Original Research Article

Role of LRINEC score in predicting mortality and limbloss in Necrotizing soft infections

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ABSTRACT

Background
Necrotizing soft tissue infections (NSTIs) are rapidly progressive fulminant infections involving soft tissue necrosis. It has a high mortality rate (ranging from 6 to 76%). There are different diagnostic adjuncts, such as finger tests, skin biopsies, ultrasounds and laboratory parameters to diagnose NSTI from other soft-tissue infections; one such modality is called LRINEC score – (Laboratory risk indicator for necrotizing fasciitis score), which predicts NSTI. A patient with an LRINEC score of 6 or more is considered at high risk of having NSTI.

Methods
A retrospective analysis was conducted for patients who were admitted with NSTI between August 2021 and September 2023. Based on LRINEC points, patients were classified into (Group 1: LRINEC < 9 and Group 2: LRINEC ≥ 9). The 2 groups were analysed and compared for mortality and limb loss.

Results
46 patients were enrolled into the study. There were 34 males and 12 females. The mean age of the study was 55.45 years. Diabetes mellitus was the most common co- morbidity, 30 cases - 65.2 %. The most common risk factor was smoking (47.8%). On analysing the clinical features of the group, 26.1% had tachypnea, 63% had tachycardia, and 43.4% had hypotension. Swelling, disproportionate pain, change in colour and temperature and tenderness were seen in all the patients enrolled (100%). Blisters were seen in 84.8%, skin necrosis in 89.1%, and ulceration was seen in 71.7% of the cases. On analysing clinical features and laboratory parameters of the group with LRINEC score ≥9 and <9. we inferred that they were significantly associated with patients having an LRINEC score of more than 9.

Conclusions
LRINEC score ≥9 predicts mortality and amputation in patients with NSTI. Hence, patients with LRINEC score ≥ 9 need aggressive surgical intervention along with intensive care and attention.

Keywords: Necrotizing Soft Tissue Infection, LRINEC.

INTRODUCTION

Necrotizing soft tissue infections (NSTIs) rank among the complex disease processes physicians and surgeons encounter. NSTIs are rapidly progressive fulminant infections involving soft tissue infection characterized by rapidly progressive necrosis of subcutaneous tissues and deep fascia planes, with resulting skin gangrene and severe systemic infection. NSTI includes all forms of necrotizing infection of the skin and soft tissues. Necrotizing cellulitis means the involvement of dermal and subcutaneous layers. Necrotizing fasciitis - Infection involving the superficial fascia, subcutaneous tissue and deep fascia.[1]Necrotizing Pyomyositis, myonecrosis involves the muscle with any of the above combinations. The clinical features

of NSTI are, however, underestimated in the initial stages of the disease due to a lack of specific clinical features and characteristics, and it is mistaken for other skin and subcutaneous infections, such as cellulitis or erysipelas.[1] The main clinical symptoms are local, such as erythema, swelling, blistering with serous fluid, tissuehardening, bluish-dark skin discolouration, hemorrhagic bullae, and skin necrosis. Thepresence of greyish necrotic fascia, demonstration of a lack of resistance ofnormally adherent muscular fascia to blunt dissection, lack of bleeding of the fascia during dissection, and the presence of foul- smelling "dish-water" pus is the characteristic feature of NSTI.[2] According to a recent study, the incidence of soft- tissue infection was found to be 0.04 cases per 1000 person-years.[3] NSTIs are typically caused by toxin-producing bacteria and are characterized clinically by rapid disease progression with significant local tissue destruction. Varying amountsof early or late systemic toxicity depends on the strain of bacteria and toxins produced. Once symptomatic, theprogression of the disease is typically measured in hours; early diagnosis and treatment are therefore crucial to survival.[4]

Diagnosis is hindered by the fact that the disease progresses below the surface, and the cutaneous manifestations belie theseverity of the disease. As the infectiondisseminates, patients develop pain and signs of systemic toxicity disproportionate to the findings of skin examination, and physicians must maintain a high index of suspicion to diagnose NSTIs rapidly. The standard treatment consists of broad- spectrum antibiotics, wide surgical debridement, and supportive care. Most patients require multiple surgical debridements, and survivors often have large and complex wounds requiring soft tissue coverage and prolonged hospitalization. Even with optimal treatment, It has a high mortality rate (ranging from 6 to 76%).[5,6] despiteadvances in modern medical care as it is associated with systemic inflammatory response syndrome (SIRS)[7] secondary to infection. There are different diagnostic adjuncts, such as finger tests, skin biopsies, ultrasounds and laboratory parameters todiagnose NSTI from other soft-tissue infections; one such modality is called the LRINEC score – (Laboratory risk indicatorfor necrotizing fasciitis score), which predicts NSTI.

