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Evaluation of Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Scoring System for Detecting Necrotizing Soft Tissues Infections in Patients with Diabetes

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ABSTRACT

Objective: To determine the risk of necrotizing fasciitis using Laboratory Risk Indicator for Necrotizing Fasciitis scoring system.

Study Design: Comparative prospective study.

Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Rawalpindi, Pakistan, from Jan to Aug 2022.

Methodology: Using non-probability consecutive sampling technique, 278 participants were enrolled in the study. Among these patients with NF, 98 were cases and 180 were controls, having uncomplicated soft tissue infections (cellulitis or abscesses). A preliminary demographic profile, history of comorbidities, drug history, smoking history, or history of trauma within a week of enrolment at the inpatient facility was acquired. LRINEC Score was calculated with baseline C-reactive protein, white cell counts, sodium, creatinine, hemoglobin, and glucose.

Results: Mean age of participants was 46.92±8.18 years where 208(74.8%) of the participants were males. LRINEC score ≥6 (cut off value) was computed among 78(79.6%) in confirmed cases of NF whereas only 13(7.2%) among controls. The sensitivity, specificity, positive predictive value, and negative predictive value were 79.6%, 92.7%, 85.7%, and 89.3% respectively.

Conclusion: LRINEC scoring system in conjunction with clinical suspicion is a useful, reliable, and cost-effective scoring system that can help diagnose NF and distinguish it from other soft tissue infections.

Keywords: Health status indicators, Inflammation, Necrotizing fasciitis, Sepsis.

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INTRODUCTION

Necrotizing fasciitis (NF) is a deadly infection of the soft tissues that carries a high mortality rate due to which treatment depends on diagnosing the condition at an early stage and distinguishing it from other soft tissue infections to decrease the morbidity and mortality reported with this condition.[1,2] Early diagnosis of the condition followed by administration of antibiotics, repeated debridement and skin grafting are necessary in such patients.[3]

One of the most common scoring systems for the diagnosis of NF is the Laboratory Risk Indicators for Necrotizing Fasciitis (LRINEC) as it employs several laboratory indices used to calculate a score thus dividing the patient into low, medium or high-risk categories.[4,5] The most common sites affected are lower limbs followed by perineum and abdomen, with localized changes in color and temperature of the skin, swelling and tenderness at an early stage but a more invasive infection of the surrounding areas with pus, gangrene, or ischemic changes at a later stage of infection combined with a history of trauma, diabetes, immunosuppression, kidney disease, liver disease or hypotension and usually older age group.[6,7] NF affects 0.4 to 1 in 100,000 people per year with 11-36% reported rate of mortality, but inconsistent symptoms and clinical presentation of NF can lead to misinterpretation and false diagnosis like abscess or cellulitis, presenting a great challenge to diagnose necrotizing fasciitis and commence early intervention.[8]

Thus, this study aims at evaluation of a scoring system in predicting risk of developing necrotizing fasciitis in our Pakistani population.

METHODOLOGY

The comparative prospective study was carried out at Combined Military Hospital (CMH), Rawalpindi, Pakistan, from January to August 2022 after obtaining approval from the Ethics Research Committee (ERC) of the institute (ERC no. 255, dated 7 January 2022). The sample size was calculated with diagnostic accuracy of LRINEC Score as 76.3%.[11]

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Inclusion Criteria: Patients of either gender, more than 16 years of age and no prior debridement history and diagnosed with NF were included.

Exclusion Criteria: Patients with no diabetes, and prior debridement history were excluded.

Using non-probability consecutive sampling technique, a total of 278 participants were enrolled in the study as cases and controls. Hence, Group 'A' were 98 cases with NF (Necrotizing Fasciitis, Fournier's gangrene, or necrotizing soft tissue infection) whereas Group 'B' were 180 Controls with a designated diagnosis of soft tissue infections, abscess or cellulitis. Demographic profile, history of comorbidities, drug intake, smoking, or trauma within a week of enrolment was acquired. The patient was labeled to be misdiagnosed if admitted as soft tissue infection and later given diagnosis of NF, which was defined as intraoperative necrosis of subcutaneous tissue, fascia particularly fascial edema and necrosis. LRINEC Score was calculated with baseline CRP, white cell counts (WCC), serum sodium, creatinine, hemoglobin, and glucose levels, with a maximum score is 13, a score of >/=6 suggestive of necrotizing fasciitis and a score of >/=8 being strongly predictive of the disease.[12] Patient risk was classified as Low with score of ≤5, Medium with score of 6-7, and High if more than ≥8, while a score of ≥6 (medium risk or higher) was taken as the reference point.

Data were analyzed using IBM Statistical Package of Social Sciences (SPSS) version 23.0. Continuous variables were demonstrated as means and standard deviation with student's t-test. Categorical variables were analyzed with Pearson's chi-square tests where the *p*-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 278 patients with 98 as cases and as 180 controls, had a mean age of 46.92±8.18 years, with 208(74.8%) being males and 70(25.2%) being females. Comorbidities included hypertension (108, 38.8%), and hypercholesterolemia (86, 31%) with associated risk factors of smoking (191, 68.7%) and a history of trauma (111, 39.9%). Non-steroidal anti- inflammatory drugs (NSAIDs) intake was 9.2% in cases but 1.1% in controls, (*p*-value=0.001), this being statistically significant. Laboratory parameters of LRINEC scoring system are enumerated in Table-I.

