

SIARI VS LRINEC: ACCURATE TOOL FOR DIAGNOSIS OF
NECROTIZING FASCIITIS

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Abstract**OBJECTIVE**

To compare the diagnostic accuracy of SIARI and LRINEC score for early detection of necrotizing fasciitis

METHODOLOGY

This cross-sectional study was conducted at the department General Surgery Civil Hospital Karachi from October 2024 to March 2025. Non-Probability consecutive sampling was used to recruit the 73 patients aged 18 years and above of both gender and with suspected severe soft-tissue infection. The inclusion criteria consist of clinical suspicion should be NF. LRINEC scores were compared to SIARI scores. The measurements of diagnostic accuracy were done through ROC analysis where $p \leq 0.05$ was taken as significant.

RESULTS

Among 73 patients (mean age 45.78 ± 17.39 years; 74% were males), the SIARI score demonstrated higher diagnostic accuracy, with a higher AUC (0.824; $p = 0.0001$), greater sensitivity (96.6%), and higher diagnostic accuracy (82.2%), whereas the LRINEC score showed comparatively lower discriminative ability (AUC = 0.665; $p = 0.018$).

CONCLUSION

The present findings revealed that the SIARI score was found to be more accurate in diagnosis of NF at an early stage than the LRINEC score. SIARI was more discriminative and sensitive in recognizing confirmed cases whereas LRINEC had lower diagnostic performance. These results revealed discrepancies in the effectiveness of the two scoring systems in separating NF and other serious soft-tissue infections.

INTRODUCTION

Necrotizing fasciitis (NF) is an progressive and life-threatening soft tissue infection that is characterized by widespread necrosis of the skin, subcutaneous and fascial tissue and in severe

cases, underlying muscle tissue. The infection tends to follow the fascia lines with quite low vascular supply that allows the initial superficial changes in the skin to appear as being of a harmless insignificance even when involving a

large portion of deep tissue. The given pathological progression is frequently marked by the delay in diagnosing and, consequently, an increase in the delay in completion of the surgical procedure, which, in turn, increases morbidity and mortality rates [1].

NF typically becomes a short-term, acute disease that clinically progresses in a few days. It usually occurs after the infiltration of bacteria due to distortion in the skin especially people with weakened immunity. Many infections have one anatomical location of origin and are largely due to gram-positive organisms (particularly *Staphylococcus aureus* and *Streptococcus* species), although polymicrobial infections are also found [2,3].

The global prevalence rate of NF stands at 0.83 to 32.64 cases per million population per year with a mortality rate of about 14% to 30% despite the development of critical care and the use of antibiotics [1-3]. Increased mortality has been linked to several clinical and laboratory factors such as advanced age, severe sepsis, renal dysfunction as indicated by serum creatinine level more than 2.0 mg/dL, toxic shock syndrome, infection with *Clostridium perfringens* and delays that take more than 24 hours before definitive treatment. Surgical exploration and vigorous debridement early on, together with a broad-based approach with antibiotic therapy, has been the mainstay and has been demonstrated to positively impact the mortality rate as well as the risk of amputating the limbs [4,5].

Although severe, the early diagnosis of NF is not easy because the early preparation of the clinical picture is like the presence of other soft tissue infections, namely severe cellulitis, erysipelas, or such diseases as deep venous thrombosis. This confusion often results in misdiagnosis or diagnostic delay, which negatively influences the outcomes [6]. NF is still diagnosed mainly through clinical examination and initial suspicion even though imaging modalities like computed tomography and magnetic resonance imaging might be helpful in some cases [7].

To aid in the early diagnosis of the disease, CH et al. came up with the LRINEC score in 2004. This scoring system uses six parameters that are

routinely available in the laboratory, that is, total leukocyte count, C-reactive protein, serum sodium, haemoglobin, serum glucose, and serum creatinine to differentiate between NF and other soft tissue infections [8]. Since its introduction, the LRINEC score has been assessed and confirmed in many studies that have shown variable diagnostic value in various populations and clinical situations [7,8].

