European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 07, Issue 11, 2020

Original research article

Evaluation of the prognostic outcome of necrotizing fasciitis among diabetics and non-diabetics: comparative study.

Dr. Shiv Narayan Singh[1*]

[1]Assistant Professor, Department of General Surgery, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

Corresponding Author: Dr. Shiv Narayan Singh

Abstract

Aim: The aim of the present study was to determine the prognostic outcome of necrotizing fasciitis patientswith and without diabetes mellitus.

Material and methods: The cross sectional comparative study was conducted in the department of General Surgery, Anugrah Narayan Magadh Medical College and Hospital , Gaya, Bihar, India for 2 years.100 cases of necrotizing fasciitis were equally divided into two groups, Group A for necrotizing fasciitis patients with diabetes mellitus and Group B for necrotizing fasciitis patients without diabetes mellitus. Hemoglobin, total leucocyte count, differential count, ESR, FBS, HbA1cand corresponding urine sugar on regular basis were investigated foe all the patients. Wound discharge for culture and sensitivity. were also done all the patients.

Results: The mean ageis higher (57.1±14.33) in group A than group B (52.23±14.85). Out of 50 patients in group A, 10 (20%) were female, 40 (80%) were males. Out of 50 patients in group B, 8 (16%) were female, 42 (84%) were males. Out of 50 patients in group A, upper extremity was involved in 2 patients (4%), lower extremities were involved in 43 (86%) patients. Scrotum was involved in 3 (6%) patients, back was involved in2 (4%) patient. Out of 50 patients in group B, upper extremity was involved in 4(8%) patient, lower extremities were involved in 45 (90%), scrotum was involved in one (2%) patient. Out of 50 patients in group A, electrocution was the etiological factor in 1 (2%) patient, insect bite was the etiological factor in 3 (6%) patients, intramuscularinjection was the etiological factor in 2 (4%) patient, trauma was the etiological factor in 25 (50%) patients andno etiological factor was found in 19 (38%) patients. Outof 50 patients in group B, insect bite was etiologicalagent in 1 (2%) patient, thorn prick was etiologicalagent in 1 (2%), trauma was etiological agent in 23 (46%) patients, no etiological agent was identified in 25 (50%) patients. Out of 50 patients in group A, 45(90%) undergone split skin grafting surgery, 3(6%) undergone flap cover surgery and primary closure was done in 2 (4%) patient.

Conclusion: Early diagnosis and aggressive debridement in necrotizing fasciitis patients results in better outcomes.

Keywords: Necrotizing fasciitis, Diabetes mellitus, Debridement, Amputation

Introduction

Necrotizing fasciitis (NF) has been defined as a severe soft-tissue infection that causes extensive necrosis of subcutaneous tissue and fascia, relatively sparing the muscle and skin tissue.[1] As the disease progresses, thrombosis of the affected cutaneous perforators subsequently devascularizes the overlying skin, causing skin necrosis and haemorrhagic bullae to form. Bacteraemia and sepsis invariably develop when the infection is well established.[2] Despite aggressive treatment, the reported case fatality rate for NF remains high at a cumulative rate up to 34 %.[3] In the literature, most NF patients have pre-existing medical conditions, including gout, peripheral arterial occlusive disease, myelodysplastic syndrome, liver cirrhosis,

