Original Research Article

A comprehensive study on LRINEC (laboratory risk indicator for necrotizing fasciitis) scoring in predicting outcome of necrotizing fasciitis

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Abstract

Background: Necrotizing fasciitis, a life-threatening disease characterized by extensive necrosis of subcutaneous tissues and fascia, needs early debridement for reducing mortality. Clinically this cannot be distinguished from other soft tissue infections. This inadequacy of early recognition, reflected by the reported mortality of 30-40%, can be easily detected by LRINEC (Laboratory Risk Indicator for Necrotizing Fasciitis) scoring system with high positive (92%) and negative (96%) predictive value.
Aim: To study the outcome in necrotizing fasciitis patients using LRINEC scoring, evaluate whether risk categorization using this score is appropriate and validate the score as a tool for early distinguishing of Necrotizing Fasciitis from other soft tissue infections.
Material and methods: Patients admitted in Department of General Surgery, Govt. Stanley Hospital, Chennai with soft tissue infections were studied for period of 6 months with sample size of 25. It was prospective observational study in which all patients admitted first time with symptoms of soft tissue infection were included. Exclusion criteria were age ≤18 years, multiple admissions, surgical site infections, no evidence of cellulitis. Patients were clinically examined, investigations done and information collected using proforma. LRINEC scoring system was applied and prognosis assessed. Based on score, the patients were categorized as low/intermediate/ high risk for the onset of Necrotizing fasciitis. Patients in each category were appropriately managed. All variables in terms of progression of the disease, associated co-morbidity, onset of necrotizing fasciitis, number of debridement, outcome of the disease in each category were documented and statistically analyzed.

Results: A total of 25 patients with soft tissue infections were prospectively evaluated and categorized using LRINEC score – 18 in Low risk, 3 in Intermediate risk and 4 in High risk group. Diabetes mellitus was the most common co-morbidity. Mean number of debridement - 1.6 times. All low and intermediate risk patients and 1 high risk patient improved with surgical intervention. One required amputation and 2 were dead.

Conclusion: LRINEC scoring can be used as an adjunct in management of soft tissue infections as it has better positive predictive value, better sensitivity and specificity in identifying the risk of the patient.

Key words

Necrotizing Fasciitis, Laboratory Risk Indicator for Necrotizing Fasciitis, LRINEC, Soft tissue infections.

Introduction

Necrotizing fasciitis is a life-threatening disease characterized by extensive necrosis of subcutaneous tissues and fascia [1]. Early debridement determines the outcome and also decreases mortality [2]. But, Clinical/Cutaneous signs cannot distinguish this from other soft tissue infections. This inadequacy of early recognition is reflected by the reported mortality of 30-40%. Hence, an easy and cost effective LRINEC (Laboratory Risk Indicator for Necrotizing Fasciitis) scoring system with high positive (92%) and negative (96%) predictive value was devised by Wong, et al. [3] This study was conducted to evaluate whether risk categorization using this score is appropriate and validate the score as a tool for early distinguishing of Necrotizing Fasciitis from other soft tissue infections.

Materials and methods

Source: Patients admitted in Department of General Surgery, Govt. Stanley Hospital, Chennai with soft tissue infections.

Duration of study: 6 months

Sample size: 25

Study design: Prospective Observational study

Inclusion criteria: All Patients admitted first time with symptoms of soft tissue infection

Exclusion criteria:

- ≤18 years
- multiple admissions for soft tissue infection
- Surgical site infections.
- No evidence of cellulitis.

Methodology

- Patients were clinically examined and investigations done. Information was collected using a proforma. LRINEC scoring system was applied and prognosis assessed.
- Maximum score-13.
- Based on their LRINEC score, the patients were categorized as
    - ≤5-no suspicion or low risk.
    - 6-7-intermediate risk.
    - ≥8-high risk for the onset of Necrotizing fasciitis.
- Patients in each category were appropriately managed. All variables in terms of progression of the disease, associated co-morbidity, onset of necrotizing fasciitis, number of debridement, outcome of the disease in each category were documented and statistically analyzed to evaluate the significance of LRINEC score in predicting the onset of Necrotizing fasciitis and its clinical outcomes.

