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# Validation of modified LRINEC scoring system in the early diagnosis of necrotizing fasciitis in patients with soft tissue infections

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**Abstract**
**Introduction:** Necrotizing fasciitis is a rapidly progressive inflammatory infection of the fascia, with secondary necrosis of the subcutaneous tissues. Necrotizing fasciitis moves along the fascial plane. Early recognition and surgical intervention at the earliest possible time are the sole factors in preventing the morbidity and mortality in patients with necrotizing fasciitis.
**Aims and Objectives:** To validate the modified LRINEC scoring system for the early diagnosis of necrotizing fasciitis among patients presenting with soft tissue infections for 1. Early diagnosis of necrotizing fasciitis, 2.To implement modified LRINEC scoring system in patients with all soft tissue infections, 3. Plan of treatment based on Outcome of the modified LRINEC scoring system.
**Materials and Methods:** This was a single centre, prospective observational study conducted from July 2022 to June 2023. It was carried out on 100 patients with soft tissue infections.
**Results:** 43% patients were involved in low risk (<6) M-LRINEC score. 21% patients were under intermediate risk group (6-8) M-LRINEC score and 35% patients were under high risk group (>8) M-LRINEC score.86 Out of 100 patients 57 patients underwent debridement in including intermediate and high risk patients of M-LRINEC score. No debridement was required for patients in low risk M-LRINEC score (<6). Among 57 patients who underwent debridement, 41 patients were confirmed with NF by histopathology which is the gold standard for diagnosing NF. On validation M-LRINEC score has sensitivity of 93.55%. Specificity of 66.67%, positive predictive value of 80.56% and negative predictive value of 89.5% with P value 0.0600.
**Conclusion:** In patients with clinical signs suspicious of severe soft tissue infection, the M-LRINEC score is an effective early diagnostic tool in distinguishing NF from other soft tissue infection in order to secure early management and debridement. M-LRINEC scoring system can be recommended routinely for clinical suspicion and early diagnosis of necrotizing fasciitis.

**Keywords:** Necrotising fascitis, soft tissue infections, modified LRINEC scoring system

## Introduction

Necrotizing fasciitis (NF) is a rapidly progressive inflammatory infection of the fascia, with secondary necrosis of the subcutaneous tissues. The speed of spread is directly proportional to the thickness of the subcutaneous layer. Necrotizing fasciitis moves along the fascial plane. The patient becomes extremely toxic, and later the skin becomes painful, red, and necrotic as it is deprived of its blood supply [1]. Necrotizing fasciitis was first described in 500 BC, when Hippocrates reported a clinical description of a complications of erysipelas disease, resembling the present description of NF [2]. In 1952, Wilson coined the term "necrotizing fasciitis" and gave a more accurate description of the disease [2]. Understanding of the disease advanced rapidly in the late 1980s. Stevens reported that, among 20 patients who presented with streptococcal shock, 11 were diagnosed as having NF. The disease became known to the layman as "flesh-eating bacteria syndrome [2]". The estimated yearly incidence of Necrotizing fasciitis is 500–1,000 cases, per 100,000 people and the estimated global prevalence is 0.40 instances of necrotizing fasciitis [3]. The male-to-female ratio is shown to be 3:1; this ratio is mostly connected with the higher frequency of Fournier's gangrene in men. Although the illness can affect anyone, people over the age of 50 and those in their middle years are more susceptible to it.[3] According to research by Anaya *et al*. the perineum, belly, and lower extremities are the

three most typical sites of NF infection. When compared to NF of the lower limbs, NF in the upper limbs is uncommon [4].

Early recognition and surgical intervention at the earliest possible time are the sole factors in preventing the morbidity and mortality in patients with necrotizing fasciitis. The paucity of specific cutaneous signs to distinguish necrotizing fasciitis from other soft tissue infections such as cellulitis makes the diagnosis extremely difficult. Hence a scoring system which is easy to follow and cost-effective, and has high positive and high negative predictive value is required [1]. One such scoring system is the LRINEC scoring system devised by Wong *et al*. in 2005, which claims to have a positive predictive value of 92.0% and a negative value of 96.0% [5]. Another such scoring system is M-LRINEC (modified LRINEC ) scoring system claims to have a sensitivity of 91.8% and a specificity of 88.4% [6].

The Modified LRINEC scoring system contains the routinely used laboratory parameters, which are:

1. Age.
2. Immunocompromised state.
3. Total white cell count.
4. Hemoglobin.
5. Sodium.
6. Potassium.
7. Glucose.
8. Serum creatinine.
9. C-reactive protein.

