and *Bacteroides* were found in only 1 case (4%) for each.

The infecting organisms were polymicrobial (69%) while (31%) were mono microbial. Average time to operative debridement is 15 hours range (10 - 72) with 4.7 per debridement per patient range (3 - 7). overall mortality is 2 patients (8%).

| Value | LRINEC |
|---|---|
| **c-reactive protein, mg/L** | |
| > 150 | 4 |
| <150 | 0 |
| **WBC count. 1000 cells/$m^3$** | |
| < 15 | 0 |
| 15 - 25 | 1 |

| | |
|---|---|
| > 25 | 2 |
| **Hemoglobin level, g/dl** | |
| > 13.5 | 0 |
| 11 - 13.5 | 1 |
| > 11 | 2 |
| **Sodium level, mol/L** | |
| > 135 | 0 |
| < 135 | 2 |
| **Creatinine level** | |
| < 1.6 | 0 |
| > 1.6 | 2 |
| **Glucose level, g/dl** | |
| < 180 | 0 |
| > 180 | 1 |

***Table 1:*** *Six different variables included in the laboratory risk indicator for necrotizing fasciitis score (LRINEC).*

| Risk Category | LRINEC Score points | Probability of NSTI (%) |
|---|---|---|
| Low | < 5 | < 50 |
| Intermediate | 6 - 7 | 50 - 75 |
| High | > 8 | > 75 |

***Table 2:*** *Patient categorized within the laboratory risk indicator for Necrotizing fasciitis LRINEC score Soft tissue infection (NSTI).*

| Organisms | No of cases |
|---|---|
| *Streptococcus species* | 13 |
| *Staphylococcus aureus* | 09 |
| *Klebsiella* species | 01 |
| *Enterococci* | 01 |
| *Actinobacteria baumannii* | 02 |
| *Escherichia coli* | 02 |
| *Pseudomonas aeruginosa* | 01 |
| *Enterobacter* species | 02 |
| *Proteus* species | 06 |
| *Bacteroides* organisms | 01 |

***Table 3:*** *Microbiology of necrotic soft tissue infection (NSTI): organisms recovered from 25 patients.*

***Figure 1-3***

## Discussion

NF is designated as an rare life-threatening disorder considered by advanced necrosis of subcutaneous tissue and profound fascia planes which is fatal if not timely identified and debrided. It is associated with high mortality rate (10% - 70%) in spite of recent advance in the investigative and beneficial treatment modalities [13]. NF could be categorized whether it is poly-microbial (Type 1) or mono microbial (Type 2) [14].

The chief impasse in the management of NF is its early finding to provide proper management. Also, it must be differentiated from cellulitis because erythema and pain out of proportion, soft tissue edema, fever, skin bullae and necrosis are shared between both of them [15-18].

In the present study patients, 52% were males and 48% were females, with average age of 55. Common comorbidity were diabetes mellitus (75%), chronic renal disease (66%), and peripheral vascular disease (31%). The overall mortality rate was 8%. A nationwide population-based case-control study in Taiwan conducted on 7391 NF patients showed that among them, 4715 patients (64%) were man and 2676 (36%) were women. The overall incidence rose with age with male predominance. The in-hospital mortality rate, which also rose with age, was 32.2%. Diabetes mellitus (P value < 0.0001), alcoholism (P <. 0001), and chronic kidney disease (P <. 001) were identified risk factors. Chronic kidney disease was also identified as predictors of in-hospital mortality [19].

Another nationwide cohort study on Danish residents between 2005 and 2018 reported that among 1527 patients with NSTI that were identified, all-cause 30-day, 90-day and 1-year mortality were 19.4%, 25.2%, and 30.4%, respectively. Diabetes was the most predominant comorbidity affecting 43% of the patients (compared to 75% in our findings), while 26% had no comorbidities. Higher age, female sex and increasing comorbidity index were found to be independent risk factors of mortality [20].

Most of our cases were idiopathic (68%), while 20% followed perirectal abscess, and 12% followed subcutaneous injection of spinal anesthesia in lumbar region. Studies showed that NF is usually caused not only by trauma to the skin, such as that induced by insect bites, scratches, and abrasion, but also by surgical wounds in the perineum and lower extremities [21]. Other less common causes include perforated or penetrated diverticulitis, ruptured appendix, and inflammatory bowel diseases. To date, few reports of NF caused by colon cancer have been published [22].

Our findings showed that the infecting organisms were polymicrobial (69%) while (31%) were mono-microbial. Average time to operative debridement is 15 hours range (10 - 72) with 4.7 debridement per patient (range 3 - 7). The most commonly cultured bacteria were *Strept.* species, found in 13 cases (52%). *Staph. aureus* was found in 9 cases (36%), while proteus was found in 6 cases (24%). Legbo., *et al*. [23] in a 5-year prospective study of bacteria isolated from patients with NF in Nigeria showed that a single organism was identified in 70 patients (61%), multiple pathogens were isolated in 20 patients (17%), and no microorganism was identified in 30 patients (26%). Among the 62 patients, 176 aerobic cultures were carried out. Of this, 147 cultures (83.5%) were positive, while the remaining 29 (16.5%) grew no organisms after 48 hours of incubation. The commonest offending organisms were *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Infection was polymicrobial in 64% of patients.

Another retrospectively studied 115 cases in Taitung showed that a single organism was identified in 70 patients (61%) and multiple pathogens were isolated in 20 patients (17%) and no organism was identified in 30 patients (26%). The most common Gram-positive bacteria were group A *Streptococcus*, followed by methicillin-resistant *Staphylococcus aureus* (MRSA) and methicillin-sensitive *Staphylococcus aureus* (MSSA). *Escherichia coli* was isolated in 11 patients and it was the most common Gram-negative bacteria [24].

Regards recent techniques of management of NF, the excision of the necrotic tissues should extend until healthy tissue is found (but should be limited to the edges of the infection), with the vacuum-assisted closure system proved to be of great use in wound management with its combined benefits of constant cleansing of the wound and the formation of granulation tissue [25].

Future therapies are under trials. A study by Anaya., *et al*. [26] emphasized the role of IVIG in the management of NSTI, especially if NSTI is associated with group A streptococcal infection. The authors concluded that the use of IVIG seemed rational in patients with group A streptococcal infection who developed streptococcal toxic shock syndrome (STSS) and in those with a higher mortality risk (hypotension, advanced age and bacteremia). However, other studies investigating its use are contentious and difficult to compare due to the small number of patients and the differences in methodology.

## Conclusion

The mainstay of management Necrotizing fasciitis is early diagnosis and extensive surgical debridement with broad spectrum antibiotic and supportive care. The mortality rate in our hospital was significantly lower than average. A high index of suspicion is called for in early diagnosis of this condition due to the paucity of specific cutaneous findings.

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**Volume 13 Issue 4 April 2022**