**Biomedical and Biopharmaceutical Research**
**Abbreviation**: Biomed. Biopharm. Res.
Volume: 22: Issue: 01 |Year: 2025
Page Number: 471-474

# Use of Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score in Early Diagnosis of Necrotizing Fasciitis in a Tertiary Health Care Center in Mangalore

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Article Received:26-02-2025

Article Accepted:21-04-2025



## Abstract

**Background**: Necrotizing fasciitis (NF) is a life-threatening soft tissue infection requiring early diagnosis and intervention to reduce morbidity and mortality. The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score is a diagnostic tool to differentiate NF from other soft tissue infections.

**Objective**: To assess the efficacy of the LRINEC score in the early diagnosis of NF and its ability to distinguish NF from other soft tissue infections.

'**Methods**: A prospective observational study was conducted at Father Muller Medical College, Mangalore, involving 80 patients aged 18–70 years with soft tissue infections. The LRINEC score was calculated based on laboratory parameters, including C-reactive protein, white blood cell count, hemoglobin, sodium, creatinine, and glucose levels. Patients were followed up, and outcomes were analyzed using sensitivity, specificity, and chi-square tests ($p<0.05$).

**Results**: Of the 80 patients, 64 were male, with a mean age of 58.47 years (SD ±9.05). The LRINEC score ≥6 had a sensitivity of 97.30% and specificity of 97.67% for NF diagnosis. Clinical judgment showed 100% sensitivity and 89.36% specificity. Diabetes mellitus was present in 56.25% of cases, and trauma was the leading etiology (50%). Intervention was required in 52.50% of cases.

**Conclusion**: The LRINEC score ≥6 is highly sensitive and specific for early NF diagnosis, supporting its use in clinical practice.

**Keywords**: Necrotizing fasciitis, LRINEC score, soft tissue infections, early diagnosis, sensitivity, specificity.

## INTRODUCTION

Necrotizing fasciitis (NF) is a rapidly progressing, life-threatening soft tissue infection characterized by necrosis of the fascia and subcutaneous tissues, occasionally involving muscles and skin [1]. Its high mortality rate, ranging from 20% to 40%, is largely attributed to delayed diagnosis and intervention [2]. NF often presents with nonspecific symptoms, mimicking less severe conditions like cellulitis or abscesses, which complicates early recognition [3]. Early diagnosis is critical, as timely surgical debridement significantly improves outcomes, reducing morbidity such as extensive tissue loss and the need for repeated procedures [4].

Soft tissue infections constitute a significant portion of surgical outpatient cases, with NF representing a rare but severe subset. The disease was first described by Wilson in 1952, who coined the term "necrotizing fasciitis" to describe its characteristic fascial necrosis [5]. NF is caused by a variety of microbes, including aerobic and anaerobic bacteria, with polymicrobial infections (Type 1) and Group A Streptococcus (Type 2) being the most common etiologies [6]. Risk factors include diabetes mellitus, immunocompromised states, trauma, and breaches in skin integrity, such as ulcers or burns [7].

The challenge in diagnosing NF lies in its clinical similarity to other soft tissue infections. Early signs, such as erythema, pain, and swelling, are often indistinguishable from cellulitis [8]. However, disproportionate pain relative to clinical findings and systemic toxicity, such as fever and tachycardia, are key indicators of NF [9]. Imaging modalities, like X-rays showing soft tissue gas, can aid diagnosis, but definitive confirmation often requires surgical exploration or biopsy [10]. Delayed recognition contributes to the high mortality rate, as necrosis can progress at a rate of up to one inch per hour [11].

To address this diagnostic challenge, the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score was developed by Wong et al. in 2004 [12]. The LRINEC score uses routinely available laboratory parameters—C-reactive protein (CRP), white blood cell (WBC) count, hemoglobin, sodium, creatinine, and glucose—to stratify the risk of NF. A score ≥6 raises suspicion for NF, while a score ≥8 is strongly predictive [12]. Studies have validated its utility, reporting sensitivities ranging from 43% to 94% and specificities from 60% to 94% [13,14]. However, its performance in diverse populations, particularly in South India, remains underexplored.

