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RELIABILITY OF THE LABORATORY RISK INDICATOR FOR NECROTIZING FASCIITIS (LRINEC) SCORE FOR EARLY DIAGNOSIS OF NECROTIZING FASCIITIS

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ABSTRACT

Objective: Necrotizing fasciitis is a surgical emergency often requiring prompt diagnosis and treatment. Delay in surgical intervention can have catastrophic results including death. The laboratory risk indicator for necrotizing fasciitis (LRINEC) score uses laboratory parameters to assess the severity of infection and helps in early recognition of necrotizing fasciitis. In this study, we collected the data of 40 patients diagnosed and treated as necrotizing fasciitis to validate the reliability of this score in early diagnosis of necrotizing fasciitis. Materials and methods: This is a retrospective study. Data of 40 patients admitted to Fr. Muller Medical College Hospital, Mangalore from August, 2012 to August, 2014 with a clinical diagnosis of Necrotizing fasciitis was analyzed and relevant statistical tests were applied to evaluate the reliability of the LRINEC score. Results: A total of 40 patients were included in the study. A LRINEC score of $\geq$ 6 had a sensitivity of 93.10 %, specificity of 90.91%, positive predictive value of 96.43%, and negative predictive value of 83.33%. The most common organism isolated on culture was Staphylococcus aureus. Conclusion: The LRINEC score is an impressive diagnostic tool to differentiate between necrotizing fasciitis and other less severe soft tissue infections. It aids in early recognition of necrotizing fasciitis enabling prompt and appropriate treatment.

Keywords: Necrotizing fasciitis, LRINEC score, Soft tissue infections, NF, C-reactive protein, Total white cell count, Hemoglobin.

Contribution/ Originality

This study contributes to the existing literature on the reliability of the LRINEC score in early diagnosis of necrotizing fasciitis. It establishes the conclusion of previous studies that a universally reproducible scoring system like the LRINEC score is essential for the early and accurate management of necrotizing fasciitis.

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1. INTRODUCTION

Necrotizing fasciitis (NF) is a rare, potentially lethal bacterial infection characterized by widespread necrosis of the skin, subcutaneous tissue, and superficial fascia [1, 2]. The incidence of NF has been estimated to lie between 0.4 and 0.53 cases per 100.000 population [3-5]. This infection is associated with a high mortality rate (ranging from 6% to 76%) [6-9] which can be significantly reduced by early aggressive surgical debridement and appropriate antibiotic therapy. However, due to lack of specific clinical features and characteristics in the initial stages of the disease, the diagnosis is often delayed resulting in a higher morbidity/ mortality. [10-15] Several diagnostic tools have been developed such as bedside finger tests, tissue biopsies, bedside ultrasounds and various laboratory parameters. [16-21] The LRINEC – laboratory risk indicator for necrotizing fasciitis is one such laboratory based indicator which was developed in 2004 by Wong et al. This score was developed on the rationale that necrotizing fasciitis, when untreated, eventually leads to systemic inflammatory response syndrome and sepsis which is reflected by predictable changes in biochemical and hematological variables. Soft tissue infections like abscesses and cellulites rarely cause a significant change in these variables. Wong, et al. [18] A LRINEC score of 6 or more is considered as high risk for necrotizing fasciitis. Wong, et al. [18] Definitive diagnosis of necrotizing fasciitis requires a frozen section biopsy or a MRI scan of the affected part. A frozen section biopsy has its own morbidity and a MRI scan might not be financially feasible for all economical sections of patients. The LRINEC score can be used for patient selection and for allocation of resources such as the MRI whenever a patient is deemed as high risk by the score. Wong, et al. [18] This score differentiates between the fatal necrotizing fasciitis and other less dangerous soft tissue infections and thus helps in initiating appropriate treatment as early as possible. This study evaluates the reliability of the LRINEC scoring system over clinical diagnosis of necrotizing fasciitis.

