THE LABORATORY RISK INDICATOR FOR NECROTISING FASCIITIS (LRINEC) SCORING- THE DIAGNOSTIC AND POTENTIAL PROGNOSTIC ROLE

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ABSTRACT

BACKGROUND

Necrotising Fasciitis (NF) is a fastly progressing infection of the fascia with the secondary involvement of skin, which causes inflammation of skin, subcutaneous tissues and muscle. NF is a life-threatening surgical emergency. We added the term medical emergency as it requires emergent and aggressive medical care as most of these patients are treated in the intensive care unit. Various terminologies are used to describe Necrotising Fasciitis (NF) such as streptococcal gangrene, hospital gangrene, acute dermal gangrene, Fournier's gangrene suppurative fasciitis and synergistic necrotising cellulitis.

The aim of the study is to evaluate the role of LRINEC score as a prognostic tool in patients with necrotising fasciitis.

MATERIALS AND METHODS

This study is a prospective study collected from patients who were admitted in surgical intensive care unit, Department of General Surgery, of Nizam's Institute of Medical Sciences, Hyderabad, with a diagnosis of necrotising fasciitis was performed provisionally irrespective of sex, age and ethnicity. Total 300 patients were included in the study who were suspected to have necrotising fasciitis and LRINEC score were calculated at the time of admission to our institute. Based on LRINEC scoring, patients having score <6 were included in Group A, 150 patients and >6 were included in Group B, 150 patients. This study was conducted in a period of August 2016 to September 2017.

Exclusion Criteria- Cases with irrelevant data and inaccurate diagnosis. Data collected included demographics, clinical presentations, infection site, comorbidities type, microbiological and laboratory findings. Based on clinical and laboratory assessments on arrival and during the hospital stay included criteria by the Center of Disease Control and Prevention and National Necrotising Fasciitis Foundation and scoring, NF was diagnosed using this tool.

RESULTS

The site of infection in both the groups was highest in lower limbs, i.e. 45 in group A and 50 in group B. The site of infection was least in chest and breast, i.e. in group A, it is 2 and in group B, it is 3. The antibiotics used was ≤2, in group A, it was 80, and in group B, it was 85. >2 in group A, it was 20, and in group B, it was 15. Mortality in % in group A was 18, and in group B, it was 38. The laboratory results in which streptococcus microorganism was highest in both groups, in group A, it was 50%, and in group B, it was 44%. Gram-positive bacteria was the highest comprising of 95% in group A and 99% in group B. The causative bacteria was type II, which comprised of 60% in each of group A and group B. C-reactive protein level in group A was 121 ± 85 and in group B was 250 ± 101. Initial procalcitonin level in group A was 0.8, and in group B, it was 8.0. The mean LRINEC score in group A was 3.5 ± 1.0 and in group B was 8.5 ± 2.0.

CONCLUSION

The high-risk patients and prediction of worst hospital outcomes in patients with NF were predicted by LRINEC scoring besides its diagnostic role.

KEYWORDS

Infection, Antibiotics, Debridements.

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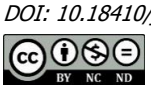

BACKGROUND

Necrotising Fasciitis (NF) is a fastly progressing infection of the fascia with the secondary involvement of skin, which causes inflammation of skin, subcutaneous tissues and muscle.[1] NF is a life-threatening surgical emergency. We added the term medical emergency as it requires emergent and aggressive medical care as most of these patients are treated in the intensive care unit. Various terminologies are used to describe Necrotising Fasciitis (NF) such as streptococcal gangrene, hospital gangrene, acute dermal gangrene, Fournier's gangrene, suppurative fasciitis and

synergistic necrotising cellulitis.[2] NF is a severe form of soft tissue infection. NF is considered as dreaded disease from the days of Hippocrates. It was documented that Fournier in late eighteenth century was a necrotising infection of the genital and perineal area, which is still known as Fournier's gangrene.[3] In 1952, Wilson gave the term 'necrotising 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.[4] NF in last century occurred sporadically mainly during the war time and it was monobacterial; but recently, its occurrence in civilian population is on rise and it's mainly polymicrobial and Methicillin-Resistant Staphylococcal Infection (MRSA).[5] NF is associated with high morbidity and mortality and this makes it an emergency. Hence, it is a surgical emergency. In more than 90% of NF patients, intensive care and organ supportive therapy is needed, which makes NF a medical emergency. 46% of NF patients may need limb amputation, disarticulation, fasciotomy or debridement. The laboratory risk indicator for NF is a scoring system, which consists of six laboratory tests and these tests used to distinguish NF from other severe soft tissue infections in the early stage. The aim of present study is to evaluate the role of LRINEC score as a prognostic tool in patients with NF.

