A COMPARATIVE STUDY OF AMPUTATION IN LOWER EXTREMITY NECROTIZING FASCITIS IN DIABETIC AND NON DIABETIC PATIENTS

Abhayaratna Mogha[1], Renuka[1], Ramappa K[2]

[1] Junior Resident,[2] Professor, Department of general surgery, Navodaya medical College and research center , Raichur.

Corresponding Author:Dr. Ramappa K

Professor,Department of general surgery

Navodaya medical College and research center , Raichur

ABSTRACT

Objective: To compare the clinical characteristics, management, and outcomes of lower extremity necrotizing fasciitis in diabetic and non-diabetic patients, with a focus on amputation rates.

Methods: This prospective study included 88 patients with lower extremity necrotizing fasciitis, equally divided into diabetic and non-diabetic groups. Patient demographics, clinical presentation, etiological factors, microbiology, management, and outcomes were analyzed and compared between the two groups.

Results: The mean age of participants was 49.6 ± 6.3 years, with a male predominance (56.8%). Minor trauma was the most common etiological factor (52.3%). Streptococcus pyogenes was the most frequently isolated organism (62.5%). Split-skin grafting was the primary surgical intervention (77.3%). The overall amputation rate was 10.2%, with a higher rate in diabetic patients (15.9%) compared to non-diabetic patients (4.5%), although this difference was not statistically significant ($p>0.05$). Diabetic patients showed a significantly higher incidence of blisters (15.9% vs 0%, $p<0.05$) and a slightly longer mean hospital stay (22.8 ± 7.6 vs 21.07 ± 8.8 days, $p>0.05$).

Conclusion: While diabetes did not significantly affect most clinical features or outcomes of lower extremity necrotizing fasciitis, it was associated with a higher incidence of blisters and a trend towards increased amputation rates. These findings highlight the need for vigilant management of necrotizing fasciitis in diabetic patients to potentially reduce the risk of amputation.

Keywords: Necrotizing fasciitis, diabetes mellitus, amputation, lower extremity, surgical management

Introduction:

Over the ages, the phrase "necrotizing fasciitis" has evolved. A Confederate army surgeon named Joseph Jones reported over 2600 cases of "hospital gangrene" in 1871, during the American Civil War. According to one definition, necrotizing fasciitis (NF) is a severe soft-tissue infection that mostly affects the subcutaneous tissue and fascia, sparing the muscle and skin tissue in the process.[1] Even though the yearly prevalence of NF is only 0.3 per 100,000 people, timely detection and surgical management have been demonstrated to enhance patient outcomes.[2–6] Diabetics make for up to 44.5% of individuals with this illness.[5]

Necrotizing soft tissue infections are frequently seen in people with diabetes mellitus, peripheral vascular disease, and immunocompromised states. The death rate from necrotizing fasciitis can be decreased with the right drugs, debridement, and diagnosis.

A number of etiological factors, including trauma, abrasions, cuts, bruises, IV drug abuse, boils, insect bites, falls, burns, perineal abscess, bartholin abscess, balanitis, intramuscular injections, foreign body injury, or no history of trauma, can cause necrotizing fasciitis. Alternatively, the condition may arise spontaneously. Necrotizing fasciitis can result after the following post-surgical procedures: hip nailing, muscle biopsy, exploratory laprotomy, appendiciectomy, inguinal herniorrhaphy, gastrectomy, and aorto-illiac endarterectomy.[7]

Necrotizing fasciitis is linked to several coexisting illnesses. Diabetes mellitus, cirrhosis, alcoholism, chronic illness, immunosuppressive medications (such as prednisolone), malnourishment, age greater than sixty, peripheral vascular disease, renal failure, underlying cancer, obesity, chronic obstructive pulmonary disease, upper gastrointestinal bleeding, cardiac illness, alcoholism, cerebrovascular accident, acute pancreatitis, and pemphigus disease are among them.[8]

Necrotizing fasciitis can present with a variety of clinical symptoms, but frequently includes systemic symptoms such as fever, tachycardia, and leukocytosis, as well as local symptoms like edoema, skin erythema, soft tissue necrosis, and soft tissue crepitus surrounding the affected area.[6,9] Surgical procedures that have been previously reported include incision and drainage, extensive soft tissue debridement, and occasionally limb amputation. Surgeons have advised amputation over lengthy debridement in patients at high anaesthetic risk who have substantial tissue necrosis and quickly progressing infection because of the extensive soft tissue necrosis frequently observed in necrotizing fasciitis.[10]