The M-LRINEC score is a robust score capable of detecting even clinically early cases of necrotizing fasciitis. The variables used are routinely measured to assess severe soft tissue infections. Patients with an M-LRINEC score of >6 should be carefully evaluated for the presence of necrotizing fasciitis.

- The maximum score is 18

**Table 1:** Modified LRINEC Scoring System

| S. No. | Variable | Range | Score |
|---|---|---|---|
| 1. | Age | 18-45 | 1 |
| | | 45-60 | 2 |
| | | >60 | 3 |
| 2. | Immunocompromised State | Absent | 0 |
| | | Present | 2 |
| 3. | Random Blood Sugar | ≤180 | 0 |
| | | >180 | 1 |
| 4. | C-Reactive Protein | Negative | 0 |
| | | Positive | 2 |
| 5. | Total Wbc Count ($Mm^3$) | <15 | 0 |
| | | 15-25 | 1 |
| | | >25 | 2 |
| 6. | Haemoglobin | >13.5 | 0 |
| | | 11-13.5 | 1 |
| | | <11 | 2 |
| 7. | Serum Sodium | ≥135 | 0 |
| | | <135 | 2 |
| 8. | Serum Potassium | ≤5 | 0 |
| | | >5 | 2 |
| 9. | Serum Creatinine | ≤ 1.4 | 0 |
| | | >1.4 | 2 |

<6 - Implies Cellulitis stage of Soft tissue infection.
6-8 – Equivocal, >8 - Implies NF stage of Soft tissue infection.

**Aim of the study**

To validate the modified LRINEC scoring system for the early diagnosis of necrotizing fasciitis among patients presenting with soft tissue infections for:

1. Early diagnosis of necrotizing fasciitis.
2. To implement modified LRINEC scoring system in patients with all soft tissue infections.
3. Plan of treatment based on Outcome of the modified LRINEC scoring system.

**Materials and Methods**

This was a single centre, prospective observational study conducted from July 2022 to June 2023 for a period of 12 months. It was carried out on 100 patients with soft tissue infection admitted in surgical wards of Mamata General Hospital, Khammam. This Study was approved by institutional ethics committee and written informed consent was obtained from all patients participating in the study.

**Study Population**

A total of 100 patients presenting with soft tissue infections, meeting the inclusion and exclusion criteria were included in the study.

**Inclusion criteria**

1. All patients above 18 years of age diagnosed with soft tissue infections on clinical evaluation.
2. Patients willing to participate in the study.

**Exclusion criteria**

1. Patients with age less than 18 years.
2. Patients who have already undergone surgical debridement for present episode of soft tissue infections.
3. Patients with burns, furuncle with no evidence of cellulitis.
4. Patients not willing to participate in the study.

**Method of collection of data**

Institutional ethics committee approval was obtained before commencing the study and prior informed written consent was obtained from the patients before enrolling them in the study. This study included 100 patients who were clinically diagnosed as having soft tissue infections. Assessment of parameters: C-

reactive protein, Total white cell count, Haemoglobin, Sodium, Potassium, Creatinine and Glucose are assessed. The demographic data was recorded in a pre-structured proforma. Modified LRINEC scoring system was applied and the scoring is recorded. As per the scoring general and medical treatment of necrotizing fasciitis was done and followed by wound debridement as the definitive procedure whenever indicated. The patients were later managed by regular wound dressings, antibiotics, and supportive therapy for maintenance of blood pressure and renal status and, in a few cases, vacuum assisted dressings were tried for faster healing. Some cases had to undergo major amputations for control of infection and its spread. Diabetic patients were managed by using oral hypoglycemic drugs and insulin.

### Statistical Analysis

Data was analysed using SPSS v28. Categorical data was represented as frequencies and percentages. Continuous data was represented as mean and specificity and sensitivity. Bar and pie charts were used for pictorial representation of data wherever suitable.

## Results

**Table 2:** Age distribution

| Age | Frequency (n = 100) | Percent |
|---|---|---|
| 18-44yrs | 20 | 20% |
| 45-60yrs | 29 | 29% |
| >60yrs | 51 | 51% |

**Table 3:** Gender distribution

| Sex | Frequency (n=100) | Percentage |
|---|---|---|
| Male | 68 | 68% |
| Female | 32 | 32% |

**Table 4:** Immunocompromised

| Immunocompromised state | Frequency (n=100) | Percentage |
|---|---|---|
| No | 42 | 42% |
| Yes | 58 | 58% |

**Table 5:** Random blood sugar (RBS) levels

| RBS | Frequency (n=100) | Percentage |
|---|---|---|
| <180mg/dl | 66 | 66% |
| >180mg/dl | 34 | 34% |

