Original Research Article

New Indian Journal of Surgery
Volume 9 Number 2, March - April 2018
DOI: https://dx.doi.org/10.21088/nijs.0976.4747.9218.3

Assesment of a Novel Scoring System in Treating Necrotising Fasciitis

Balaji Jayasankar[a], Chethan Kishanchand[b], Raunak Maru[c]

[a]Senior Resident [b]Associate Professor [c]Junior Resident, Department of General Surgery, Kasturba Medical College, Manipal, Karnataka 576104, India.

Abstract

Background: Early operative debridement is a major determinant of outcome in necrotizing fasciitis which could often prove clinically difficult. The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score was devised as a scoring system for necrotising fasciitis. Our study was done for the validation of the same. *Methods:* The study was a prospective observational and descriptive study in a tertiary care teaching hospital. This was mainly done to assess the LRINEC scoring system and validate the system Patients presenting with soft tissue infections admitted over a period of two years were clinically examined and subjected to a proforma of the LRINEC scoring system. The same was assessed statistically to interpret the outcomes with regards to the scoring. *Results:* A total of 152 patients with suspected necrotising fasciitis were taken for the study out of which 96 patients underwent surgical debridement. On calculating the strength of association of individual variable with the scoring system LRINEC - Age/Hb/TLC/ RBS/S. Creatinine/CRP has been found to be independently significant variables. Receiver operating characteristic (ROC) curves showed a positive predictive value of 94.7%. *Conclusions:* LRINEC scoring system is helpful in stratifying patients into risk categories, thus appears capable of detecting early cases of necrotizing fasciitis and is simple enough for routine use.

Keywords: Debridement; LRINEC Scoring System; Necrotising Fasciitis.

Corresponding Author: Chethan Kishanchand, Associate Professor, Department of General Surgery, Kasturba Medical College, Manipal, Karnataka 576104, India.
E-mail: drcheths@yahoo.co.in

Received on 01.02.2018, **Accepted on** 16.02.2018

Introduction

Necrotising fasciitis is one of a group of highly lethal infections caused by microbes that cause rapidly spreading necrosis of fascia and subcutaneous tissues, sometimes involving muscles and skin. However, its diagnosis can be mimicked by other soft tissue infections.

The differentiation of necrotizing fasciitis from other soft tissue infections is therefore critically important. Delayed recognition and diagnosis is one of the main reasons for the high mortality rate [1]. Early operative debridement is a major determinant of outcome in necrotizing fasciitis [2]. However, early recognition is difficult clinically.

The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score was devised as a scoring system for necrotising fasciitis. It is a novel, simple, and objective scoring system, based on routine laboratory investigations readily available at most centers, that can help distinguish necrotizing fasciitis from other soft tissue infections [1]. We have checked for the validation of LRINEC scoring system for the diagnosis of necrotizing fasciitis in patients with soft tissue infections and prospectively examined patients with soft tissue infection.

Aims and Objectives

This study has been done prospectively to assess

- The diagnostic utility of LRINEC scoring system in early diagnosis of necrotizing soft tissue infections.
- As a tools for distinguishing necrotizing soft tissue infections from other soft tissue infections.
- Comment on the relations of the variables used in the LRINEC scoring system with necrotizing soft tissue infections.

Materials and Methods

The study was a prospective observational and descriptive study conducted under the department of general surgery, Kasturba Hospital, Manipal

Patients presenting with soft tissue infections admitted over a period of two years (Sept 2012 - August 2014) were studied. 150 patients were clinically examined and subjected to a proforma of the LRINEC scoring system. Each patient was included only once in the study. A detailed clinical history and clinical assessment of signs of infection was performed. All the patients included in the study were informed about the objectives and nature of the study.

Inclusion Criteria

- Patients presenting with soft tissue infections during the course of the study.

Exclusion Criteria

- Patients who have been diagnosed with chronic renal failure.
- Patients who have undergone surgical debridement for the present episode of soft tissue infection.

Clinical Data

Patients were selected on their presentation in the Emergency triage or in the Out-Patient department. Details of cases were recorded including history, clinical examination, and investigations done after taking informed consent from the patient for the study. Score was calculated and patient was followed up during the course of stay in the hospital with respect to the management received by the patient. Final outcome was evaluated.