MATERIALS AND METHODS

This study is a prospective study collected from patients who were admitted in surgical intensive care unit of Nizam's Institute of Medical Sciences, Hyderabad, with a diagnosis of NF was performed provisionally irrespective of sex, age and ethnicity. This study was conducted in a period of August 2016 to September 2017.

Exclusion Criteria- Cases with irrelevant data and inaccurate diagnosis. Data collected included demographics, clinical presentations, infection site, comorbidities type, microbiological and laboratory findings. Based on clinical and laboratory assessments on arrival and during the hospital stay included criteria by the Center of Disease Control and Prevention and National Necrotising Fasciitis Foundation and Scoring, NF was diagnosed using this tool. Based on histopathology analysis, the final diagnosis of NF was done.

Variable (Units)		**Score Points**	
Haemoglobin (g/dL)		Serum Glucose (mg/dL)	
>13.5	0	≤180	0
11-13.5	1	>180	1
<11	2		
C-Reactive Protein (mg/L)			
<150		0	
>150		4	
White Blood Cells (per mm³)			
<15		0	
15-25		1	
>25		2	
Serum Sodium (mmol/L)		**Serum Creatinine (mg/dL)**	
≥135	0	≤1.6	0
<135	2	>1.6	2

Types of NF Based on Microorganisms	
Type I	NF comprised of synergistic polymicrobial infection
Type II	NF caused by monomicrobial gram-positive organisms
Type III	NF caused by gram-negative organisms (marine)
Type IV	NF caused by fungal infection

Table 1. Shows Laboratory Risk Indicator for Necrotising Fasciitis

LRINEC was calculated using six variables results of haemoglobin, serum glucose, C-reactive protein, white blood cell counts, serum sodium and serum creatinine. In the study, the patients who fulfilled the laboratory findings to calculate LRINEC score. The patients were divided into two groups based on the scoring points namely Group A, who had a score of <6 and Group B who had a score of ≥6.

RESULTS

This study consisted of 310 NF cases were admitted in hospital and LRINEC score was calculated successfully in 300 cases. In group A, 150 patients were included and in group B, 150 patients were included.

	Group A (LRINEC<6)	**Group B (LRINEC≥6)**
Age, years (mean ± SD)	49 ± 16	52 ± 17
Males (%)	75	76
Diabetes mellitus (%)	42.6	62.5
Kidney disease (%)	15	25
Hypertension (%)	23	45
Site of Infection (%)		
Lower limbs	45	50
Perineum and genitalia	34	33
Abdominal and groin	10	8
Chest and breast	2	3
Face and neck	8	6
Number of debridement	2.11 ± 2	2.01 ± 1.8

Table 2. Shows Demographics, Site of Infection and Outcomes

Table 2 shows that the age in years in Group A is 49 ± 16 and in Group B is 52 ± 17. Males (%) in group A is 75 and in group B is 76. Diabetes mellitus in % in group A is 42.6 and in group B is 62.5. Kidney disease in % is 15 and in group B is 25. Hypertension in % is 23 in group A and in group B is 45. The site of infection in both the groups was highest in lower limbs, i.e. 45 in group A and 50 in group B. The site of infection was least in chest and breast, i.e. in group A it is 2, and in group B, it is 3.

Antibiotics Used (%)	**Group A (LRINEC <6)**	**Group B (LRINEC ≥6)**
≤2	80	85
>2	20	15
Hospital LOS; days	10	20
Intensive care LOS; days	6	8
Septic shock (%)	18	40
Mortality (%)	18	38

Table 3. Shows Number of Antibiotics Used, Outcomes

Table 3 shows the antibiotics used was ≤2, in group A, it was 80, and in group B, it was 85. >2 in group A, it was 20, and in group B, it was 15. Mortality in % in group A was 18, and in group B, it was 38.