The most frequently presenting region in cases the perineum region, whereas the affected region in controls was the upper limbs. A longer hospital stay of 24 versus 4 days (*p*-value<0.001) was recorded in cases and controls respectively where 53 (54.08%) NF patients required ICU stay whereas only 1(0.6%) control patient did. Mortality rate was 9(9.18%) and 1(0.5%) in cases and controls respectively (*p*-value <0.001). Stratification of total LRINEC scores into risk categories (high, medium, or low risk) is depicted in Table-II.

Table-I: Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score Laboratory Parameters, (n=278)

Parameters	Controls (n=180)	Cases (n=98)	*p*-value
C- Reactive Protein (mg/dl)	72.06±23.79	245.40±65.10	0.001
White Blood Cell Count (mm3)	10.41±2.59	20.08±4.01	0.001
Hemoglobin (g/dl)	13.02±1.61	11.92±1.51	0.001
Serum Sodium (mmol/L)	136.76±1.95	127.76±2.76	0.001
Serum Creatinine (µmol/L)	77.88±16.18	155.04±54.54	0.001
Serum Glucose (mmol/L)	7.28±2.50	15.71±4.72	0.001

Table-II: Stratification of Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score (n=278)

LRINEC Score	Controls (n-180)	Cases (n- 98)	*p*-value
'Low risk ≤5'	167(92.8%)	26(26.5%)	0.001
'Medium risk 6-7',	10(5.6%)	24(24.5 %)	
'High risk ≥8'	3(1.7%)	48(48.9%)	

LRINEC score ≥6 was used as a reference point as described by relevant literature 13 for a high-risk score of NF suspicion. The specificity, positive predictive value (PPV), and negative predictive value (NPV) were 92.7%, 85.7%, and 89.3% respectively as shown by Table III.

Table-III: Diagnostic Accuracy of Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score in Diagnosing Necrotizing Fasciitis (n=278)

LRINEC Score	Necrotizing Fasciitis Positive	Necrotizing Fasciitis Negative
LRINEC Positive (Score>6)	78(79.6%)	13(7.2%)
LRINEC Negative (Score <6)	20(20.4%)	167(92.8%)

*Sensitivity= TP/(TP+FN)= 78/(78+20)*100=79.59%*
*Specificity= TN/(TN+FP)= 167/(167+13)*100=92.77%*
*Positive Predictive Value= TP/(TP+FP)*100=78/(78+13)=85.71%*
*Negative Predictive Value=TN/(TN+FN)*100=167/(167+20)= 89.30%*
*Diagnostic Accuracy=(TP+TN)/All patients*100=(78+167)/278=88.13%*

DISCUSSION

The aim of this cross section analytical research was to find the effectiveness of LRINEC scoring system for diagnosing and distinguishing NF from other soft tissue infections. Based on laboratory parameters, patients who had a high LRINEC score were diagnosed with necrotizing fasciitis as compared to those with low scores. Patients with high scores were of old age with higher mortality rates and longer hospital stay signifying the importance of LRINEC in predicting the diagnosis, hospital stay and mortality of patients. The high mortality rate of 25-35% associated with this condition requires a multidisciplinary approach.[9] In one study, the evaluation of this scoring system revealed a high sensitivity of 100% in diagnosing cervical necrotizing fasciitis and differentiating it from deep infections of the neck.[10] Patients who had high levels of procalcitonin due to NF as compared to those with other soft tissue infections, proves it to be a reliable marker in the early recognition of NF.[13] As Computed tomography (CT) is an expensive technique and is rarely available in the peripheral hospitals , it cannot be used reliably in patients with NF or likely to develop or already had developed, but the absence of such findings does not rule out the disease.[14,15] Lactate levels in the serum were studied in patients with and without NF and the results revealed 4.1 vs 2.0 mmol/l (p<.001) which shows diagnostic ability in diagnosing NF.[16] For the prediction of mortality in necrotizing fasciitis MNF scoring technique was employed in patients diagnosed with the condition and the results revealed that this scoring technique correctly predicted or denied mortality in 91% patients while only 8.7% of the patients had incorrect prediction.[17,18] Several parameters, if employed with high LRINEC scoring as presence of fever, intravenous drug abuse, male gender and elevated lactate can be useful in diagnosing necrotizing fasciitis in the early stages of presentation to prevent a fatal outcome.[19,20] The LRINEC scoring technique is easy to employ and cost effective with promising results.

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CONCLUSION

Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) scoring system in conjunction with clinical suspicion is a useful, reliable, and cost-effective scoring system that can help diagnose NF and distinguish it from other soft tissue.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SAZ & FAO: Data acquisition, critical review, approval of the final version to be published.

MUK & AR: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

WFA & MS: Conception, data analysis, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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