

INVESTIGATION OF PROGNOSTIC INDICATORS FOR NECROTIZING FASCIITIS CARE AND PROGNOSIS

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KEYWORDS

Necrotizing fasciitis, LRINEC score, prognostic indicators, debridement, amputation, diabetes mellitus, microbial profile.

ABSTRACT

Background

Necrotizing fasciitis (NF) is a severe soft tissue infection characterized by rapid progression, high morbidity, and mortality. Early diagnosis and intervention play a crucial role in improving patient outcomes. Several prognostic indicators, including the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score, comorbid conditions, and microbiological profiles, influence disease severity and treatment strategies. This study aims to assess the clinical predictors, microbiological spectrum, and surgical outcomes in NF patients.

Materials & Methods

This prospective analytical study was conducted in the Department of General Surgery, Meenakshi Medical College Hospital, from January to June 2024. Fifty patients diagnosed with NF were included. Clinical and laboratory parameters, including the LRINEC score, were evaluated. Patients underwent debridement or amputation based on disease severity. Pus cultures determined microbial patterns, and patient outcomes were assessed based on risk stratification, surgical intervention, and comorbidities.

Results

Among the 50 patients, 70% had diabetes mellitus, highlighting its strong association with NF. The LRINEC score was a significant prognostic tool, with patients scoring >8 showing higher morbidity (64.2%) and mortality (21.4%). Monomicrobial infections (56%) were more common than polymicrobial infections (26%), with Staphylococci (18%) and E. coli (14%) being the predominant pathogens. Debridement was the most frequently performed surgical intervention (88%), with 68.1% of these patients recovering without complications. However, amputation (12%) was associated with a higher mortality rate (33.3%).

Conclusion

Early diagnosis using the LRINEC score, timely surgical debridement, and targeted antibiotic therapy are critical for improving NF outcomes. Diabetes and elevated LRINEC scores were strong predictors of complications. Prompt intervention significantly reduced the need for amputation and improved survival rates.

Introduction:

Necrotizing fasciitis (NF) is a rapidly progressing and severe soft tissue infection that leads to extensive necrosis of the skin, subcutaneous tissue, and superficial fascia or muscles. This condition primarily affects the deep fascial layers and advances quickly. Prompt clinical diagnosis is essential, as NF spreads aggressively. In some cases, the infection extends to the underlying muscles, leading to necrotizing myositis.

The infection typically spreads through direct tissue invasion, but in severe cases, microorganisms can disseminate through the bloodstream and lymphatic system, potentially causing sepsis and shock. Early detection is challenging due to the absence of distinct pathognomonic signs. The clinical presentation of NF varies widely, including symptoms such as vesicles, edema, bullae, cellulitis, erythema, crepitus, and fever. Severe complications often involve sepsis and, in extreme cases, mortality.

The rising prevalence of diabetes and other immunocompromising conditions has contributed to a significant increase in NF cases. This has placed a considerable burden on healthcare infrastructure, particularly in managing patients who develop sepsis and require ventilatory support. To aid in early identification and risk stratification, various scoring systems have been developed. This study focuses on the diverse clinical presentations, early diagnostic approaches, and effective management strategies for necrotizing fasciitis. This study is to evaluate the factors that aid in diagnosing necrotizing fasciitis and to identify the determinants contributing to morbidity and mortality.

Materials & Methods

This prospective analytical study was conducted in the Department of General Surgery at Meenakshi Medical College and Hospital, Kanchipuram, over a six-month period from January 2024 to June 2024. The study focused on patients diagnosed with necrotizing fasciitis, with a total sample size of 50 participants.

Inclusion Criteria:

- All patients diagnosed with necrotizing fasciitis and admitted for treatment.
- Patients who provided informed consent.

Exclusion Criteria:

- Patients with non-necrotizing soft tissue infections (e.g., cellulitis, abscess) were excluded.
- Patients who did not provide consent for participation.