**Table 6:** C - reactive protein (CRP)

| CRP | Frequency (n=100) | Percentage |
|---|---|---|
| Negative | 65 | 65% |
| Positive | 35 | 35% |

**Table 7:** Total Leucocyte Count (TLC)

| TLC | Frequency (n=100) | Percentage |
|---|---|---|
| <15 /mm$^3$ | 49 | 49% |
| 15-25 /mm$^3$ | 41 | 41% |
| >25 /mm$^3$ | 10 | 10% |

**Table 8:** Haemoglobin

| Hb (g/dl) | Frequency (n=100) | Percentage |
|---|---|---|
| >13.5 | 11 | 11% |
| 11-13.5 | 48 | 48% |
| <11 | 41 | 41% |

**Table 9:** Serum sodium

| Sodium | Frequency | Percentage |
|---|---|---|
| >135 mEq/L | 79 | 79% |
| <135 mEq/L | 21 | 21% |

**Table 10:** Serum potassium

| Potassium | Frequency | Percentage |
|---|---|---|
| <5 mEq/L | 98 | 98% |
| >5 mEq/L | 02 | 02% |

**Table 11:** Serum creatinine

| Creatinine | Frequency | Percentage |
|---|---|---|
| <1.4 mg/dl | 69 | 69% |
| >1.4 mg/dl | 31 | 31% |

### Modified LRINES scoring

In the present study of 100 patients after application of M-LRINEC score, patients were categorized into low, intermediate and high risk, in which the Low Risk group, 43 patients (43%), Intermediate Risk 21 patients (21%), and High Risk 36 patients (36%).

**Table 12:** Modified LRINES scoring

| Risk | Frequency | Percentage |
|---|---|---|
| Low risk (<6) | 43 | 43% |
| Intermediate risk (6-8) | 21 | 21% |
| High (>8) | 36 | 36% |

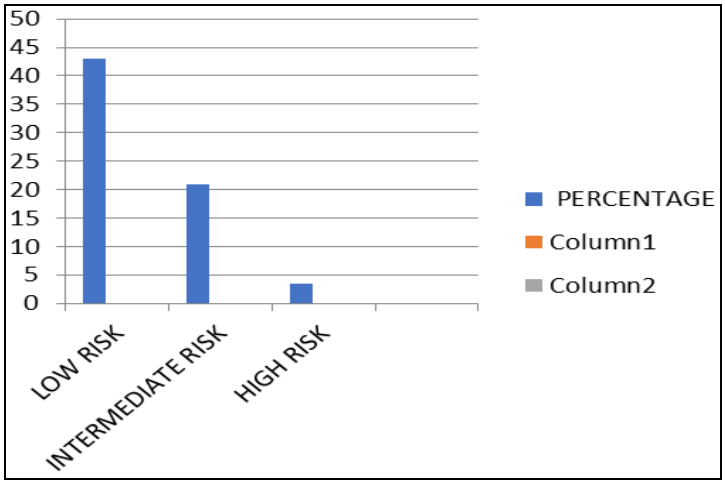


**Fig 1:** Modified LRINES scoring

**Table 13:** Debridement

| Group | Total debridement's |
|---|---|
| Low risk | 00 |
| Intermediate risk | 21 |
| High risk | 36 |

### Histopathology

Out of 100 patients in the present study only 57 patients underwent debridement for which tissue was sent for histopathology examination for definitive diagnosis of Necrotizing fasciitis in which only 12 patients in intermediate risk group out of 21 patients and 30 patients out of 36 patients in high risk group were confirmed to have necrotizing fasciitis.

**Table 14:** Histopathology

| Risk Category | HPE Negative | HPE Positive | Total |
|---|---|---|---|
| Low risk | 00 | 00 | 00 |
| Intermediate risk | 09 | 12 | 21 |
| High risk | 05 | 30 | 36 |
| Total | 14 | 42 | 57 |

