

# Validation of Laboratory Risk Indicator for Necrotizing Fasciitis Scoring System for Diagnosis of Necrotizing Fasciitis in Patients Presenting with Soft-Tissue Infections

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## Abstract

**Introduction:** Necrotizing fasciitis (NF) is a rapidly progressive inflammatory infection of the fascia, with secondary necrosis of the subcutaneous tissues. The speed of spread is directly proportional to the thickness of the subcutaneous layer.

**Aim:** The aim of this study was to validate the Laboratory Risk Indicator for NF (LRINEC) scoring system for the diagnosis of necrotizing fasciitis among patients presenting with soft tissue infections.

**Materials and Methods:** Patients presenting with signs and symptoms of NF admitted were counseled to investigate and treat NF and its complication. Using a semi-structured pro forma to collect information on patients' characteristics and covariates of soft-tissue infections.

**Results:** Out of 100 patients, 93 patients had lower limb cellulitis and seven patients had upper limb cellulitis. While comparing the HPE with the LRINEC scoring system, 18 patients were true positive for NF, 76 patients true negative for NF, two patients were false positive, and 4 patients were false negative. In my study, the sensitivity is 81.82%, specificity is 97.44%, the positive predictive value is 90.00%, the negative predictive value is 95.00%, and accuracy is 94.00%.

**Conclusion:** LRINEC scoring system has a better positive predictive value in identifying the onset of NF and risk strategizing of the patients with severe soft-tissue infection. There is a statistically significant association between diabetes mellitus and the severity of the risk.

**Key words:** Laboratory risk indicator for necrotising fasciitis score, Necrotising fasciitis, Peripheral vascular disease, Systemic inflammatory response syndrome

## INTRODUCTION

Necrotizing fasciitis (NF) causes significant inflammation and destruction of skin, deep fascia and soft tissues, toxemia typically caused by *Streptococcus pyogenes* bacteria, but sometimes due to mixed infections such as anaerobes, coliforms, and Gram-negative species.<sup>[1]</sup>

The disease is prevalent in patients with age, smoking, diabetes, immunosuppression, malnutrition, obesity, steroid therapy, and HIV. Diabetes and injury are a significant factor/cause of precipitation – 80%.

The patient is highly toxic and then the skin is painful, red and gangrenous as blood supply is depleted. Fascial gangrene is usually wider than the involvement of clinically evident skin.<sup>[2]</sup>

Diagnosis is challenging due to the absence of clear skin signs to distinguish NF from certain soft-tissue diseases such as cellulitis. Since decades, this illness has baffled physicians.<sup>[3]</sup>

While understanding NF pathophysiology continues to improve, this disease's mortality indicates surprisingly high with recorded death rates ranging from 6% to 76%.

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Prompt diagnosis and prompt surgical intervention are the only factors in reducing morbidity and mortality in patients with NF.<sup>[4]</sup>

This can be easily understood: The longer the lag, the higher the loss of tissue and sepsis, resulting in increased deaths.

One of the main reasons for the growing high mortality rate of patients with NF today is the lack of early diagnosis and management of the condition due to the absence of clinical symptoms of the skin early in its formation.<sup>[5]</sup>

This needs an easier-to-follow scoring system and a high positively and negatively predictive value that is price-effective.

One possible scoring system developed by Wong *Et al* is the Laboratory Risk Indicator for NF (LRINEC) scoring system in 2005, the predictive value was 92.0% positive and the predictive value was 96.0% negative.<sup>[6]</sup>

Therefore, I would like to check this scoring system in our patients and, if it was found to have similar predictive values, it would be a blessing for developing countries like India, where disease mortality ranges from 7% to 76% and where resources are also scarce.<sup>[7]</sup>

**Aim**

The aim of this study was to validate the LRINEC scoring system for the diagnosis of NF among patients presenting with soft-tissue infections.

**MATERIALS AND METHODS**

The study data were obtained from patients hospitalized with a provisional diagnosis of NF on clinical evaluation and who are admitted at Tirunelveli Medical College and Hospital, Tirunelveli. Patients presenting with signs and symptoms of NF admitted during January 2018 to September 2019 at Tirunelveli Medical College and Hospital were counseled for Necrotizing investigation and treatment fasciitis and its complication.

**Exclusion Criteria**

The following criteria were included in the study:

- Patients below 15 years or above 75 years of age.
- Patients who have received antibiotic treatment in the last 48 h or have received a minimum of three doses of antibiotics before presentation.
- Patients who have undergone surgical debridement for present episode of soft-tissue infections.
- Patients with burns or furuncles with no evidence of cellulitis.