Procedure

Patients diagnosed with necrotizing fasciitis were admitted, and a detailed history, including comorbidities and smoking habits, was recorded using a structured proforma. A thorough clinical examination was conducted, and relevant laboratory investigations, including C-reactive protein (CRP), total white blood cell count, hemoglobin, serum sodium, creatinine, and glucose levels, were performed.

The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score was calculated for risk assessment. Depending on the duration of symptoms and local examination findings, debridement or amputation was performed under appropriate anesthesia. Daily debridement was carried out as required. Pus samples were collected for culture and sensitivity testing, and antibiotic therapy was adjusted based on the results.

Patients were discharged once healthy granulation tissue was observed, with regular follow-ups conducted to monitor recovery.

LRINEC Score

The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) is a clinical tool used to assess the likelihood of necrotizing fasciitis. It is based on six common laboratory parameters at the time of presentation: CRP, total white blood cell count, hemoglobin, serum sodium, creatinine, and glucose levels. A LRINEC score of six or higher indicates a higher risk of necrotizing fasciitis.

Result:

Figure 1. Age-related distribution of patients

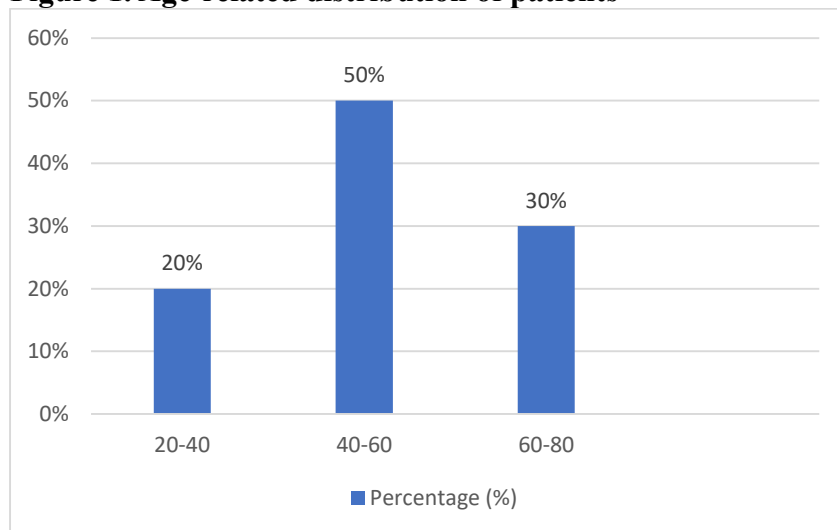


Figure 2. Gender-related distribution of patients (N=50)

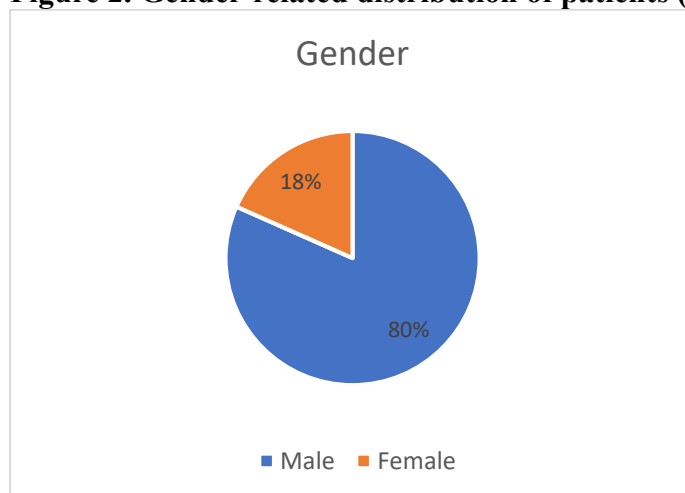


Table 1. Distribution of patients according to the duration of symptoms (N=50)

Presentation	Number	Percentage (%)
Early (<7 days)	30	60%
Late	20	40%

In the study, 60% of patients (30 out of 50) presented early (within 7 days of symptom onset), while 40% (20 patients) presented late (after 7 days). Early presentation was associated with better prognosis, as timely intervention likely reduced complications, whereas late presentation led to higher morbidity and mortality due to disease progression.