and other immunosuppressive conditions.[4-7] Diabetes mellitus (DM) has been reported to be a common underlying disease in NF patients, accounting for 44.5–72.3 % in various series.[1,6,8,9] Diabetic patients exhibit impaired cutaneous wound healing and increased susceptibility to infection, which may affect the course of soft-tissue infections.[10] It is thus reasonable to speculate that this chronic, debilitating disease contributes to a more serious nature of NF Based on bacterial culture results, NF is classified into the following categories: type I, which consists of synergistic polymicrobial infection; type II, representing infections caused by group A Streptococcus alone or combined with Staphylococcus; and type III, which comprises infections caused by Vibrio species.[11] However, recent studies have revealed emerging monomicrobial pathogens of NF, such as methicillin-resistant Staphylococcus aureus (MRSA), indicating that the bacteriology of the causative agent of NF is constantly changing.[12-14] Moreover, certain causative agents of NF, including Klebsiella pneumonia, are more likely to involve underlying immunocompromising conditions.[8] Therefore, exploration of the bacteriology of NF patients with specific underlying conditions is of great value in guiding the empirical antimicrobial therapy. In necrotizing fasciitis anaerobic organism proliferate in an environment of local tissue hypoxia. So this is the reason necrotizing fasciitis is most commonly associated with diabetes mellitus. High blood sugar in necrotizing fasciitis patients provides a good medium for bacterial growth and predisposes to an environment of low oxygen tension. Diabetics also cause defective phagocytosis, decreased cellular immunity and micro-vascular disease with resultant ischemia. As the condition evolves, ischemic necrosis of the skin develops with gangrene of the subcutaneous fat, dermis and epidermis, manifests progressively as bullae formation, ulceration and skin necrosis.[15] The aim of the present study was to determine the prognostic outcome of necrotizing fasciitis patientswith and without diabetes mellitus.

Material and methods

The cross-sectional comparative study was conducted in the Department of General Surgery, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India for 2 years, after taking the approval of the protocol review committee and institutional ethics committee.100 cases of necrotizing fasciitis were equally divided into two groups, Group A for necrotizing fasciitis patients with diabetes mellitus and Group B for necrotizing fasciitis patients without diabetes mellitus. Both groups were having men and women in age groupof 18-70 years with the signs and symptoms of necrotizing fasciitis were included in this study. Patients below 18 years of age and patients who left the treatment against the medicaladvice were excluded from this study.

Methodology

Signs and symptoms of necrotizing fasciitis includes intense pain and tenderness over the involved skin and underlying muscle. It is associated with fever, malaise and myalgias. Other findings include edema extending beyond the areas of erythema, skin vesicles and crepitus. In some cases subcutaneous tissue have a wooden, hardened feel. Medical management was done according to wound swab culture sensitivity report. Hemoglobin, total leucocyte count, differential count, ESR, FBS, HbA1cand corresponding urine sugar on regular basis were investigated foe all the patients. Wound discharge for culture and sensitivity were also done all the patients.

Results

The present study of 100 patients in age group of 18-70 years having signs and symptoms of necrotizing fasciitis were observed after taking informed consent. Patientswere divided into two groups of 50each. Group A: (n=50) necrotizing fasciitis patients with Diabetes mellitus.

Group B: (n=50) necrotizing fasciitis patients without diabetes mellitus. Table 1 shows that out of 50 patients in group A, 3(6%) was<30-year age, 3 was 30-40 (6%) years, 15 (30%) were in between 40-50 years, 29 (58%) were>50 years. Out of 50 patients in Group B, 18 (36%) were<30 years, 7 (14%) were in between 30-40 years, 10 (20%) patients were 40- 50 years and 15 (30%) were>50 years age. The mean ageis higher (57.1±14.33) in group A than group B (52.23±14.85) and data is statistically insignificant as p>0.05.

Table 1: Age distribution of subjects & mean age inboth the study groups.

Age (years)	**Group A**		**Group B**	
	N	**%**	**n**	**%**
Below 30	3	6	18	36
30-40	3	6	7	14
40-50	15	30	10	20
Above 50	29	58	15	30
Total	25	100	50	100
Mean±SD	57.1±14.33		52.23±14.85	
P value	0.273			

Out of 50 patients in group A, 10 (20%) were female, 40 (80%) were males. Out of 50 patients in group B, 8 (16%) were female, 42 (84%) were males. From the above observation, male predominance is present in both the groups and data is statistically insignificant as p>0.05 as shown in Table 2.

Table 3 shows that out of 50 patients in group A, upper extremity was involved in 2 patient (4%), lower extremities were involved in 43 (86%) patients. Scrotum was involved in 3 (6%) patients, back was involved in2 (4%) patient. Out of 50 patients in group B, upper extremity was involved in 4(8%) patient, lower extremities were involved in 45 (90%), scrotum was involved in one (2%) patient. From this observation most common site involved in both the groups is lower extremity and data is statistically insignificant as p>0.05.

Table 2: Gender distribution of subjects in both thestudy groups.