2. METHODS

This was a retrospective study done in Fr. Muller Medical College Hospital, Mangalore. A total of 40 patients admitted to the hospital between August 2012 and August 2014 and diagnosed as necrotizing fasciitis based on clinical examination and intra-operative findings were selected. The definitive diagnosis was a pathological report confirming necrotizing fasciitis.

Patients were excluded if they were < 15 yrs or >90 yrs old or were transferred from other institutions after treatment was initiated. For patients with multiple admissions due to necrotizing fasciitis, only the first admission details were recorded. Age, sex, co-morbidities, clinical symptoms/ signs, site and etiology of infection, laboratory findings at the time of admission and microbiology of wound cultures were reviewed. Duration of time between onset of symptoms and hospital presentation, duration of stay in the hospital and mortality rates was also documented.

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Based on the laboratory parameters, the LRINEC score was applied. The LRINEC scoring system is shown in Table 1.

Table-1. The Laboratory risk indicator for necrotizing fasciitis score

Variable, Units	Score
C-reactive protein, mg/L	
<150	0
≥150	4
Total White cell count, per mm^3	
<15000	0
15000-25000	1
>25000	2
Hemoglobin, g/dL	
>13.5	0
11-13.5	1
<11	2
Sodium, mmol/L	
≥135	0
<135	2
Creatinine, mg/dL	
≤1.6	0
>1.6	2
Glucose, mg/dL	
≤180	0
>180	1

The maximum score is 13; a score ≥ 6 should raise the suspicion of necrotizing fasciitis and a score ≥ 8 is strongly predictive of the disease

3. RESULTS

A total of 40 patients were studied in this study between the age groups ranging from 15 yrs to 90 yrs. The maximum incidence of necrotizing fasciitis was seen in the age group of 41 to 60 yrs. (45%). The youngest patient in this series was 17 yrs and the oldest was 87 yrs. The mean age was 53.42 yrs

Table-1. Age Wise Distribution

Age In Years	Number of Cases	Percentage (%)
<20	1	2.5
21-40	8	20
41-60	18	45
>60	13	32.5
Total	40	100

A number of 40 patients were included in this study of which 82.5% were males and 17.5% were females

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Table-2. Sex Wise Distribution

Sex	Number of Cases	Percentage (%)
Male	33	82.5
Female	7	17.5

In this study, the lower limbs were the commonest site of involvement (67.5%), left leg (37.5%) being affected more commonly. The next common site involved were the upper limbs (12.5%) followed by the perineum, which is also referred to as Fournier's gangrene.

Table-3. Site of Lesion

Site Of Involvement	Number of Patients	Percentage (%)
Left leg	15	37.5
Right leg	12	30
Left upper limb	3	7.5
Right upper limb	2	5
Perineum and genitalia	6	15
Abdomen	0	0
Gluteal region	2	5
Back	0	0

In this study of 40 patients, the most common co-morbid condition associated with necrotizing fasciitis was diabetes mellitus (37.5%) followed by Hypertension.

Table-4. Co Morbid Conditions

Co-Morbid Conditions	Number of Patients	Percentage (%)
Diabetes	15	37.5%
Hypertension	8	20%
Chronic Liver Disease	o	0
Immunosupression	1	2.5%

Table 5 shows the analyzed laboratory data. Wound culture data are presented in Table 6

Table-5. Laboratory Parameters of Patients In This Study

Variable, Units	Number of patients	Percentage (%)
C-reactive protein, mg/L		
<150	12	30
≥150	28	70
Total White cell count, per mm^3		
<15000	16	40
15000-25000	13	32.5
>25000	11	27.5
Hemoglobin, g/dL		
>13.5	6	15
11-13.5	16	40
<11	18	45
Sodium, mmol/L		
		Continue

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≥135	20	50
<135	20	50
Creatinine, mg/dL		
≤1.6	32	80
>1.6	8	20
Glucose, mg/dL		
≤180	27	67.5
>180	13	32.5