**Assessment of Parameters**

All consenting patients with NF would be clinically examined after history taking and then subjected to blood investigations as follows:

- C-reactive protein
- Hemoglobin
- Glucose
- Creatinine
- Sodium
- Total white cell count
- Tissue for histopathology
- Patients presenting with symptoms suggestive of soft-tissue infections will undergo clinical examinations and the above mentioned investigations.
- Using a pre-tested semi-structured pro forma cum quantitative checklist, which will collect information on characteristics and covariates of soft-tissue infections.
- LRINEC scoring system will be applied to each of the study subjects. The confirmatory diagnosis for necrotizing fasciitis will be done with histopathology for all patients, irrespective of the result of the LRINEC scoring system [Table 1].

**RESULTS**

Out of 100 patients studied, 65 patients belong to the age group of 41–60 years and it is evident that the incidence of soft-tissue infection increases in this age group. Out of 100 patients, 72 patients were male and 28 were female. Out of 100 patients, 93 patients had lower limb cellulitis and seven patients had upper limb cellulitis [Figure 1]. Diabetes mellitus (DM) is being responsible for most cases of soft-tissue infection in my study group around 46% followed by trauma – 18%,

**Table 1: LRINEC scoring scale**

Laboratory parameter	LRINEC points
C-reactive protein (mg/l)	
<150	0
≥150	4
Total white blood cell count (μl)	
<15	0
15–25	1
>25	2
Hemoglobin (g/dl)	
>13.6	0
11–13.5	1
<10.9	2
Sodium (mmol/l)	
≥135	0
<135	2
Creatinine (mg/dl)	
≤1.6	0
>1.6	2
Glucose (mg/dl)	
≤180	0
>180	1

LRINEC: Laboratory risk indicator for necrotizing fasciitis.

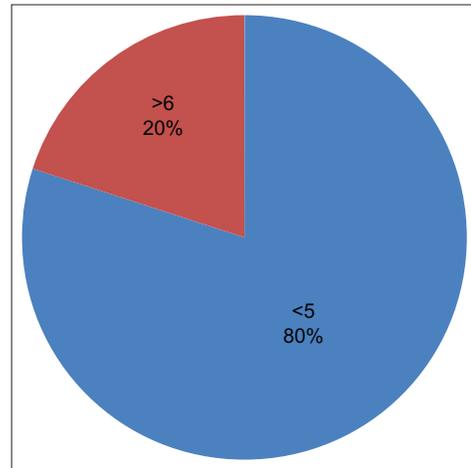
bites – 14%, CKD – 12%, PVD – 7%, and unknown – 3% [Table 2]. In LRINEC score variables, Hb <13 gm% is being the most common biochemical abnormality that is seen in necrotizing fasciitis around 77 patients followed by RBS – 55, creatinine – 39, CRP – 34, sodium – 16, and WBC – 15. Out of 100 patients, 80 patients had LRINEC score <5 and 20 patients had LRINEC score > or = 6 [Figures 2 and 3]. HPE group shows, out of 100 patients, 78 had cellulitis, 22 had necrotizing fasciitis [Figure 4]. While comparing the HPE with the LRINEC scoring system, 18 patients were true positive for NF, 76 patients true negative for NF, 2 patients were false positive, and 4 patients were false negative. In my study, the sensitivity is 81.82%, specificity is 97.44%, the positive predictive value is 90.00%, the negative predictive value is 95.00%, and accuracy is 94.00% [Figure 5].

**Table 2: Etiological distribution**

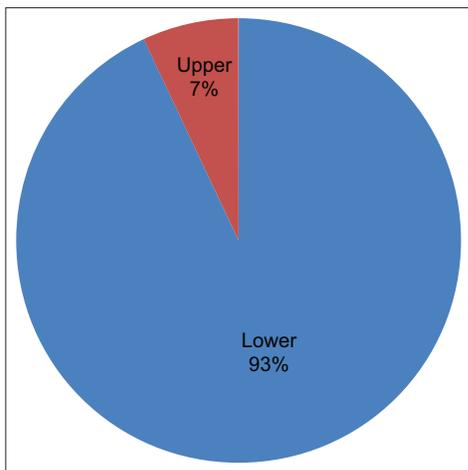
Etiology	Frequency	Percent
Diabetes mellitus	46	46.0
Trauma	18	18.0
Bites	14	14.0
CKD	12	12.0
PVD	7	7.0
Unknown	3	3.0
Total	100	100.0

**DISCUSSION**

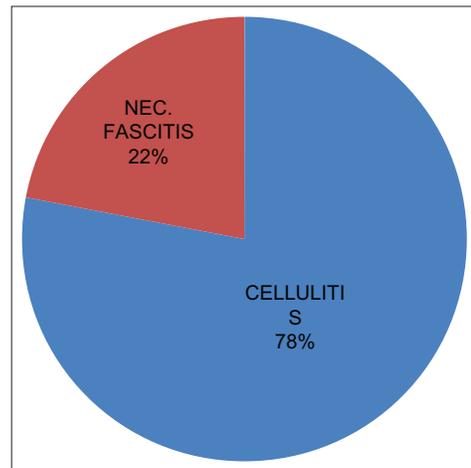
NF is a rare but rapidly progressive, devastating soft-tissue necrosis that usually involves fascia and subcutaneous tissues with a significant hospital morbidity and mortality.