While debridement methods frequently necessitate a "second look" surgery within 24 hours and improve the chance of death, amputation may decrease blood loss and require

fewer trips back to the operating room.[4,11] Research has indicated that individuals with congestive heart failure, diabetes mellitus, and renal failure are more susceptible to necrotizing fasciitis.[9,11-13]

Diabetes mellitus is associated with greater incidence of limb amputation, according to two studies that evaluated necrotizing fasciitis in patients with and without the disease. Nevertheless, neither study discovered a link between DM status and death. [14,15]

Diabetes mellitus patients' lower extremities necrotizing fasciitis has not been thoroughly studied. Furthermore, independent risk factors for lower extremity amputation (LEA) or mortality in patients with and without diabetes mellitus have not been found in the existing studies looking into lower extremity necrotizing fasciitis. Our objectives were to assess the characteristics of patients with lower extremity necrotizing fasciitis who had diabetes mellitus versus those who did not, and to analyse the risk factors for lower extremity amputation and postoperative mortality.

Methods:

This prospective study was conducted at Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka, India, over an 18-month period from November 2022 to May 2024. The study population comprised patients admitted with clinically diagnosed necrotizing fasciitis of the lower extremities. Patients aged 30-60 years were included, while those with necrotizing fasciitis in other body regions, pregnant females, and individuals outside the specified age range were excluded.

A sample size of 88 patients was determined based on previous literature, with 44 patients each in the diabetic (Group A) and non-diabetic (Group B) groups. Data collection was performed using a pre-tested, semi-structured questionnaire through direct interviews. Comprehensive patient histories were recorded, and thorough physical examinations were conducted, focusing on the extent of necrotizing fasciitis, presence of blisters/bullae, crepitus, ulceration, and tissue necrosis.

Baseline investigations were carried out for all patients. The management of necrotizing fasciitis was tailored according to its severity, and the sequelae were also addressed. Ethical clearance was obtained from the Institutional Ethics Committee, and informed consent was secured from all participants. The study adhered to the principles of autonomy, beneficence, non-maleficence, and justice.

Data analysis was performed using SPSS version 20. Descriptive statistics, including mean, median, standard deviation, and ranges, were calculated for quantitative data.

Appropriate tests of significance were applied, with $p<0.05$ considered statistically significant. The results were presented in tabular and graphical forms to compare outcomes between diabetic and non-diabetic patients with lower extremity necrotizing fasciitis.

Results:

The study included 88 patients with lower extremity necrotizing fasciitis, divided equally into diabetic (Group A) and non-diabetic (Group B) groups. The majority of patients were aged 51-60 years (48.9%), with a mean age of 49.6 ± 6.3 years. Males comprised 56.8% of the study population.

Most patients (55.7%) presented with symptoms lasting less than 5 days. The primary etiological factor was minor trauma (52.3%), followed by idiopathic causes (30.7%). All patients experienced swelling, with pain (83%) and ulceration (67%) being common symptoms.

Streptococcus pyogenes was the most prevalent organism in cultures (62.5%), followed by Pseudomonas (44.3%). The mean hospital stay duration was 21.9 ± 8.2 days.

Regarding treatment, 77.3% of patients underwent split-skin grafting, while 10.2% required amputation. Amputation rates were higher in diabetic patients (15.9%) compared to non-diabetic patients (4.5%), although this difference was not statistically significant ($p>0.05$).

There were no significant differences between diabetic and non-diabetic groups in terms of age distribution, gender, etiological factors, or cultured organisms ($p>0.05$). However, diabetic patients showed a significantly higher incidence of blisters (15.9% vs 0%, $p<0.05$) and a slightly longer mean hospital stay (22.8 ± 7.6 vs 21.07 ± 8.8 days, $p>0.05$).

Table 1: Comparison of various characteristics among study groups

Characteristic		**Diabetic**	**Non-diabetic**	**P value**
Age (in years)	**30-40**	4 (9.1%)	5 (11.4%)	>0.05
	41-50	18 (40.9%)	18 (40.9%)	
	51-60	22 (50%)	21 (47.7%)	
Gender	**Female**	18 (40.9%)	20 (45.5%)	>0.05
	Male	26 (59.1%)	24 (54.5%)	
Etiological factors	**Insect bite**	3 (6.8%)	4 (9.1%)	>0.05
	Minor trauma	22 (50%)	24 (54.5%)	
	Snake bite	1 (2.3%)	1 (2.3%)	
	Thorn prick	3 (6.8%)	3 (6.8%)	
	Idiopathic	15 (34.1%)	12 (27.3%)	
Symptoms	**Swelling**	44 (100%)	44 (100%)	>0.05
	Pain	36 (81.8%)	37 (84.1%)	>0.05
	Ulceration	29 (65.9%)	30 (68.2%)	>0.05
	Blisters	7 (15.9%)	0	**<0.05**

