Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Use of Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score in differentiating Necrotising Fasciitis cases from Soft tissue infections: A Prospective Study

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Received: March 2018
Accepted: March 2018

ABSTRACT

Background: Necrotising fasciitis is a progressive, fulminant, inflammatory infection of deep fascia with secondary necrosis of subcutaneous tissue. The present study was carried out to evaluate the usefulness of LRINEC score to differentiate Necrotising fasciitis (NF) from other soft tissue infections (STI). **Methods:** Ours was a prospective observational study carried out in a tertiary care setting over a period of one year from November 2013 to November 2014. 150 patients of soft tissue infections were included. Clinical evaluation was done based on the signs and symptoms which included a rapidly progressive oedema, bullae, blue-grey cyanotic lesions, erythema and necrotic patches. The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score including Haemoglobin count, Total leucocyte count, C - reactive protein, Platelet count, Fasting blood sugar and Serum sodium, was calculated for all the patients. **Results:** Among 150 patients with soft tissue infection, 108 (72%) patients were clinically proven to be NF, rest 42(28%) were soft tissue infections. Based on LRINEC score out of 42 STI, 15 % had moderate to high risk of NF while out of the 108 confirmed NF cases 55 % had low to moderate risk of NF. **Conclusion:** The low sensitivity and low positive predictive value achieved in this study as well as other studies makes the LRINEC score unsuitable to be used solely to distinguish NF with other soft tissue infections.

Keywords: Necrotising Fasciitis (NF), Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score, Soft Tissue Infections (STI).

INTRODUCTION

Necrotizing fasciitis (NF) or necrotizing soft-tissue infections (NSTI) are infrequent but highly lethal infections.[1] Necrotising fasciitis (NF) is defined as a rapidly progressive soft tissue infection, characterized by necrosis of the subcutaneous tissue containing vessels, nerves and fat (fascia superficialis).[1,2]

Necrotising fasciitis infections were initially described by Jones in 1871 and were termed as "hospital gangrene". They had a mortality rate of 46%.[3] Surgical debridement was first performed by Meleney in the early 1920s and has since remained an integral part of current treatment.[4,5]

Based on microbiology of the wound, necrotising fasciitis is divided into four types.[6,7]

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Type 1 - Polymicrobial /synergestic
Type 2 - Monomicrobial including Group A Beta haemolytic Streptococcus
Type 3 - Marine related organisms including Vibrio vulnificus
Type 4 - Fungal

Wong et al developed the Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) scoring system for accurately identifying necrotising fasciitis based on laboratory values at the time of hospital admission.[8] According to Wong et al,[8] the Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) score can stratify patients with soft-tissue infection into high-risk and moderate-risk categories in the early course of disease. It is based on only six common laboratory variables. Also, it was noted by them that the Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) score can differentiate between life threatening necrotising fasciitis and other soft-tissue infection, theoretically because NF is associated with severe sepsis more often than other soft-tissue infections.

The Laboratory Risk Indicator for Necrotising Fasciitis LRINEC score is composed of the following six laboratory parameters: C - reactive protein, total white cell count, haemoglobin, serum sodium, serum creatinine and serum glucose. Out of these factors, serum sodium, serum creatinine, white blood cell count and haemoglobin, all have been predictors of mortality in previous studies.[9,10]

Table 1: Laboratory Risk Indicators For Necrotising Fasciitis (LRINEC) Score,[9,10]

- **The maximum score is 13; a score of 6 should raise the suspicion of Necrotising fasciitis**
- **To convert the values of glucose to miiligrams per deciliter, multiply by 18.015.**
- **To convert the values of creatinine to milligrams per deciliter, multiply by 0.0113**

Variable units	Score
C-Reactive protein, mg/L	
<150	0
≥ 150	4
Total white cell count, per mm3	
<15	0
15-25	1
>25	2
Hemoglobin, g/dl	
>13.5	0
11-13.5	1
<11	2
Serum Sodium (mmol/L)	
≥135	0
< 135	2
Serum Creatinine (mg/dL)	
≤ 1.6	0
>1.6	2
Plasma Glucose (mg/dL)	
≤ 10	0
>10	1

With a LRINEC Score of 6 or greater, the model has a positive predictive value of 92.0% (95% CI 84.3-96.0) and negative predictive value of 96.0% (95%, CI 92.6-97.9). A score of 8 or more has a strong positive predictive value of 93.4% (95% CI 85.5-97.2).[11]

According to Yi-Chun Su et al significant differences in mortality and amputation were noted between Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) scores of >6 and LRINEC scores of <6 in patients with Necrotising Soft Tissue Infections. Patients of former group may have a higher mortality rate and a higher amputation rate.[12] The median mortality rate for NF is 32.2% but varies throughout the literature from 8.7% to 76%.[12,13]

Present study was aimed at stratifying patients with soft tissue infections and NF into high, moderate and low risk categories using Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) score. The aim is also to evaluate the sensitivity and positive predictive ability of the LRINEC score among clinically confirmed cases of NF and other soft tissue infections including cellulitis.

MATERIALS AND METHODS

A prospective observational study was carried out in a tertiary care hospital in
South India. It extended over a period of one year from November 2013 to November 2014.
A total number of 150 patients were considered.

Inclusion And Exclusion Criteria

All patients with clinical diagnosis of cellulitis based on ICD 9 were included in this study.
The ICD-9 diagnosis of NF was confirmed if any of the following criteria were met.