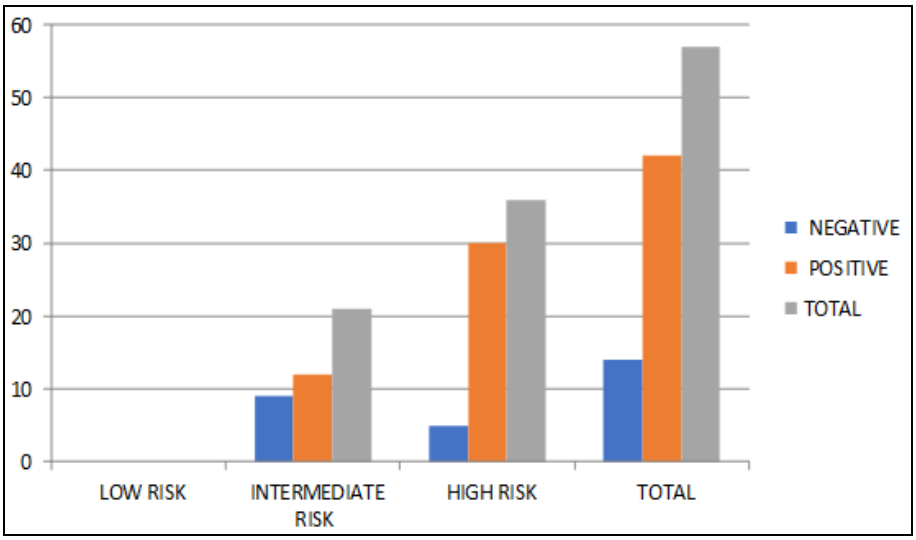


**Fig 2:** Histopathology

### Gram stain

In the present study of 100 patients, 57 patients underwent debridement and tissue was sent for gram stain, among which gram positive cocci in 20 patients and gram negative bacilli in 19 patients were noted.

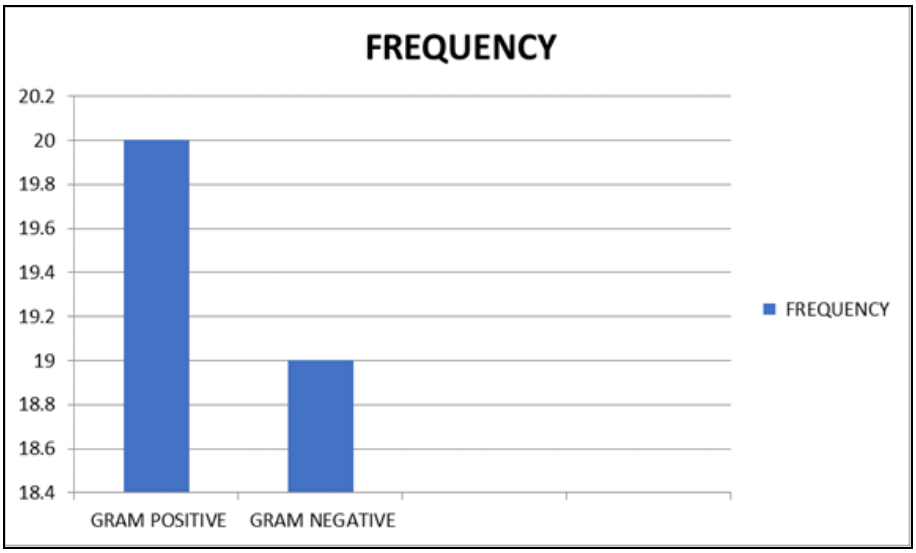


**Fig 3:** Gram stain

### Tissue for culture and sensitivity

In the present study, 57 patients underwent debridement and tissue was sent for culture and sensitivity. total of 44 patients among 57 patients who underwent debridement showed growth of microorganisms, among which 30 patients in the high risk group showed bacterial growth and 14 patients in the intermediate risk group showed growth of microorganisms. 52% out of 57% patients who underwent debridement showed growth of microorganism in which 14% were in intermediate and 30% were in the high risk group.