Microorganisms (%)	Group A (LRINEC<6)	Group B (LRINEC≥6)
Streptococcus	50	44
Staphylococcus	35	30
Bacteroides	10	9
Escherichia coli	3	4
Pseudomonas	2	5
Proteus mirabilis	0	8
Gram positive (%)	95	99
Gram negative (%)	5	1
Causative Bacteria (%)		
Type I	35	36
Type II	60	60
Type III	0	0
Type IV	5	4

Table 4. Shows Laboratory Results

Table 4 shows the laboratory results in which streptococcus microorganism was highest in both groups, in group A, it was 50%, and in group B, it was 44%. Gram-positive bacteria was the highest comprising of 95% in group A and 99% in group B. The causative bacteria was type II, which comprised of 60% in each of group A and group B.

LRINEC Score		
Mean	3.5 ± 1.0	8.5 ± 2.0
Median	5	8
C reactive protein level	121 ± 85	250 ± 101
Initial procalcitonin level	0.8	8.0

Table 5. Shows LRINEC Score

Table 5 shows C-reactive protein level in group A was 121 ± 85 and in group B was 250 ± 101. Initial procalcitonin level in group A was 0.8 and in group B, it was 8.0. The mean LRINEC score in group A was 3.5 ± 1.0 and in group B was 8.5 ± 2.0.

DISCUSSION

In the present study, the age in years in Group A is 49 ± 16 and in Group B is 52 ± 17. Males (%) in group A is 75 and in group B is 76. Diabetes mellitus in % in group A is 42.6 and in group B is 62.5. Kidney disease in % is 15 and in group B is 25. Hypertension in % is 23 in group A and in group B is 45. The site of infection in both the groups was highest in lower limbs, i.e. 45 in group A and 50 in group B. The site of infection was least in chest and breast, i.e. in group A, it is 2, and in group B, it is 3. The antibiotics used was ≤2; in group A, it was 80, and in group B, it was 85. >2 in group A, it was 20, and in group B, it was 15. Mortality in % in group A was 18, and in group B, it was 38. The laboratory results in which streptococcus microorganism was highest in both groups, in group A, it was 50%, and in group B, it was 44%. Gram-positive bacteria was the highest comprising of 95% in group A and 99% in group B. The causative bacteria was type II, which comprised of 60% in each of group A and group B. C-reactive protein level in group A was 121 ± 85 and in group B was 250 ± 101. Initial procalcitonin level in group A was 0.8, and in group B, it was 8.0. The mean LRINEC score in group A was 3.5 ± 1.0 and in group B was 8.5 ± 2.0. Ayman El-Menyar et al[6] conducted a study to evaluate the prognostic value of LRINEC scoring in NF patients. A retrospective analysis was conducted for patients who were admitted with NF between 2000 and 2013. Based on LRINEC points, patients were classified into (Group 1- LRINEC <6 and group 2- LRINEC ≥6). The 2 groups were analysed and compared. Primary outcomes were hospital length of stay, septic shock and hospital death. A total of 294 NF cases were identified with a mean age 50.9 ± 15 years. When compared to Group 1, patients in Group 2 were 5 years older (p = 0.009), more likely to have diabetes mellitus (61 vs. 41%, p <0.001), Pseudomonas aeruginosa infection (p = 0.004), greater Sequential Organ Failure Assessment (SOFA) score (11.5 ± 3 vs. 8 ± 2, p = 0.001), and prolonged intensive care (median 7 vs. 5 days) and hospital length of stay (22 vs. 11 days, p = 0.001). Septic shock (37 vs. 15%, p = 0.001) and mortality (28.8 vs. 15.0%, p = 0.005) were also significantly higher in Group 2 patients. Using receiver operating curve, cutoff LRINEC point for mortality was 8.5 with area under the curve of 0.64. Pearson correlation analysis showed a significant correlation between LRINEC and SOFA scorings (r = 0.51, p <0.002). Early diagnosis, simplified risk stratification and on-time management are vital to achieve better outcomes in patients with NF. Beside its diagnostic role, LRINEC scoring could predict worse hospital outcomes in patients with NF and simply identify the high-risk patients. However, further prospective studies are needed to support this finding. Madhumita Mukhopadhyay et al[7] conducted a study to validate whether the LRINEC score can help in the management of Necrotising Soft Tissue Infections (NSTI). This was a retrospective, observational study of patients admitted to our hospital with a diagnosis of NSTI. The LRINEC score was calculated for each case based on points assigned for each of the six laboratory variables at the time of patient presentation, including C-reactive protein, total white cell count, haemoglobin, serum sodium, serum creatinine and blood glucose. The study included 57 males and three females. Their ages ranged from 27-75 years, the mean age being 48.72 ± 10.16 years. The mean age among diabetic patients was slightly higher. In 37 patients, the condition was of unknown aetiology. Diabetes was the most common comorbid condition found in 19 (31.67%) patients. The wound culture was polymicrobial in all patients. Four patients died giving a mortality of 6.67% in this study. The LRINEC score was calculated for each patient and according to the score, the patients were categorised into low, intermediate and high-risk groups. Notably, amputations were required only in the high-risk group. The four patients who died also belonged to the high-risk category. It was also noted in this study that patients with scrotal NSTI had a low LRINEC score compared to those with trunk and lower extremity NSTI. The LRINEC score is helpful in predicting the clinical course of NSTI and helps in taking necessary precautions to reduce the mortality of the disease. Syed