Investigations

- Hemoglobin
- Total white cell counts
- Random blood sugar
- Serum creatinine
- Serum sodium
- Serum C-reactive protein.

Special investigations:

- Tissue for histopathology

- Tissue for culture and sensitivity

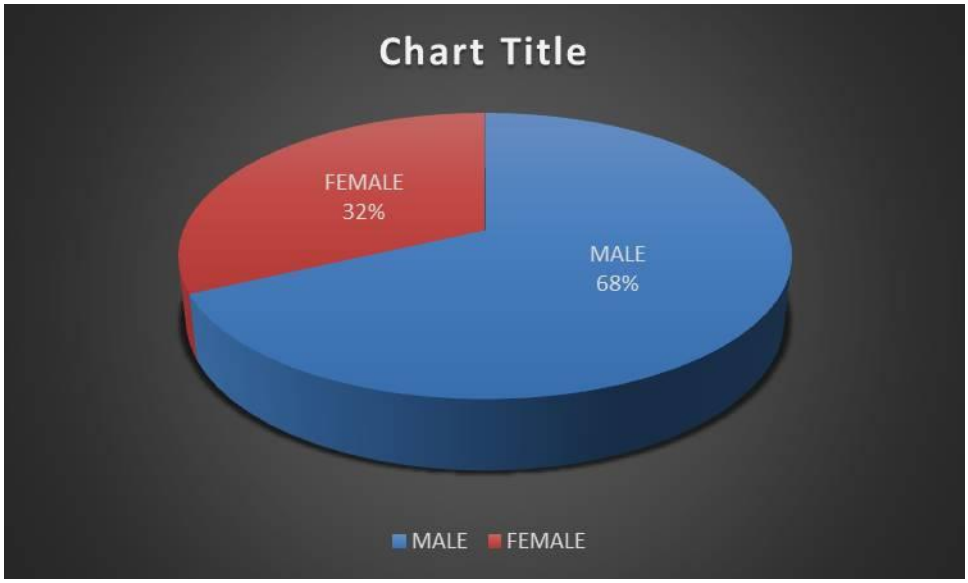
Results

A total of 25 patients (17 males (68%) and 8 females (32%)) with soft tissue infections were prospectively evaluated. This study population with soft tissue infections comprises 68% males and the rest 32% being females (**Graph – 1**).

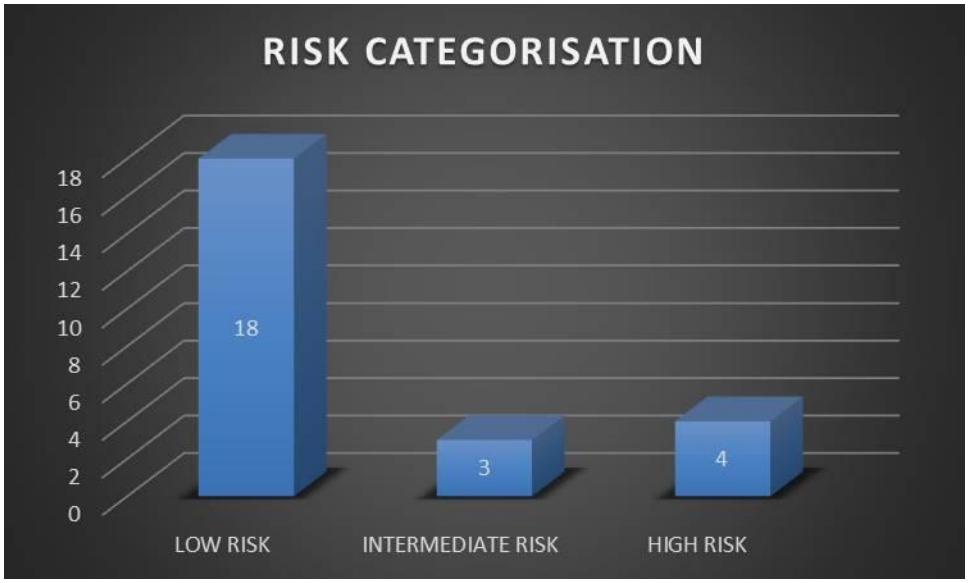
Patients were categorized using LRINEC score as 18 (12 males, 6 females) in Low risk, 3 (2 males, 1 female) in Intermediate risk and 4 (3 males, 1 female) in High risk group (**Graph – 2**).