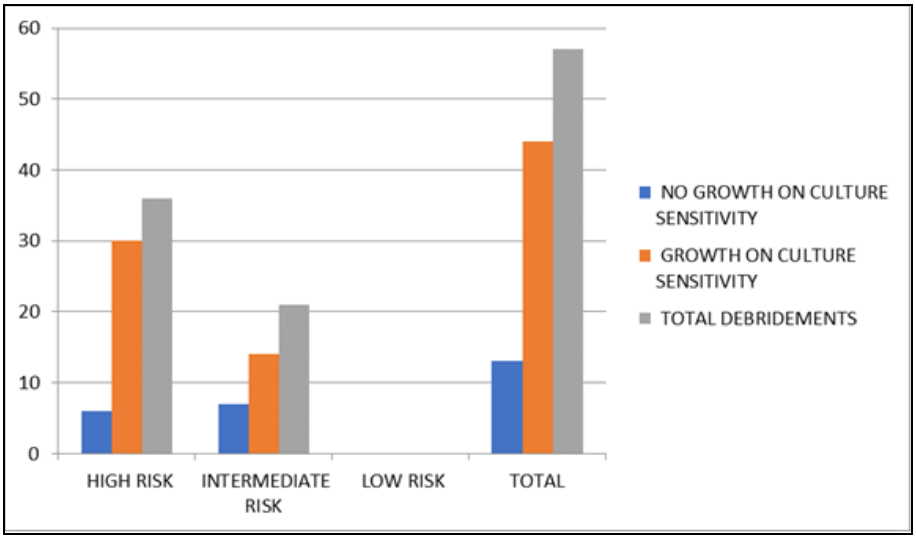


**Fig 4:** Tissue for culture and sensitivity

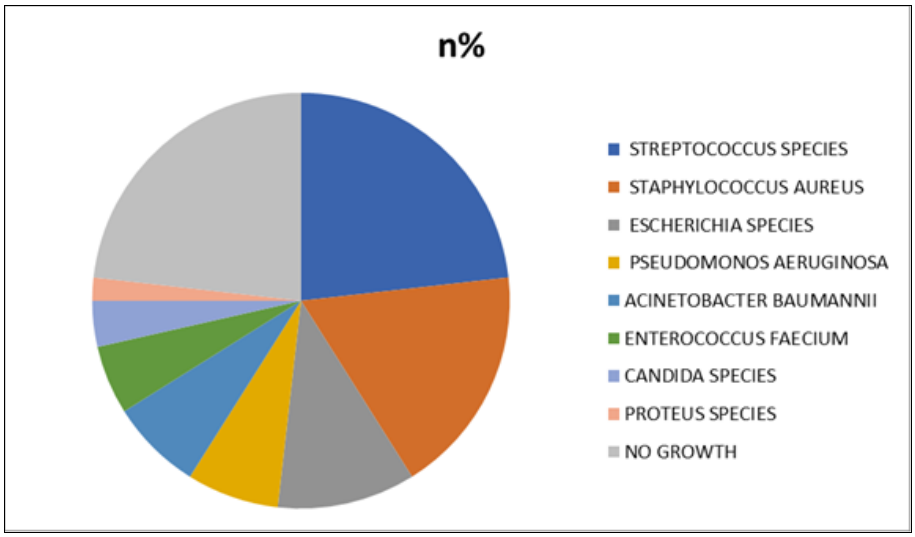


**Fig 5:** Micro-organisms grown

**Outcome of treatment**

Out of 100 patients in the present study who were categorized according to M-LRINEC score, Low Risk group 43 patients (43%) all of them were treated conservatively. Intermediate Risk group 21 patients (21%), and High Risk group 36 patients (36%) were treated with debridement and medical management. In the present study 97 patients were discharged and 3 patients died.

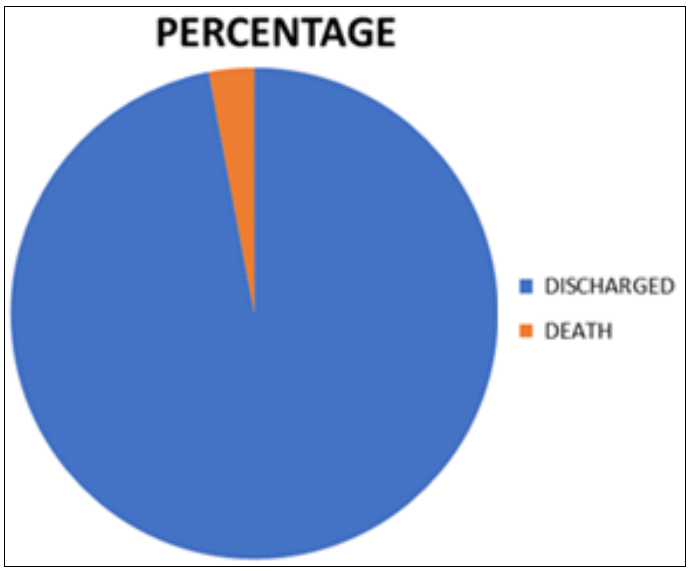


**Fig 6:** Outcome of treatment

**Validation of m-LRINEC score in relation to HPE for diagnosing of necrotizing fasciitis**

In the present study, after categorizing the study population based on M-LRINEC scoring. Debridement was done and a histopathology examination of the tissue specimen was done, which is diagnostic for NF. After compiling the results, validation of M-LRINEC score is done. Sensitivity, Specificity, Positive predictive value and Negative predictive value were calculated. The M-LRINEC score has sensitivity of 93.55%, specificity of 66.67%, with a positive predictive value of 80.56% and a negative predictive value of 89.5%.