Table 2. Distribution of patients according to co-morbidities (N=50)

Co-morbidities	No. of Cases	Percentage (%)
Diabetes Mellitus	35	70%
Cardiovascular Disease	3	6%
Renal Disease	2	4%
None	10	20%

In this study, 70% of patients had diabetes mellitus, making it the most common co-morbidity, followed by cardiovascular disease (6%) and renal disease (4%). Only 20% had no underlying

conditions. The high prevalence of diabetes suggests a strong link between metabolic disorders and necrotizing fasciitis, emphasizing the need for early intervention in high-risk patients.

Figure 3. Distribution of patients according to smoking habit (N=50)



Table 3. Distribution of patients according to LRINEC score (N=50)

LRINEC Score	Number	Percentage (%)
<6	25	50%
6-7	10	20%
>8	15	30%

In this study, 50% of patients had an LRINEC score of less than 6, indicating a lower risk of necrotizing fasciitis, while 20% had a score between 6-7, suggesting a moderate risk. However, 30% had a score greater than 8, which is associated with severe disease and a higher likelihood of complications. The findings highlight the importance of LRINEC scoring in early diagnosis and risk stratification for better management and outcomes.

Table 4. Distribution of cases according to surgery (N=50)

Type of Surgery	Number	Percentage (%)
Debridement	44	88%
Amputation	6	12%

In this study, 88% of patients underwent debridement, which is the preferred surgical approach for removing infected and necrotic tissue while preserving the limb. However, 12% required amputation due to severe infection and extensive tissue damage. These findings emphasize the importance of early intervention to prevent disease progression and reduce the need for limb loss.

Table 5. Analysis of type of organism (N=50)

Monomicrobial	Percentage	Polymicrobial	Percentage
<i>E. coli</i> (n=7)	14%	<i>Proteus, Klebsiella</i> (n=1)	2%
<i>Acinetobacter</i> (n=5)	10%	<i>Pseudomonas, E. coli</i> (n=1)	2%
<i>Pseudomonas</i> (n=3)	6%	<i>Klebsiella, E. coli</i> (n=5)	10%
<i>Staph. Aureus</i> (MSSA) (n=2)	4%	<i>Pseudomonas, Klebsiella</i> (n=2)	4%
<i>Enterococci</i> (n=5)	10%	<i>Enterococci, Acinetobacter</i> (n=2)	4%
<i>Klebsiella</i> (n=6)	12%	<i>Acinetobacter, Klebsiella</i> (n=2)	4%
<i>Staphylococci</i> (n=9)	18%	—	—

In this study, monomicrobial infections (56%) were more common than polymicrobial infections (26%). The most frequently isolated monomicrobial organism was *Staphylococci* (18%), followed by *E. coli* (14%) and *Klebsiella* (12%). Among polymicrobial infections, the most common combinations included *Klebsiella* with *E. coli* (10%) and *Pseudomonas* with *Klebsiella* (4%). These findings highlight the diverse microbial profile of necrotizing fasciitis, emphasizing the need for targeted antibiotic therapy.

Table 6. Analysis of LRINEC score with outcome (N=50)

LRINEC Score	Discharge without Sequelae	Morbidity	Mortality
<6 (n=20)	18 (90%)	2 (10%)	0 (0%)
6-7 (n=16)	10 (62.5%)	6 (37.5%)	0 (0%)
>8 (n=14)	2 (14.3%)	9 (64.2%)	3 (21.4%)

In this study, patients with an LRINEC score of <6 had the best outcomes, with 90% discharged without sequelae and no mortality. Those with a score of 6-7 had moderate risk, with 62.5% discharged and 37.5% experiencing morbidity. However, patients with a score >8 had the worst prognosis, with only 14.3% discharged, 64.2% facing significant morbidity, and 21.4% mortality, highlighting the LRINEC score's role in predicting disease severity.