LRINEC Scoring

A LRINEC score ≥ 6 is a reasonable cut-off to rule in necrotizing fasciitis, but a LRINEC < 6 does not rule out the diagnosis (Table 1).

Results

A total of 152 patients with suspected necrotising fasciitis were taken for the study

Out of which after evaluation 96 patients underwent surgical debridement and 56 patients were managed conservatively as severe cellulitis.

Laboratory Results

Mean SD, and ranges of the laboratory results of patients with necrotizing fasciitis (cases) and control patients with severe cellulitis and abscesses at admission. In the study following individual variables were found to have P value < 0.01, proving to be significant in diagnosis of cases.

In the study, it was found that 47% of the cases had Hb < 11gm/dl and 40% of the cases had Hb between 11-13.5gm/dl with P value < 0.05 proving it to be statistically significant variable. Total leucocyte count is indicative of SIRS with 38% cases in the study with counts more than >15000/mm3 and less than < 25000/mm3 and 12% of the cases with counts > 25000/mm3. P value calculated was found to be statistically significant. 65% cases had RBS>180 mg/dL indicating that diabetes plays an important role of a co-morbid condition responsible for NSTI. Result was also found to be statistically significant. Serum creatinine value was found to be statistically significant in the chi square test performed with p-value < 0.01. 70% of the cases had serum sodium value < 135 mmol / l, but the serum sodium does not

Table 1: LRINEC Scoring

Parameter	Value	Score
C reactive protein (mg/dL)	<150	0
	>= 150	+4
White Blood Cell count (x10,000 uL)	<15	0
	15-25	+1
	>25	+2
Hemoglobin (g/dL)	>13.5	0
	11-13.5	+1
	<11	0
Serum Sodium (mmol/L)	>=135	0
	<135	+2
Serum Creatinine	<= 1.6 mg/dL (141 umol/L)	0
	> 1.6 mg/dL (141 umol/L)	+2
Blood Glucose	<= 180 mg/dL (10 mmol/L)	0
	>180 mg/dL (10 mmol/L)	+1

Table 2: Laboratory Values of the Variables and Their Significance

Variables	Group	Mean	Std. Deviation	Std. Error Mean	p-value
Age (years)	Operated	56.2	14.5	1.5	< 0.01
	Non-Operated	49.5	16.2	2.2	
SBP (mm Hg)	Operated	125.82	13.19	1.3	0.47
	Non-Operated	127.30	10.17	1.4	
DBP (mm Hg)	Operated	82.12	7.40	1.4	0.40
	Non-Operated	81.04	7.10	1.3	
Pulse (/min.)	Operated	83.3	9.6	1.0	< 0.01
	Non-Operated	78.6	5.3	0.7	
RR (/min.)	Operated	18.0	2.6	0.3	< 0.01
	Non-Operated	16.8	2.8	0.4	
HB (gm %)	Operated	11.3	2.0	0.2	< 0.01
	Non-Operated	12.1	1.8	0.2	
TLC (/cu mm)*1000	Operated	15.6	7703.7	786.3	< 0.01
	Non-Operated	11.8	4363.4	583.1	
RBS (mg %)	Operated	174.7	109.4	11.2	< 0.01
	Non-Operated	128.2	47.0	6.3	
S.creat (µmol/l)	Operated	133.7	99.7	10.2	< 0.01
	Non-Operated	88.9	66.2	8.9	
Na (mmol/lit.)	Operated	131.8	5.3	0.5	0.112
	Non-Operated	133.2	4.8	0.6	
CRP (mg/l)	Operated	83.9	92.2	9.5	< 0.01
	Non-Operated	44.7	65.0	8.7	
LRINEC Score	Operated	5.4	2.9	0.3	< 0.01
	Non-Operated	2.8	1.7	0.2	

Table 3: Sensitivity and Positive Predictive Value of the Scoring System

LRINEC	Group		Total
	Operated	Non-Operated	
>/= 6	54	3	57
>/= 6	56.20%	5.40%	37.50%
< 6	42	53	95
< 6	43.80%	94.60%	62.50%
Total	96	56	152
	100.00%	100.00%	100.00%

