



Prognostic Value of the LRINEC Score in Predicting Mortality and Limb Loss among Patients with Necrotizing Fasciitis: A Prospective Study at Reference Tertiary Hospital of Hodeidah, Yemen

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Abstract

Background: The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score distinguishes necrotizing fasciitis (NF) from other soft-tissue infections using admission laboratory values. However, its prognostic utility for predicting clinical deterioration, tissue destruction, and mortality remains debated, particularly in resource-limited emergency surgical settings with complex patient presentations. **Objective :** The purpose of this research is to evaluate the LRINEC score for predicting the mortality and limb loss among patients with NF. **Methodology:** This prospective observational study evaluated 100 consecutive patients with intraoperatively confirmed necrotizing fasciitis at a tertiary referral hospital in Hodeidah, Yemen. The demographics, clinical characteristics, and LRINEC components were recorded at admission. Adverse outcomes were tracked throughout hospitalization. Predictive accuracy was assessed via cross-tabulation, diagnostic metrics and receiver operating characteristic (ROC) curve analysis. Also, the multivariable logistic regression was used in this study. **Results:** The results showed that predominantly male (85.0%, n=85) with a mean age of 46.15±21.12 years. Lower extremities were the primary infection site in 75.0% of cases. The mean LRINEC score was 8.78±3.99, with 76.0% (n=76) classified as high-risk (≥8). The major amputation rate was 40.0% (n=40), while inpatient mortality was 3.0% (n=3). Cross-tabulation showed no linear relationship between LRINEC risk strata and outcomes; amputation rates were 40.0% in the low-risk group versus 40.79% in the high-risk group. ROC analysis revealed poor discrimination for amputation (AUC=0.53) and mortality (AUC=0.35). In multivariable regression, the continuous LRINEC score showed no association with amputation (p=0.992, aOR=0.999) or mortality (p=0.968, aOR=1.008). Chronic comorbidities—particularly Type II Diabetes Mellitus—were sole independent predictor of limb loss, nearly tripling amputation risk (p=0.046, aOR=2.959, 95% CI: 1.018–8.600). **Conclusion:** The admission LRINEC score reflects severe systemic inflammatory response but possesses poor prognostic value for mortality or limb loss in necrotizing fasciitis. Adverse outcomes are driven by physiological reserves and pre-existing vasculopathy rather than laboratory risk stratification. Surgical teams should prioritize rapid clinical triage and immediate operative intervention over score-based thresholds to optimize survival and limb preservation in critically ill patients.

Keywords: Necrotizing Fasciitis, LRINEC Score, Prognostic Value, Amputation, Mortality, Comorbidities, Yemen

1. Introduction

Necrotizing fasciitis (NF) is a fast progressive and potentially lethal soft tissue infection that is defined by necrosis of the fascia and subcutaneous layers. Even with advanced surgical and intensive care techniques, NF still has high morbidity and mortality rates. The condition can advance rapidly and cause septic shock, multiple organ dysfunction, amputation, and even death if treatment is not delivered promptly. Early detection and timely surgical debridement are therefore critical for the patient's well-being. Nevertheless, the first signs of NF tend to resemble those of other, milder conditions like cellulitis and abscesses, which makes diagnosing it difficult and causes treatment delay [1].

Objective laboratory methods have also been created in order to increase the diagnostic precision. In particular, one of the most frequently utilized diagnostic instruments in this regard is the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score created by Wong et al. The LRINEC score is based on six standard laboratory tests: C-reactive protein, total white blood cell count, hemoglobin level, serum sodium, serum creatinine, and serum glucose. All of these tests represent different parameters that are typi-

cal for the systemic inflammatory reaction, metabolic abnormalities, and organ dysfunctions in patients with NF. The scale varies between 0 and 13, where higher values represent the increased likelihood of the presence of NF, while any scores 6 or higher can be regarded as indicative of increased risk. The development of the LRINEC scoring system was aimed to offer clinicians an easily applicable and evidence-based tool for distinguishing NF from less severe types of soft tissue infection. This score is particularly beneficial since it is based on standard laboratory tests, and thus, can be quickly implemented at the bedside without the necessity of performing complicated diagnostic examinations and using sophisticated technology [2].

