Original Research Article

Study of the effectiveness of laboratory risk indicator for necrotizing fasciitis scoring system in the diagnosis of necrotizing fasciitis among patients presenting with soft tissue infections

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ABSTRACT

Background: Necrotizing soft tissue infection (NSTI) is an uncommon but life threatening disease with a high mortality rate. Delay in diagnoses and in surgery for debridement is associated with increased mortality rates. Hence here we would like to use this scoring system - laboratory risk indicator for necrotizing fasciitis (LRINEC) in patients presenting to our hospital with necrotizing soft tissue infection and if found to have good predictive values, it would be a boon to developing countries like India where the mortality of the disease is high (7% to 76%).
Methods: Patients presenting with symptoms suggestive of soft tissue infection underwent clinical examination and basic laboratory investigations. Following which, information collected using semi structured proforma cum observational checklist. LRINEC scoring system applied to each of the study subjects at admission. The confirmatory diagnosis of necrotizing fasciitis done on patients who undergo surgery vide histopathology, irrespective of the result of the LRINEC scoring system. Tissue cultures and sensitivity patterns analyzed.
Results: A total of 100 patients were enrolled. LRINEC score has an ability to diagnose necrotizing fasciitis from other soft tissue infections. High LRINEC score had more incidences of features of sepsis. Presence of the co morbidities tended to increase the LRINEC score. And defines patients with a high LRINEC score of >8 had higher mortality rate.
Conclusions: LRINEC score is a simple clinical tool for the diagnosis of necrotizing fasciitis from other soft tissue infections. LRINEC scoring system and clinical assessment should be used concurrently for diagnosing necrotizing fasciitis from other soft tissue infections.

Keywords: LRINEC, Necrotizing fasciitis, Necrotizing soft tissue infection

INTRODUCTION

Necrotizing fasciitis (NF) is a rapidly progressing, inflammatory infection of the fascia with the secondary involvement of skin, subcutaneous tissues and muscle, associated with substantial morbidity and mortality.[1,2] Various terminologies are used to describe NF such as hospital gangrene, streptococcal gangrene, acute dermal gangrene, Fournier's gangrene, suppurative fasciitis, and synergistic necrotizing cellulitis.

Wilson in 1952 gave the term 'necrotizing fasciitis' to describe the disease and it is the preferred terminology in these days, as it describes the most consistent and key features of the disease; the fascial necrosis. Necrosis means death of a portion of the tissue and fascia is fibrous tissue that encloses muscle.[2] It is a severe form of soft tissue infection and with no surgical treatment the mortality rate reaches up to 30-60 percent.[3] High morbidity and mortality associated with NF makes it an emergency; early debridement will have a favourable outcome. Hence,

it is a surgical emergency. Mortality is directly proportional to time to intervention. More than 90% of NF patients will also need intensive care and organ supportive therapy; that makes NF a medical emergency.[4] Delay in surgical intervention has been shown to increase the mortality rate.[3-9]

However, the lack of specific clinical features in the early stages of the disease may be the main reason for failure of early recognition of necrotizing soft tissue infection (NSTI).

The laboratory risk indicator for necrotizing fasciitis (LRINEC) score was first introduced by Wong et al in 2004. Laboratory data such as hemoglobin, serum creatinine, blood glucose, Serum sodium, total white cell count and C-reactive protein (CRP) level are used for early recognition of NF. Only one study has validated the score however with a small group of 28 NF patients. Most studies validated the score system for vibrio soft tissue infection.[11-13] Two studies have discussed its prognostic value with NF.[14-15]

A laboratory risk indicator, score of 6 or more in necrotizing fasciitis is considered as high risk for NF. With this background in mind that this study set forward to validate the effectiveness in patients presenting with soft tissue infection using LRINEC scoring system. This kind of trials will be beneficial if its results have good predictive value. It would be a boon to the developing countries like India, where the mortality of disease is high ranging from 7% to 76% and there is also a constraint on resources.

Objectives of the study

Objective was to validate the effectiveness of LRINEC scoring system for the diagnosis of necrotizing fasciitis among patients presenting with soft tissue infections to KIMS, Hubballi.

METHODS

Prospective study was conducted at KIMS hospital, Hubballi a tertiary care center from October 2016-October 2018 in which the patient presenting with skin and soft tissue infections were evaluated and treated accordingly. Demographic data were recorded including duration of their hospital stay.