Table 7. Analysis of type of surgery with outcome (N=50)

Type of Surgery	Discharge without Sequelae	Morbidity	Mortality
Debridement (n=44)	30 (68.1%)	13 (29.54%)	1 (2.2%)
Amputation (n=6)	0 (0%)	4 (66.6%)	2 (33.3%)

In this study, patients who underwent debridement had better outcomes, with 68.1% discharged without sequelae and only 2.2% mortality. In contrast, those requiring amputation had worse outcomes, with no patients discharged without sequelae, 66.6% experiencing morbidity, and a higher mortality rate (33.3%). This highlights the importance of early intervention to reduce the need for amputation and improve prognosis.

Table 8. Analysis of type of organism with outcome (N=50)

Organism	Discharge without Sequelae	Morbidity	Mortality
<i>E. coli</i> (n=7)	4 (57.1%)	1 (14.2%)	2 (28.57%)
<i>Acinetobacter</i> (n=5)	4 (80%)	1 (20%)	0 (0%)
<i>Pseudomonas</i> (n=3)	2 (66.6%)	1 (33.3%)	0 (0%)
<i>Klebsiella</i> (n=6)	3 (50%)	3 (50%)	0 (0%)

In this study, patients infected with *E. coli* had the worst outcomes, with 28.57% mortality. *Acinetobacter* had better prognosis, with 80% discharged and no mortality. *Pseudomonas* and *Klebsiella* showed moderate outcomes, with *Klebsiella* causing the highest morbidity (50%). These findings highlight the varying impact of different pathogens on disease severity and patient outcomes.

Discussion:

Necrotizing fasciitis (NF) is a severe, rapidly progressive soft tissue infection with high morbidity and mortality. Early recognition and intervention significantly improve patient outcomes. Prognostic indicators such as clinical scoring systems, laboratory markers, co-morbidities, and microbiological profiles help guide management.

Clinical and Laboratory Indicators

The LRINEC score is a key prognostic tool. In this study, patients with LRINEC <6 had the best outcomes (90% discharged), while those with >8 had higher morbidity (64.2%) and mortality (21.4%). This aligns with findings by Gohil et al. (2020) [4] and Das et al. (2012) [6], where higher LRINEC scores correlated with worse outcomes.

Impact of Co-Morbidities

Diabetes mellitus was a significant risk factor, present in 70% of patients, leading to increased morbidity and mortality. Similar trends were noted by Kaur et al. (2021) [6] and Kumar et al. (2020) [10], who reported higher amputation rates in diabetic patients. Bodansky et al. (2020) [18] found diabetes contributed to prolonged hospital stays and septic shock.

Microbiological Profile and Outcomes

E. coli infections had the highest mortality (28.57%), while *Acinetobacter* and *Pseudomonas* had lower fatality rates. Ajitha et al. (2020) [1] and Pitché et al. (2022) [2] reported similar findings, linking *E. coli* and polymicrobial infections to severe complications. Gohil et al. (2020) [3] observed that polymicrobial infections often required aggressive intervention.

Surgical Interventions and Prognosis

Debridement was the primary treatment (88% of cases), with a 68.1% discharge rate, while amputation had a 33.3% mortality rate. Kaur et al. (2021) [6] and Leiblein et al. (2017) [19] emphasized that early debridement improves survival, while delayed intervention increases amputation rates.

Conclusion:

Early diagnosis, risk assessment using the LRINEC score, and timely surgical intervention are critical for improving NF outcomes. Diabetes and elevated LRINEC scores are strong predictors of complications, while microbial profiling aids in selecting appropriate antibiotics. Early debridement is essential to reducing morbidity and mortality, emphasizing the importance of rapid intervention in disease management.

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