Father Muller Medical College, a tertiary care center in Mangalore, receives a high volume of soft tissue infection cases, including referrals for snake bites, which are a unique risk factor for NF in this region. The prevalence of diabetes mellitus, a major risk factor, is also high in South India, further necessitating reliable diagnostic tools [15]. This study evaluates the efficacy of the LRINEC score in the early diagnosis of NF in a South Indian population, comparing its performance with clinical judgment and assessing its ability to guide timely intervention.

## AIMS

The objectives of this study were to:

1. Assess the efficacy of the LRINEC scoring system in the early diagnosis of necrotizing fasciitis.
2. Determine whether the LRINEC score can differentiate necrotizing fasciitis from other soft tissue infections.

## MATERIALS AND METHODS

### Study Design

This prospective observational and descriptive study was conducted in the Department of General Surgery at Father Muller Medical College, Mangalore, India, over 18 months from 2019 to 2021. Ethical clearance was obtained from the institutional ethics committee, and informed consent was secured from all participants.

### Study Population

A total of 80 patients aged 18–70 years presenting with soft tissue infections were enrolled. Inclusion criteria included symptoms suggestive of NF, such as increasing pain, redness, warmth, edema, flu-like symptoms, or skin changes (e.g., violet marks, blisters, or tissue necrosis). Exclusion criteria included patients with chronic renal failure, those previously diagnosed with NF, or those who had undergone surgical debridement for the current episode.

### Data Collection

Patients were evaluated in the emergency or outpatient department. A detailed clinical history was recorded, including presenting complaints, comorbidities (e.g., diabetes mellitus, hypertension), and etiology (e.g., trauma, snake bite, spontaneous). Clinical examination assessed signs of infection, such as erythema, edema, and systemic toxicity. Laboratory investigations included CRP, WBC count, hemoglobin, serum sodium, serum creatinine, and blood glucose levels, which were used to calculate the LRINEC score. The scoring system assigns points based on the following parameters: CRP (>150 mg/L: 4 points), WBC count (<15, 15–25, >25 × 10^9/L: 0, 1, 2 points), hemoglobin (>13.5, 11–13.5, <11 g/dL: 0, 1, 2 points), sodium (<135 mmol/L: 2 points), creatinine (>141 μmol/L: 2 points), and glucose (>10 mmol/L: 1 point). A score ≥6 indicated a high suspicion of NF.

### Outcome Assessment

Patients were followed during their hospital stay, and outcomes were recorded, including the need for surgical intervention (e.g., debridement or amputation). Clinical judgment for intervention was based on physical findings and systemic symptoms. The LRINEC score's diagnostic performance was compared with clinical judgment using sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).

### Statistical Analysis

Data were entered into a master chart and analyzed using SPSS version 25. Descriptive statistics, including mean, standard deviation (SD), and frequency percentages, were calculated. The chi-square test was used to assess associations between LRINEC scores, clinical judgment, and intervention outcomes, with a p-value <0.05 considered statistically significant. Sample size was calculated using the formula: $n = [Z^2_{(1-\alpha/2)} \times p(1-p)] / (d^2 \times e)$, where p = estimated sensitivity (94%), e = prevalence of NF (29%), d = estimated error (10%), and α = 5%, yielding a sample size of 80.

## RESULTS

The study included 80 patients with soft tissue infections, of whom 64 (80%) were male. The mean age was 59.41 years (SD ±9.19) for patients with an LRINEC score <6 and 57.53 years (SD ±8.90) for those with a score ≥6. Diabetes mellitus was present in 56.25% of patients, and hypertension in 47.50%. The etiology of NF was trauma in 40 cases (50%), snake bite in 16 cases (20%), and spontaneous in 24 cases (30%).