	Bullae formation	44 (100%)	44 (100%)	>0.05
Surgery performed	**Flap cover**	4 (9.1%)	7 (15.9%)	>0.05
	Primary closure	3 (6.8%)	6 (13.6%)	
	SSG	37 (84.1%)	31 (70.5%)	

Table 2: Comparison of outcomes among study groups

Characteristic		**Diabetic**	**Non-diabetic**	**P value**
Amputation		7 (15.9%)	2 (4.5%)	>0.05
Culture	**Streptococcus pyogenes**	29 (65.9%)	26 (59.1%)	>0.05
	Pseudomonas	18 (40.9%)	21 (47.7%)	>0.05
	Staphylococcus aureus	10 (22.7%)	7 (15.9%)	>0.05
	Klebsiella	3 (6.8%)	3 (6.8%)	>0.05
Duration of hospital stay		22.8±7.6	21.07±8.8	>0.05

Discussion:

Necrotizing fasciitis (NF) predominantly affects middle-aged to elderly individuals, with our study showing higher prevalence in patients over 50 years in both diabetic (50%) and non-diabetic (47.7%) groups, consistent with findings by Korhan et al.[16] and Rea et al.[17]

Males were more affected (56.8% overall), possibly due to higher exposure to outdoor activities and occupational risks, aligning with studies by Shiakh et al.[18] and Jain et al.[7]

Streptococcus pyogenes was the most commonly isolated pathogen in both diabetic (65.9%) and non-diabetic (59.1%) groups, differing from findings by Wang et al.[19] and Legbo et al.[20], but consistent with Khamuan et al.[21] However, organism identification can be challenging, as noted by Yu et al.[22] and others.[23].

Minor trauma was the primary etiological factor in both groups (50% in diabetic, 54.5% in non-diabetic), supporting Mittal et al.'s[24] findings.

The amputation rate was higher in diabetic patients (15.9%) compared to non-diabetic patients (4.5%), consistent with Cheng et al.[25] and other studies.[26,27] This underscores diabetes as a significant risk factor for amputation in NF cases.

Split skin grafting was the most common surgical procedure (84.1% in diabetic, 70.5% in non-diabetic group), aligning with Rajappan K et al.'s[28] findings.

The mean hospital stay was slightly longer for diabetic patients (22.8±7.7 days) compared to non-diabetic patients (21.07±8.8 days), though shorter than reported by Cheng et al.[25]

This study highlights the impact of diabetes on NF outcomes, particularly in terms of amputation rates, emphasizing the need for vigilant management in diabetic patients with NF.

Conclusion:

A potentially fatal infection of the fascia and subcutaneous tissue is called necrotizing fasciitis. Patients with diabetes mellitus have higher rates of morbidity and mortality, including longer hospital stays, a higher amputation rate, and more debridements. The cornerstones of management are early diagnosis and vigorous debridement. Early on in the clinical process, aggressive surgical debridement can stop the disease process and improve the patient's prognosis. Debridement alone is insufficient for diabetes patients who have been ignored; in certain situations, amputation may be necessary. Despite prompt identification and vigorous treatment, the condition nevertheless has a high death and morbidity rate. Surgical management needs to be aggressive, with standard operating procedures being adhered to. Treatment techniques such as VAC and HBOT may be explored.

References:

1. Lin C, Yeh FL, Lin JT, Ma H, Hwang CH, Shen BH, et al. Necrotizing fasciitis of the head and neck: an analysis of 47 cases. Plast Reconstr Surg. 2001;107(7):1684–93
2. Centers for Disease Control and Prevention. Active Bacterial Core Surveillance (ABCs). ABCs Report: Group A Streptococcus, 2016. Atlanta, GA: Centers for Disease Control and Prevention; 2016. https://www.cdc.gov/abcs /reports-findings/survreports/gas16.html.
3. Majeski JA, Alexander JW. Early diagnosis, nutritional support, and immediate extensive debridement improve survival in necrotizing fasciitis. Am J Surg. 1983;145:784-787.
4. Wong CH, Yam AK, Tan AB, Song C. Approach to debridement in necrotizing fasciitis. Am J Surg. 2008;196:e19-e24.
5. McHenry CR, Piotrowski JJ, Petrinic D, Malangoni MA. Determinants of mortality for necrotizing soft-tissue infections. Ann Surg. 1995;221:558-565.
6. Brook I, Frazier EH. Clinical and microbiological features of necrotizing fasciitis. J Clin Microbiol. 1995;33:2382-2387.
7. Jain A, Varma A, Mangalanandan Kumar PH, Bal A. Surgical outcome of necrotizing fasciitis in diabetic lower limbs. J Diab Foot Comp. 2009;4(1):80-4.
8. Shaikh N, Abdel Rahman H, Hanssens Y, Najyemuddin M. Necrotizing fasciitis and its association with Diabetes Mellitus. Qatar Medical J. 2009;18(1):136-4.
9. Gozal D, Ziser A, Shupak A, Ariel A, Melamed Y. Necrotizing fasciitis. Arch Surg. 1986;121:233-235.