	Group A		Group B	
Gender	N	%	N	%
Female	10	20	8	16
Male	40	80	42	84
Total	50	100	50	100

X^2 (df: 1, n=100)=1.39, p=0.287

Table 3: Distribution of subjects on the basis of siteinvolved in both the study groups.

Group A			**Group B**	
	N	%	N	%
Upper Extremity	2	4	4	8
Lower Extremity	43	86	45	90
Scrotum	3	6	1	2
Back	2	4	0	0.00
Total	50	100	50	100

X^2 (df: 5, n=100)=3.98, p=0.562

Out of 50 patients in group A, electrocution was the etiological factor in 1 (2%) patient, insect bite was the etiological factor in 3 (6%) patients, intramuscularinjection was the etiological factor in 2 (4%) patient, trauma was the etiological factor in 25 (50%) patients and no etiological factor was found in 19 (38%) patients. Outof 50 patients in group B, insect bite was etiologicalagent in 1 (2%) patient, thorn prick was etiologicalagent in 1 (2%), trauma was etiological agent in 23 (46%) patients, no etiological agent was identified in 25 (50%) patients. From the above observation most common etiological agent identified in group A was trauma and in group B was idiopathic and data is statistically insignificant as p>0.05 as depicted in Table 4.

Table 4: Distribution of subjects on the basis ofetiological factors in both the study groups.

Etiological factors	**Group A**		**Group B**	
	N	**%**	**N**	**%**
Electrocution	1	2	0	0.00
Insect bite	3	6	1	2
Intramuscular Injection	2	4	0	0.00
Thorn Pick	-	0.00	1	2
Trauma	25	50	23	46
No	19	38	25	50
Total	50	100	50	100

X^2 (df: 5, n=100)=3.944, p=0.623

Table 5 depicted that out of 50 patients in group A, 45(90%) undergone split skin grafting surgery, 3(6%) undergone flap cover surgery and primary closure was done in 2 (4%) patient. Out of 50 patients in group B, 36(72%) patients undergone split skin grafting, 3 (6%) patients undergone flap cover surgery and 11 (22%) patients undergone primary closure. In both the groups split skin surgery was the most common definitive surgery performed and data is statistically insignificant p>0.05.

Table 5: Distribution of subjects on the basis ofdefinitive surgery in both the study groups

Definitive Surgery	**Group A**		**Group B**	
	N	**%**	**N**	**%**
SSG	45	90	36	72
Flap cover	3	6	3	6
Primary closure	2	4	11	22
Total	50	100	50	100

X2 (df: 1, n=100)=1.127, p=0.325

Out of 50 patients in group A, amputation was performed in 5 (10%) patients and amputation was not required in 45 (90%) patients. Out of 50 patients in group B, amputation was performed in 1 (2%) patient and amputation was not required in 49 (98%) patients. From this observation, more number of amputations were performed in group A as compared to group B. The comparison of both the groups is statistically insignificant(p>0.05) as shown in Table 6.

Table 6: Distribution of subjects on the basis of requirement of amputation in both the study groups.

Amputation	Group A		Group B	
	N	%	N	%
No	45	90	49	98
Yes	5	10	1	2
Total	50	100	50	100

X^2 (df: 1, n=100)=1.16, p=0.398

Table 7 shows that the mean hospital stay in days ingroup A was 27.36±12.16 and mean hospital stay in days in group B was 19.77±77. The mean hospital stays in days found to be higher in group A as compared to group B. Comparison of both the groups was found to be statistically significant (p<0.05).

Table 8 shows that out of 50 patients in group A, 37 (74%) patients underwent 1 debridement, 15(30%) patients underwent 2 debridements and 3(6%) patient underwent 3 debridements. Out of 50 patients in group B, 41(82%) patients underwent 1 debridement, 9 (18%)patients underwent 2 debridement's. The number of debridements required was more in group A as compared to group B. Comparison of both the groups was found to be statistically significant (p<0.05).

