

Risk Factors and Predictors of Outcome for Necrotising Fasciitis

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ABSTRACT

Background: Necrotising fasciitis (NF) is one of the most fulminant infection of skin and soft tissue. It is a fatal rapidly progressing disease causing Multi organ Dysfunction syndrome (MODS), septic shock & death if not identified early & treated accordingly. The aim is to study risk factors associated with NF and predictors of outcome.

Settings & design: Prospective observational study in a single tertiary care center.

Materials and Methods: Prospective analysis of patients with NF from March 2018 – August 2019 was done. The known risk factors were studied.

Results: A Total 120 patients were reviewed. Out of which 81 (67.5%) were males and 39 (32.5%) were females. The mortality rate in our study was 14.16%. It was significantly high in patients with CRF (p 0.045), HIV (p <0.001), Diabetes with other risk factors (p 0.003), BSA > 10% (p <0.01), Type 3 culture (0.027), LRINEC score >6 (p 0.015).

Conclusion: NF in patients with known risk factors progresses rapidly, so aggressive treatment should be given at the earliest. Early identification & prompt intervention is the key for better survival outcome in NF.

KEYWORDS: Necrotizing Fasciitis, Risk factors, Predictors, Multiorgan dysfunction

INTRODUCTION

Necrotizing fasciitis (NF) is a rare but life threatening condition first described by Wilson in the 1950s.^[1] NF involves necrosis of the fascia and subcutaneous tissue with relative sparing of the underlying muscle. It is commonly known as flesh-eating disease.^[2] According to the causative pathogens, NF is classified into three types. This classification system was first described by Giuliano and his colleagues in 1977.^[3] Type I infections are polymicrobial (mixture of aerobic and anaerobic bacteria) which is

responsible for about 80% infections. Type II infections are monomicrobial caused by group A Streptococcus (*Streptococcus pyogenes*). Type III are infections caused by *Vibrio* or *Aeromonas* species. It has been identified in patients in contact with contaminated water or food.^[4] NF can occur anywhere in the body, but commonly affected sites are extremities, perineum, and abdominal wall. Infection starts in the deeper tissue planes and progress to vascular thrombosis and cutaneous gangrene. The precise mechanism resulting in fascial necrosis is not known. Bacterial enzymes like lipase and hyaluronidase which degrade fat and fascia, are thought to be the causative factors. Activation of interleukins, tumor necrosis factor alpha, and gamma-interferon through a triggering mechanism, results in capillary thrombosis with necrosis of the fascia, cutis, and sub cutis.^[5, 6]

Patients with NF can present with symptoms of sepsis, systemic toxicity, or evidence of skin inflammation, with pain that is disproportional to the degree of inflammation. Due to minimal specific signs, it is often diagnosed late. If untreated, it may result in severe systemic toxicity, seen as septic shock and progressive multi organ failure.^[7] The treatment for NF is a combination of aggressive surgical debridement, appropriate antibiotics and optimal oxygenation of the infected tissues. Unfortunately, mortality rates are still high, despite high-quality treatment. The risk of mortality is between 25 and 35%.^[8] Previous studies have reported independent risk factors for mortality among NF patients. These are being female, having advanced age, diabetes mellitus, heart disease, liver cirrhosis, serum creatinine level >2 mg/dl, white blood cell count >30,000/mm³, hypoalbuminemia, presence of hemorrhagic bleb and skin necrosis.^[9]

The purpose of this study was to analyze risk factors and predictors of outcomes among patients with NF.

METHODOLOGY:

A total of 120 patients were enrolled in this study during the period of 18 months from March 2018 - August 2019 after taking Ethics approval. All cases were assessed, investigated, evaluated, and treated with broad spectrum antibiotics along with prompt emergency surgical treatment. The surgical procedures carried out were fasciotomy, debridement of the necrotic fascia or muscle, and amputation of unhealthy limb. Wound culture was sent for all the cases and antibiotics were given accordingly.

The collected data included age, sex, presenting symptoms, location, wound dimensions on the basis of body surface area involved, microbiological culture, risk factors, Laboratory risk indicator for necrotizing fasciitis score (LRINEC), treatment modality and outcome. The laboratory parameters used to calculate LRINEC score were C-reactive protein (CRP), WBC count, hemoglobin, serum sodium level, serum creatinine and blood glucose level.