Recently, a new diagnostic tool called SIARI score suggested by Cribb et al. in 2019 was introduced that combined both clinical and laboratory variables, such as the location of infection, immunosuppression, age, renal failure, and inflammatory markers [9]. Due to the combination of readily available parameters, SIARI has been proposed to provide a better level of diagnostic accuracy and clinical utility. It has been shown that SIARI score has a higher sensitivity and specificity than the LRINEC score in the early detection of NF [10]. Nevertheless, there are also opposing findings, and prospective validation studies show that LRINEC is expected to continue to be a useful instrument in the differentiation between NF and severe cellulitis and that some ambiguity remains as to which diagnostic scoring system to use best [11,12].

Timely distinction between NF and severe cellulitis is important to avert diagnostic errors that largely deteriorate patient outcomes. As the evidence concerning the diagnostic capability of SIARI and LRINEC scores is contradictory, the direct comparison of the accuracy level of these two test scores is necessary. The determination of the more credible system of scoring could improve the timely clinical decision-making process, the timely surgical intervention, and eventually, the decreased morbidity and mortality.

METHODOLOGY

It was a comparative cross-sectional study carried out at Civil Hospital Karachi, Pakistan, from October 2024 to March 2025, after obtaining approval from the Ethical Review Committee (ERC). Patients aged 18 years and above of either gender who presented with a clinical suspicion of severe soft-tissue infection were included in the

study. The enrolled participants were selected through non-probability consecutive sampling while pregnant women and patients with a history of peripheral vascular disease, compartment syndrome, and superficial abscess were excluded. NF were conducted using intraoperative observations, such as the dishwasher fluid, grey or necrotic fasciitis, little or no bleeding of the superficial tissue, and histopathological examination was used as the reference standard of definite diagnosis. The index tests included the LRINEC score, which was calculated with the use of C-reactive protein, total leukocyte count, haemoglobin, serum sodium, serum glucose, and creatinine with the cut-off value of ≥ 6 and the SIARI score, which was obtained by using site of infection, immunosuppression status, age, renal impairment, and inflammatory markers with a cut-off of ≥ 4 . The main outcome measures were the parameters of diagnostic accuracy, such as sensitivity, specificity, positive predictive value, negative predictive value, and ROC curve of both scoring systems. ROC curve approach was used to determine the sample size of 73 patients based on an anticipated AUC (0.82)¹⁰, 95% C.I, and 80% statistical power. Written informed consent was obtained from all participants, and demographic, clinical, and laboratory data

required for calculation of the LRINEC and SIARI scores were collected and recorded using a structured proforma at initial assessment. Data were analysed using SPSS-26; diagnostic accuracy of both scores was evaluated against the reference standard using Chi-square testing and ROC curve analysis, including comparison of AUCs, with a p-value ≤ 0.05 as significant.

RESULTS

Table I presents the baseline demographic and clinical characteristics of the 73 patients enrolled in the study. The mean age was 45.78 ± 17.39 years. The mean C-reactive protein level was 181.99 ± 55.09 mg/dl, and the mean white blood cell count was $20,420.52 \pm 4,301.02$ per mm³. The mean haemoglobin concentration was 11.32 ± 1.54 g/dl. Mean serum sodium, creatinine, and glucose levels were 131.92 ± 4.14 mmol/l, 2.06 ± 0.65 mg/dl and 222.16 ± 51.60 mg/dl, respectively. The mean LRINEC and SIARI scores were 5.13 ± 2.28 and 4.16 ± 1.95 , respectively. Most patients were male (74.0%), while females constituted 26.0% of the study. Immunosuppression was observed in 15.1% of patients, and the lower limb was the most frequently involved site of infection (53.4%).

Table I: Baseline Demographic and Clinical Characteristics of Patients (n=73)		
Mean $\pm$ Standard Deviation		95% C.I.
Age in years = 45.78 ± 17.39		41.72~49.84
CRP in mg/dl = 181.99 ± 55.09		169.14~194.85
WBC per mm ³ = 20420.52 ± 4301.02		19417.02~21424.02
Haemoglobin in g/dl = 11.32 ± 1.54		10.96~11.68
Serum Sodium in mmol/l = 131.92 ± 4.14		130.95~132.88
Serum Creatinine in mg/dl = 2.06 ± 0.65		1.91~2.22
Serum Glucose in mg/dl = 222.16 ± 51.60		210.12~234.20
LRINEC Score = 5.13 ± 2.28		4.60~5.67
SIARI Score = 4.16 ± 1.95		3.70~4.62
Frequency (%)		
Gender	Male	54 (74.0)
	Female	19 (26.0)
Immunosuppression		11 (15.1)
Site of Lower Limb		39 (53.4)

Figure I illustrates the ROC curve of the SIARI score, demonstrating good discriminatory ability for the diagnosis of NF.