Additional studies have demonstrated the practical value of the LRINEC score in various medical settings. Use of the score early on has been found to help clinicians identify patients at increased risk prior to the development of symptoms of advanced disease. This will facilitate early surgical intervention, which may enhance survival chances [3]. The score has turned out to be especially useful in emergency departments, where distinguishing between NF and cellulitis is important since these two conditions are similar in their symptoms yet completely different in terms of treatment. The research of Neeki et al. showed that the score may help emergency physicians to identify patients that need to be referred to surgery

and undergo aggressive resuscitation [4]. What is more, validation of the score in various countries has proven its generalizability and robustness [5,3].

Validation studies have added further proof of the efficacy of the LRINEC score, especially in cases involving NF of the extremities. According to Hsiao et al., the score is capable of maintaining its discriminatory ability when used prospectively, which proves its external validity [6]. Other comparative studies between LRINEC and new scoring models like SIARI (Site other than lower limb, Immunocompromised state, Age, Renal insufficiency, and Inflammation markers) have added knowledge to the pros and cons of both methods [7].

In addition to diagnostic accuracy, the LRINEC score has been found to be of significant value as a prognostic factor. Numerous studies have documented associations between higher LRINEC scores and worse clinical outcomes such as increased mortality, increased frequency of surgical procedures and amputations. For instance, Sen and Demirdal established a connection between higher LRINEC scores and increased likelihood of limb loss and mortality of patients with diabetic foot infections complicated by NF. Additionally, Kumar et al., found significant associations between LRINEC scores and clinical outcomes, which suggested that LRINEC score could be used for both diagnosing and predicting patient's prognosis. Such prognostic value could be beneficial for physicians' decision making and planning treatment strategies and post surgical care [8,9].

Utility of the LRINEC score was also demonstrated among specific etiological subgroups, such as necrotizing fasciitis due to *Vibrio vulnificus*, which is an extremely virulent organism associated with marine injury and chronic liver disease. According to Chao et al., the score retained its diagnostic accuracy among patients with this etiology [10].

The present study addresses this gap by examining the performance of the LRINEC score in a specific clinical setting where prospective data on NF outcomes remain limited. This prospective study aimed to evaluate the prognostic value of the LRINEC score in predicting mortality and limb loss among patients with NF at a reference tertiary hospital in Hodeidah, Yemen.

2. Methodology

2.1 Study Design

This research was designed as a prospective, observational, hospital-based cohort study. Because NF is a surgical emergency requiring immediate clinical decisions, this design was selected to evaluate the prognostic value of the LRINEC score under real-world clinical conditions without altering standard therapeutic workflows. The exposure of interest was the calculated LRINEC score at initial presentation, and the primary outcome evaluated was all-cause in-hospital mortality.

2.2 Study Area, Setting and Duration

Hodeidah governorate has a hot tropical climate characterized by high temperatures and humidity throughout most of the year, creating favorable conditions for the transmission of several tropical and infectious diseases. As a result, the governorate is considered one of the most vulnerable areas in Yemen for infectious disease transmission and public health emergencies [11,12]. The study was conducted within the Department of Surgery at the Authority of Public Al Thawara Hospital in Hodeidah, Yemen. The study encompassed a 12-month period, running from January 1st, 2025, through December 31, 2025.

2.3 Study Population

2.3.1 Inclusion Criteria

To be eligible for enrollment in the study cohort, patients had to meet all of the following criteria:

- Presented to the emergency department or surgical outpatient clinic with an acute, severe soft tissue infection.
- Age ≥ 18 years.
- Patients with complete LRINEC score lab tests.
- Underwent definitive operative exploration with direct visual inspection of the deep fascia, or had a clinical presentation unequivocally confirmed as necrotizing

fasciitis by an attending surgeon based on the "Finger Test" or presence of clear gray "dishwater pus."

2.3.2 Exclusion Criteria

Patients matching any of the following parameters were excluded from final analysis:

- Superficial skin infections including uncomplicated cellulitis, simple cutaneous abscesses, or erysipelas that did not involve deeper fascial planes.
- Incomplete baseline laboratory data preventing the full calculation of the LRINEC score at admission.
- Pregnant women, due to altered baseline physiological and hematological parameters (e.g., physiological leukocytosis and altered sodium balance).

