Evaluation of the LRINEC Score for Risk Stratification in Suspected Necrotising Fasciitis Patients: A Retrospective Descriptive Study

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ABSTRACT

Introduction: Necrotising Fasciitis (NF) is a severe, rapidly spreading infection of the superficial layers of the body. The mortality rate is high unless treatment is started early; therefore, early detection is key. The Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) score is the based on laboratory values and aids in the early detection of cases.

Aim: To assess the use of the LRINEC scoring system in risk stratification for patients presenting with soft-tissue infections.

Materials and Methods: A retrospective descriptive study was conducted in the General Surgery department at NRIGH Mangalgiri, Guntur, Andhra Pradesh, India, involving 40 patients from April 2021 to April 2022. Complete epidemiological, clinical, and laboratory data were analysed, and the need for surgical intervention was compared with the LRINEC score.

Results: The mean age of the study population was 58.3 years, with 27 patients being male and 13 female. The majority (98%) presented with discoloured skin. The LRINEC score of <5 was considered low risk, 6-7 as intermediate, and >8 as high risk. The LRINEC score was ≥6 in 29/40 of the patients; 19 underwent debridement, four required amputation, one needed fasciotomy, and five were managed conservatively. In the group with LRINEC score ≤6, one patient underwent debridement, and 10 were treated conservatively. Overall, 25 (63%) patients required surgical intervention. Of these, 17 (70%) were operated on within 3-24 hours and 8 (30%) between 2-5 days, based on clinical presentation. In this group, 20 (80%) underwent debridement, 4 (16%) underwent amputation, and 1 (4%) underwent fasciotomy. Out of the 25 patients who underwent surgical intervention, 5 (20%) required repeat surgery.

Conclusion: The LRINEC score is a good predictor for the early diagnosis of NF. However, periodic and successive scoring is necessary, as disease progression is inevitable. Larger studies are required to strongly affirm these findings.

INTRODUCTION

Necrotising Fasciitis (NF) is a rare but fulminant, life-threatening soft-tissue infection characterised by rapidly progressing necrosis of subcutaneous tissue and the deep layers of fascia, resulting in severe systemic infection [1]. It is a dangerous illness that affects the subcutaneous tissue, fascia, and fat, causing significant morbidity and mortality [2]. NF is uncommon, occurring in approximately four cases per 100,000 individuals. However, the mortality rate varies between 20 to 30% and can escalate to as high as 100% if there are delays in both diagnosis and treatment [3-5].

The primary factor in the failure of early diagnosis of Necrotising Soft-Tissue Infection (NSTI) may be the absence of certain clinical symptoms and characteristics in the early stages of the disease. The LRINEC score is used to distinguish NF from other soft-tissue infections such as cellulitis or abscess [1].

Skin and Soft-Tissue Infections (SSTIs) are divided into three groups by the Infectious Disease Society of America: superficial infections, uncomplicated infections, and necrotising infections [6]. There has been a recent increase in the prevalence of necrotising fasciitis due to the rising incidence of diabetes and other immunocompromised states such as HIV [7]. Wong CH et al., first presented the LRINEC score in 2004 [8,9]. For early NF detection, laboratory results such as hemoglobin, serum creatinine, blood glucose, serum sodium, total white blood cell count, and C-Reactive Protein (CRP) level are employed. However, only one trial, involving just 28 NF patients, verified the score. The scoring system for vibrio soft-tissue infection was verified in the majority of studies [10-13]. A score of six or higher on the LRINEC fasciitis score is regarded as high risk for NF [3]. This study examined the use of the LRINEC scoring system to predict the need for surgical intervention in patients with soft-tissue infections.

MATERIALS AND METHODS

A retrospective descriptive study was conducted in the General Surgery department at NRIGH Mangalgiri, Guntur, Andhra Pradesh, India, involving 40 patients from April 2021 to April 2022. The Institutional Ethical Committee (IEC) approval was obtained (IEC/NRIMC 349).

Inclusion criteria: Patients presenting with clinical features (severe pain, cellulitis, skin necrosis, haemorrhagic bullae, blisters, crepitus, severe sepsis, systemic inflammatory response syndrome, multiorgan dysfunction syndrome) and/or histopathology, irrespective of the result of the LRINEC scoring system, were included.

Exclusion criteria:

- Patients below 15 years of age;
- Patients who have received antibiotic treatment in the last 48 hours or a minimum of three doses of antibiotics before presentation;
- Patients who have undergone surgical debridement for the present episode of soft tissue infection;
- Patients with abscesses, boils, or furuncles without evidence of cellulitis.

