

A Clinical and Microbiological Analysis of Necrotizing Fasciitis**Rakesh Kumar Thakur¹, Vijay Shankar Prasad²**¹Specialist Medical Officer (Surgery), Andhratharhi, Madhubani, Bihar²Associate Professor and Head of Department, Upgraded Department of Surgery, Darbhanga Medical College and Hospital, Laheriasarai, Bihar

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Abstract:

Background: Necrotizing fasciitis is a group of illnesses caused by an infectious bacterium that causes deeper soft tissue necrosis. It is an infectious condition that can be fatal, with a death rate that can range from 17% to 34%. Having a deeper understanding of pathophysiology is essential to giving superior medical or surgical care. The current investigation sought to quantify the incidence of necrotizing fasciitis and ascertain the most successful course of treatment for the condition.

Methods: The study included all patients of necrotizing fasciitis admitted to DMCH between November 2009 and October 2011. A combination of clinical and gross anatomical observations, biochemical characterisation, and microbiological assessment were used to make the diagnosis.

Results: Among the patients, a male predominance was seen. The majority of symptoms (95%) were reported as pain, with a mean duration of 10.08 days. The most prevalent etiological factor was trauma (30%), and the most common associated comorbid disease among patients was diabetes mellitus (38.3%), followed by hypertension (30%) in 18 cases. In 37 (61.7%) patients, the culture was monomicrobial; in 22 (36.7%) patients, it was polymicrobial; and in 1.7% of patients, it was sterile. Of the isolates, 86.7% were aerobic and 13.3% were anaerobic. The most prevalent bacterium among the patients was *E. coli*.

Conclusion: In extreme situations, the presence of soft tissue gas and necrotic skin helps with the proper diagnosis. Debridement should then be performed right away and frequently. Since the anaerobes are isolated, a quick and thorough second inspection is required. Therapeutic planning might benefit greatly from the study's findings.

Keywords: Necrotizing fasciitis, Soft tissue infection, Diabetes mellitus, Comorbid condition, Trauma.

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Introduction

A gradual and rapidly spreading inflammatory infection of the deep fascia, necrotizing fasciitis often affects the skin and subcutaneous tissue but can also spread to other soft tissues, including muscles (also known as necrotizing myositis).

Via the blood vessels, it spreads to other locations, causing severe shock, organ failure, and even death. Adults have a higher prevalence of it than children do (0.4 and 0.08/100,000, respectively). Changes in physiology, including immunodeficiency, diabetes mellitus, complement C4 insufficiency, AIDS, cancer, and medication use, appear to have increased the occurrence in recent years.

Diabetic patients typically have problems such as diabetic neuropathy, microvascular disease, and big vessel atherosclerosis. Patients who suffer from neuropathy and vasculopathy are more likely to be at risk for developing foot ulcers. Long-lasting ulcers cause microbial contamination at the sites,

which in turn causes deep site necrosis and a complicated infectious process. Insufficient cutaneous blood flow, pressure ulcers, and neuron loss are the results of diabetic neuropathy. These alter the overall outcome in terms of increased secondary invasive infection. There is a real risk of climbing due to the deep places these lesions reach in the leg. Infection can seep through any factor that affects the integrity and health of the skin or mucous membranes. Skin trauma, an infected needle in IV drug users, or prior dermatological conditions like psoriasis and bed sores can all cause a primary infection. The alternative routes of infection are mucosal membranes in the gastrointestinal or genitourinary systems [1–9].

Materials and Methods

A unique group of patients admitted to Darbhanga Medical College and Hospital in Laheriasarai, Bihar between November 2009 and October 2011 were included in this study, which is a type of

descriptive investigation on necrotizing fasciitis. Individuals who left the treatment before it was finished because of necrotizing fasciitis were not included. In this investigation, patients with necrotizing fasciitis were included.

During the procedure, a mix of gross anatomical discoveries and clinical observations were used to make the diagnosis. In addition to pre-medical history such as diabetes mellitus and antibiotic use, demographic data was gathered.