2.4 Sample Size and Sampling Strategy

The study included 100 cases which satisfied the inclusion criteria were enrolled. The number of cases in this study is indicative of the total number of severe necrotizing soft tissue infections admitted into the facility that satisfied the complete laboratory data requirement.

2.5 Data Collection Tools and Procedures

2.5.1 Clinical Triage and Laboratory Profiling

Immediately after admission to the emergency surgery ward, all patients received an immediate clinical evaluation. Demographics, symptom duration, presence of any comorbidity (particularly diabetes mellitus), and signs presented (erythema, edema, blistering, crepitus, or necrosis of the skin) were noted. At the same time, peripheral blood samples from veins were collected before instituting aggressive intravenous fluid resuscitation or empirical broad-spectrum antibiotics. These samples were then immediately processed at the central hospital laboratory to derive the following six biochemical markers needed for the conventional LRINEC score:

Table 1. Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score

Variable	Laboratory Value	Score
C-Reactive Protein (CRP), mg/L	< 150	0
	≥ 150	4
White Blood Cell Count ($\times 10^3/\text{mm}^3$)	< 15	0
	15–25	1
Hemoglobin (g/dL)	> 25	2
	> 13.5	0
	11–13.5	1
Serum Sodium (mmol/L)	< 11	2
	≥ 135	0
Serum Creatinine (mg/dL)	< 1.6	2
	≤ 1.6	0
Serum Glucose (mg/dL)	> 180	2
	≤ 180	0
	> 180	1

2.5.2 Operative Confirmation and Outcome Tracking

The gold standard for the diagnosis of necrotizing fasciitis was established through direct operative findings during emergency surgical exploration. Key diagnostic visual criteria included:

- A lack of normal resistance of the superficial fascia to blunt finger dissection (positive "Finger Test").
- Extensive necrosis of the subcutaneous fat and a dull, grayish appearance of the deep fascial tissue.
- The presence of foul-smelling, thin, grayish fluid ("dishwater discharge") along the fascial planes without frank localized abscess formation.
- Widespread thrombosis of small sub-fascial blood vessels.

Data regarding the total number of surgical debridements, the requirement for mechanical ventilation or intensive care unit (ICU) admission, the development of acute kidney injury (AKI), limb amputations, and final discharge or in-hospital mortality status were systematically logged.

2.6 Data Variables and Operational Definitions

- **LRINEC Score (Independent Variable):** A continuous score ranging from 0 to 13 derived from admission

laboratory results. For categorical analysis, it was stratified into three predefined risk categories: Low Risk (5), Moderate Risk (6 - 7), and High Risk (8).

- **In-Hospital Mortality (Primary Outcome Variable):** All-cause mortality occurring during the index hospitalization window directly related to necrotizing fasciitis complications (e.g., septic shock, multi-organ dysfunction syndrome).
- **Time to Surgery:** The interval, measured in hours, between the patient's arrival at the hospital emergency department and the initial skin incision for radical surgical debridement.

2.7 Statistical Analysis

Data were cleaned, coded, and imported into statistical software for detailed analysis. Normality testing for quantitative variables was performed by using Shapiro Wilk's test. Normally distributed continuous variables were presented as mean with standard deviation (SD). Receiver Operating Characteristic (ROC) curve analysis was performed in order to ascertain the ability of the continuous LRINEC score to predict mortality. Area under the curve (AUC) was calculated to measure overall discrimination ability. The best cut off value based on sensitivity and specificity was estimated using Youden's index $\{(Sensitivity) + (Specificity)\}$. Finally, in order to rule out the effect of confounders such as age, presence of diabetes mellitus, and time to first surgery, significant variables from univariate were included in a binary logistic regression analysis. OR and 95% confidence interval (CI) were reported. All statistical tests were two-tailed, and an alpha level of $p < 0.05$ was considered statistically significant.

2.8 Ethical Considerations

The study protocol was formally reviewed and approved by the Institutional Review Board and Ethical Committee of Yemeni Board of Medical and Health Specialization, Hodeidah Branch, Yemen. Prior to enrollment, written informed consent was obtained from each patient or their legally authorized representative. All patient data were anonymized using secure alphanumeric coding systems to maintain strict patient confidentiality in accordance with the Declaration of Helsinki.