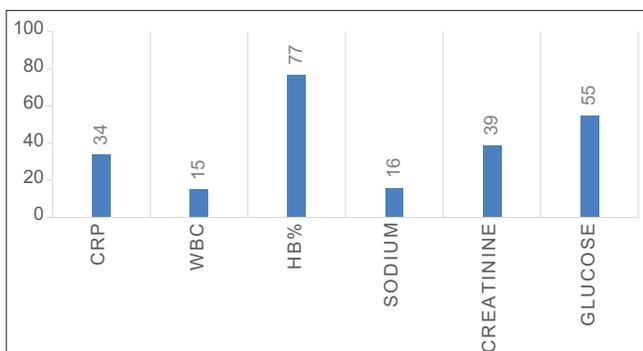
**Figure 3: Laboratory risk indicator for necrotizing fasciitis <5 and >6**



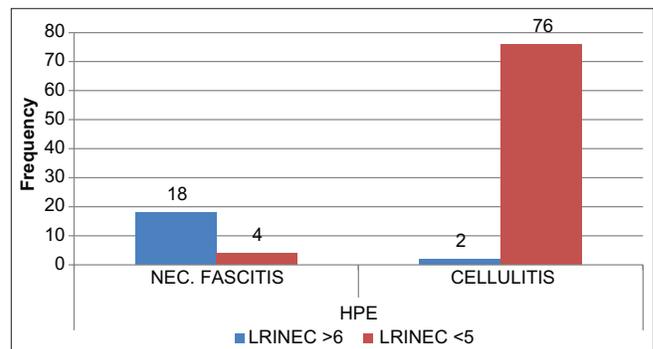
**Figure 1: Limb distribution**



**Figure 4: HPE group**



**Figure 2: Score distribution**



**Figure 5: Cross-tabulation of laboratory risk indicator for necrotizing fasciitis versus HPE**

It has been estimated that 13 per million of populations are hospitalized each year for NF, of which the mortality is 20–30%.

The mortality rate could reach up to 100% in the absence of proper and timely diagnosis and treatment.

The most common risk factors for NF are DM, immunodeficiency diseases, illicit drug use, and malnutrition.

This kind of infection can occur with a trivial wound or often without any provocation.

Early diagnosis, aggressive serial debridement, broad-spectrum antibiotics, and multidisciplinary critical care approach are vital to attain favorable outcomes in NF patients.

The LRINEC is a scoring system driven from six routinely performed laboratory tests and used initially to early distinguishing NF from the other severe soft-tissue infections.

Multiple studies have evaluated the usefulness of LRINEC for early detection of NF and found that it could be used to identify and classify NF patients into differing categories, thus facilitating the adequate management of hospital resources.

However, few studies have observed an association between LRINEC scoring values and outcomes in patients with NF.

Chao *et al.* in Korea (2012) Studies show that the average LRINEC rating of 2 or higher was 71% adaptive, 83% precise, and 85% positive predictive, with an 11.9-fold increased risk for the presence of NF ( $P < 0.0001$ ).<sup>[8]</sup>

Su *et al.* in Taiwan (2002–2005) shows patients with a LRINEC score of more than or equal to 6 have a higher mortality rate as well as an amputation rate.<sup>[9]</sup>

Corbin *et al.* in France (2008) shows that in patients with LRINEC score above 6, the complication rate was higher than, in patients with a score below 6.<sup>[10]</sup>

Swain *et al.*, in UK, overall mortality was 3 out of 15 patients. The median LRINEC score in all deaths was 9.0 (range: 6–13).<sup>[11]</sup>

Colak *et al.* in turkey (2013), the mean number of debridement and LRINEC score was higher in the non-surviving group.<sup>[12]</sup>

There is always a need to find a simplified bedside, validated, and rapid tool to early stratify patients with a potential life-threatening illness.

The present study aims to evaluate the role of LRINEC score as a diagnostic tool for in-hospital outcomes in patients with NF.

## CONCLUSION

LRINEC scoring system has a better positive predictive value in identifying the onset of NF and risk strategizing of the patients with severe soft-tissue infection. There is a statistically significant association between DM and the severity of the risk. At the end of my study, the LRINEC scoring has been validated and found to have an accurate diagnostic tool in predicting the outcome of patients with soft-tissue infections.

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