Wong developed a scoring criterion (LRINEC score) in 2004 to aid practitioners in distinguishing necrotizing fasciitis from other soft tissue infections and help in early management of the disease.[8] (Table 1). Wong's scoring has a positive predictive value of 92% and a negative predictive value of 96%.[8] A patient with an LRINEC score of 6 or more is considered at high risk of having NSTI[8,9] and stratifies patients into low,medium, or high risk of NF (Table 2).

Parameter	Score
C-reactive protein, mg/dL	
<150	0
>150	4
WBC count, cells/mm3	
<15 k	0
15–25 k	1
>25 k	2
Hemoglobin level, g/dL	

>13.5	0
11–13.5	1
<11 .0	2
Sodium level, mmol/L	
>135	0
<135	2
Creatinine level, mg/dL	
<1.6	0
>1.6	2
Glucose level, mg/dL	
<180	0
>180	1

Table 1: Laboratory risk indicator for necrotizing fasciitis (LRINEC) score

Risk Category	LRINEC Points	Probability for Presenceof NSTI
Low	≤5	<50%
Medium	6-7	50-75%
High	≥8	>75%

Table 2. LRINEC risk assessment (based on Table 1)

AIM AND OBJECTIVES
Aim
To study the role of LRINEC scorein predicting mortality and limb loss in NSTI

Objective
Primary Objective
To identify the cut offLRINEC score which predicts mortality and limb loss in patients with NSTI.
Secondary Objective
To analyse theclinical features associated with thosepatient having cut off LRINEC score or more.

MATERIALS AND METHODS
Patient Selection
For this study, data were collected retrospectively from all patients hospitalized and surgically treated between September 2021 and September 2023 in the General Surgery department in Rajarajeswari Medical College & Hospital, Bangalore – 74, a tertiary care centre. Standard treatment after admission included surgical debridement and broad- spectrum antibiotics based on microbiological findings. Critical care support was required for most of the patients.

After the collection of all relevantparameters, a total of 46 patients could be included in this study. A total of 6 patients had to be excluded due to missing data, inconclusive diagnosis, or initial surgical treatments performed at referring hospitals.Each patient's record was analyzed for the following: age at admission, gender, presence of predisposing factors and comorbidities, anatomic site of infection, microbiological findings, histopathological findings, duration of hospitalization, intensive care unit stay, in-hospital lethality rate, frequency and type of operative procedures performed, time from admission to operative treatment, need for amputation, type of antibiotic therapy and vacuum-assisted-closure therapy (VAC) administered, as well as laboratory results for calculation of the LRINEC.

Patients were divided into 2 groups based on LRINEC score. Group A score ≤ 8 and Group B score ≥9.

Inclusion Criteria

All consecutive patients were admitted with a clinical diagnosis of NSTI, which was later confirmed with operative findings and histopathological tissue examination.

Exclusion Criteria

Patients who are a case of chronic renal failure.Patients who have already undergone surgical debridement for the same earlier.

Statistical Methods

Receiver–operator characteristic (ROC) curves were calculated to identify LRINEC score cut-off values for predicting outcomes (amputation rate and mortalityrate).

The cut-off value for the LRINEC score for amputation and mortality will derived from the ROC curve based on maximum sensitivity and specificity.

Enrolled patients were divided into two groups based on the cut-off value of the LRINEC score. The patient characteristics and clinical presentations of underlying disease were analysed between these two groups and compared.

Statistical analysis was carried out using the software SPSS 22.0 (SPSS, Chicago, IL, USA).Mann–Whitney U-test and a Student's t-test were used to compare the statistically significant differences betweenthe two groups. The difference was considered significant if p-the value was
<0.05.

RESULTS

46 patients were enrolled on the study. There were 34 males and 12 females. The mean age of the study was 55.45 years.

Diabetes mellitus was the most common co-morbidity; 30 cases - 65.2 % of the study group were suffering from it. The most common risk factor was smoking (47.8%).

On analysing the clinical features of the group, 26.1% had tachypnea, 63% had tachycardia, and 43.4% had hypotension. Swelling, disproportionate pain, change in colour and temperature and tenderness were seen in all the patientsenrolled (100%).

Blisters were seen in 84.8%, skin necrosisin 89.1% (Figure 1), and ulceration was seen in 71.7% of the cases (figure 2).

Figure 1: Pictures depicting bullae, necrosis anderythema

Figure 2: Pictures depicting ulcers

Polymicrobial NSTIs of acinetobacter and Klebsiella constituted 56.5% of NSTIs in our study group. Five patients (10.8%) underwent amputation (figure 3), and 7 patients (15.2 %) had succumbed.