Shayan Ali et al,[8] necrotising fasciitis is a rare bacterial skin condition, which forms a major diagnostic challenge and is associated with poor prognosis unless promptly treated. Initial clinical presentation is often misleading with characteristic features developing only late in the course of the disease. In this review, we discuss the applicability and usefulness of laboratory risk indicator for necrotising fasciitis score in facilitating rapid diagnosis of necrotising fasciitis in emergency department by differentiating it from other skin infections like cellulitis and abscesses. A high index of suspicion resulting from the laboratory risk indicator for necrotising fasciitis score can facilitate early diagnosis enabling prompt antibiotic administration and timely referral to surgery for wound debridement, ultimately reducing both the morbidity and mortality. Hannah Watson et al[9] conducted a study, which aimed to document mortality rates, assess the value of the Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) score as a diagnostic tool and examine outcomes following reconstructive surgery for wound closure. A retrospective case note review of patients presenting to institute between 2004 and 2012 with a histological or clinical diagnosis of necrotising fasciitis were identified. Thirty-three patients with primary NSTI were identified with a male-to-female ratio of 1.6:1 and an average age of 50 years. Two patients with secondary reconstruction were identified with a male-to-female ratio of 1:1 and an average age of 63 years. Twenty patients required admission to the intensive care unit. On an average, each patient required two tissue debridements under anaesthesia to achieve a healthy wound base suitable for reconstruction. Reconstruction with an Anterolateral Fasciocutaneous Thigh (ALT) flap was carried out in two patients (6%), delayed split skin grafting in 13 patients (39%) and limb amputation in 3 patients (9%). Partial flap loss with skin necrosis requiring debridement and advancement occurred in both patients who underwent ALT, whilst complete loss of skin graft occurred in one patient. Thirty-day mortality was 27% with an average time from presentation to death approximately 5 days. Managing necrotising soft tissue infections has been mixed. Early diagnosis and aggressive debridement with frequent monitoring and return to theatre are essential. These interventions must be coupled with early administration of antimicrobials and supportive fluid resuscitation to provide optimal treatment in the care of NSTI patients. Syed A et al[10] conducted a study to establish whether the LRINEC score is applicable in Malaysian setting. A cross-sectional study of all patients admitted to hospital diagnosed with NF or to rule out NF (TRO NF) between January 1, 2016, to June 30, 2016. The sensitivity, specificity, positive and negative predictive values were then calculated for LRINEC score of ≥6 and ≥8. 44 patients were identified with the diagnosis of NF or TRO NF in the study. Twenty-seven patients (61.4%) were deemed postoperatively as having NF and 17 patients (38.6%) not having NF. A sensitivity of 59.3% and specificity of 47.1% when a LRINEC score of ≥6 was taken with Positive Predictive Value (PPV) of 64.0% and the Negative Predictive Value (NPV) of 42.1%. When score ≥8 was taken, the sensitivity was 48.1% and specificity of 58.8% with PPV of 65% and NPV of 41.7%. The low sensitivity and low PPV 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.

CONCLUSION

The high-risk patients and prediction of worst hospital outcomes in patients with NF were predicted by LRINEC scoring besides its diagnostic role.

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