Clinical examination

Vitals included pulse rate, blood pressure, respiratory rate, and temperature.

Systemic examination included drowsiness, and chest infection.

Local examination included swelling of the involved limb, necrotic patch, discharge from wound site, local rise in temperature, and tenderness.

Comorbidities included diabetes mellitus, hypertension, cardiac disease, and chronic obstructive pulmonary disease (COPD).

Blood investigations

It included haemoglobin, random blood glucose, serum creatinine, serum CRP, serum sodium, total white cell count, coagulation profile (PT/INR), and blood urea.

Imaging

It included chest X-ray, and X-ray of involved limb and lower limb venous Doppler.

LRINEC scoring system was applied at time of admission.

The need for any operative intervention (debridement/fasciotomy/amputation) was decided.

Diagnosis of NF was made on the basis of clinical features and/or histopathology, irrespective of the result of the LRINEC scoring system.

Case definition

NF was defined as case with histopathology results demonstrating necrosis of superficial fascia, polymorphonuclear infiltrate and edema of reticular dermis, subcutaneous fat and superficial fascia or in the absence of histology, gross fascial edema and necrosis detected at surgery or frank cutaneous necrosis seen on physical examination. Culture and sensitivity was sent.

Study design

It was a hospital based observational study.

Source of data

The study was performed in patients with soft tissue infection using LRINEC score.

Duration of study

The study duration was of 2 years from October 2016 to October 2018.

Inclusion criteria

Patients presenting to KIMS, Hubballi with symptoms suggestive of soft tissue infection during the study period were included.

Exclusion criteria

Patients who have received antibiotic treatment in the last 48 hours or a minimum of 3 doses of antibiotic prior to presentation; patients who has undergone surgical

debridement for present episode of soft tissue infection; and patients with boils or furuncles with no evidence of cellulitis were excluded.

Statistical analysis

Sample size estimation

All the patients admitted in department of general surgery during the study period with minimum of 70 cases.

Descriptive statistics

Quantitative data like age, was calculated as mean and standard deviation. All qualitative data like gender, symptoms, examination findings and histopathology were presented as frequency and percentages.

Analytical statistics

Effectiveness of LRINEC scoring system will be analyzed vide sensitivity, specificity, positive predictive value and negative predictive value. Analysis was done by Chi-square and Fisher exact test using statistical package for the social sciences (SPSS) version 16 software. The difference was considered significant if p value was <0.05.

RESULTS

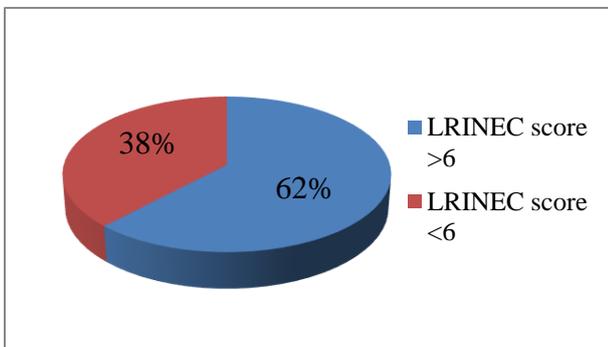In our study sample n=100. 62 patients had LRINEC score >6.32 patient had score <6 (Figure 1).

Figure 1: Over all LRINEC score.

Table 1: Under the ROC curve (AUC).

Parameter	Value
Area under the ROC curve (AUC)	0.982
Standard error	0.0109
95% confidence interval	0.933 to 0.998
Z statistic	44.181
Significance level P (area=0.5)	<0.0001