Sensitivity - 94.6%, PPV - 94.7%

Table 4: Strength of Association of Individual Variables

Variable		Univariate Analysis		Multivariate Analysis	
		Odds Ratio	p-value	Odds Ratio	p-value
Age (years)	≤ 50				
	> 50	3.72	< 0.01	3.38	< 0.01
Gender	Female				
	Male	0.76	0.49	0.57	0.35
Hb (gm %)	> 13.5				
	11-13.5	0.39	0.017	0.58	0.51
	< 11.5	0.33	0.031	0.92	0.29
TLC (/cumm)	< 15				
	15-25	2.7	0.012	1.46	0.14
	> 25	21.09	< 0.01	18.4	< 0.01
RBS (mg %)	≤ 10				
	> 10	3.83	< 0.01	2.69	0.1
S. Creatinine	≤ 141				
	> 141	14.14	< 0.01	4.64	< 0.05
S. Na (mmol/L)	≥ 135				
	< 135	0.68	0.276	2.44	< 0.05
CRP (mg/L)	< 150				
	≥ 150	7.5	< 0.01	1.26	0.87
LRINEC Score	< 6				
	≥ 6	22.71	< 0.01	9.81	< 0.01

Table 5: Receiver Operating Characteristic Curve

Area Under the Curve				
Area	**Std. Error**	**Asymptotic Sig.b**	**95% Confidence Interval**	
			Lower Bound	**Upper Bound**
0.777	0.038	< 0.01	0.703	0.850

prove to be a significant independent variable. C Reactive Protein was >/= 150mg/l for 22% of the cases. P value < 0.01 is proving CRP as a significant variable for the scoring system in the study. The same has been depicted in Table 2.

Applying the scoring in our patients, amongst 96 cases debrided, 56.20% of the cases had score >/=6. Positive predictive value calculated for the LRINEC scoring system in our study is 94.7% with a sensitivity of 94.6%. Represented in Table 3

On calculating the strength of association of individual variable with the scoring system LRINEC. Age/Hb/TLC/RBS/S. Creatinine/CRP has been found to be independently significant variables constituting the scoring system. This has been represented in Table 4.

Receiver operating characteristic (ROC) curves

Receiver operating characteristic (ROC) curves for accuracy of the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score in predicting the presence necrotizing fasciitis showed the area under the curve of 0.777 with a Positive predictive Value of 94.7%. Depicted the curve and characteristic in Table 5 and Figure 1.

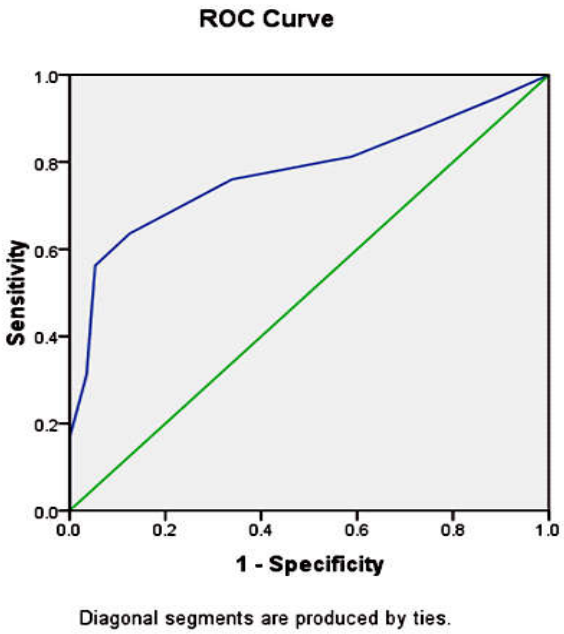

Fig. 1: Receiver Operating Characteristic (ROC) Curves

Discussion

The present study comprised of 152 cases which presented with soft tissue infection during the study period. A meticulous history, clinical examination and laboratory investigations were carried out on day of admission pre-operatively in study. Data recorded included patient characteristics, underlying co-morbid condition, clinical features, scoring system investigations. This data was analyzed for validating the LRINEC scoring system using statistical analysis.