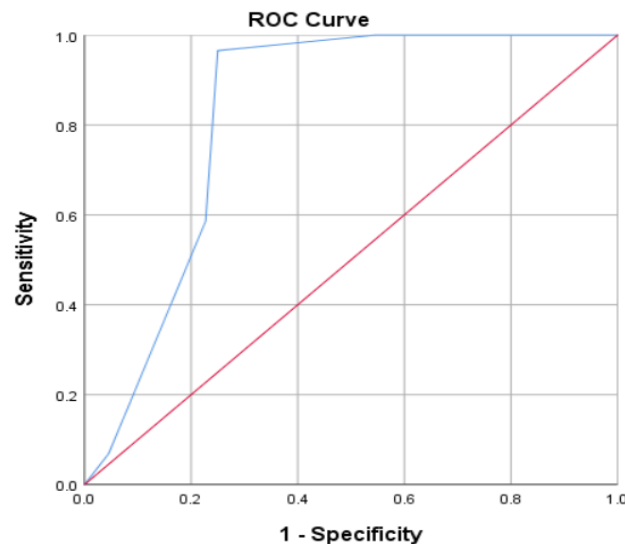


FIGURE I: SIARI Score

Figure II depicts the ROC curve of the LRINEC score, showing comparatively lower discriminative performance for identifying NF.

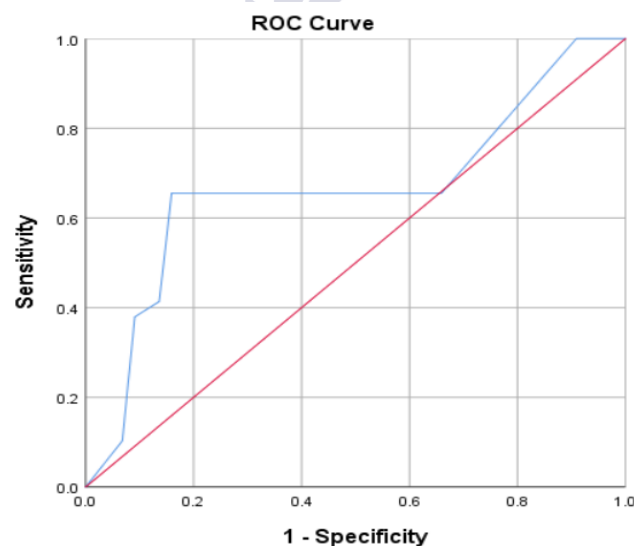


FIGURE II: LRINEC Score

Table II presents the ROC curve analysis and diagnostic performance of the SIARI and LRINEC scores for the detection of NF among the 73 patients. The SIARI score demonstrated superior discriminatory ability with an area under the curve (AUC) of (0.824, $p=0.0001$), compared with an AUC of (0.665; $p=0.018$) for the

LRINEC score. At an optimal cutoff value of ≥ 4.00 , the SIARI score achieved a high sensitivity of 96.6% and a specificity of 71.6%, with a PPV of 70.0% and a NPV of 97.0%. The overall diagnostic accuracy of SIARI was 82.2%, with a LR+ of 3.4 and a low LR- of 0.05. In contrast, the LRINEC score, at a cutoff of ≥ 5.50 , showed

lower sensitivity (65.5%) and specificity (49.6%), with a PPV of 46.3% and a NPV of 68.8%. The diagnostic accuracy of LRINEC was 56.2%, and

the corresponding LR_s were 1.3 for LR₊ and 0.7 for LR₋, indicating comparatively limited diagnostic utility.