About 72% (67% males, 33% females) of patients with soft tissue infections were categorized as low risk for progression to Necrotizing Fasciitis. About 12% (67% males, 33% females) and 16% (75% males and 25% females) of patients with soft tissue infections were categorized as intermediate and high risk for progression to Necrotizing Fasciitis respectively (**Graph – 3, 4, 5**).

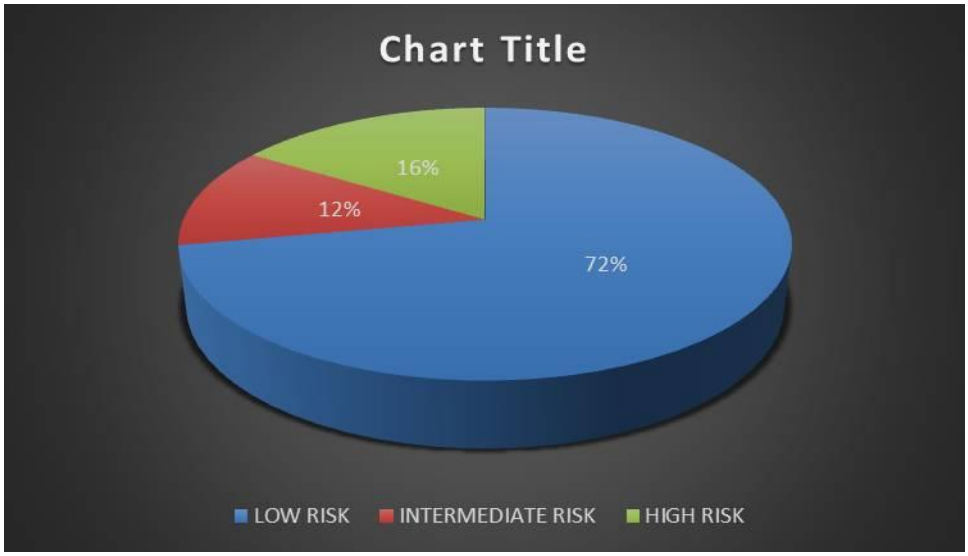
Graph – 1: Sex distribution.



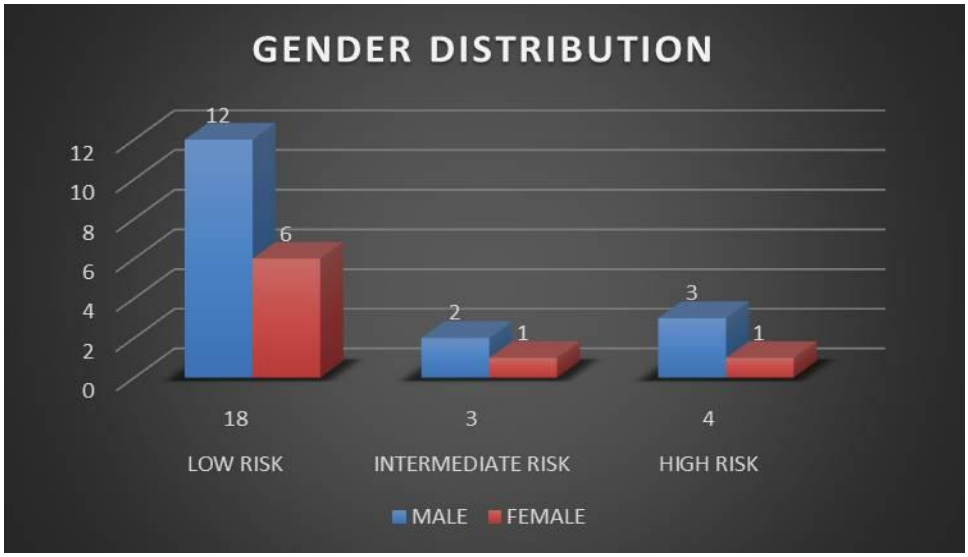
Graph – 2: Risk categorization.