To check for any bullae formation, a physical examination and assessment of vital indicators were conducted. To examine the subcutaneous gas generation, blood parameters including hemoglobin, platelets, RBS, urea, creatinine, sodium, and potassium levels were measured. The patients received blood-spectrum antibiotics, vigorous wound debridement, and hemodynamic stabilization as part of their treatment. During fasciotomy or debridement, the infected wound's microbial culture and sensitivity were removed,

primarily to check for aerobic and anaerobic organisms. The Clinical and Laboratory Standards Institute (CLSI) guidelines were used as the basis for the microbial analyses. The wound swab or tissue sample was inoculated for further identification and anaerobic culture.

The statistical software namely, Statistical Package for the Social Sciences software, SPSS 15.0 (SPSS Inc., Chicago, IL), and R environment ver.2.11.1 were used in the study.

Results

60 patients with necrotizing fasciitis who were hospitalized to DMCH in Laheriasarai, Bihar, were used in the current study. The individuals under study ranged in age from 29 to 81.

The male to female ratio was 4:45:1, with 49 males and 11 females. It was 50.42 ± 17.31 years old on average. The majority of incidents included individuals over 50 (Table 1). The profession has a big impact on illnesses.

Table 1: Age and gender distribution of necrotizing fasciitis in the study

Age in years	Male		Female		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
<20	2	4.1%	2	18.2%	4	6.7%
21-30	1	2.1%	1	9.1%	2	3.3%
31-40	10	20.4%	2	18.2%	12	20%
41-50	7	14.3%	1	9.1%	8	13.3%
51-60	14	28.6%	3	27.3%	17	28.3%
>60	15	30.6%	2	18.2%	17	28.3%
Total	49	0%	11	100%	60	100%
Mean \pm SD	52.27 \pm 17.1		42.18 \pm 16.71		50.42 \pm 17.31	

($P=0.081+$, Lower age was statistically significant for female with $P=0.081+$)

Of the 60 patients in the current study, 17 (28.3%) worked as farmers. Table 2 shows that 10 (16.7%) were housewives. The research revealed a possible relationship between the occupation and the severity of the condition.

Table 2: Occupation of patients participated in the study

Occupation	Number of patients	Percentage
Farmer	17	28.3%
Housewife	10	16.7%
Unskilled	12	20%
Service	9	15%
Skilled	10	16.7%
Not applicable	2	3.3%
Total	60	100%

According to the study, 32 (53.3%) patients had lower limb involvement, which was followed by perineum involvement in 18 (30%) patients and trunk involvement in 5 (8.3%) patients (Table 3).

Table 3: Site of infection in the patients (Confidence Interval with lower limit more than 50% was associated with statistical significance)

Site	Number of Patients	Percentage	95% CI
Lower limb	32	53.3%	40.89-65.37
Perineum	18	30%	19.90-42.61
Trunk	5	8.3%	3.61-18.07
Upper limb	4	6.7%	2.62-15.93
Anterior Abdominal wall	1	1.7%	0.3-8.96
Total	60	100%	-

In terms of symptoms, the majority of cases (57, 95%) had pain. Thirty-seven (61.7%) and thirty-five (58.3%) had fever and discharge, respectively. Table 4 further shows that blisters/skin vesicles occurred in 11 cases (18.3%) and swelling in 27 cases (45%).

Table 4: Symptoms at Presentation in the patients

Symptoms	Number of patients (n=60)	Percentage	95% CI
Pain	57	95%	86.30-98.29
Fever	37	61.7%	49.62-72.91
Discharge	35	58.3%	45.73-69.94
Swelling	27	45%	33.09-57.51
Blisters/Skin Vesicles	11	18.3%	10.56-29.52
Hyper pigmentation/Hard Texture of skin	8	13.3%	6.91-24.17

Thirty-three patients (55%), presented within a week, 19(31.7%) in 2 weeks and 8(13.3%) beyond 2 weeks. Mean duration of symptoms was 10.08 ± 10.09 days (Table 5).

Table 5: Duration of symptoms in the patients

Duration of symptoms	Number of patients (n=60)	Percentage
1-7 days	33	55%
8-14 days	19	31.7%
>14 days	8	13.3%
Mean ± SD: 10.08 ± 10.09		

Clinical signs of oedema and ulcer was present in 51(85%) & 46(76.7%) respectively (Table 6).