RESULTS:

During the study period, a total of 120 admissions were recorded for NF. The mean age was 51.84 ±15.79 years (range 18-82 years). Majority of patients belonged to age group of 51-70 years followed by 31-50years. Out of these 120 patients, 81 (67.5%) were males and 39(32.5%) were females. On admission the most common presenting complaint was pain (100%), tenderness at site (99.2%). The lower limbs were the most frequently involved site in 49 patients (40.83%) followed by upper limb in 26 patients (23.3%). The least common sites were chest and face. It was found that 23 patients had wound dimensions > 10% of BSA. Bacteriological study identified type I polymicrobial culture in 68 patients (56.6%), type II monomicrobial culture in 37 patients (30.8%) and type III culture being identified in 6 patients (5%). The most common organism isolated either alone or with other organisms in polymicrobial culture was E.coli (30%) followed by Methicillin resistant Staphylococcus aureus (18.3%) and Klebsiella (18.3%). Beta-hemolytic Streptococcus (10.8%), Staphylococcus (10.8%) and MRSA (8.3%) were found to be the important cause of monomicrobial infection in NF. The most common associated co morbid condition was diabetes mellitus (45.83%). Other co-morbid factors were chronic renal failure (CRF-10%), peripheral vascular disease (8.3 %), smoking (9.16 %), alcohol consumption (25%), chronic liver disease (2.5%) and HIV (5%). Thirty four patients (28.3%) had no relevant comorbidities. Table 1 shows demographic and clinical details of these patients.

Patients were categorized into two groups depending on outcome into survival group and non-survival group. On comparing these groups we found that the mortality rate was significantly high in patients with renal failure, HIV, patients with type III culture and patients with LRINEC score >6 (p value < 0.05) Though the most common associated co morbid condition was diabetes mellitus, mortality rate was

comparable. Table 2 Presence of additional risk factor along with diabetes mellitus was found to be significant in terms of mortality rate. LRINEC Score was >6 in 74 patients out of which 15 died. Using Receiver operating curve (ROC), cutoff LRINEC point for mortality was 6.5 with area under the curve of 0.679. Table 3

Seventy four patients underwent debridement (61.6%), whereas fasciotomy was done in 29 patients (24.2 %). Amputation was done in 11 patients (9.2%) and 6 (5%) patients were treated conservatively. The mortality rate was 14.16% (17 out of 120 patients). The mortality was high in patients who underwent amputation (36%). The treatment modality and outcome are shown in Table 4

Characteristics	Patient with NF (n = 120)
18-30yrs	13 (10.8%)
31-50yrs	40 (33.3%)
51-70yrs	56 (46.7%)
71-90yrs	11 (9.2%)
Male	81 (67.5%)
Female	39 (32.5%)
Diabetes	55 (45.8%)
Chronic renal failure	12 (10%)
Chronic Liver Disease	3 (2.5%)
HIV	6 (5%)
Chronic smoking	11 (9.2%)
Chronic alcoholism	30 (25%)
PVD	10 (8.3%)
No comorbidity	34 (28.3%)
Pain	120 (100%)
Pus discharge	96 (80%)
Redness	117 (97.5%)
Increased local temperature	120 (100%)
Tenderness	119 (99.2%)
Skin bleb	20 (16.7%)

Table 1: Demography and clinical presentation of all patients

Area Under the Curve	Standard Error	Significance
0.679	0.058	p = 0.018

Table 3: ROC curve for LRINEC vs Outcome

Risk Factors present	Outcome (N=120)		Total	Significance
	DIED	SURVIVED		
DM	7 (12.7%)	48 (87.30%)	55	$p = 0.68$
CKD	4 (33.3%)	8 (66.7%)	12	$p = 0.045$
HIV	5 (83.3%)	1 (16.7%)	6	$p < 0.001$
PVD	2 (20%)	8 (80%)	10	$p = 0.58$
Alcoholism	5 (16.7%)	25 (83.3%)	30	$p = 0.65$
Smoking	2 (18.2%)	9 (81.8%)	11	$p = 0.69$
CLD	1 (33.3%)	2 (66.7%)	3	$p = 0.33$
DM with other risk factor	13 (25%)	39 (75%)	52	$p = 0.003$
LRINEC Score >6	15 (20.3%)	59 (79.7%)	74	$p = 0.015$
BSA >10%	17 (73.9%)	6(26.1%)	23	$p < 0.001$