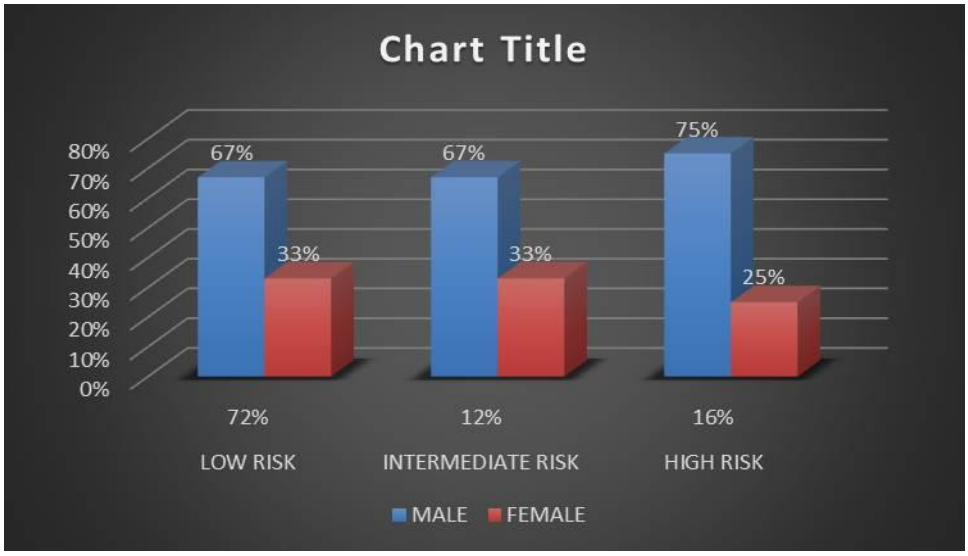
Graph – 3: Risk categorization.



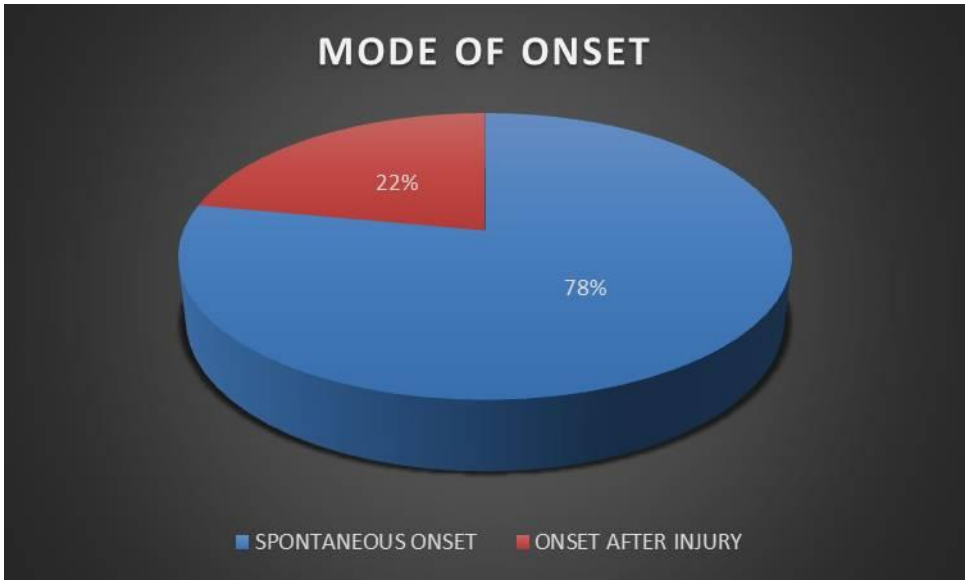
Graph – 4: Risk wise gender distribution.