Table 6: Signs in the patients

Signs	Number of patients (n=60)	Percentage	95% CI
Pallor	6	10%	3.61-18.07
Oedema	51	85%	73.89-91.90
Ulcer	46	76.7%	64.56-85.56
Lymph Adenopathy	11	18.3%	10.56-29.92

The most frequent etiological factor, accounting for 18 (or 30%) of the cases, was trauma. In 4 patients (6.7%), there was no predisposing factor. Table 7 discusses the diversification of etiological components.

Table 7: Etiology in the patients

Etiology	Number of patients(n=60)	Percentage	95% CI
Trauma	18	30%	19.90-42.61
Alcoholism	8	13.3%	6.91-24.17
Native drug allergy	9	15%	8.10-26.11
RTA	6	10%	4.86-20.15
Insect bite	6	10%	4.86-20.15
Thorn prick	4	6.7%	2.62-15.93
Post-surgery	3	5%	1.71-13.70
Injection	2	3.3%	0.9-11.36
Abrasion	1	1.7%	0.3-8.86
Eczema	1	1.7%	0.30-8.86
Episiotomy sepsis	1	1.7%	0.30-8.86
Septic abortion	1	1.7%	0.30-8.86
IR Rays	1	1.7%	0.30-8.86
Idiopathic	4	6.7%	2.62-15.93

The most prevalent concomitant comorbid condition, affecting 23 patients (38.3%), was diabetes mellitus, followed by hypertension in 18 patients (30%). HIV positive status was present in two of the study's patients (Table 8).

Table 8: Associated co morbid conditions

Associated Co morbid conditions	Number of patients(n=60)	Percentage
1.DM	21	38.3
2.Hypertension	18	30
3.Smoking	11	18.3
4.CKD	9	15
5.COPD	8	13.3
6.CAD	6	10

7.Cirrhosis	3	5
8.HIV	2	3.3
9.Tuberculosis	2	3.3
10.Anemia	1	1.7
11.Eczema	1	1.7
12.Osteo arthritis	1	1.7
13.Sepsis	1	1.7
14.Idiopathic	10	16.7

The parameters in the laboratory were assessed. Based on a recently developed Laboratory Risk Indicator score for necrotizing fasciitis (LRINEC) by Wong et al. [6], it was observed that 11 (18.3%) patients had hemoglobin <10gm%, 18 (30%) had RBS >180mg/dl, 14 (23.3%) had serum creatinine >1.6 mg/dl, and 9 (15%) had sodium levels <128mEq/l. These findings are all risk indicators (Table 9).

Table 9: Laboratory investigations on admission

Blood parameters	No. of patients (n=60)	Percentage	95% CI
Hemoglobin gm%			
<10	11	18.3%	10.66-29.92
≥10	49	81.7%	70.08-89.44
RBS mg/dl			
<180	42	70%	57.49-80.10
≥180	18	30%	19.90-42.51
Serum creatinine mg/dl			
>1.6	46	76.7%	64.56-85.66
≥1.6	14	23.3%	14.44-35.44
Serum sodium mEq/L			
<128	9	15%	8.10-26.11
≥128	51	85%	73.89-91.90

In 37 (61.7%) patients, the culture was monomicrobial; in 22 (36.7%) patients, it was polymicrobial; and in 1.7% of patients, it was sterile. Of these 52 isolates, 8 (13.3%) were anaerobic and 8 (86.7%) were aerobic. (Table 10).

Table 10: Bacteriological study of the specimen tissue

Bacteriological Study	Number of patients(n=60)	Percentage	95%CI
Monomicrobial	37	61.7%	49.02-72.91
Polymicrobial	22	36.7%	25.62-49.32
Sterile	1	1.7%	0.3-8.86
Aerobic	52	86.7%	75.83-93.09
Anaerobic	8	13.3%	6.91-24.17

According to Table 11, the most frequently isolated bacteria were E. Coli from 21 patients (35%) and P. Aeruginosa from 14 patients (23.3%) and L. pneumoniae from 11 patients (18.3%). First, patients received a broad range antibiotic combination that included aminoglycosides, metronidazole, and second or third generation cephalosporins. Culture-based antimicrobials were then administered after that.