Table 8: Distribution of subjects on the basis ofdebridement in both the study groups

Number of debridement	Group A		Group B	
	N	%	N	%
1	37	74	41	82
2	15	30	9	18
3	3	6	-	-
Mean±SD	1.41±0.63		1.11±0.32	
P value	0.028			

Table 9 shows that out of 50 patients in group A, swab culture sensitivity report of 14(28%) patients had *E. coli* growth, 9 (18%) had *Klebsiella pneumonia* growth, 9(18%) patients had *Pseudomonas aeruginosa* growth, 16 (32%) patients had *Staph aureus* growth, 1(2%) patients had *Burkhoederia cepacia* growth and 1 (2%) patientshad no growth. Out of 50 patients in group B, swabculture sensitivity of 1 (2%) patient had *Acinobacter baumanii* growth, 5 (10%) had *E coli* growth, 11(22%) patients had *Klebsiella pneumonia* growth, 13 (26%) patients had *Pseudomonas aeruginosa* growth, 5(10%) patients had staph aureus growth and 15 (30%) patients had no growth. From this observation, most common organism isolated in group A is staph aureus and most common organism isolated in group B is *Pseudomonas aeruginosa*. The data is statistically insignificant as p>0.05.

Table 9: Distribution of subjects on the basis of swabculture in both the study groups

Swab C/S	Group A		Group B	
	N	%	N	%
Acinobacter Baumanii	-	-	1	2
E Coli	14	28	5	10
Klebsiella Pneumoniae	9	18	11	22

Pseudomonas Aeruginosa	9	18	13	26
Staph Aureus	16	32	5	10
Burkhoederia Cepacia	1	2	-	-
No growth	1	2	15	30
	50	100	50	100

X^2 (df: 6, n=100)=9.324, p=0.184

Discussion

Males are more commonly involved with necrotizing fasciitis. The reason could be males are more commonly involved in outdoor activities and work place hazards. Minor injuries are common at work place. Shiakh conducted a study on necrotizing fasciitis: A decade of surgical care experience. 94 patients with necrotizing fasciitis were included in their study. He concluded that disease is more prevalent in males (75.5%) than females (24.5%).[16] In another study by Jain et al. on surgical outcome of necrotizing fasciitis in diabetic lower limbs. They reported that male to female ratio is 3:1.[17] Similarly in our study disease is more prevalent in males, 80% in group A and 84% in group B.

Necrotizing fasciitis can occur at any age group, but the most common age group involved is middle age to old age. This might be due to occurrence of risk factors in these age groups. Korhan et al. conducted a study on idiopathic necrotizing fasciitis: risk factors and strategies for management. Theyconcluded that necrotizing fasciitis is prevalent in patient age>55 years and median age is 60 years. In anotherstudy conducted by Rea et al. on necrotizing fasciitis, they reported that disease is more prevalent in 50-59-yearage group patients. In our study necrotizing fasciitis is more prevalent in patients>50 years of age in group A, while in group B most patients affected are<30 years of age. The mean ageis higher (57.1±14.33) in group A than group B (52.23±14.85) and data is statistically insignificant as p>0.05.

Most common site involved in necrotizing fasciitis is lower limb. This might be due to lower limbs being commonly injured by trauma. Wang et al. conducted a study on necrotizing fasciitis: eight-year experience and literature review. They included 115 patients in their study. In their study most common site involved with necrotizing fasciitis was lower limb (61%), followed by upper limb (10%), trunk (13%), perineum & scrotum (10%) and head and neck in order (3%). In Rea et al conducted a study on necrotizing fasciitis. They reported that most common site of occurrence is lower extremity followed by upper extremity, abdomen, inguinal region. Back and buttocks and subcostal region. Another prospective study of cases with necrotizing fasciitis: experience at a tertiary care hospital by Mittal et al they included 50 patients in their study. They concluded that most common site involved in necrotizing fasciitis is lower extremity (34 patients), followed by scrotum (10 patients), upper extremity (4 patients) and face (2patients). Similarly, in our study, out of 50 patients in group A, upper extremity was involved in 2 patients (4%), lower extremities were involved in 43 (86%) patients. Scrotum was involved in 3 (6%) patients, back was involved in2 (4%) patient. Out of 50 patients in group B, upper extremity was involved in 4(8%) patient, lower extremities were involved in 45 (90%), scrotum was involved in one (2%) patient.