3. Results

3.1 Sociodemographic Profiles

The sample size comprised a total of 100 subjects diagnosed with NF where there was a marked preponderance of males (85% males and 15% females) ($\chi^2 = 49.0$, $p < 0.001$). The mean age of the overall cohort was 46.15 ± 21.12 years, spanning a broad spectrum from pediatric presentation to advanced geriatric tissue injury (range: 19 to 90.0 years). Stratification by age cohorts revealed that younger adults (40 years) formed the largest subset ($n = 41$, 41.0%), followed by middle-aged adults aged 41–60 years ($n = 31$, 31.0%), and older adults aged > 60 years ($n = 28$, 28.0%) ($\chi^2 = 2.7$; p -value = 0.249) (Table 2).

Table 2. Sociodemographic Characteristics of the Study Cohort (N = 100)

Demographic Variable	(n)	(%)	p – value
Gender Distribution			
Male	85	85.0%	< 0.0001
Female	15	15.0%	
Age Distribution (Years)			
40 Years (<i>Young Adults</i>)	41	41.0%	0.249
41 – 60 Years (<i>Middle-Aged</i>)	31	31.0%	
> 60 Years (<i>Geriatric / Elderly</i>)	28	28.0%	

3.2 Anatomical Distribution and Clinical Presentation

The lower extremities were the most frequently affected anatomical sites, accounting for 75.0% ($n = 75$) of all cases. The left lower limb was involved in 41.0% ($n = 41$) of patients, while the right lower limb was affected in 34.0% ($n = 34$). Fournier's gangrene involving the perineal and genital regions was observed in

13.0% ($n = 13$) of cases. Upper extremity involvement was identified in 8.0% ($n = 8$) of patients, truncal disease in 3.0% ($n = 3$), and bilateral lower limb involvement in 1.0% ($n = 1$). In terms of clinical evolution, 77.0% ($n = 77$) of patients exhibited a sub-acute/gradual progression characterized by progressive induration and ascending erythema prior to full systemic decompensation. Conversely, 23.0% ($n = 23$) presented with hyper-acute, fulminant tissue necrosis rapidly expanding within hours of symptom onset. Among clinical manifestations at presentation, severe pain associated with skin necrosis and ecchymosis was the most common finding 73.0% ($n=73$), followed by bullae formation 47.0% ($n=47$) and deep tissue induration ("wooden-hard" consistency) in 14.0% ($n=14$) of patients. Forty-two patients (42.0%) had no documented pre-existing comorbidities. Diabetes mellitus was the most common comorbidity, occurring in 36.0% of patients. Combined diabetes mellitus and hypertension were present in 8.0%, while complex cardiovascular and renal comorbidities, including chronic kidney disease, ischemic heart disease, stroke, and dilated cardiomyopathy, were identified in 14.0% of cases (Table 5).

3.3 Baseline Laboratory Markers and Scores

Laboratory investigations demonstrated marked systemic inflammatory and metabolic disturbances at presentation. The mean C-reactive protein (CRP) level was 210.17 ± 79.11 mg/L, while the mean white blood cell count was $19.84 \pm 4.97 \times 10^9/L$. Patients also demonstrated anemia, with a mean hemoglobin concentration of 10.65 ± 1.64 g/dL, and hyponatremia, with a mean serum sodium level of 130.93 ± 4.15 mmol/L. The mean serum creatinine level was 156.99 ± 57.93 μ mol/L, and the mean blood glucose level was 10.55 ± 3.11 mmol/L. Based on these laboratory parameters, the mean LRINEC score for the entire cohort was 8.78 ± 3.99 .

3.4 Stratification of LRINEC Risk Groups

Applying the standard diagnostic risk thresholds established by the LRINEC scoring system, the cohort was classified into low, intermediate, and high risk strata:

- **Low Risk (5 points):** 20.0% ($n = 20$) of the study population fell into this group, demonstrating that low scores remain common despite severe underlying pathologies.
- **Intermediate Risk (6–7 points):** This group comprised 4.0% ($n = 4$) of the sample.
- **High Risk (8 points):** The vast majority of presentations—76.0% ($n = 76$)—presented with a score strongly indicating a high probability of necrotizing fasciitis.