Figure 3: Trans metatarsal amputation

Figure 4: Intra operative picture of Debridement of left upper limb

Figure 5: intra operative picture of Debridement of right lower limb
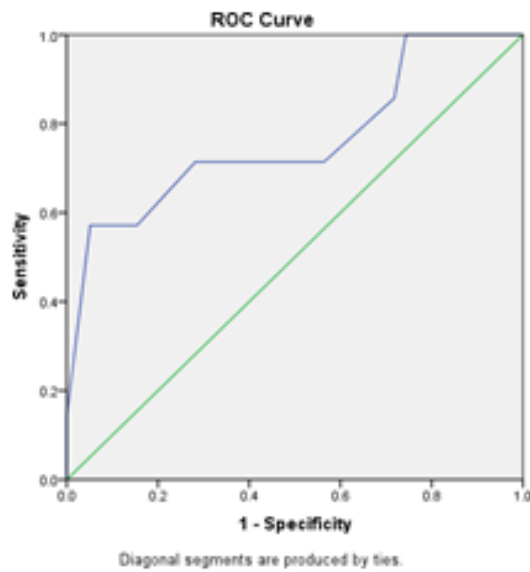
Figure 6: ROC curve of LRINEC Score in predicting mortality
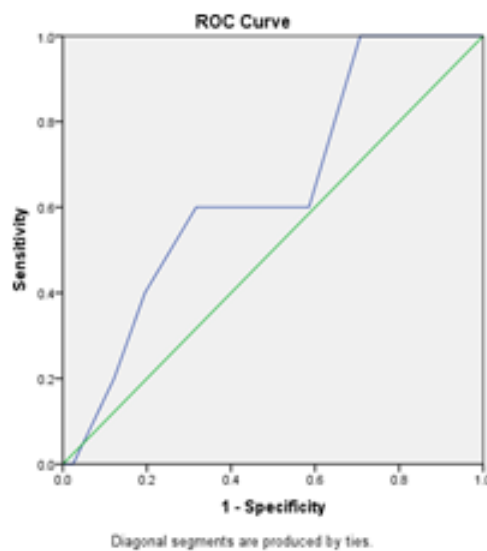

Figure 7: ROC curve of LRINEC Score in predicting amputation

Figure 8: Post-operative picture of Debrided right lower limb

Cut off value of LRINEC score for mortality was 9 with sensitivity of 71.4 % and specificity of 71.8% (Figure 6). While the cut off value for amputation was also 9 with sensitivity of 60 % and specificity of 68.3 %. (Figure 7)

On analysing clinical features and laboratory parameters of the group with LRINEC score >9 and <9 we inferred that Skin necrosis, CRP >150mg/l, Random blood sugar >180 mg/dl, serum creatinine>1.6mg/dl, sodium <135 mEq/L and total count >25000 were significantly associatedwith patients having LRINEC score more than 9.

DISCUSSION

LRINEC score was initially derived to assess the probability of a patient having NSTI.[10] It was based on the principle that NSTI is a rapidly progressive systemic inflammatory response syndrome. So, we proposed that when the LRINEC score canpredict NSTI based on the above principle,it can also predict mortality and limb loss based on the same principle because severe SIRS is the cause of death in patients with NSTI. We found that patients with an LRINEC score ≥ 9 were more prone todeath and amputation. In our study, 5 outof 7 (71.4%) patients who succumbed and 3 out of 5 (60%) who underwent amputation had LRINEC scores more than or equal to 9.

CRP>150 mg/L and total count > 25000 are markers that indicate severe sepsis. Hyponatremia, which is secondary to SIADH and adrenocortical insufficiency,[11,12] can lead to cerebral oedema and seizures.

Elevated serum creatinine associated with severe sepsis indicates acute kidney injury[2,13,14] and will require renal replacement therapy in order to prevent complications secondary to it. Hyperglycaemia impairs bacterial phagocytosis in sepsis, thereby leading to poor control of sepsis.[15]

Hence NSTI patients who have skin necrosis, CRP >150mg/l,Random blood sugar >180 mg/dl, serum creatinine >1.6mg/dl, sodium <135 mEq/L and total count >25000 need to be intensively monitored and treated aggressively as they are anticipated to have unfavourable outcomes.

As per Wong et al.[8], LRINEC ≥ 6 predictsthe presence of NSTI in patients with soft tissue infections, but the same cut-off value, i.e. 6, cannot be used to predict mortality and amputation as it only impliesthat patients with NSTI are eventually bound to die.

Hence, cut off value of 9 will be moreappropriate in predicting mortality and amputation than 6, as suggested by other studies. Review of literature: Yi-Chun Su[16] 2002-2005 conducted a Retrospective study on 209 patients and concluded that an LRINEC score of ≥6 has a higher rate of both mortality and amputation. ElMenyar et al[17] 2017 conducted aRetrospective study on 294 patients, concluding that LRINEC scoring could predict worse hospital outcomes in patients with NF and simply identify the high-risk patients. Vanessa Hoes [18] 2009-2019 conducted a retrospective study on 70 patients and concluded that an initial LRINEC equal to or greater than seven is an independent prognostic marker for lethality and can help identify high-risk patients.

CONCLUSION

LRINEC score ≥ 9 predicts mortality and amputation in patients with NSTI.

Hence, patients with LRINEC score ≥ 9 need aggressive surgical intervention along with intensive care and attention.

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