Swab culture is important for the management ofnecrotizing fasciitis. On the basis of swab culturesensitivity report patient can be managed by appropriate antibiotics. On swab culture sensitivity of patients with necrotizing fasciitis growth can be monomicrobial or polymicrobial. In study by Wang et al on necrotizingfasciitis: eight-year experience and literature review. They reported that most common microorganism isolated in patients with necrotizing fasciitis is staph aureus, followed by streptococci, *E coli*, *klebsiella pneumonia*, enterobacter species

and *proteus mirabilis*. In another study conducted by Legbo of necrotizing fasciitis. They concluded that the most common organism isolated on Swab culture sensitivity from infected area is staph aureus (60.7%). followed by pseudomonas aeruginosa (51.8%), klebsiella species (50%), *streptococcus pyogenes* (46.2%), *E. coli* (37.5%) in order. While no growth in 8.9% of cases. Similarly, in our study, out of 50 patients in group A, swab culture sensitivity report of 14(28%) patients had *E. coli* growth, 9 (18%) had *Klebsiella pneumonia* growth, 9(18%) patients had *Pseudomonas aeruginosa* growth, 16 (32%) patients had *Staph aureus* growth, 1(2%) patients had *Burkhoederia cepacia* growth and 1 (2%) patientshad no growth. Out of 50 patients in group B, swabculture sensitivity of 1 (2%) patient had *Acinobacter baumanii* growth, 5 (10%) had *E coli* growth, 11(22%) patients had *Klebsiella pneumonia* growth, 13 (26%) patients had *Pseudomonas aeruginosa* growth, 5(10%) patients had staph aureus growth and 15 (30%) patients had no growth. From this observation, most common organism isolated in group A is staph aureus and most common organism isolated in group B is *Pseudomonas aeruginosa*.

The data is statistically insignificant as $p>0.05$.
Mittal conducted a prospective study of cases with necrotizing fasciitis: experience at a tertiary care hospital.They included 50 patients in their study over a period of 3 years. They reported that most common etiological factor in patients was trauma. More than two- thirds (78%) of the patients presented with history of trivialtrauma. The other common cause was post insect bite.44 Similarly, in our study most common etiological factorsin both the groups is trauma (50% in group A and 46% in group B). Other etiological factors are insect bite, intramuscular injection, thorn prick and electrocution.

Ekka et al conducted a study on necrotizing fasciitis.They observed that debridement and fasciotomy were the main stay of management. They included 60 patients in the study. Out of 60 patients, 14 patients required amputation (23.33%). Diabetes mellitus was the only co-morbidity that was significantly associated with limb loss ($p=0.02$). Cheng et al conducted a study on necrotizing fasciitis. They compare clinical characteristics of the non-diabetics and diabetic patients. They reported that amputation rate was more in diabetic patients (24%) as compared to non- diabetic patients (11%).[18] Similarly in our study, amputation rate is more in group A patient (10%) as compared to group B patients (2%). Cheng et al also reported that mean hospital stay in days in diabetic patients was 39.1±28.6 and non-diabetics was 41.1±38.4.18[19] In our study, the mean hospital stay in days ingroup A was 27.36±12.16 and mean hospital stay in days in group B was 19.77±77. The mean hospital stays in days found to be higher in group A as compared to group B. Necrotizing fasciitis involves skin and subcutaneous tissues. After debridement wound is closed by split skin grafting or by primary closure in small wounds. Rajappan K conducted a comparative study on the incidence of necrotizing fasciitis in diabetic and non- diabetic and its outcome. They included 50 patients in their study. They reported that most common surgery performed was split skin grafting in diabetic (52.9%) and non- diabetic (43.8%) patients.[19] Similarly in our study, most common surgery performed is split skin grafting, 90% in group A and 78% in group B.

