

Laboratory Risk Indicator for Necrotizing Fasciitis Score-is it Useful in Emergency Settings

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Abstract

Background: Necrotizing fasciitis is a rapidly progressing mono-/ polymicrobial skin infection that spreads to underlying tissues leading to life threatening situations. Immediate surgical debridement together with i.v antibiotic administration is required to avoid fatal outcome. Early diagnosis is often delayed due to underestimation or confusion with cellulitis. The laboratory risk indicator for necrotizing fasciitis (LRINEC) is useful for early recognition of necrotizing fasciitis. **Objective:** To validate the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) scoring system for the diagnosis of necrotizing fasciitis among patients presenting with soft tissue infections. **Materials and Methods:** This is a Hospital based Diagnostic Evaluation Study. All patients presenting with soft tissue infections during the period of 18 months (1st September 2015 to 28th February 2017) were included in the study and LRINEC scoring system was applied. Parameters included are Haemoglobin, Total WBC count, Serum Creatinine, Serum Sodium, Random Blood Glucose value and CRP at the time of admission. A score ≥ 6 was found to be highly suspicious of Necrotising Fasciitis. The confirmatory diagnosis for necrotising fasciitis was done with histopathology. **Results:** A total of 112 patients were evaluated during the study period of 18 months. Of this 41 patients had necrotising fasciitis and 71 had Cellulitis. The LRINEC score ≥ 6 had a sensitivity of 63.4%, specificity of 73.2%, positive predictive ratio of 57.7% and negative predictive ratio of 77.6%.

Conclusion: The LRINEC score is a very useful diagnostic tool which can be used to distinguish necrotizing fasciitis from soft tissue infections.

Keywords: LRINEC Score Necrotizing Fasciitis; Soft Tissue Infection; Early Diagnosis; Urgent Care.

Introduction

Necrotizing fasciitis is perhaps the most severe form of soft tissue infection primarily involving the superficial fascia. Necrotizing soft tissue infections (NSTI) are relatively infrequent but highly lethal infections. They encompass a wide variety of soft-tissue infections associated with necrosis that shares the same diagnostic and treatment principles. Establishing the diagnosis of NSTI is one of the biggest challenges in treating patients with NSTI. Accuracy increases with familiarity of clinical findings and knowledge of laboratory, imaging, and macroscopic and microscopic findings, all combined with a high index of suspicion. Surgical debridement is the primary means of treating NSTIs, and antimicrobial therapy and physiologic monitoring and support constitute adjuvant therapies. Delayed diagnosis and consequently delayed operative debridement have been shown in multiple studies to increase mortality [1-5]. This is understandable: the greater the delay, the greater the tissue loss and sepsis with consequent increased mortality. Its rarity and the paucity of early pathognomonic signs make N necrotizing fasciitis a major diagnostic challenge and is one of the main reasons for the continued high mortality of patients afflicted by necrotizing fasciitis today. Scores that identify high-risk patients serve to guide novel therapeutic strategies and to identify patients for future trials. While the understanding of the pathophysiology of necrotizing fasciitis continues to improve, the mortality of this disease remains

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alarmingly high with reported mortality rates ranging from 6 to 76%. The Laboratory Risk Indicator for Necrotizing Fasciitis Scoring System (LRINEC) was introduced as a screening tool in 2004 to aid in rapid diagnosis [6]. The use of routine laboratory blood tests and reported sensitivity and positive predictive value of 89.9% and 92% respectively made it an attractive additional tool in the diagnosis of necrotizing fasciitis.

Aim and Objective

To validate the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) scoring system for the diagnosis of necrotizing fasciitis among patients presenting with soft tissue infections.

Materials and Methods

It's a diagnostic evaluation study conducted in our hospital who presented with soft tissue infections during the period of Sept 2015 to Feb 2017. With the following exclusion criteria

1. Patients below 15 yrs or above 80 yrs of age.
2. Patient who has undergone surgical debridement for present episode of soft tissue infection.
3. Patients with boils or furuncles with no evidence of cellulitis

Method of Data Collection

All patients presenting with symptoms suggestive of soft tissue infections meeting the inclusion and exclusion criteria will be included in the study after taking informed written consent. Socio demographic

factors of the patient will be collected using a pretested semi- structured proforma. Detailed clinical examination and scoring system will be applied to each patient. Based on the investigations LRINEC scoring system will be applied and the findings will be recorded in a predesigned checklist. The confirmatory diagnosis for necrotizing fasciitis will be done with histopathology for all patients, irrespective of the result of the LRINEC scoring system.

Parameters Studied

- Hemoglobin
- Total white cell counts
- Random blood sugar
- Serum creatinine
- Serum sodium
- Serum C-reactive protein
- Tissue for histopathology

Results

The study group consists of 112 patients in the study, 66.1% of patients were males and 33.9% were females.

Of the 112 patients studied, a clinical diagnosis of cellulitis was made for 71 patients and of Necrotizing Fasciitis was found in 41 patients (Table 1).

Of the 71 patients with Cellulitis 64.8% were males and 35.2% were females. And among the 41 patients with Necrotizing Fasciitis, 68.3% were males and 31.7% were females (Table 2).