Table II: ROC Curve Analysis and Diagnostic Accuracy of SIARI and LRINEC Scores (n=73)		
Diagnostic Variables	SIARI Score	LRINEC Score
Area under the curve	0.824	0.665
Std. Error	0.050	0.071
95% Confidence Interval	0.725---0.922	0.526---0.803
P-Value	0.0001	0.018
Threshold Value	≥4.00	≥5.50
Sensitivity	96.6%	65.5%
Specificity	71.6%	49.6%
Positive Predictive Value	70.0%	46.3%
Negative Predictive Value	97.0%	68.8%
Diagnostic Accuracy	82.2%	56.2%
Positive Likelihood Ratio	3.4	1.3
Negative Likelihood Ratio	0.05	0.7

DISCUSSION

NF is a fast-progressing life-threatening soft tissue infection where initial signs are not specific and thus may be confused with severe cellulitis and other soft tissue infections [1,6]. The patients in the present study who had confirmed NF showed a strong systemic inflammatory response as evidenced by elevated C-reactive protein and leukocyte count, hyponatremia, and renal dysfunction, which are consistent with the existing clinical criteria as documented in previous studies [2-5]. The observed epidemiological characteristics of middle-aged patients and the male gender reflect epidemiological data presented in previous reports when males were estimated to be about 60% to 75% of the affected sample with mean age of 40-55 years [1-3,12]. Likewise, more than half of the cases had lower limb involvement, which is consistent with the literature that the extremities are described as the main location of disease in 50%-70% of the patients [2, 3, 12]. The key findings of current research was SIARI score had better diagnostic capability 82.2% than the

LRINEC score 56.2% in identifying NF at an early stage. SIARI showed superior area under the ROC curve 0.824, sensitivity 96.6% and overall diagnostic accuracy than LRINEC, in the current cohort. These results are consistent with those of the original research by Cribb et al., who have stated that SIARI had an AUC of 0.83 and a sensitivity of over 90%, which is higher than LRINEC which had an AUC of about 0.70 [9]. Notably, the validation of the current results can be further enhanced with a direct comparison with the prospective study by Kishor and Srikant [10]. SIARI had a diagnostic accuracy of 76.2% in the cohort, which was calculated using histopathological confirmation, compared to LRINEC with a less diagnostic accuracy of 61.9% [10]. The finding that SIARI was more accurate in diagnosis in the current study is indicative of a uniform pattern of a superior performance in multiple populations with a small margin that could be most likely attributed to the difference in the severity of the disease and the attributes of the patient. Additionally, a prospective validation study by Karthikk et al. had an AUC of 0.86 of

SIARI versus 0.69 of LRINEC and the findings of SIARI showed a significantly better level of sensitivity and negative predictive value [11].

Conversely, various studies and meta-analyses assessing LRINEC as an independent diagnostic test have reported significant heterogeneity in its diagnostic sensitivity with pooled sensitivities of between 36% to 77% and pooled specificities of between 72% to 93% with respect to its inconsistent application across different clinical scenarios [7]. According to Tarricone et al., the pooled AUC of LRINEC was about 0.74, which was lower than the ones found in composite clinical-laboratory instruments like SIARI [7]. The comparatively poorer results of LRINEC in the current research could be explained by the fact that it depends on laboratory parameters which could be affected by chronic comorbidities, early disease manifestation, or previous fluid resuscitation so that the disease severity could be underestimated [8,11,12].

The higher diagnostic performance of SIARI can be attributed to the fact that it used in both clinical and laboratory variables, such as the site of infection, the immunosuppression condition, age, and impaired renal condition which allowed the assessment of disease risk in a holistic manner [9,11]. This combined method can be especially helpful in the resources-constrained environment, where timely clinical decision-making is essential, and more sophisticated imaging modalities are not easily accessible [13-15]. The prompt surgical exploration and aggressive debridement in the first 24 hours have been associated with reduced mortality and amputation of the limb when NF is identified early [4,5,14,16]. The strong points of this study are the application of histopathological confirmation as a reference standard, and unified computation of both scoring systems and thorough ROC-based analysis. Nonetheless, there are some restrictions which should be considered. The single-centre nature can be restrictive to generalizability, and the sample is quite small, making it impossible to conduct a large-scale subgroup analysis. Moreover, the inclusion of patients who need surgical intervention might also lead to selection bias towards more

progressive disease. Despite these restrictions, the uniformity of the results with previous prospective and validation research increases the validity of the results. The current study contributes to the accumulating evidence that the SIARI score exhibits better diagnostic accuracy than LRINEC score in the early diagnosis of NF. The agreement of these results with the prior studies, with even direct comparison with available prospective data, both validate the potential usefulness of SIARI as a good supplement to clinical evaluation in the early detection of this potentially fatal disease.