Age and Gender Distribution

75% of the total cases found to have NSTI with age beyond 50 years co-relating with the fact that NSTI is more common in older age groups. P value < 0.01 proving it to be statistically significant. Wong et al study [1] had a mean age of 56 years amongst its cases. YI-CHUN SU et al study [3] found to have a mean age of 56.8 yrs amongst its cases. Old age has a predilection for soft tissue infections. Of the 152 patients in our study group, 116 (76.30%) were males and females were 36 (23.70%). The disease occurrence rate for males was more than females. The disease status among males and females when analyzed was not statistically significant (p value of 0.62). This is in variance with the findings of most studies. Wong et al in a study of 314 patients with evidence of soft tissue infections showed a male predominance with 201 (64%) male patients. In another study, a study by YI-CHUN SU, a total of 209 patients were enrolled and analyzed out of which 146 were male patients (69.9%) and 63 were female patients (30.1%).

Co-morbidities

Co-morbidities play an important role of etiological factor for NSTI with P-value < 0.01.69. Patients in the present study had an underlying co-morbid condition which made them susceptible to necrotizing soft tissue infection. Wong et al study [1] had 233 patients with co-morbid conditions in the developmental cohort study with 179 patients having diabetes mellitus. YI-CHUN SU et al study [3] had 157 patients with co-morbid conditions with 116 patients having diabetes mellitus.

Laboratory parameters

Temperature - 10% of the operated group was found to be febrile preoperatively. The data with regards to temperature is statistically insignificant. The p value being 0.72.

Hemoglobin - The groups were compared by Chi-square test. Results show that < 11gm% Hb level was more significantly associated with operated group i.e. significantly lower Hb levels were observed in subjects of operated group. A validation cohort study by Chun-I Liao et al [4], had an average Hb 12.26 gm% for patients with necrotizing fasciitis and 12.57 gm% for patients with cellulitis. P-value calculated was 0.072 which was not significant.

Total Leucocyte count - Total leucocyte count is significant indicator of SIRS with 49% cases had counts more than >15000/mm3 compared to 21% in controls. (P< 0.01).

Chun-I Liao et al [4] cohort study also had significant p-value < 0.05 with average total leucocyte count 15,951/ mm3 amongst 233 patients with necrotizing fasciitis.12.9% of the patients with necrotizing fasciitis had total leucocyte count > 25000/mm3.

Random Blood Sugar - 35% of the cases had RBS > 180mg/dl compared to 12.5% controls, indicating that diabetes plays an important role as a co-morbid condition responsible for NSTI. Result was found to be statistically significant. Chun-I Liao et al cohort study [4] also had an average glucose level of 206 mg/dl with 40.6% of the patients with necrotizing soft tissue infections having glucose levels > 180mg/dl. Wong et al study [1] and YI-CHUN SU et al study [3], diabetes mellitus was found to be most common co-morbid condition associated with soft tissue infections with elevated blood glucose levels.

Serum Creatinine - Association of Serum creatinine was found to be statistically significant with P-value < 0.01 in present study. 29.6% of the patients with necrotizing fasciitis and 12.8% of the patients with cellulitis had serum creatinine value > 141 µmol/L in the study done in Chun-I Liao et al cohort study.

Serum Sodium - Around 70% of the cases in the present study had serum sodium value < 135 mmol/L but the serum sodium does not prove to be a significant predictor variable.

Chun-I Liao et al cohort study had 64.4% of the patients with necrotizing fasciitis with serum sodium < 135 mmol/L with a significant p-value < 0.05.

C-Reactive Protein - C Reactive Protein was ≥150 mg/l in 22% of the cases. P value < 0.01 proving CRP as a significant variable for the scoring system in the study. Chun-I Liao et al cohort study and Wong et al cohort study, multiple imputation method was used to handle missing CRP data.

LRINEC Score

Amongst 96 cases debrided, 56.20% of the cases had score ≥ 6. Positive predictive value calculated for the LRINEC scoring system in our study is 94.7% with a sensitivity of 94.6%.

In Wong et al study [1], at a cutoff of a LRINEC score of 6, the model had a Positive predictive value 92.0%. Validation cohort study was done at Chun-I Liao et al [4].