3.5 Primary Clinical Outcomes

The overall therapeutic amputation rate across the entire study sample was **40.0% ($n = 40$)**, underscoring the aggressive local destruction of this disease process. In contrast, the overall inpatient crude mortality rate was successfully limited to **3.0% ($n = 3$)** within this cohort.

3.6 Cross-Tabulation Matrix

To evaluate the prognostic value of the score, clinical outcomes were cross-tabulated across the three risk tiers. This analysis revealed a non-linear relationship between the score's diagnostic strata and actual clinical deterioration:

- Within the Low-Risk Stratum ($n = 20$; 20%): 8 patients required therapeutic major limb amputation, resulting in an amputation rate of 40.0%, while 1 patient died (5.0% mortality).
- Within the Intermediate-Risk Stratum ($n = 4$; 4%): 1 patient required amputation (25.0%), with 0% mortality.
- Within the High-Risk Stratum ($n = 76$; 76%): 31 patients underwent major surgical amputation, translating to an amputation rate of 40.79%, while 2 patients died (2.63% mortality).
- **Core Finding:** The rate of limb loss remained almost identical between the low-risk category (40.0%) and the high-risk category (40.8%), providing initial descriptive evidence of the score's limitations as an isolated prognostic monitoring tool (Table 3).

Table 3. Clinical Outcomes According to LRINEC Severity Category

LRINEC Category	Total Patients (n)	Amputation n (%)	Managed Without Amputation n (%)	Deaths n (%)
Low Risk (≤ 5)	20	8 (40.0)	12 (60.0)	1 (5.0)
Intermediate Risk (6–7)	4	1 (25.0)	3 (75.0)	0 (0.0)
High Risk (≥ 8)	76	31 (40.8)	45 (59.2)	2 (2.6)
Total	100	40 (40.0)	60 (60.0)	3 (3.0)

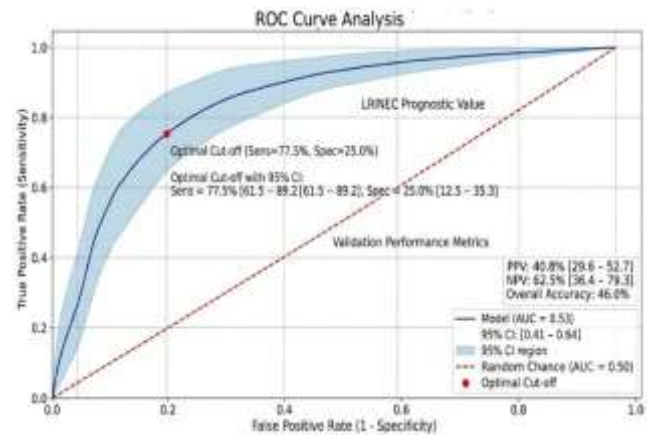
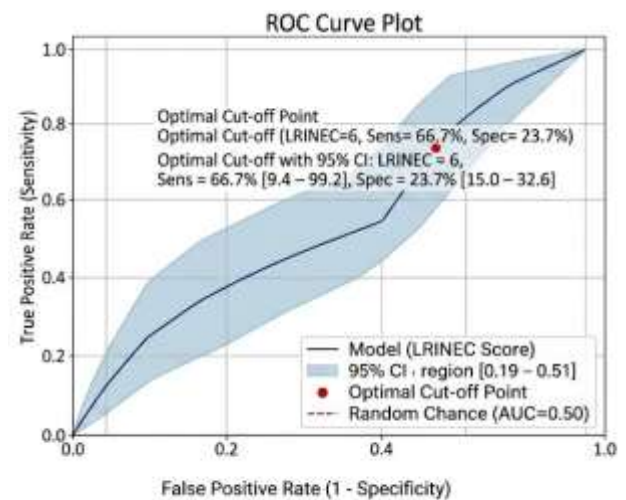
3.7. ROC Performance Curves

To mathematically quantify the discriminative accuracy of the admission LRINEC score as a prognostic tool, ROC curve analyses were conducted for both primary endpoints (Table 4) :