CONCLUSION

The present findings revealed that the SIARI score was found to be more accurate in diagnosis of NF at an early stage than the LRINEC score. SIARI was more discriminative and sensitive in recognizing confirmed cases whereas LRINEC had lower diagnostic performance. These results revealed discrepancies in the effectiveness of the two scoring systems in separating NF and other serious soft-tissue infections.

REFERENCES

- Allaw F, Wehbe S, Kanj SS. NF: an update on epidemiology, diagnostic methods, and treatment. *Curr Opin Infect Dis.* 2024;37(2):105–111.
- Magala J, Makobore P, Makumbi T, Kagwa S, Kalanzi E, Galukande M. The clinical presentation and early outcomes of NF in a Ugandan tertiary hospital: a prospective study. *BMC Res Notes.* 2014;7(1):476.
- Khamnuan P, Chongruksut W, Jearwattananok K, Patumanond J, Tantraworasin A. NF: epidemiology and clinical predictors for amputation. *Int J Gen Med.* 2015;8:195–20.
- Darenberg J, Luca-Harari B, Jasir A, Sandgren A, Pettersson H, Schalen C, et al. Molecular and clinical characteristics of invasive group A streptococcal infection in Sweden. *Clin Infect Dis.* 2007;45(4):450–458.

- Urbina T, Madsen MB, de Prost N. Understanding necrotizing soft tissue infections in the intensive care unit. *Intensive Care Med.* 2020;46(9):1739-1742.
- Friederichs J, Hutter M, Hierholzer C, Novotny A, Friess H, Bühren V, et al. Procalcitonin ratio as a predictor of successful surgical treatment of severe necrotizing soft tissue infections. *Am J Surg.* 2013;206(3):368-373.
- Tarricone A, De La Mata K, Gee A, Axman W, Buricea C, Mandato MG, et al. A systematic review and meta-analysis of the effectiveness of LRINEC score for predicting upper and lower extremity NF. *J Foot Ankle Surg.* 2022;61(2):384-389.
- CH W. The LRINEC score: a tool for distinguishing NF from other soft tissue infections. *Crit Care Med.* 2004;32:1535-1541.
- Cribb BI, Wang MT, Kulasegaran S, Gamble GD, MacCormick AD. The SIARI score: a novel decision support tool outperforms LRINEC score in NF. *World J Surg.* 2019;43(10):2393-2400. Excellence in Education & Research
- Kishor M, Srikant A. SIARI score versus LRINEC score for diagnosis of NF: a prospective comparative study. *Ann Emerg Surg.* 2022;10:2573-1017.
- Karthikk R, Tandup C, Reddy D, Jayant D, Naik K, Sahu S, et al. Prospective validation and comparison of Laboratory Risk Indicator for NF (LRINEC) and site other than lower limb, immunosuppression, age, renal impairment, and inflammatory markers (SIARI) scoring systems for NF. *J Surg Res.* 2023;283:719-725.
- Gupta Y, Chhetry M, Pathak KR, Jha RK, Ghimire N, Mishra BN, et al. Risk factors for NF and its outcome at a tertiary care centre. *J Ayub Med Coll Abbottabad.* 2016;28(4):680-682.
- Fernando SM, Tran A, Cheng W, Rochweg B, Kyeremanteng K, Seely AJ, et al. Necrotizing soft tissue infection: diagnostic accuracy of physical examination, imaging, and LRINEC score: a systematic review and meta-analysis. *Ann Surg.* 2019;269(1):58-65.
- Stevens DL, Bryant AE. Necrotizing soft-tissue infections. *N Engl J Med.* 2017;377(23):2253-2265.
- Goh T, Goh LG, Ang CH, Wong CH. Early diagnosis of NF. *Br J Surg.* 2014;101(1):e119-e125.
- Bonne S, Kadri SS. Evaluation and management of necrotizing soft tissue infections. *Infect Dis Clin North Am.* 2017;31(3):497-511.