Study Procedure

Patients presenting with Soft Tissue Infections (STI) were evaluated and treated accordingly [Table/Fig-1a,b]. All suspected patients underwent routine blood investigations, including haemoglobin, blood glucose, C-reactive Protein (CRP), serum electrolytes, coagulation profile, and renal parameters. Routine imaging, such as chest X-ray, X-ray of the involved limb, and lower limb Doppler studies, were carried out whenever necessary [Table/Fig-2]. The data collected included demographic information, a detailed history, thorough clinical examination, and a local examination, which involved assessing swelling of the affected limb, necrotic patches, discharge from the wound site, local rise in temperature, tenderness, and a pin prick test (considered positive if suspected necrotic tissue bled upon pin pricking) [Table/Fig-3,4]. The LRINEC scoring system


[Table/Fig-1]: a) Necrotic patch over medial aspect of right lower limb; b) Necrotising fasciitis progressing from ankle to mid tigh.
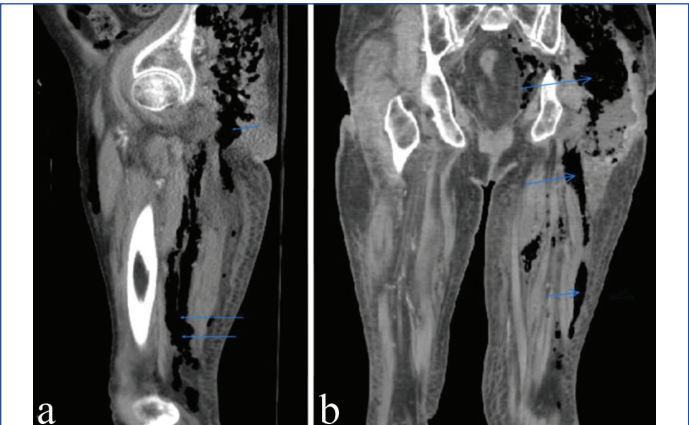
[Table/Fig-2]: a) MRI of left lower limb in saggital view showing hypo-intense area (blue arrow) (air foci) in intramuscular plane; b) MRI of bilateral lower limbs in coronal section showing air foci levels in the intramuscular plane of left lower limb.
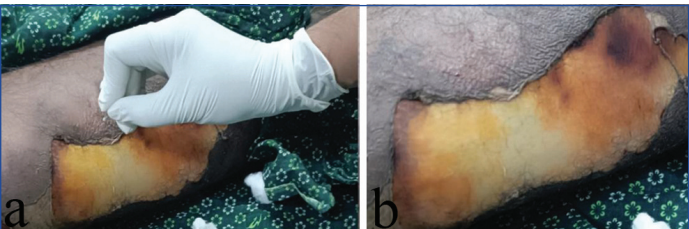
[Table/Fig-3]: Prick test negative. a) Demonstrates a prick with a 5cc needle at the border of demarcated site; b) No signs of bleeding from prick test.
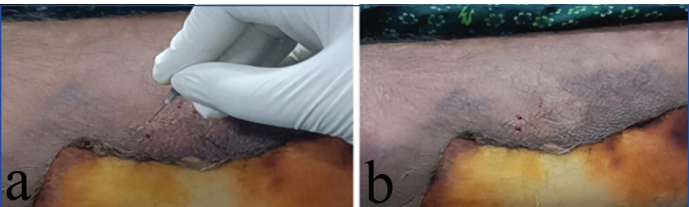
[Table/Fig-4]: Prick test positive. a) Demonstrates prick with 5cc needle 1 cm, 1.5 cm from the demarcated site; b) Showing bleed from prick site.

was applied at the time of admission [Table/Fig-5,6]. The need for any operative intervention (debridement, fasciotomy, or amputation) was noted. NF is defined as a case with histopathology results demonstrating necrosis of the superficial fascia, polymorphonuclear infiltrate, and edema of the reticular dermis, subcutaneous fat, and superficial fascia; or, in the absence of histology, gross fascial edema and necrosis detected during surgery or frank cutaneous necrosis observed upon physical examination. Culture patterns were analysed.

Variables	Score
C-Reactive Protein (CRP), mg/L	
<150	0
>150	4
Total white cells, per mm³	
<15	0
15-25	1
>25	2
Haemoglobin, g/dL	
>13.5	0
11-13.5	1
<11	2
Sodium, mmol/L	
>135	0
<135	2
Creatinine, lmol/L	
>141	0
<141	2
Glucose, mmol/L	
<10	0
>10	1

[Table/Fig-5]: Laboratory Risk Indicator for Necrotising Fascitis (LRINEC) Score.

Risk category	LRINEC score	Probability for presence of NF
Low	<6	<50%
Medium	6-7	50-75%
High	≥8	>75%

[Table/Fig-6]: LRINEC risk assessment.

STATISTICAL ANALYSIS

Continuous data, such as age, were calculated as mean and standard deviation. All categorical data, including gender, symptoms, examination findings, and histopathology, were presented as frequencies and percentages.

RESULTS

A total of 40 patients were enrolled in the study. The age of the study population ranged from 22 to 83 years, with a mean age of 58.35 years (SD=13.73). Among them, 27 were male and 13 were female. In nearly all patients 39 (98%), a necrotic patch was observed over the affected limb. The other presenting complaints included swelling of the affected limb in 38 (94%) patients, wound with discharge in 35 patients, and pain in 34 patients.