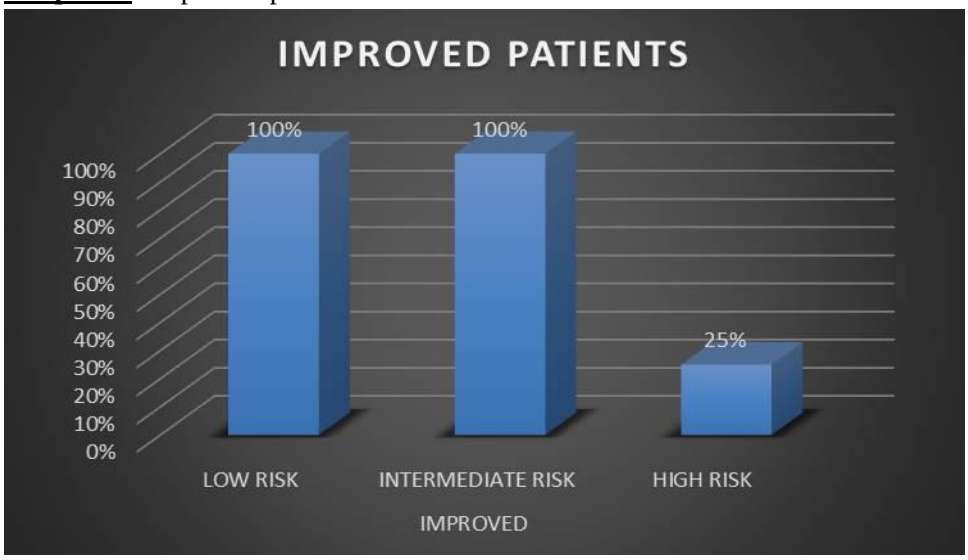
Graph – 5: Gender wise risk distribution.



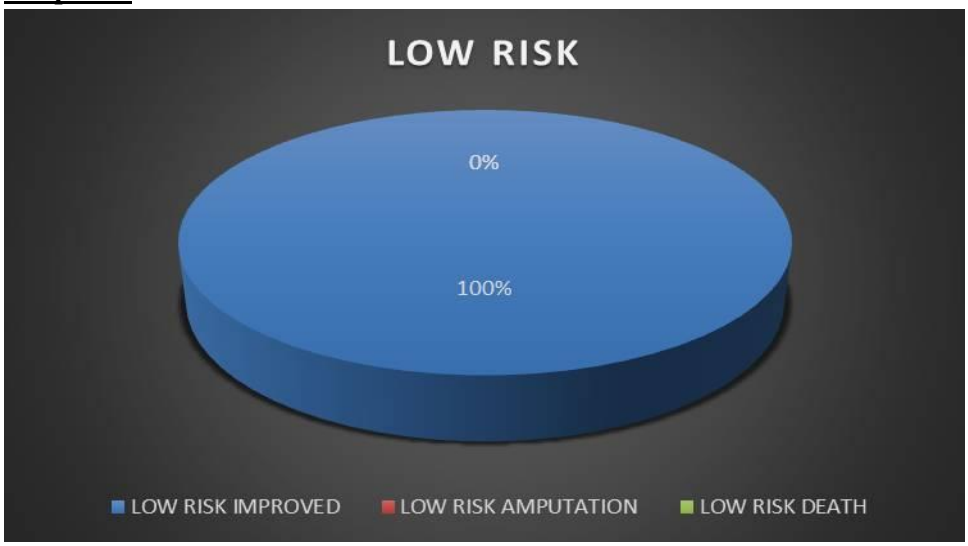
Graph – 6: Mode of onset.