1) NF was diagnosed on the basis of hospital discharge or death summary
2) NF was confirmed at surgery on the basis of documented operative report
3) Fascial necrosis was diagnosed on the basis of documentation on an anatomic pathology specimen.

Patients with ICD-9 coding of "NF" in whom none of the above criteria were met, were classified as "unconfirmed" and were excluded.
The medical history, including information regarding underlying diseases such as chronic liver disease, diabetes mellitus, hypertension, adrenal insufficiency and renal failure, was obtained from the case sheets. The laboratory parameters (including hemoglobin, total leucocyte count, serum sodium, serum creatinine, random blood sugar level, C- reactive protein) were also noted.
Doppler ultrasound, Chest Xray, soft tissue Xray and computered tomographic (CT) scans were performed to confirm the diagnosis.
Patients were divided in two groups i.e. - Cellulitis (Non NF) and NF groups. We calculated a LRINEC score ranging from 0-13 for each patient in both groups. LRINEC scores ≥8 fell into the high-risk category, LRINEC scores of 6 or 7 fell into the moderate-risk category, and LRINEC scores ≤5 were considered low risk. [8,14] To determine the validity (accuracy) of LRINEC test we calculated the sensitivity and specificity by applying it to both cellulitis (Non NF) group and NF group. The predictive value was calculated and the results were compared with previous studies.

RESULTS

Out of 150 cases, clinically confirmed cases of Necrotising fasciitis were 108 and those of cellulitis were 42. A lower number of cases of cellulitis were due to the fact that every case did not have all six laboratory parameters available at the time of admission. The LRINEC score of 42 cellulitis patients showed a moderate to high risk of having NF in 15 % cases (High risk ≥ 8 = 9.5%, Moderate risk 6-7 = 7.14% and Low risk ≤ 5 = 83.33%) [Figure 1]. The score was then calculated for the remaining clinically confirmed necrotising

fasciitis cases. The total number of patients who had low to moderate risk was 59 (54.6%) [Table 2].

Table 2: Laboratory Risk Indicator For Necrotising Fasciitis (LRINEC) Score For Necrotising Fasciitis And Cellulitis

LRINEC score	Necrotising fasciitis		Cellulitis (Non NF)	
High Risk ≥8	49	(45.37 %)	4	(9.5%)
Moderate Risk 6-7	25	(23.12%)	3	(7.14%)
Low Risk ≤5	34	(31.48%)	35 (83.33%)	
Total	108		42	

Our analysis of the LRINEC score indicated a sensitivity of only 68.5% and a positive predictive value of 82.2% when assessing against confirmed cases of NF. In addition, we got about 38.1% false positives while testing the validity of the score [Table 3].

Table 3: To Determine The Validity Of LRINEC Score

LRINEC test	Necrotising Fasciitis	Cellulitis (Non NF)
Positive	74 (68.52%)	16(38.1%)
	True Positives	False Positives
Negative	34(31.48%)	26(61.9%)
	False Negative	True Negative
Total	108	42

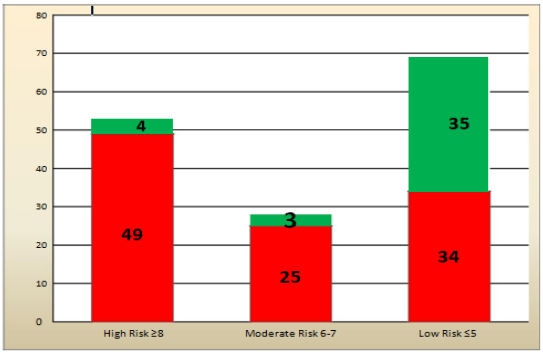

Figure 1: Stratification Of Nf And Cellulitis Cases In Different Risk Groups Based On LRINEC Score

DISCUSSION

Among the patients with confirmed clinical diagnoses of cellulitis, 16.6% were categorized as moderate to high risk for NF based on the LRINEC score which was consistent with the study of Neeki et al.[15] Whereas in case of confirmed NF cases about 55 % cases were classified under low to moderate risk by LRINEC score. The incidence of false positives (38.1%) adds a new dimension to investigations seeking to assess the validity of the LRINEC score.

Additionally, among patients with confirmed diagnoses of NF, 31.48% were categorized as low risk for NF based on the LRINEC score. Based on the initial LRINEC validation study by Wong et al.[8], there was a positive predictive value of 92% and negative predictive value of 96% while our prospective analysis had a positive predictive value of 82.22% and negative predictive value of 43.33%. Many other studies reported inadequate sensitivity of the LRINEC score to rule out NF in cases of confirmed NF.[16-18]

The sensitivity of the score calculated in our findings was found to be 68.51% which was consistent with reports of sensitivities between 68% and 80% in smaller studies based in surgical referral centres.[19.20]

CONCLUSION

In the emergency setting, the LRINEC score may not be an accurate tool to determine NF risk stratification or to differentiate between cellulitis and NF. Emergency physicians should be cognizant of the limitations of the LRINEC score and continue to carry a high index of suspicion in patients who present with pain out of proportion, signs of skin necrosis, and subcutaneous gas on imaging studies. A majority were therefore initially missed resulting in delayed operative debridement. Hence it should not be used as a sole tool for the identification of these infections in hospital settings.

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How to cite this article: Bharadwaj R, Ali AM, Faruqi NA. Use of Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Score in differentiating Necrotising Fasciitis cases from Soft tissue infections: A Prospective Study. Ann. Int. Med. Den. Res. 2018; 4(3):MB01-MB04.

Source of Support: Nil, **Conflict of Interest:** None declared