A total of 67 patients were operated, out of which 58 (87%) had LRINEC score above and equal to 6. 9 (13%) patients had low LRINEC score (Figure 2).
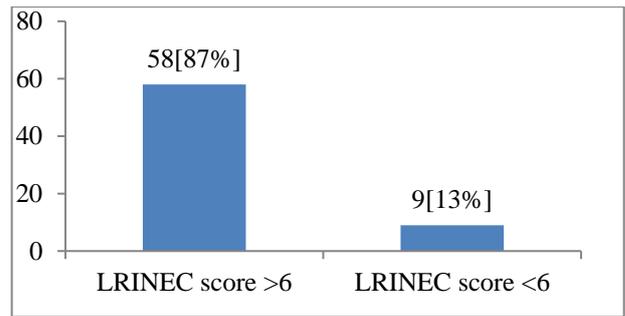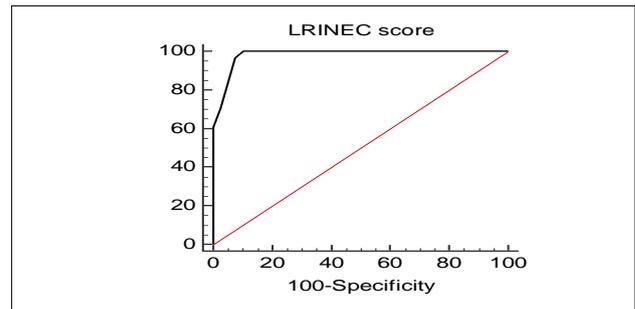

Figure 2: LRINEC score and surgery.

Figure 3: Area under the ROC curve (AUC).

Table 2: LRINEC score.

LRINEC code	Biopsy		Total	McNe-mar test
	NF present	NF absent		
NF present (≥6 score)	59 (96.7)	3 (7.7)	62 (62)	P=1.00 (not signific-ant)
NF absent (<6 score)	2 (3.3)	36 (92.3)	38 (38)	
Total	61 (100)	39 (100)	100 (100)	

Table 3: Specificity and sensitivity.

Parameters	Value (%)	95% CI
Sensitivity	96.72	88.65-99.60
Specificity	89.74	75.78-97.13
Positive predictive value	93.65	84.53-98.24
Negative predictive value	94.59	81.81-99.34
Accuracy	95	

DISCUSSION

Our study was comparable to Wong et al study. LRINEC scoring system has an impressive ability to diagnose necrotizing fasciitis from other soft tissue infections, with positive predictive value of 93.6% and negative predictive value of 94.6%, in our study. We found that in our study

there was fairly false positive rate, hence application of LRINEC score alone has tendency to over treat patients with NF.

The mortality rates for NF vary considerably with the best centers claiming less than 10% and others as high as 75%.[1-5] Our study showed mortality of 12% in patients with high LRINEC score. There is a host of variables associated with higher mortality. These include delayed initial debridement, age >60, hypotension, acidosis, bacteremia, total body surface area involved more than 250 cm^3, acute kidney injury, hyponatremia, leukocytosis, elevated blood lactate, peripheral vascular disease and number of co-morbidities.[11-13]

We found in our study that the patients with high LRINEC score had tachycardia, hypotension, tachyopnea, and comorbidities like diabetes mellitus, hypertension and cardiac disease. Presence of these comorbid conditions tend to increase the LRINEC score. Wound culture data showed that beta haemolytic *Streptococcus* and *E. coli* were the most important pathogen causing NF in our study.

The difference in mortality rates does not represent the severity of these infections but rather the difference and timing of the methods of treatment. The role of early radical surgical treatment is confirmed as the most important factor affecting outcome.

The selection of appropriate antibiotics keeping in perspective the critical period during which the blood and tissue cultures are not available, our study highlights the importance of early empirical combination antibiotic therapy for patients of necrotising fasciitis. The timely initiation of fluid and electrolyte management, antimicrobial therapy, and surgical debridement with wound care and support for organ failure has markedly reduced the mortality in necrotising soft tissue infections.[16]

We found in our study that 33 patients (33%) who were managed conservatively with IV antibiotics, improved significantly. 67 patients who were operated in our study were taken to operation theater for surgical procedure within 8 hours of admission. However around 50 percent of patients required repeated debridements.

Table 3: Comparison with other studies.

Author	Sensitivity of LRINEC score >6 (%)	Specificity of LRINEC score >6 (%)	Positive predictive value (%)	Negative predictive value (%)
Wong et al	89.9	96.9	92	96
Holland et al	80	67	57	86
Our study	96.7	89.7	93.6	94.6

CONCLUSION

The LRINEC score is a useful clinical determinant in the diagnosis and surgical treatment of patients with necrotizing fasciitis, from other soft tissue infections. The LRINEC score is a useful adjunct in the clinical diagnosis of necrotizing fasciitis with a statistically positive correlation. LRINEC scoring system and clinical assessment should be used concurrently for predicting need for early surgical intervention.

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