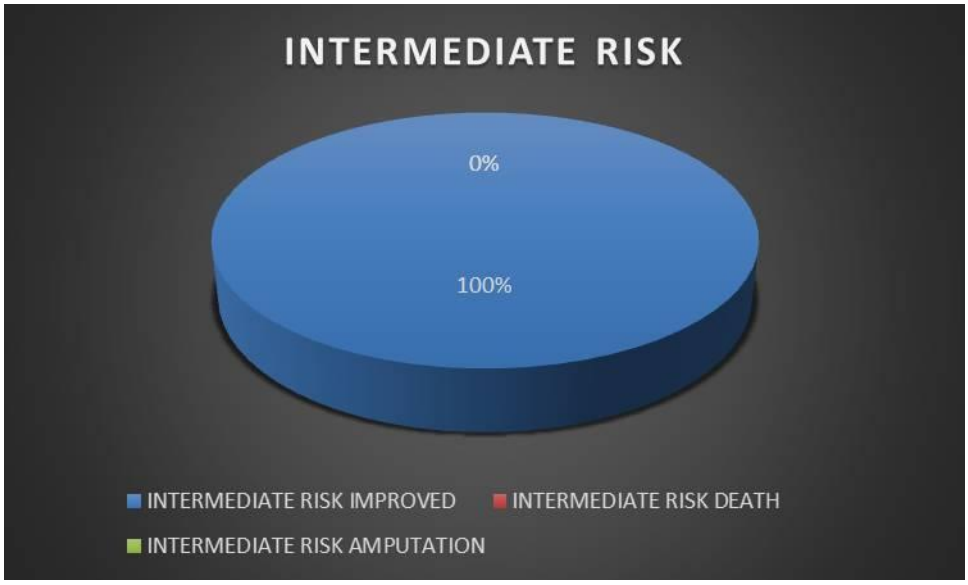
Graph – 7: Improved patients.



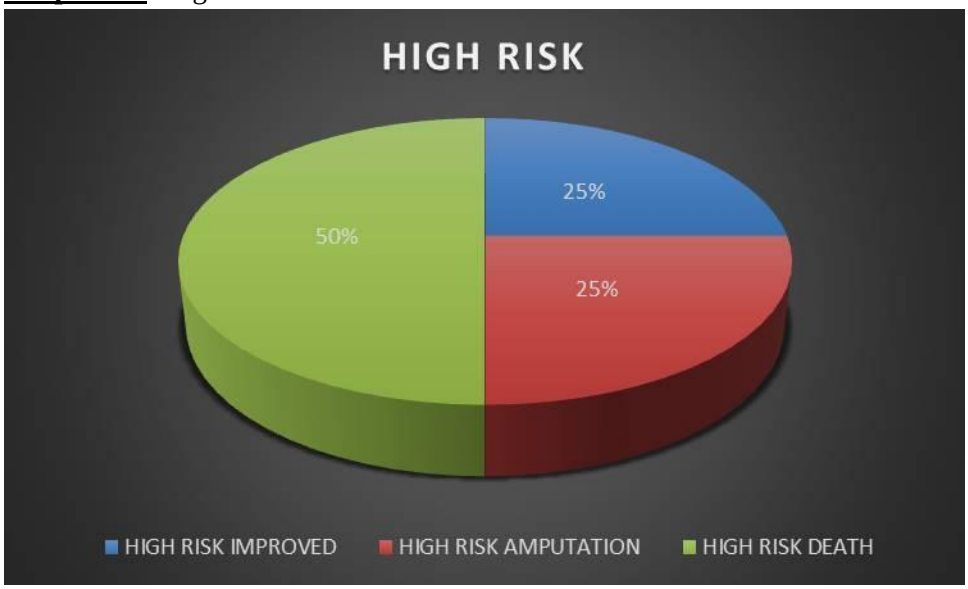
Graph – 8: Low risk.