**Table 1: Age Distribution**

| Age Group (Years) | LRINEC <6 (n=37) | LRINEC ≥6 (n=43) | Total (n=80) |
|---|---|---|---|
| 18–40 | 2 (5.41%) | 3 (6.98%) | 5 (6.25%) |
| 41–60 | 18 (48.65%) | 22 (51.16%) | 40 (50%) |
| 61–70 | 17 (45.95%) | 18 (41.86%) | 35 (43.75%) |
| **Mean ± SD**: LRINEC <6: 59.41 ± 9.19 years; LRINEC ≥6: 57.53 ± 8.90 years. | | | |

**Table 2: Gender Distribution**

| Gender | Number (n=80) | Percentage |
|---|---|---|
| Male | 64 | 80% |
| Female | 16 | 20% |
| **Male:Female Ratio**: 4:1. | | |

**Table 3: Etiology of Necrotizing Fasciitis**

| Etiology | Number (n=80) | Percentage |
|---|---|---|
| Trauma | 40 | 50% |
| Snake Bite | 16 | 20% |
| Spontaneous | 24 | 30% |

**Table 4: LRINEC Score Distribution**

| LRINEC Score | Number (n=80) | Percentage |
|---|---|---|
| <6 | 37 | 46.25% |
| ≥6 | 43 | 53.75% |

**Table 5: Sensitivity and Specificity**

| Diagnostic Method | Sensitivity | Specificity | PPV | NPV |
|---|---|---|---|---|
| Clinical Judgment | 100% | 89.36% | 86.8% | 100% |
| LRINEC Score ≥6 | 97.30% | 97.67% | 94.7% | 92% |

Intervention was planned based on clinical judgment in 38 cases (47.50%) and on LRINEC score ≥6 in 34 cases (43.00%). Ultimately, 42 patients (52.50%) required surgical intervention, including debridement or amputation. The LRINEC score ≥6 showed a strong correlation with the need for intervention ($\chi^2 = 45.12$, $p<0.001$). Clinical judgment was highly sensitive (100%) but less specific (89.36%) compared to the LRINEC score (sensitivity: 97.30%, specificity: 97.67%). The presence of diabetes mellitus was significantly associated with higher LRINEC scores (p=0.036).

## DISCUSSION

This study demonstrates that the LRINEC score is a highly effective tool for the early diagnosis of necrotizing fasciitis (NF), with a sensitivity of 97.30% and specificity of 97.67% at a cutoff of ≥6. These findings align with previous studies, such as Wong et al. [12], who reported a positive predictive value (PPV) of 92% and negative predictive value (NPV) of 96% at a cutoff of ≥8. However, our study found a lower cutoff (≥6) to be more sensitive, which is consistent with Jayasankar et al. [1], who reported a sensitivity of 94.6% and PPV of 94.7% in a similar Indian population.

The high prevalence of diabetes mellitus (56.25%) in our cohort underscores its role as a major risk factor for NF, as noted by El-Menyar et al. [13], who found diabetes in 50% of NF cases. The significant association between diabetes and higher LRINEC scores ($p=0.036$) suggests that metabolic derangements may exacerbate laboratory abnormalities, enhancing the score's diagnostic utility. Trauma was the leading etiology (50%), followed by snake bites (20%), a unique finding in our region due to the high incidence of snake bites in South India. This contrasts with studies like Hsiao et al. [14], where spontaneous infections were more common (40%).

Clinical judgment in our study was highly sensitive (100%) but less specific (89.36%) than the LRINEC score. This suggests that while clinicians can reliably identify NF, the LRINEC score reduces false positives, improving diagnostic precision. However, Hsiao et al. [14] reported a lower sensitivity (43% at ≥6), possibly due to differences in patient populations or disease severity. The strong correlation between LRINEC scores ≥6 and intervention ($p<0.001$) supports its role in guiding treatment decisions, as early debridement is critical for reducing mortality [2].

Limitations of our study include its hospital-based design, which may not reflect the general population, and the lack of long-term follow-up. Additionally, no other scoring systems were compared, limiting our ability to assess the LRINEC score's relative performance. Future studies should validate these findings in larger, multicenter cohorts and explore the score's utility in resource-limited settings.

## CONCLUSION

The LRINEC score ≥6 is a highly sensitive and specific tool for the early diagnosis of necrotizing fasciitis, outperforming clinical judgment in specificity. Its ability to differentiate NF from other soft tissue infections supports its integration into clinical practice, particularly in high-risk populations with diabetes or trauma. Males are more prone to NF, and diabetes mellitus is a significant risk factor. The score's strong correlation with the need for intervention highlights its prognostic value. Further research is needed to confirm these findings in diverse settings and to compare the LRINEC score with other diagnostic tools.

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