**Table 15:** Validation of m-LRINEC score in relation to HPE for diagnosing of necrotizing fasciitis

| Parameter | Estimate | Lower-Upper 95% CI |
|---|---|---|
| Sensitivity | 93.55% | 79.28 - 98.21 |
| Specificity | 66.67% | 45.37 - 82.81 |
| Positive predictive value | 80.56% | 64.97 - 90.25 |
| Negative predictive value | 89.50% | 63.98 – 96.51 |

## Discussion

### Age distribution

Most of the patients in the present study who represented with soft tissue infections were in the age group of more than 60 years which correlates with the study done by Wong *et al*., [5] Captain S. Nedunchezhian *et al*., [6] J Bechar *et al*., [7] which showed >50 years,50-70 years, 60 years respectively in their studies., remaining 29 patients were in the age group of 45-60 years and patients 18-44 years were 20 patients which correlates with the studies by Wong *et al*., Captain S. Nedunchezhian *et al*. [6], J Bechar *et al*. [7], Chun-I Liao *et al*. [8].

### Gender distribution

In the present study of 68 patients were males and 32 patients were females. There is a male predominance with male to female ratio of 2.33:1. Which correlates with the studies by Captain S. Nedunchezhian *et al*. [6], J Bechar *et al*. [7], Chun-I Liao *et al*. [8], Haotian Wu 12, *et al*. [9], which showed male predominance of 71%, 58%, 82%, 68% respectively. Similar gender 77distribution seen in other studies by Po-Han Wu, *et al*. [10], Wu PH *et al*. [11], were female distribution is of 40% and 36% respectively.

### Immunocompromised state

In the present study series of 100 patients, 58 patients were in immunocompromised state and remaining 42 patients were stable and do not have any immunocompromised state. A study done by Captain S. Nedunchezhian *et al*. [6] of 50 patients 25 patients were in immunocompromised which correlates with the present study where as in study like Johnson, L. J., Crisologo *et al*[12] and longmore *et al*. diabetes plays an major role in validating the score, patients with uncontrolled diabetes in these studies showed to have cut off value <200 which correlates with the present study in which cut off value is <180.

### Random blood sugars

In the present study of 100 patients, only 34 patients had random blood sugar above 180 mg/dl and remaining 66% patients had random blood sugars <180 mg/dl. When compared to studies done by Johnson, L. J., Crisologo *et al*. [12] and longmore *et al*. [2], random blood sugars cutoff was <200, which showed to have 73% of population random blood sugars above 200 mg/dl which does not correlate with the present study, whereas the study done by Captain S. Nedunchezhian *et al*. [6] showed 34 patients out of 50 study population had random blood sugars above 180 mg/dl which is correlating with the present study results.

### C. Reactive Protein

Among the 100 patients in present study, 35 patients (35%) had CRP positive (>6 mg/dl), remaining 65 patients (65%) had CRP negative (<6 mg/dl). All the 35 patients had M-LRINEC score of 2 which had an impact on the M-LRINEC score among the remaining eight other parameters. Patients with CRP positive were diagnosed with NF. Our results are comparable with that of S. Nedunchezhian *et al*. [6] which showed 38% study population had CRP positive and 62% had CRP negative. Other studies by Wong CH *et al*. [5], Su, Y. C., Chen *et al*. [13] in which CRP is taken as high sensitive CRP which showed to have more sensitivity when compared to present study.

### Total leucocuyte count

In the present study series of 100 patients, 10 patients had TLC. 25/mm3, 41 patients had TLC between 15-25/mm3, and 49 patients had TLC <15/mm3. Patients who had TLC > 25/mm$^3$ had an M-LRINEC score of 2 and patients with TLC counts between 15-25/mm$^3$ had an M-LRINEC score of 1. When compared with the study done by Captain S. Nedunchezhian *et al*. [6] of 50 patients 9 patients had TLC>25/cu.mm, and 21 patients had TLC between 15-25/mm$^3$ which correlates with the present study. Other studies like Tarricone A *et al*. [14], Corbin, V *et al*. [15], J Bechar *et al*. [7], Chun-I Liao *et al*. [8] also proposed TLC >25/cu.mm parameter had significant impact on the M-LRINEC score which is used to differentiate NF from other soft tissue infections.

### Hemoglobin

When compared to the study by Captain S. Nedunchezhian *et al*. [6] of 50 patients which showed 25 patients had HB <11 gm/dl and 15 patients had HB in between 11-13.5 gm/dl which is single independent parameter of entire M-LRINEC score which had significant impact on total score and in anticipating the risk of NF among these patients, which when compared to present 79 study of 100 patients, 41 patients had HB <11gm/dl and 48 patients had HB between 11-13.5gm/dl which is of 89% total study population had less haemoglobin which suggested that HB is an single independent risk parameter among the other parameter in M-LRINEC score. Other studies like Kai-Hsiang Wu [16] of 70 patients, 14 patients had haemoglobin <11 gm/dl, and 30 patients had haemoglobin in between 11-13.5 gm/dl.