Graph – 9: Intermediate risk.



Graph – 10: High risk.



Diabetes mellitus was the most common co-morbidity (19 cases). Mean number of debridement - 1.6 times. Extremity was the most common site involved in soft tissue infections followed by scrotum and perineum. Lower limb was the more common site of infection than Upper limb. 78% of the patients had their illness of spontaneous onset and 22% had a preceding history of injury, more often a thorn / nail prick or a road traffic accident or a history of fall (**Graph – 6**).

The Patients under high risk category required higher number of surgical debridement than the low and intermediate risk groups. And nearly 50% of patients in low risk group did not require debridement. Patients in Intermediate risk group had required at least two debridement for the regression of their soft tissue infection. 100% in low risk group (18 cases) 100% in intermediate risk group (3 cases) and 25% in high risk group (1 case) improved with surgical debridement and fasciotomy (**Graph – 7**).

All patients in low risk group (18 cases) improved with surgical debridement and fasciotomy (**Graph – 8**).

All patients in intermediate risk group (3 cases) improved with surgical debridement and fasciotomy (**Graph – 9**).

In high risk group 1 case improved with surgical debridement, 1 case required amputation and 2 patients were dead (**Graph – 10**). There was no statistically significant difference between the mean age and gender in the groups of severity.

Discussion

Overlapping diagnostic characteristics among cellulitis and necrotizing fasciitis, often initially mislead the diagnosis to cellulitis, resulting in delayed management of much severe condition underneath [4]. Not uncommonly, pain out of proportion to the elicited sign is the only early differentiating feature. In cellulitis, infection starts at the junction of dermis and superficial fascia, but in necrotizing fasciitis it begins at the level of subcutaneous fat and deep fascia. The early stages of NF spare the epidermal and dermal layers. Erythema of skin and edema of the epidermal and dermal layers are therefore not obvious initially [5]. A number of symptoms and signs, however have been proposed that may help differentiate the two mentioned conditions. A Canadian study outlined patients with necrotizing fasciitis as more likely to have a generalized erythematous rash and a toxic appearance. The pyogenic exotoxins and cytolysin produced by organisms are responsible for hypotension, disseminated intravascular coagulation and multi-organ failure.

This study also described that patients with necrotizing fasciitis were more likely to have thrombocytopenia at presentation. Radiological studies help in assessing the extent of tissue infection, the presence of sub cutaneous gas aids in determining the extent of infection, especially in mixed aerobic – anaerobic or Clostridial infections [6]. Plain radiographs may detect gas in soft tissues, but Magnetic Resonance Imaging and Computed Tomography are superior at revealing the extent of affected area which will not be readily available at primary or secondary care centers. CT scan features of Necrotizing Fasciitis include thickening and enhancement of deep fascia, fluid and gas in the soft tissue planes in and around the superficial fascia [7]. The features indicative of NF in USG include distortion and thickening of the deep fascia and fluid collections along the deep fascia. MRI is better to CT in distinguishing healthy and necrotic tissue. Features in MRI that are distinct for NF includes deep fascial fluid collections and thickening, and hyperintense T2W signal within the muscles. In MRI the sensitivity often exceeds its specificity that ensues in overestimation of extent of deep fascial involvement. Despite, a negative deep fascial involvement on MRI almost certainly excludes NF.

However, routine application of Computed Tomography, Magnetic Resonance Imaging and frozen section biopsy in the evaluation of soft tissue infections is limited by cost and availability [8].