Table 11: Commonly identified bacteria

Commonly Identified Bacteria	Number of patients (n=60)	Percentage
E. Coli	21	35%
P. Aeruginosa	14	23.3%
K. Pneumoniae	11	18.3%
P. Mirabilis	7	11.7%
Cons	6	10%
S. Aureus	6	10%
MRSA	5	8.3%
P. Vulgaris	5	8.3%
Citrobacter	4	6.7%
NFGNB	4	6.6%
B.H. Streptococci (Gr. A)	4	6.6%
Acinetococcus	3	5%
Peptococcus	3	5%
Fusobacterium	2	3.3%

P. Species	2	3.3%
Psuedomonas	2	3.3%
Anaerobic cocci	1	1.7%
Bacteriods	1	1.7%
Citrobacter Freundii	1	1.7%
Enterobacter	1	1.7%
Enterococci	1	1.7%
P. Streptococcus	1	1.7%
	CONS: Coagulase Negative Staphylococcus	
	MRSA: Methicillin Resistant Staph Aureus	
	NFGNB: Non-Fermenting Gram Negative Bacilli	
	Group A BH: Group A Beta Haemolytic Streptococci	

Surgical treatment included debridement's in 57(95%), Fasciotomy 3(5%), followed by Split skin grafting in 21(35%) and secondary suturing in 17(28.3%) (Table 12).

Table 12: Treatment

Treatment	Number of patients	Percentage
Debridement	57	95%
Fasciotomy	3	5%
Split Skin Graft	2	35%
Secondary Suturing	17	28.33%

Duration of hospital stay, 9 patients stayed for more than 30 days (Table 13). The mortality rate was nil (0%).

Table 13: Hospital stay in days of studied patients

Hospital stays in days	Number of patients(n=60)	Percentage
<7 days	1	1.7%
7-14 days	12	20%
15-21 days	25	41.7%
22-30 days	13	21.7%
>30 days	9	15%

Discussion

Analyzing the prevalence and incidence of necrotizing fasciitis in hospitalized patients was the goal of the current study. Sepsis can occur from necrotizing fasciitis, which is typically accompanied by hypotension, fever, tachycardia, tachypnea, and test results showing leukocytosis and metabolic acidosis. Our research revealed that age was a significant factor in determining the disease's severity. The findings also showed a preponderance of men, which may be related to a higher risk of trauma and outdoor activities. Our findings are in line with earlier research conducted by Wilkerson et al. [10] and Childer et al. [11]. Necrotizing fasciitis has been associated with genitourinary infections, anorectal abscesses, instrumentation, septic abortions, insect bites, pustules, and minor surgeries. In our study, trauma accounted for thirty percent of the patients' predisposing factors.

The patients did not exhibit any etiological factors. When there is no recognized or identifiable etiologic cause, necrotizing fasciitis arises as primary or idiopathic fasciitis. It is yet unknown what causes idiopathic necrotizing fasciitis. These results coincided with those of Mukhopadhyay and colleagues [12]. Perineum (30%) and lower limbs (53.3%) were the most frequently affected sites in

our study. Other investigations, with the perineum being the most prevalent site, did not yield similar findings. A variation in hygiene could lead to a variation in the orunary site of infection. However, in line with our findings, Tian et al. [13] had reported that the infection was more prevalent in the lower limbs. The most prevalent co-morbid condition in our study (23%) was diabetes mellitus, which is consistent with the earlier findings by Kobayashi et al.[14]. Other co-morbid factors associated with necrotizing fasciitis include chronic alcoholism, drug abuse, corticosteroid use, immune-suppression, AIDS, malignancy, chronic obstructive lung disease, chronic venous or lymph insufficiency, obesity, malnutrition, peripheral vascular diseases, tuberculosis, and leprosy. In our series, other co - morbid factors noted were: hypertension in 18 patients (30%), CKD in 9(15%), COPD in 8(13.3%), CAD in 6(10%), Cirrhosis in 3(5%), Tuberculosis in 2(3.3%). Two patients were HIV positive. Tian et al. [13] reported similar previously.