### Serum sodium

In the present study series of 100 patients, 21 (21%) patients had serum sodium <135mEq/L, 79 patients had serum sodium>135mEq/L. which correlates with study done by Captain S. Nedunchezhian *et al*. [6] of 50 patients, 14 patients had serum sodium < 135mEq/L, and 36 patients had serum sodium >135mEq/L. In the study done by Kai-Hsiang Wu[16] of 70 patients 15 patients had serum sodium levels less than 135mEq/L and 55 patients had serum sodium levels above 135mEq/L.

### Serum pottasium

In the present study series of 100 patients, only 2 patients had serum sodium levels >5mEq/L, and 98 patients had serum sodium levels less than 5mEq/L. The results are similar with study done by S. Nedunchezhian *et al*. [6] of 50 patients 9 patients had serum potassium >5mEq/L, and 41 patients had serum sodium levels >5mEq/l. Study done by Kai-Hsiang Wu[16]

of 70 patients 10 patients had serum potassium >5mEq/L which correlates with the present study.

**Serum creatinine**

80 Serum creatinine is another laboratory parameter useful in M-LRINEC score which had significance in differentiating the NF from other soft tissue infections. In the present study of 100 patients, 31 patients had serum creatinine >1.4 mg/dl and remaining 69 patients had serum creatinine < 1.4mg/dl. When compared to study done by S. Nedunchezhian *et al.* [6] of 50 patients, 35 patients had serum creatinine >1.4mg/dl and 15 patients had creatinine less than 1.4mg/dl which is not correlating with the present study, but when compared with another studies like Neeki, M. M *et al*., [17] Abdullah *et al.* [18] which are correlating with present study.

**Modified LRINEC score**

Based on original LRINEC score and proposed by Wong *et al*. and M-LRINEC score, modifications were done to LRINEC score to M-LRINEC score which is having the total score of 18, in the present study of 100 patients, 43 patients were categorized under low risk group (score<6), 21 patients were in intermediate group (score between 6-8), 36 patients were in high risk group (score>8). When compared with Captain S. Nedunchezhian *et al.* [6] of 50 patients 27,8,15 patients were in high, intermediate, and low risk group respectively. According to the study done by Po-Han Wu [10] out of 25 patients, 12 patients were in low risk group and 7 patients were in the high risk and 6 patients were intermediate risk, but study done by Hsiao CT *et al.* [11] of 303 patients 123 patients were in intermediate risk group and 80 patients were in high risk group and 100 patients in low risk group.

**Outcome of treatment**

Out of 100 patients in present study patients in low risk group 43 patients were managed conservatively without any debridement, whereas remaining 57 patients in intermediate and high risk group underwent debridement as they are in high risk for developing NF according to the M-LRINEC score. Need for debridement is accessed by bedside skin incision test in which it comments about the muscle, any pus and the need for the debridement. Out of 100 patients 97 patients were discharged and 3 patients died. Hsiao CT *et al.* [11] study showed out of 303 patients 101 patients underwent debridement based on M-LRINEC score and remaining 202 patients were managed conservatively and diagnosed as cellulitis. Another study by Tsai Y.H *et al.* [12] out of 70 patients 18 patients died and 52 patients discharged. Wu H *et al.* [9] study showed out of 177 patients 59 patients underwent debridement among them 25 patient were died and remaining patients were discharged.

**Histopathology**

Out of 57 patients who underwent debridement and tissue sent for HPE, which showed 42 patients were confirmed to have NF in which 30 patients belonged to the high risk (36), 12 patients belong to the intermediate risk group. In statistical analysis 57 patients were prone to have risk for NF according to M-LRINEC score, but only 42 patients actually developed Necrotizing fasciitis, when compared with the study done by Wu H *et al.* [9] showed out of 177 patients, 59 patients were diagnosed to have NF, whereas 118 patients diagnosed as non-NF and managed conservatively. Wu P.H *et al.* [10] a total of 303 patients, 101 patients were diagnosed to have NF after histopathology examination, where 202 patients were diagnosed as cellulitis and managed conservatively. Wu K.H *et al.* [16] study showed out of 25 patients, 13 patients were differentiated as NF and 12 patients were diagnosed as cellulitis.