Table-6. Wound Culture Results of Necrotizing Fasciitis Patients

Organisms	Number of Cases	Percentage (%)
Klebsiella	10	25
Staphylococcus aureus	12	30
Escherichia coli	7	17.5
Citrobacter	4	10
Pseudomonas	5	12.5
Acinetobacter	8	20
Enterococcus	5	12.5
Proteus	2	5
Streptococcus pyogenes	5	12.5
Bacteroides fragilis	3	7.5
Peptostreptococcus	3	7.5
Porphyromonas	1	2.5

Staphylococcus aureus was the most common organism causing necrotizing fasciitis (30%).

LRINEC SCORE

LRINEC score was calculated for all the patients and patients were divided into two groups:

- Those patients with a score ≥ 6 - 28 patients (70%)
- Those patients with a score < 6 - 12 patients (30%)

Histopathological confirmation was done from the tissue sampled during the first debridement and 27 of the 40 patients (67.5%) were confirmed to have necrotizing fasciitis. 24 of the 28 patients with LRINEC score > 6 had histological evidence of Necrotizing fasciitis. 3 of the 12 patients with LRINEC score < 6 had histological evidence of Necrotizing fasciitis.

Table-7. Shows the LRINEC scores of the patients with confirmed histopathological evidence of Necrotizing Fasciitis:

LRINEC score	Number of patients	Histologically confirmed
≥ 6	28	27
< 6	12	2

Sensitivity: 93.10 % (95% CI: 77.19 % to 98.95 %)

Specificity: 90.91 % (95% CI: 58.67 % to 98.49 %)

Positive predictive value: 96.43 % (95% CI: 81.59 % to 99.40 %)

Negative predictive value: 83.33 % (95% CI: 51.58 % to 97.42 %)

Positive likelihood ratio: 10.24 (95% CI: 1.58 to 66.54)

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Negative likelihood ratio: 0.08 (95% CI: 0.02 to 0.29)

In this study of 40 patients, 38 patients (95%) recovered from necrotizing fasciitis and its complications while 2 patients (5%) expired.

Table-8. Outcome (Mortality)

Outcome	Number of Cases	Percentage (%)
Recovered	38	95

4. DISCUSSION

The developmental study by Wong et al reported that a LRINEC score ≥6 had a sensitivity of 89.9%, specificity of 96.9%, positive predictive value of 92.0% and negative predictive value of 96.0% [22]. Liao, et al. [22] did a study in 2011 on 223 patients [22]. The study showed a sensitivity of 59.2%, specificity of 83.8%, positive predictive value of 37.9 % and negative predictive value of 92.5 %. Our study showed that the LRINEC scoring system for necrotizing fasciitis was comparable to the study done by Wong et al. LRINEC scoring system has an impressive ability to discriminate NF from other severe soft tissue infections. It is also a good diagnostic tool for diagnosis of necrotizing fasciitis due to its high sensitivity (93.10%) and can prevent misdiagnosis and delay in treatment.

Wound culture data revealed that Staphylococcus aureus and Klebsiella were the two most common organisms likely to cause Necrotizing fasciitis. Antibiotic therapy must therefore be targeted towards these organisms.

Our study limitations were as follows:

- This is retrospective study
- Patients were selected on the basis of a clinical diagnosis of necrotizing fasciitis. Therefore patients with less severe forms of the disease or with early disease might have been missed.
- We did not differentiate extent of the body involved which may have influenced the laboratory data.

5. CONCLUSION

The LRINEC scoring system is a useful tool in the early and accurate diagnosis of Necrotizing fasciitis. It also helps to distinguish necrotizing fasciitis from other less severe soft tissue infections. LRINEC scoring has an impressive predictive value of 96.43 %. Staphylococcus is the most common causative organism of necrotizing fasciitis and antibiotic therapy must be directed towards dealing with this organism.

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