At a cutoff of a LRINEC score of 6, the model had a

Sensitivity: 59.2% (95% CI 52.9–65.6%). Positive predictive value: 37.9% (95% CI 32.9–42.9%).

Age/Hb/TLC/RBS/S.Creatinine/CRP has been found to be independently significant variables constituting the scoring system. Variable proved to be independent predictors for the LRINEC scoring system with significant p values. Positive strength of association was noted of each variable for the LRINEC scoring system.

Area under curve in ROC for our model is 0.777 (95% confidence interval, 0.703-0.805) in the study. The accuracy of this diagnostic model was validated in a study of patients with necrotizing fasciitis and control patients with severe cellulitis and abscesses.

Positive predictive value calculated to be 94.7% at Cut off Value of ≥6. Curve represents the relationship between corresponding values of sensitivity and specificity with all possible values of probabilities as a cutoff point to predict for the presence of necrotizing fasciitis.

Risk Categories

Stratification of the patients with soft tissue infections based on the LRINEC scoring system was done.

Low risk - score 5 or less

Intermediate risk - score 6-7

High risk - 8 or more

In present study stratification of the patients based on LRINEC scoring system is found to be significant with p value <0.01

The present study was compared to study by Wong et al [1] and another study carried out by D. B. Wall et al [5] Wall et al., in a retrospective study, compared a set of admission variables of patients with NSTI and

patients with non-necrotizing soft-tissue infection. After univariate and multivariate analysis, they found that having a WBC count >15,400 cells/mm3 or a serum sodium level <135mmol/L was associated with NSTI and that a combination of both increased the likelihood of NSTI. It had a negative predictive value (NPV) of 99%, but not very specific, with a Positive predictive value (PPV) of only 26%.

Conclusion

Present study showed that LRINEC score is capable of detecting early cases of necrotizing fasciitis among patients with severe soft tissue infections. Positive predictive value for the LRINEC scoring system was 94.7% with a sensitivity value of 94.6% in the present study. 96 patients with soft tissue infections were debrided based on LRINEC scoring system. The investigations for the scoring were cheap and were readily available in the study area for the present study. LRINEC scoring system is helpful in stratifying patients into risk categories and thus is a robust index that is capable of detecting early cases of necrotizing fasciitis and is simple enough for routine use.

Drawbacks of the LRINEC Scoring System

In patients with multiple co morbidities, the inflammatory response may be blunted and the score should be interpreted with caution. Once in the hospital, interventions to correct laboratory disturbances described (intravenous normal saline, insulin infusions, and blood transfusions) tend to interfere with the accuracy of the score.

Acknowledgements

We would like to place on record our sincere thanks to all the unit chiefs and faculty of Dept of General Surgery, Kasturba Medical College, Manipal, India for the promptness and co-operation towards this study.

Declarations

Institutional Ethical Committee clearance has been obtained for this study

The author(s) declare(s) that there is no conflict of interest.

Source of Funding

The study was a part of postgraduation thesis and no funding was sought from external agencies

References

1. Wong CH, Khin LW, Heng KS, et al. The LRINEC (Laboratory Risk Indicator for Necrotizing Fasciitis) score: A tool for distinguishing soft tissue infection from other soft tissue infections. Crit Care Med 2004; 32:1535–1541.
2. Voros D, Pissiotis C, Georgantas D, et al. Role of early and aggressive surgery in the treatment of severe necrotizing soft issue infections.Br J Surg 1993; 80:1190–1191.
3. Yi-chun su, Hung-wen chen, Yu-cheng hong, Chih-tsung chen, Cheng-ting hsiao and I-chuan chen. Laboratory risk indicator for necrotizing fasciitis score and the outcomesanz j. Surg. 2008;78:968–972.
4. Chun-i liao, Yi-kung lee, Yung-cheng su, Chin-hsiang chuang, Chun-hing wong. Validation of the laboratory risk indicator for necrotizing fasciitis (lrinec) score for early diagnosis of necrotizing fasciitis. tzu chi medical journal 2012;24:73e76.
5. Wall DB, Klein SR, Black S, de Virgilio C. A simple model to help distinguish necrotizing fasciitis from nonnecrotizing soft tissue infection. J Am Coll Surg 2000;191:227–31.