Table 2: Risk factors with outcome

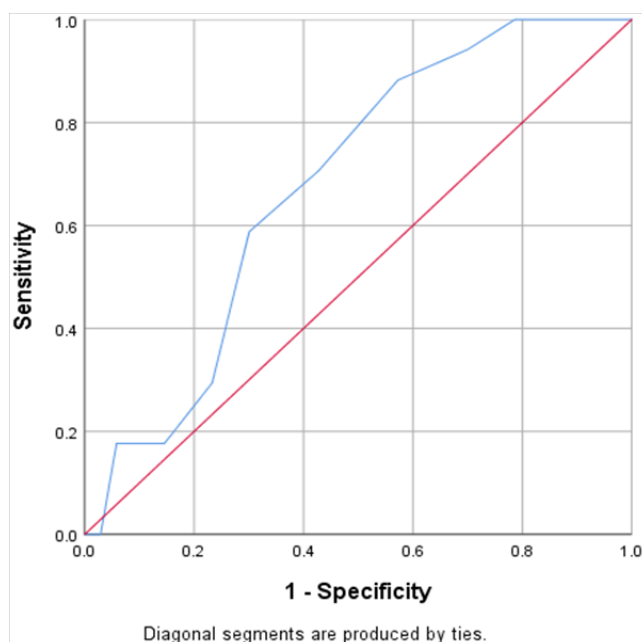


Figure 1: ROC curve with cutoff point at 6.5

DISCUSSION:

Necrotizing fasciitis (NF) is one of the fatal surgical infectious commonly seen in Indian subcontinent. NF involves necrosis of any layer within the soft tissue compartment i.e. skin, fascia and subcutaneous tissue with relative sparing of the underlying muscle or even muscle sometimes.

The mean age of patients in present study was 51.84 ± 15.79 . It is quite evident from our study that NSTIs was more common in 51-70 years (46.7%) age group. The male patients were found to be more affected than female

Parameter	No.	%	Survive	Died	Mortality Rate (%)
Conservative	6	5	6	0	0
Fasciotomy	29	24.2	27	2	6.8
Debridement	74	61.6	63	11	14.9
Amputation	11	9.2	7	4	36
Total	120	100	103	17	14.2

Table 4: Outcome of patients with different modality of treatment

patients in all age groups. Male patient comprised 2/3rd of all patients while 1/3rd were female making male: female ratio 2:1. In literature, this ratio ranges from 1.3:1 to 8:1. The mortality rates of NF in men (14.8%) and women (12.8%) were comparable.

The literature showed the lower limbs were mostly affected as they are injured more compared to other parts of body^[10], same was confirmed in our study. The lower limbs were the most frequently involved site in 49 patients (40.83%) followed by upper limb in 26 patients (23.3%). The least common sites were chest and face. The patients presented with a wide range of clinical features pain, swelling were the main presenting complaints followed by redness and fever as in other previous studies.^[9] It was found that higher involvement of body surface by wound dimensions had higher mortality rates.^[11] The body surface area >10% had exceedingly worse outcome. In present study, most of the survivors had involvement of <10% of BSA, while the

percentage of BSA involved in most of the non-survivors was >10% which was clinically significant. Mean percentage BSA involvement was 14.02% in patients who did not survive, which was significantly higher than mean BSA of total patients 8.24%. ($P = 0.001$) The most common risk factor for NF in the literature is diabetes mellitus.^[12] Diabetes (45.8%) was the most common co-morbid condition associated with NSTIs but it did not affect the outcome alone. Nai-Chen Chang presented a study which showed that diabetic patients exhibited higher chances of limb loss, although case fatality between diabetic and non-diabetic groups were comparable.^[13] Patients with HIV had highest mortality, though they were less in terms of overall incidence. Study done by Keung EZ et al showed that immunocompromised patients had higher NSTI-associated in-hospital mortality.^[14] In our study, when Diabetes was associated with other risk factor, it was significantly associated with higher mortality rate.

The LRINEC score was introduced in 2004 by Wong et al as a diagnostic tool for NF.^[15] The systemic review and observational studies report the LRINEC score can stratify the high-risk patients and predict outcome. Present study showed a significant correlation between higher LRINEC score and mortality.

The microbiological culture greatly varies according to geographical area. In our study the most common infection was a type I polymicrobial infection with a prevalence of 56.6%. Type- III Infections were least common consistent with the literature.^[16, 17] E.coli has been found as most common organism from the wound culture in current study either alone or with other organisms in polymicrobial cultures. On investigating the association of mortality with microbiological profile, we found out that the mortality rate was significantly high in patients with type III culture. In this study mortality rate was 50 % in type III culture.

Out of 120 only 6 patients were managed conservatively, rest of them required surgical intervention in one form or the other. The mortality rate in our study was 14.16%. Amputation was required in 9.2 % of NF hospitalizations. In small cohort studies, reported rates of amputation varied from 5% to 25.7%.^[18]

CONCLUSION

The occurrence & progression of NSTIs is multifactorial and the risk of mortality is determined by complex interaction. In the current study mortality rate was 14.16%. The mortality was significantly high in patients with CRF, HIV, with LRINEC Score >6, with involvement of >10% BSA and diabetes mellitus along with other risk factor. So early identification of NF and prompt surgical intervention increases survival outcomes. In patients with one or more risk factors, it is imperative to be more vigilant and aggressive.

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