Hence, Wong et al designed a simple scoring system, the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC), which is based on routine laboratory investigations that are readily available at most centres, and that can help distinguish Necrotizing Fasciitis from other soft tissue infections. The LRINEC score is calculated based on points assigned for six laboratory variables at the time of presentation including: C-reactive protein, hemoglobin, total leukocyte count, serum glucose, serum sodium, serum creatinine [9]. The LRINEC score stratifies patients with soft tissue infection into low, moderate and high-risk categories of necrotizing fasciitis even when the clinical picture is equivocal (**Table – 1**).

- Low risk- $\leq$5
- Intermediate risk- 6 to 7
- High risk- $\geq$8

LRINEC Score Inference:

- $\geq$ 6 Suspicious of NF
- $\geq$ 8 Strong prediction of NF

Tissue biopsy obtained at wound exploration and surgical debridement has remained the gold standard for detecting necrotizing soft tissue

infection. Biopsy diagnosis of NF is made when it shows infiltration of fascia by polymorphonuclear leukocytes [10]. Integrity of tissue and depth of invasion during wound exploration can also be evaluated. Evidence of myonecrosis and fascial necrosis are indicative of necrotizing infection. Definitive features of loss of fascial integrity along the tissue planes and presence of involvement of muscles are also diagnostic.

Table – 1: LRINEC score [11].

CRP (mg/dL)	<15	0
	≥15	4
WBC (per mm³)	<15	0
	15-25	1
	>25	2
Hemoglobin (g/dL)	>13.5	0
	11-13.5	1
	<11	2
Sodium (mEq/L)	≥135	0
	<135	2
Creatinine (mg/dL)	≤1.6	0
	>1.6	2
Glucose (mg/dL)	≤180	0
	>180	1
Composite Score	**Score < 6**	**Low Risk**
	Score 6-7	**Intermediate**
	Score ≥ 8	**High Risk**

Management [12]

- Initial evaluation and infection issues
- Initial resuscitation
- Antibiotics
- Hemodynamic Support and Adjunctive Therapy
- IV fluids
- Inotropes
- Blood transfusion
- Mechanical ventilation
- Glycemic control (diabetes is the most common associated comorbidity)

Pharmacotherapy

- Antibiotic selection is difficult in patients who have rapidly progressing infection. Antibiotic therapy is specifically directed to provide broad spectrum coverage for gram positive organisms especially S. pyogenes, gram negative organisms and anaerobes.
- The choice of empiric antibiotics is controversial and is dependent primarily on personal preference.
- Broad spectrum antibiotics are commonly used. High dose penicillin is effective. Clindamycin, cephalosporins and aminoglycosides are also needed.
- The major emphasis in treatment is inevitably surgical.

It is often difficult to distinguish necrotic from edematous tissue. Careful daily inspections of the wound will determine whether repeated debridement will be necessary [13]. Daily debridement under anesthesia may be required, since these lesions are extensive and the degree of tissue viability is often difficult to assess in the operating room. Tight fascial compartments must

be decompressed. Wide-open drainage is essential and may require extensive denudation. A functional extremity can usually be salvaged in fasciitis [14]; if not, amputation can be safely performed later. It is important to avoid confusing fasciitis with deep gangrene. It is a tragic error to amputate an extremity when removal of dead skin and fascia will suffice. Immediate amputation is necessary when there is diffuse myositis with complete loss of blood supply or when adequate debridement would clearly leave a useless limb. When viability of the remaining tissue is assured and the infection has been controlled, soft tissue deficits can be covered with skin grafts.

Conclusion

LRINEC - Laboratory Risk Indicator for Necrotizing Fasciitis score is based on routine laboratory investigations that are readily available, at most centers that can help distinguish Necrotizing Fasciitis from other soft tissue infections. LRINEC scoring has a better positive predictive value and appropriate risk categorization. Cut off ≥ 6 has better sensitivity and specificity in identifying the risk of the patient.

This study concludes that this score can be used as an adjunct in management of soft tissue infections especially in secondary care hospitals and may prevent delayed referral to tertiary centers and may guide immediate operative and ancillary management, thereby improving the clinical outcome of the patient.

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