Surgical debridement is a mandatory life saving step and should be performed as soon as possible. The most important determinants of mortality are the timing and adequacy of debridement. Surgical debridement must be done until brisk bleeding occurs from adjacent overlying subcutaneous tissues and underlying muscles, if involved. All necrotic tissues, including fascia must be removed to reduce the bacterial load, stimuli to inflammation and facilitate recovery. In addition, as it exposes tissues to oxygen, surgery may prove antagonistic to anaerobic bacteria. The wound should be bluntly probed in all directions, especially in highly

suspected areas such as pockets or subcutaneous or submuscular extension of infection. Repeated debridements may be necessary (as dictated by the state of the wound) until the infections is adequately controlled. Tissues are often edematous and highly secreting, so wounds are usually left open after debridement. Second debridement is done only if needed.

Conclusions

Early diagnosis and aggressive debridement in necrotizing fasciitis patients results in better outcomes.

Reference

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. Green RJ, Dafoe DC, Raffin TA. Necrotizing fasciitis. Chest. 1996;110(1):219–29.
3. McHenry CR, Piotrowski JJ, Petrinic D, Malangoni MA. Determinants of mortality for necrotizing soft-tissue infections. Ann Surg. 1995;221(5):558–63. discussion 563–555.
4. Cheng NC, Tai HC, Tang YB, Chang SC, Wang JT. Necrotising fasciitis: clinical features in patients with liver cirrhosis. Br J Plast Surg. 2005;58(5):702–7.
5. Tang WM, Ho PL, Fung KK, Yuen KY, Leong JC. Necrotising fasciitis of a limb. J Bone Joint Surg (Br). 2001;83(5):709–14.
6. 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(8):1454–60.
7. Yu KH, Ho HH, Chen JY, Luo SF. Gout complicated with necrotizing fasciitis–report of 15 cases. Rheumatology (Oxford). 2004;43(4):518–21.
8. Cheng NC, Yu YC, Tai HC, Hsueh PR, Chang SC, Lai SY, et al. Recent trend of necrotizing fasciitis in Taiwan: focus on monomicrobial Klebsiella pneumoniae necrotizing fasciitis. Clin Infect Dis. 2012;55(7):930–9.
9. Goh T, Goh LG, Ang CH, Wong CH. Early diagnosis of necrotizing fasciitis. Br J Surg. 2014;101(1):e119–25.
10. Giaccari A, Sorice G, Muscogiuri G. Glucose toxicity: the leading actor in the pathogenesis and clinical history of type 2 diabetes - mechanisms and potentials for treatment. Nutr Metab Cardiovasc Dis. 2009;19(5):365–77.
11. Giuliano A, Lewis Jr F, Hadley K, Blaisdell FW. Bacteriology of necrotizing fasciitis. Am J Surg. 1977;134(1):52–7.
12. Cheng NC, Wang JT, Chang SC, Tai HC, Tang YB. Necrotizing fasciitis caused by staphylococcus aureus: the emergence of methicillin-resistant strains. Ann Plast Surg. 2011;67(6):632–6.
13. Lee CY, Kuo LT, Peng KT, Hsu WH, Huang TW, Chou YC. Prognostic factors and monomicrobial necrotizing fasciitis: gram-positive versus gram-negative pathogens. BMC Infect Dis. 2011;11:5.
14. Miller LG, Perdreau-Remington F, Rieg G, Mehdi S, Perlroth J, Bayer AS, et al. Necrotizing fasciitis caused by community-associated methicillin-resistant Staphylococcus aureus in Los Angeles. N Engl J Med. 2005;352(14):1445–53.
15. Witt C, Dissanaike S. Demographics, Microbiology and outcome in necrotizing soft tissue infections. Southwest Respirat Critic Care Chronic. 2013;1(1):4-10.
16. Shaikh N. Necrotizing fasciitis: A decade of surgicalintensive care experience. Indian J Crit Care Med. 2006;10(4):225–9.
17. 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
18. Cheng NC, Tai HC, Chang SC, Chang CH, Lai HS. Necrotizing fasciitis in patients with

diabetes mellitus: clinical characteristics and risk factors for mortality. Bio Med Cent Infect Diseas. 2015;15(1):41

19. Rajappan K. Comparative study on the incidence of Necrotizing fasciitis in Diabetics and Non diabetics and its outcome. TNMGRMU Reposit. 2011;1(4):1.

Received: 15-09-2020 // Revised: 30-10-2020 // Accepted: 18-11-2020