Table 1: Gender Distribution

Gender	Count	Percentage
Male	74	66.1%
Female	38	33.9%
Total	112	100%

Table 2: Clinical Diagnosis

Diagnosis	Count	Percentage
Cellulitis	71	63.3%
Necrotizing Fasciitis	41	36.6%
Total	112	100%

Table 3: Age Distribution

Age	Count	Percentage
15 - 30 yrs	10	8.9%
31 - 45 yrs	11	9.8%
46 - 60 yrs	51	45.5%
61 - 80 yrs	40	35.7%
TOTAL	112	100%

The Mean age of the study population was found to be 56.07yrs \pm 14.66, with a range spanning between 15 - 80yrs. The mean age among patients with Cellulitis was found to be 54.46 \pm 15.23yrs, and that among patients with Necrotizing Fascitis was found to be 58.85 \pm 13.34 yrs. (Table 3)

Considering the co morbid conditions, Diabetes Mellitus was found to be more common in both the groups. It was also seen that patients with coronary artery disease and chronic kidney disease was more prone for development of Necrotizing Fascitis when compared with patients with cellulitis (Table 4)

Table 4: Comparison of Co morbid conditions of patients with Cellulitis and Necrotizing Fascitis

Comorbid Conditions	Cellulitis (71)		Necrotising Fascitis (41)	
	Count	Percentage	Count	Percentage
Diabetes Mellitus	43	60.6%	26	63.4%
Systemic	35	49.3%	21	51.2%
Hypertension				
Dyslipidemia	6	8.5%	7	17.7%
COPD	11	15.5%	5	12.2%
Coronary Artery Disease	6	8.5%	13	31.7%
Chronic Kidney Disease Others	5	7%	5	12.2%

Table 5: Comparison of average values of the LRINEC Score Parameters in patients with Cellulitis and Necrotizing Fascitis

Score Parameters	Cellulitis	Necrotising Fascitis
Haemoglobin (gm/dl)	11.2	10.0
Total Count (cells/cm ³)	12900	19000
Serum Creatinine (mg/dl)	1.3	1.59
Serum Sodium (mmol/L)	133.5	129.24
Blood Sugar (mg/dl)	191	217.39
CRP (g/dl)	4.95	9.37

Table 6: Comparison of Haemoglobin values

gm/dl	Number	%
< 11	61	54.4
11- 13.4	41	36.6
> 13.5	10	8.9

Table 7: Comparison of Total Count Values

3 cells/cm	Number	%
< 15,000	60	53.5
15,000 - 25,000	37	33
\geq 25,000	15	13.3

Table 8: Comparison of Serum Creatinine values

mg/dl	Number	%
\geq 1.5	36	32.1
< 1.5	76	67.9

Table 9: Comparison of Serum Sodium values

mmol/l	Number	%
\geq 135	51	45.6
< 135	61	54.4

Table 10: Comparison of Blood Sugar Values

Mg/dl	Number	%
< 180	55	49
\geq 180	57	51

Table 11: Comparison of CRP values

g/dl	Number	%
< 15	99	88.3
≥ 15	13	11.6

Table 12: Comparison of Biochemical Results of patients

Scoring parameters	Clinical Diagnosis C	Count 71	t	P
HB	NF	41	3.370	0.001
	C	71		
TC	NF	41	-5.141	0.000
	C	71		
S. Cr	C	71	-.982	0.328
	NF	41		
S.Na	C	71	3.431	0.001
	NF	41		
RBS	C	71	-1.435	0.154
	NF	41		
CRP	C	71	-5.480	0.000
	NF	41		

The LRINEC scoring system was applied to all the 112 patients in the study group.

Table 13: Patients with Cellulitis and Necrotizing Fascitis as per LRINEC scoring system.

LRINEC Score	Count	Percentage
< 6	67	59.8%
> 6	45	40.2%
Total	112	100%

Table 14: Cross tabulation between LRINEC score and clinical diagnosis

LRINEC Score	Clinical Diagnosis		Total
	C	NF	
< 6	52	15	67
>6	19	26	45
Total	71	41	112

Sensitivity = 73.2, Specificity= 63.4, PPV= 77.6, NPV= 57.7. ODDS= 4.74 the 112 patients who took part in the study, 85 patients underwent surgical

debridement during the course of the hospital stay. A histopathology sample was set for all these patients who underwent surgical debridement (Table 14).

Table 15: Comparison of HPR Reports

HPR Report	Count	Percentage
Cellulitis	44	39.2%
Necrotising Fascitis	41	36.6%
No HPR	27	24.1%
Total	85	100%

Table 16: Cross tabulation between LRINEC score and clinical diagnosis

Lrinec Score	Based on HPR		Total
	C	NF	
< 6	29	16	45
>6	15	25	40
	44	44	85

Sensitivity = 60.9, Specificity= 65.9, PPV= 62.5, NPV= 64.4. ODDS= 3.021

Table 18: Comparison of Pus Culture Sensitivity Reports

Organism	Count	Percentage
Staphylococcus aureus	26	23.2
MRSA	14	12.5
Klebsiella	8	7.1
Pseudomonas	7	6.2
Streptococcus	4	3.6
E coli	3	2.7
Enterococcus	3	2.7
Citrobacter	2	1.8
Proteus	2	1.8
Enterobacter	1	0.9
No growth	22	19.6
Not sent	20	17.9
Total	112	100

Discussion

It has been observed from the literature that the LRINEC scoring system is of great use in differentiating necrotizing fasciitis from cellulitis in patients presenting with soft tissue infections. The earliest study on this was by that of Wong et al [6] in 2004 which showed a positive predictive value of 92% and a negative predictive value of 96%. For a surgeon this is of great significance as it helps in early surgical intervention and decreased mortality and morbidity for the patient.