Sixty-seven percent of the individuals in our study had monomicrobial infections. This is not consistent with other research indicating that the primary flora is polymicrobial illness. Of these 52 isolates, 8 (13.3%) were anaerobic and 8 (86.7%) were aerobic. In our investigation, E. Coli was the most often found and isolated bacteria from

diabetic patients' necrotic tissue. Others have shown that among the four prevalent organisms recovered from Type I necrotizing fasciitis, *E. Coli* was one. Necrotizing fasciitis can be fatally caused by *Pseudomonas aeruginosa*. *P. aeruginosa* was the most often isolated bacterium, accounting for 85% of 39 individuals with necrotizing fasciitis, according to earlier investigations. Before culture reports are available, broad spectrum antibiotics should be begun early in the course of treatment to combat gram positive, gram negative and anaerobic bacteria. The period of time between initial presentation and surgical debridement is the single most critical indicator of survival; according to Wipf et al. [15] the present study had revealed the incidence and precaution measures for effective treatment on Necrotizing Fasciitis.

Conclusion

Necrotizing A precise diagnosis of fasciitis, a potentially fatal soft tissue infection marked by severe necrosis, is essential for the patient's survival and depends on the clinical picture. The current study conducted a thorough analysis of the associated etiology, comorbidities, and demographic relationships. This study demonstrated that managing diabetes well may be a useful strategy to lessen the severity. It also demonstrated the part debridement had in the disease's eradication. The therapy of NF will benefit from these discoveries.

References

1. Sarani B, Strong M, Pascual J, et al. Necrotizing fasciitis: Current concepts and review of the literature. *J Am Coll Surg* 2009; 208:279.
2. Anaya DA, Dellinger EP. Necrotizing soft-tissue infection: Diagnosis and management. *Clin Infect Dis* 2007; 44:705-710.
3. Anaya DA, McMahan K, Nathens AB, et al. Predictors of mortality and limb loss in necrotizing soft tissue infections. *Arch Surg* 2005; 140:151-157.
4. Boyer A, Vargas F, Coste F, et al. Influence of surgical treatment timing on mortality from necrotizing soft tissue infections requiring intensive care management. *Intensive Care Med* 2009; 35:847-853.
5. McHenry CR, Piotrowski JJ, Petrinic D, et al. Determinants of mortality for necrotizing soft-tissue infections. *Ann Surg* 1995; 221:558-563.
6. Wong CH, Chang HC, Pasupathy S, et al. Necrotizing fasciitis: clinical presentation, microbiology, and determinants of mortality. *J Bone Joint Surg Am* 2003; 85:1454-1460.
7. Hsiao CT, Weng HH, Yuan YD, et al. Predictors of mortality in patients with necrotizing fasciitis. *Am J Emerg Med* 2008; 26:170-175.
8. Secil M, Topacoglu H. Retroperitoneal necrotizing fasciitis secondary to colonic diverticulitis. *J Emerg Med* 2008; 34:95-97.
9. Woodburn KR, Ramsay G, Gillespie G, et al. Retroperitoneal necrotizing fasciitis. *Br J Surg* 1992; 79:342-344.
10. Wilkerson R, Paull E, Coville FV. Necrotizing fasciitis. Review of the literature and case report. *Clin Orthop Related Res* 1987; 216:187-192.
11. Childers BJ, Potyondy LD, Nachreiner R, et al. Necrotizing fasciitis: A fourteen-year retrospective study of 163 consecutive patients. *Am Surg* 2002; 68:109.
12. Mukhopadhyay M, Saha AK, Biswas RR, Biswas S. A clinicopathological study of necrotizing fasciitis. *Diabetes*. 2011; 17:34.
13. Tian GJ, Guo Y, Zhang L. Non-invasive treatment for severe complex pressure ulcers complicated by necrotizing fasciitis: A case report. *J Med Case Reports* 2015; 9:1-4.
14. Kobayashi L, Konstantinidis A, Shackelford S, et al. Necrotizing soft tissue infections: delayed surgical treatment is associated with increased number of surgical debridements and morbidity. *J Trauma* 2011; 71:1400-1405.
15. Wipf SA, Greenhagen RM, Mandi DM, et al. Necrotizing soft tissue infection of the foot: A case report. *Foot Ankle J* 2008; 1:2.