**Culture and sensitivity and gram stain**

44 patients among 57 patients who underwent debridement had shown growth of bacteria in culture and sensitivity among which Streptococcus species (13), *Staphylococcus aureus* (10), *Escherichia coli* (7), 20 patients showed gram positive cocci whereas 19 patients showed gram negative bacilli. In the present study streptococcal species is found more common which is similar with that of Tarricone A *et al.* [14], Corbin, V *et al.* [15], J Bechar *et al.* [7], Chun-I Liao *et al.*, [8] streptococcal species causing the Necrotizing fasciitis most commonly. Streptococcus species (group a beta haemolytic) is dangerous and most common microorganism grown in patients diagnosed with Necrotizing fasciitis. In our study staphylococcus species was second most organism grown, when compared with study done by Cheng NC *et al.* [19], Chao WN *et al.* [20], staphylococcus species causing the Necrotizing fasciitis is most common. This may be because of the locally prevalent micro-organisms patterns.

**Validation of M-LRINEC score**

The results in the present study showed that the M-LRINEC scoring system exhibited good capacity in discriminating NF from other severe soft-tissue infections, with high sensitivity and specificity (93.55) and (66.67%) respectively, positive predictive value (80.56) and negative predictive value (87.5%) with p value 0.0600.The LRINEC score is capable of detecting early cases of necrotizing fasciitis in patients diagnosed with cellulitis: a developmental study by Wong *et al.* [5] reported that a LRINEC score >/= 6 had a sensitivity of 89.9%, specificity of 96.9%, positive predictive value of 92% and negative value of 96%.In 2012, Chun-I liao *et al.* [8] studied a group of 233 patients in Taiwan using LRINEC score > 6 to evaluate its ability to discriminate NF from severe soft tissue infection. The result showed a sensitivity of 59.2%, specificity 83.8%, positive predictive value of 92.5%.

In 2021 Haotian Wu *et al.* [9] studied a group of 177 patients included, 59 in the NF group and 118 in the non-NF group. This study added co-morbid diabetes and kidney disease to the original LRINEC scoring system, used high-sensitivity C - reactive protein (HCRP) to replace the CRP and redefined the cut-off values for the other four variables, to develop the M-LRINEC system. The cut-off values for m-LRINEC was 17 points, with corresponding sensitivity and specificity of 93.2% and specificity of 86.9%, and the AUC was 0.935 (95% CI 0.892 to 0.977; p<0.001).In 2020, Captain S. Nedunchezhian *et al*[6] a study on validation of m-LRINEC scoring system showed that About 16% of patients with modified LRINEC score of >8 had repeated debridement's with p-value of test 0.585. About 42% of patients with modified LRINEC score of >8 had serum CRP values with P-value 0.443. About 10% of patients with modified LRINEC score had Total counts >25/mm3and 32% of patients had total counts between 15-25/mm3 with a p value of 0.452.Because NF and its rapidly progressive infection remain associated with high mortality, the LRINEC score, developed by Wong *et al.* [5] Based on readily available laboratory markers, has been consistently evaluated for its efficacy in various studies. Variable sensitivity ranging from 28.6 to 88.5% was found. These results may be associated with race, ethics, demographic, bacterial species, and timing of blood sampling for laboratory tests.

In this study, on basis of original LRINEC proposed by Wong *et al*. [5], we made some modifications to develop the m-LRINEC scoring system. Besides, in this study some parameters were redefined the cut-off values for CRP, Total leucocytes count, and haemoglobin levels to be 6mg/dl, 15 x 104/UL, and 11 g/dl, respectively. At 84 such cut-off values, each variable could discriminate NF from other soft-tissue infections and each variable was identified to be independently associated with NF after adjusting for con-founders. The clinical value of the M-LRINEC score was determined by its sensitivity and specificity. The M-LRINEC score could stratify patients into high- and low risk categories for NF and help make critical decisions for duty surgeons.

For high risk patients serial m-LRINEC score monitoring may be useful for stopping the progression of NF. An early aggressive surgical intervention may reduce mortality and related complications in high risk patients. A high index of suspicion, along with early diagnosis and aggressive surgical treatment, remains the supreme management strategy for NF. The adjunct risk evaluation model based on laboratory investigations may be useful in the early stages of NF.

## Conclusion

In patients with clinical signs suspicious of severe soft tissue infection, the M-LRINEC score is an effective early diagnostic tool in distinguishing NF from other soft tissue infection in order to secure early management and debridement. Early debridement results in decrease in morbidity, mortality rates, and number of days of hospital stay. There exists a statistically significant correlation between Modified LRINEC scoring system and diagnosis of necrotizing fasciitis. M-LRINEC scoring system can be recommended routinely for clinical suspicion and early diagnosis of necrotizing fasciitis.

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## Conflict of interest

None declared.

## Ethical approval

The study was approved by the institutional ethics committee.

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