We analyzed 112 patients with soft tissue infections presenting to our hospital during our study period. The socio demographic details of the patients were recorded and the LRINEC score was applied for them. Gender distribution showed that 66.1% of the patients were males and 33.9% of them were females. The age distribution of the study population showed that 45.5% of patients belonged to the age group of 46 - 50 years followed by 35.7% of the patients in the age group of 60- 80 years. The average of the patients in our study was found to be 56 years and that of in patients with cellulitis was found to be 54 and that in the necrotizing fasciitis was found to be 58 years where as it was found to be 61.2 years and 60.8 yrs for patients with Necrotizing fasciitis and cellulitis respectively according to the study by Chun-I Liao et al [7]. However this difference of age in both the groups was not found to be significant in our study.

The most common risk factor for NF in the literature is diabetes mellitus [7-10]. In the study conducted by Wong et al [6] diabetes was seen in 70.8% of patients and in that by Chun-I Liao et al [8] showed 82% of patients had diabetes. In our study 61.1% of the patients had diabetes mellitus with 60.6% of patients with cellulitis and 63.4% of patients with necrotizing fasciitis having Diabetes mellitus. The next common

co morbid conditions in our study were that of Systemic Hypertension in 50.9% of patients and Coronary artery disease in 17% patients. These results were similar to that of the study conducted by van Stigt et al [10] which showed coronary artery disease in 50% of patients.

We calculated the LRINEC score for all patients and the cutoff level was a score of ≥ 6 according to the study by Wong et al [6]. In our study we had a score of ≥ 6 in 45 patients. The average values of all the 6 parameters in our study as shown in Table 5 were compared with that of the values in study by Chun-I Liao et al [8]. The Hemoglobin values was found to be an average of 10 in patients with Necrotizing fasciitis and 11.2 in patients with cellulitis. 33% of our patients at the time of presentation were found to be anaemic. When we compared the total count values of both the groups it was found to be 12900 in that of the cellulitis group and 19000 in patients with necrotizing fasciitis. The Creatinine values were found to be 1.59 in the necrotizing fasciitis group when compared to 1.3 in patients with Cellulitis. The values of serum sodium and Blood sugars were 129.24 and 217.39 in patients with necrotizing fasciitis when compared to 133.5 and 191 in patients with cellulitis. The average CRP values were 4.95 in patients with cellulitis when compared to 9.37 in patients with Necrotizing fasciitis. The results were almost comparable to our study. Of these the values of serum Creatinine and CRP were found to have a p value of <0.05 and thus was significant.

A cross tabulation was done comparing the patients who was diagnosed to have cellulitis and necrotizing fasciitis according to the LRINEC score and clinically. The results showed a Sensitivity of 73.2, Specificity of 63.4, PPV of 77.6 and a NPV of 57.7 when compared to the results in the Chun-I Liao et al [7] study which were Sensitivity of 59.2, Specificity of 83.8, PPV of 37.9 and a NPV of 92.5. The Odds ratio was calculated to be 4.74.

Among the 112 patients, 85 patients underwent surgical debridement and all the 85 patients had a sample sent for histopathology. According to the histopathology reports 44 patients were found to have Cellulitis and 41 of these had Necrotizing Fasciitis. The cross tabulation was done comparing the patients who was diagnosed to have cellulitis and necrotizing fasciitis according to the LRINEC score and by Histopathology. The results showed a Sensitivity of 60.9, Specificity of 65.9, PPV of 62.5 and a NPV of 64.4. The Odds ratio was calculated to be 3.021.

Additional to our primary objectives, a Pus culture and Sensitivity was done for 92 patients among the 112 patients in the study group. Our study showed that 23.2% of the patients had Staphylococcus aureus, followed by MRSA in 12.5% of the patients. A report of no growth was seen in 19.6% of the patients. The results were compared to the study by Chun-I Liao et al⁷ which showed similar results of Staphylococcus aureus being the most common organism followed by Methicillin Resistant Staphylococcus aureus. The other common were Group A streptococci, Klebsiella, Escherichia coli and Vibrio vulnificus which except of the type III NF were similar to our study. In another studies on NF in South East Asia and Australia, in addition to type 1 and type 2 NF, type 3 was described regularly. We had no patients in our study with NF type 3. Huang described 11.9% wound cultures with Vibrio spp, it was the most common pathogen leading to bacteraemia (29.5%) in their population [11]. In a similar study by van Stigt et al Klebsiella was found to be the most common organism

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