- Limb Loss Prediction (Amputation): Concerning the predictability performance of major amputation, the LRINEC score was found to have a sensitivity of 77.5% (95% CI: 61.5 – 89.2), and a specificity of 25.0% (95% CI: 12.5 – 35.3). The positive predictive value (PPV) and negative predictive value (NPV) were found to be 40.8% (95% CI: 29.6 – 52.7), and 62.5% (95% CI: 36.4 – 79.3), respectively. Overall accuracy for this end point was found to be 46.0%, and an area under the curve (AUC) of 0.53 (95% CI: 0.41 – 0.64) (Figure 1).
- From the results of the analysis of prognostic performance in order to validate the LRINEC score, the following metrics have been identified in terms of predicting In-Hospital Mortality. From the analysis, the sensitivity was 66.7% (95% CI: 9.4 – 99.2) and the specificity 23.7% (95% CI: 15.0 – 32.6). Additionally, the positive predictive value was 2.6% (95% CI: 0.3 – 9.2) and the negative predictive value 95.8% (95% CI: 78.1 – 99.9) (Figure 2) . The overall accuracy of the LRINEC score in predicting the outcome was 25.0% with AUC of 0.35 (95% CI: 0.19 – 0.51). The prognostic performance characteristics of a high-risk LRINEC score (≥ 8) are presented in Table 4.

Table 4. Validation of LRINEC

Performance Metric	Major Amputation (%)	In-Hospital Mortality (%)
Sensitivity	77.5	66.7
95% CI	61.5 – 89.2	9.4 – 99.2
Specificity	25.0	23.7
95% CI	12.5 – 35.3	15.0 – 32.6
PPV	40.8	2.6
95% CI	29.6 – 52.7	0.3 – 9.2
NPV	62.5	95.8
95% CI	36.4 – 79.3	78.1 – 99.9
Overall Accuracy	46.0	25.0
AUC	0.53	0.35
95% CI	0.41 – 0.64	0.19 – 0.51
Positive Predictive Value (PPV)		
Negative Predictive Value (NPV)		

**Figure 1.** ROC Curve Analysis of LRINEC for Predicting the Amputation in NF Patients**Figure 2.** ROC Curve Analysis of LRINEC for Predicting the Mortality in NF Patients

3.8 Prediction if LRINEC based on Logistic Regression

To isolate independent clinical drivers of adverse outcomes and control for confounding factors, logistic regression models were constructed for both amputation and mortality. The multivariable model for limb loss included patient age, sex, delay presentation, and the LRINEC score (Table 6).

LRINEC Score: Showed no independent association with limb loss ($p = 0.992$, Adjusted Odds Ratio [aOR] = 0.999, 95% CI: [0.896 – 1.115]).

- Systemic Comorbidities: The presence of at least one major underlying chronic comorbidity (primarily Type II Diabetes Mellitus) emerged as a strong independent predictor. Patients with pre-existing comorbidities had nearly three times the risk of undergoing therapeutic amputation ($p = 0.046$, aOR = 2.959, 95% CI: [1.018 – 8.600]). Due to the low number of mortality events ($n = 3$), the regression model for mortality served primarily to identify directional clinical trends:
- LRINEC Score: Showed no statistical association with death ($p = 0.968$, aOR = 1.008, 95% CI: [0.688 – 1.477]).
- Age and Sex: Advanced age continuous tracking ($p = 0.059$, aOR = 1.154) and female sex ($p = 0.065$, aOR = 158.50) demonstrated borderline trends toward increased mortality risk.

Table 5. Primary Clinical Characteristics and Comorbidity Profiles (N = 100)

Clinical Feature / Variable Category	Frequency (n)	Percentage (%)
Anatomical Infection Site		
Left Lower Limb	41	41.0%
Right Lower Limb	34	34.0%
Perineum / Genital (<i>Fournier's Gangrene</i>)	13	13.0%
Upper Extremities (<i>Arm / Forearm / Hand</i>)	8	8.0%
Trunk Axis (<i>Chest Wall, Neck, Back</i>)	3	3.0%
Bilateral Lower Extremities	1	1.0%
Comorbidity Classification		
No Pre-existing Comorbidities (<i>Healthy Baseline</i>)	42	42.0%
Isolated Diabetes Mellitus (DM Type II)	36	36.0%
Diabetes Mellitus + Hypertension (DM + HTN)	8	8.0%
Complex Cardiovascular / Renal Overlap (<i>CKD, IHD, Stroke, DCM</i>)	14	14.0%
Local Clinical Signs at Presentation		
Severe Pain, Skin Necrosis, & Ecchymosis	73	73.0%
Concomitant Bullae Formation / Blistering	47	47.0%
"Wooden-Hard" Deep Tissue Induration	14	14.0%
Mode of Disease Progression		
Subacute / Gradual Inflammatory Induration	77	77.0%
Hyper-Acute / Fulminant Tissue Necrosis	23	23.0%