In 37 (94%) of patients, the lower limb was affected, with the thigh and leg being the most commonly involved regions. In the remaining patients (n=3), the upper limb was affected. Clinical examination revealed a local rise in temperature in 35 patients (88%), while tenderness was present in 28 patients (70%). A positive pinprick test was observed in 20 patients (50%). The most common abnormality in vital signs among our patients was tachycardia, seen in 10 patients (25%), followed by tachypnea in 9 (22.5%), hypotension in 7 (17.5%), and fever in 7 (17.5%) patients as well.

The most commonly associated co-morbidity was diabetes mellitus in 24 patients (60%), followed by hypertension in 22 patients (55%). Ischemic heart disease (IHD) was present in 19 patients (47.5%), and chronic obstructive pulmonary disease (COPD) was observed in five patients (12.5%). The most frequently associated etiological factor was preceding trauma, which occurred in 26 patients (65%), followed by idiopathic causes in 9 (22.5%) and infections in 5 (12.5%) patients.

Out of 40 patients, 29 had a score ≥6, of which 24 required surgical management. Five were managed conservatively. For the remaining 11 patients who had a score <6, one required surgical intervention, while the other 10 were managed conservatively [Table/Fig-7]. Overall, 25 patients (63%) required surgical intervention. Among these, 17 patients (70%) were operated on within 3-24 hours, while 8 patients (30%) underwent surgery between 2-5 days later. Out of the 25 patients who had surgical intervention, 5 patients (20%) required repeat surgery.

Variables	Results
Total no. patients	40
Mean age	58.35 years
M:F	2.07.1
Surgical intervention	25
Debridement	20
Amputations	4
Fasciotomy	1
LRINEC score	
<6	11
≥6	29

[Table/Fig-7]: Descriptive statistics of the variables.

A positive culture was obtained in 25 patients, with *Escherichia coli* being the most common organism isolated, found in eight patients (32.5%). Other organisms included Streptococcus in 7 patients (28%), Klebsiella in 3 patients (12%), Staphylococcus in 3 patients (12%), Enterococcus in 2 patients (8%), Proteus in 1 patient (4%), and Pseudomonas in 1 patient (4%). The overall mortality rate was three patients, i.e., 7.5%, and all three had undergone some form of surgical management with an LRINEC score ≥6.

DISCUSSION

The LRINEC scoring system was designed to address this challenge by integrating laboratory values into a scaled score to categorize individuals at high risk of necrotising fasciitis (NF). Although the LRINEC score was presented as an effective tool for the diagnosis of NF in the study by Wong CH et al., [9], among the patients who underwent surgical intervention, 22 (89%) recovered, while 3 (11%) did not survive. Biopsy results were positive in 23 cases (92%) and negative in 2 cases (8%).

The incidence of necrotising fasciitis in women has a more even distribution, with a peak in the 50-60 year age group. Older age is a separate predictor of fatality in individuals with necrotising fasciitis (NF), according to numerous studies [14-16]. Elliott DC et al., further concluded that NF is associated with increased lethality in women [15]. The workplace is one of the most common environments for the origin of infection. Minor injuries are common in workplaces that require physical labor. A lack of proper safety precautions and poor hygiene in the workplace creates a perfect combination for the onset of infection. This pattern indicates that improving hygiene, safety, and the working environment, along with proper training in manual labor, can reduce the incidence of NF.

The incidence of NF is highest following trauma. Foreign bodies that may become lodged or deep inoculation that occurs with trauma, such as thorn pricks, create an ideal incubator for organisms to flourish. This is further exacerbated by lowered host defenses due to conditions such as alcoholism and diabetes, leading to fulminant local infections that result in NF. The lower limb is the most common site for NF infections, followed by the perineum and upper limb [17].

The best centers report death rates for NF at less than 10%, whereas some report rates as high as 75% [18,19]. Lethality ranges from 20% to 30% and could reach up to 100% if there are delays in diagnosis and treatment [16-18]. In the retrospective study by Hoesl V et al., the lethality rate was 28.6% [20]. In our study, patients with high LRINEC scores had a death rate of 11%. A delay in initial debridement is associated with increased morbidity and mortality. El-Menyar A et al., also described significantly higher lethality in patients with an LRINEC score equal to or greater than six in their patient population [4]. Hoesl V et al., revealed a statistical relationship between the initial LRINEC score and the progression of lethal disease. A cut-off threshold of 6.5 points was established for forecasting lethality, demonstrating a sensitivity of 70%, specificity of 60%, positive predictive value of 41.2%, and negative predictive value of 83.3% [20]. Conversely, several studies argue that the LRINEC score is insufficient for differentiating NF from other soft-tissue infections due to its low sensitivity [21-24].

Limitation(s)

The significance of the LRINEC score in predicting the clinical outcome of the disease could not be outlined because of the limited population included in this study. The study was conducted at a single center, and hence, the findings cannot be generalised.

CONCLUSION(S)

The LRINEC score is a simple clinical tool for predicting the need for early surgical intervention in suspected necrotising soft tissue infections (NSTI). Early diagnosis of NF is essential to advocate for timely management to ensure better well-being for the patient.

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