10. Tang WM, Ho PL, Fung KK, Yuen KY, Leong JC. Necrotising fasciitis of a limb. J Bone Joint Surg Br. 2001;83: 709-714.
11. Wong CH, Chang HC, Pasupathy S, Khin LW, Tan JL, Low CO. Necrotizing fasciitis: clinical presentation, microbiology, and determinants of mortality. J Bone Joint Surg Am. 2003;85-A:1454-1460.
12. Roje Z, Matić D, Librenjak D, Dokuzović S, Varvodić J. Necrotizing fasciitis: literature review of contemporary strategies for diagnosing and management with three case reports: torso, abdominal wall, upper and lower limbs. World J Emerg Surg. 2011;6:46.
13. Sudarsky LA, Laschinger JC, Coppa GF, Spencer FC. Improved results from a standardized approach in treating patients with necrotizing fasciitis. Ann Surg. 1987;206:661-665.
14. Cheng NC, Tai HC, Chang SC, Chang CH, Lai HS. Necrotizing fasciitis in patients with diabetes mellitus: clinical characteristics and risk factors for mortality. BMC Infect Dis. 2015;15:417.
15. Tan JH, Koh BT, Hong CC, et al. A comparison of necrotising fasciitis in diabetics and non-diabetics: a review of 127 patients. Bone Joint J. 2016;98-B:1563-1568.
16. Taviloglu K, Cabioglu N, Cagatay A, Yanar H, Ertekin C, Baspinar I, Ozsut H, Guloglu R: Idiopathic necrotizing fasciitis: risk factors and strategies for management. Am Surg 2005, 71:315- 320.
17. Rea WJ, Wyrick WJ Jr. Necrotizing fasciitis. Ann Surg. 1970 Dec;172(6):957-64.
18. Shaikh N. Necrotizing fasciitis: A decade of surgical intensive care experience. Indian J Crit Care Med. 2006;10(4):225–9.
19. Wang, J. M., & Lim, H. K. (2014). Necrotizing fasciitis: eight-year experience and literature review. The Brazilian journal of infectious diseases: an official publication of the Brazilian Society of Infectious Diseases, 18(2), 137–143.
20. Legbo, Jacob & Shehu, Bello. (2006). Necrotizing fasciitis: A comparative analysis of 56 cases. Journal of the National Medical Association. 97. 1692-7.
21. Khamnuan P, Chongruksut W, Jearwattanakanok K, Patumanond J, Tantraworasin A: Necrotizing fasciitis: epidemiology and clinical predictors for amputation. Int J Gen Med. 2015, 8:195-202.

22. Yu SN, Kim TH, Lee EJ, et al.: Necrotizing fasciitis in three university hospitals in Korea: a change in causative microorganisms and risk factors of mortality during the last decade. Infect Chemother. 2013, 45:387-93
23. Awsakulsutthi S: A retrospective review of necrotizing fasciitis in Thammasat University Hospital . J Med Assoc Thai. 2010, 7:246-53.
24. Mittal S, Singh B, Mittal R, Singh K. A prospective study of cases with necrotising fasciitis: Our experience at a tertiary care teaching hospital. International Surgery Journal. 2017;4(10):3326. doi:10.18203/2349-2902.isj20174164
25. Cheng NC, Wang JT, Chang SC et al. Necrotizing fasciitis caused by Ataphylococcus aureus: the emergence of methicillin-resistant strains. Ann Plast Surg 2011; 67: 632–636.
26. Espandar R, Sibdari SY, Rafiee E, Yazdanian S: Necrotizing fasciitis of the extremities: a prospective study. Strategies Trauma Limb Reconstr. 2011, 6:121-5. 10.1007/s11751-011-0116-1 19.
27. Ahn J, Raspovic KM, Liu GT, Lavery LA, La Fontaine J, Nakonezny PA, Wukich DK: Lower extremity necrotizing fasciitis in diabetic and nondiabetic patients: mortality and amputation. Int J Low Extrem Wounds. 2019, 18:114-21. 10.1177/1534734619836464 2
28. Rajappan K. Comparative study on the incidence of Necrotizing fasciitis in Diabetics and Non diabetics and its outcome. TNMGRMU Reposit. 2011;1(4):1.