Table 6. Multivariate Clinical Predictors (N = 100)

Target Outcome / Covariates Evaluated	aOR	95% CI	p-value	Statistical Significance
Endpoint: Major Amputation				
<i>Presence of Chronic Comorbidity</i>	2.959	[1.018 – 8.600]	0.046	Significant ($p < 0.05$)
<i>Surgical Delay Time (Hours)</i>	1.253	[0.886 – 1.772]	0.203	Not Significant
<i>Continuous Admission LRINEC Score</i>	0.999	[0.896 – 1.115]	0.992	Not Significant
Endpoint: Inpatient Mortality				
<i>Patient Age (Continuous)</i>	1.154	[0.994 – 1.340]	0.059	Borderline Trend
<i>Patient Sex (Female)</i>	158.50	[0.730 – 34396.0]	0.065	Borderline Trend
<i>Continuous Admission LRINEC Score</i>	1.008	[0.688 – 1.477]	0.968	Not Significant

4. Discussion

This was a prospective cohort study assessing the predictive performance of LRINEC score among 100 patients diagnosed with surgically proven NF at a reference tertiary hospital in Hodeidah, Yemen. It revealed that LRINEC score lacks adequate prognostic value in predicting major limb amputation (AUC = 0.53) and mortality among inpatients (AUC = 0.35) since the laboratory values obtained during admission alone do not provide adequate information in predicting such negative outcomes in NF patients [13,8]. Such data further contribute to the expanding body of literature suggesting that the use of the LRINEC score is inappropriate and recommend focusing mainly on clinical assessment and surgery [14,15].

The demographic distribution in the current study is consistent with previous research indicating NF to be a disease prevalent among mid-aged males. In the current study, men constituted 85% of the group, and the mean age of the sample group was 46.15 years. Comparable age and gender distribution has been recorded in studies carried out in countries such as Australia, Asia, and the Middle East, indicating that host-based factors have more bearing on the development of the disease than geographic differences [16,5,2]. Younger than 60 years patients make up the bulk of the population, indicating the socio-economic implications of NF since it tends to affect people in their productive years [17,6].

Anatomically, the lower limbs represented the most common site of infection, accounting for nearly three-quarters of cases. This pattern aligns with previous investigations and is likely related to the increased susceptibility of lower extremities to trauma, impaired circulation, and diabetic microvascular disease [18,2]. Fournier's gangrene constituted 13% of cases, a prevalence comparable to regional studies, emphasizing the importance of early recognition of genital and perineal infections [16,17]. Although upper-extremity and truncal infections were less frequent, previous studies have shown that these sites may be associated with delayed diagnosis and distinct clinical challenges [19-21].

Another interesting observation was that chronic comorbidity was very prevalent, occurring in 58% of all cases studied. The highest prevalence of comorbidity was for Type II Diabetes Mellitus (DM II), which affected 36% of the population. Diabetes has

been recognized as a major risk factor in NF development by virtue of its contribution to immunologic dysfunction, vasculopathy, and poor wound healing [8,16]. Multivariate analysis showed that independent of laboratory abnormalities, the presence of chronic comorbidities increases the chance of major amputations, and that diabetics have poor outcome. Our results confirm previous studies where host factors were found to be more important than laboratory findings in disease progress and limb salvage [8,13].

The mean LRINEC score at admission was 8.78 ± 3.99 , and a majority of patients (76%) belonged to the high-risk group. However, even 20% of the surgically diagnosed NF cases had low-risk scores (≤ 5), which is one major drawback in the applicability of LRINEC as a diagnostic tool. This view has also been expressed by Burner et al. and Stallwood-Hall et al., where they found that many patients having surgically proven NF cases had lower than normal scores [22,23].

The most significant finding of the current investigation was the inability of LRINEC to predict major amputation. Patients in both low and high-risk categories had similar amputation rates, and multivariate logistic regression model revealed no correlation between LRINEC scores and the occurrence of limb loss when adjusted for demographic and other confounding clinical variables [8,18]. Similar observations have been made by Hoesl et al. and Abdullah et al., who called into question the reliability of LRINEC as a tool of predicting individual prognosis [14,15]. The inability of LRINEC to predict amputation could be attributed to its sole reliance on systemic markers of inflammation, which do not account for local tissue damage and fascial necrosis [24,16].

Mortality prediction was also inadequate. Though the overall mortality rate was low (3%), the discriminatory ability of the LRINEC score was found to be very poor. The presence of fatal cases could not be predicted as having high risk, implying that the score fails to reflect the interaction between the host, pathogen, and therapy variables which determine the outcome [13, 22]. Similar findings have been observed previously in relation to the poor prognostic capability of LRINEC score in predicting mortality, especially among the elderly and in cases of polymicrobial infection

[25]. Timely surgical debridement, appropriate antimicrobial therapy, and intensive supportive care appear to exert a greater influence on survival than admission laboratory findings [26, 16].

While the LRINEC score identified most patients who eventually required amputation (sensitivity 77.5%) or died (66.7%), it incorrectly labeled the vast majority of patients without these outcomes as high-risk, reflected in very poor specificities of 25.0% and 23.7%. Consequently, positive predictive values were low (40.8% and 2.6%), and overall accuracies weak (46.0% and 25.0%), indicating that an elevated score more often represents a false alarm than a true prognostic warning. These limitations are consistent with prior reports by Abdullah et al. [15], Burner et al. [22], Stallwood-Hall et al. [23], and Breidung et al. [25].

The conclusions above support the idea that LRINEC score must be perceived mainly as an adjunctive diagnosis rather than a prognostic instrument. A number of studies proved that it is very helpful for distinguishing between NF and cellulitis and other soft tissue infections in emergency conditions. But after the diagnosis of NF has been confirmed surgically, prognostic evaluation should take into account a number of parameters, such as patient comorbidity, anatomical location of infection, the degree of tissue damage, the time of surgery and intra-operative findings [26,16]. Other techniques can give more accurate prognostic data. Imaging techniques, for instance, contrast-enhanced CT have been shown to better estimate the degree of deep fascial involvement and tissue destruction in comparison with lab scores [24]. The same is true about some new scores, such as NSTI Assessment Score and SIARI score [7, 14, 27].

Generally, the results show that the admission LRINEC score does not have enough prognostic accuracy for predicting the outcome of major amputation and in-hospital mortality in patients with diagnosed necrotizing fasciitis. The presence of chronic conditions, especially Type II diabetes mellitus, was found to be better predictors [16,8].

The current study has several limitations. Firstly, this study was performed at one tertiary center in Hodeidah, which would reduce its generalizability to other regions of Yemen. Secondly, the sample size was limited to 100 patients, and there were very few events in terms of mortality (n=3), which would decrease the statistical power for analysis of mortality. Thirdly, the role of microorganisms and antibiotic administration timing was not considered in the multivariate analysis even though it is known to affect patient outcomes. Finally, the study concentrated on laboratory risk assessment and did not consider any other prognostic factors.

5. Conclusion

The use of LRINEC score was found to have little predictive value for the occurrence of amputation and death in cases of NF. Despite their indicating systemic inflammatory response syndrome, no correlation was observed between higher scores and poor clinical results. On the other hand, presence of pre-existing conditions such as Type II diabetes mellitus substantially heightened the chance of amputation. This indicates that patient-related factors are more responsible for the clinical outcome than laboratory predictors. Therefore, the LRINEC score should be used as a supplementary diagnostic tool rather than a standalone predictor of prognosis. Patients with diabetes mellitus and other significant comorbidities are at increased risk of adverse outcomes and require closer monitoring and more aggressive treatment. In resource-limited settings, early recognition, rapid resuscitation, and timely surgical debridement are essential, as prompt intervention remains the most important factor for improving survival and preserving limbs.

Authors' contributions

A. Alsamei: Methodology, formal analysis, software Supervision and writing-review and editing; **S. Kashah:** Conceptualization, Methodology, formal analysis; **Y. A. Obadiel and : S Moogam :** Supervisor and Investigation, validation. All authors reviewed and approved the final manuscript.

Data Availability

The data that support this study are available from the corresponding author upon reasonable request

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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