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Original Article

To Study and Compare the Necrotizing Fasciitis in Diabetics and Non-Diabetics Patients in Tertiary Care Hospital

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Introduction: Necrotizing fasciitis is a rare disease potentially life-threatening infection of fascia, subcutaneous tissue with occasionally muscular involvement. Necrotizing Fasciitis is a surgical emergency with high morbidity and mortality (carries a mortality of 10 to 25%).

Aims: Ais of the study, is to compare necrotizing fasciitis in diabetic and non-diabetic patients concerning age, sex, and duration of symptoms, site of involvement, causative organism, duration of hospital stay, and its outcome.

Materials and methods: In this study mean age was 54.81 years for diabetics and 44.06 years for non-diabetics, which implies Necrotizing Fasciitis is more common in middle-aged persons. This is a prospective study in Bhim Rao Ambedkar Hospital in Raipur Department of General Surgery.

Result: In both the group most common micro-organisms found in culture was *Staphylococcus* (43% in Diabetics and 45% in Non-Diabetics). The second most common micro-organism was *Streptococcus* (39% in Diabetics and 35% in Non-Diabetics). Other significant micro-organisms found were *Klubsella Pneumococcus* and polymicrobial. P Value 0.410 > 0.05 There is no statically significant; there is no difference in micro-organism culture between Diabetics and Non- Diabetics. Trauma was the most common predisposing cause in both groups (55.8% in diabetes and 62.8% in non-diabetes).

Conclusion: In conclusion, the study reveals several key insights into necrotizing fasciitis, highlighting significant differences and similarities between diabetic and non-diabetic patients. Diabetic patients, typically over 60 years old, and non-diabetic patients, generally under 40 years old, both show a higher prevalence of necrotizing fasciitis among males, with trauma identified as the primary precipitating factor in both groups. *Staphylococcus* and *Streptococcus* were the predominant causative organisms in both categories.

ABSTRACT:

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INTRODUCTION

Necrotizing fasciitis is a rare disease potentially life-threatening infection of fascia, subcutaneous tissue with occasionally muscular involvement. Necrotizing Fasciitis is a surgical emergency with high morbidity and mortality. As the disease progresses, thrombosis of the affected cutaneous tissue and perforators subsequently devascularize the overlying skin, causing skin necrosis and hemorrhagic bullae to form. Bacteraemia and sepsis invariably develop when the infection is well established, because of its rapid progression and high mortality; it continues to be a dire emergency, as it was when Meleney [1] first described the disease in 1924 in China. Despite aggressive treatment, the reported case fatality rate for Necrotizing fasciitis remains high. Patient survival is inversely related to the time interval between the onset of the disease and initiation of appropriate treatment.

Although it's not very much common compared with other skin infections such as cellulites or abscesses, the incidences of Necrotizing fasciitis are increasing nowadays. This is often linked to the increased prevalence of Obesity, Diabetes, and people living with Immunocompromise. Diabetes mellitus (DM) has been reported to be a common underlying disease in Necrotizing fasciitis patients, accounting for 44.5–72.3 % in various series. Diabetic patients exhibit impaired cutaneous wound healing and increased susceptibility to infection, which may affect the course of soft-tissue infections. It is thus reasonable to speculate that this chronic, debilitating disease contributes to a more serious nature of Necrotizing Fasciitis. Mortality from necrotizing fasciitis can be reduced by proper diagnosis, adequate debridement, and appropriate antibiotics. The formation of necrosis stands out as the clinching diagnostic clue. Cellulitis accompanied by ecchymoses, bullae, dermal gangrene, extensive edema or crepitus suggests an underlying necrotizing infection and mandates operative intervention to the diagnosis and definitively treat the infection.

Based on bacterial culture results, Necrotizing fasciitis 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. However, recent studies have revealed emerging monomicrobial pathogens of Necrotizing fasciitis, such as methicillin-resistant *Staphylococcus aureus* (MRSA), indicating that the bacteriology of the causative agent of

Necrotizing fasciitis is constantly changing. Moreover, certain causative agents of Necrotizing fasciitis, including *Klebsiella pneumoniae*, are more likely to involve underlying immunocompromised conditions. Therefore, exploration of the bacteriology of Necrotizing fasciitis patients with specific underlying conditions is of great value in guiding empirical antimicrobial therapy. Broad-spectrum antibiotics, aggressive surgical debridement, and intensive care unit support are essential.

Here we intend to compare the incidence of necrotizing fasciitis in diabetic and non-diabetic patients concerning age,

sex, duration, symptoms, hospital stay, and outcome of necrotizing fasciitis in our hospital study the available treatment and surgical option in our setup for the management.

The aims of the study, are to compare necrotizing fasciitis in diabetic and non-diabetic patients to age, sex, duration of symptoms, site of involvement, causative organism, duration of hospital stay, and its outcome.

MATERIALS AND METHODS

Type of study: Prospective study.

Place of study: Dr Bhimrao Ambedkar Memorial Hospital Raipur & Associated Pt. JNM Medical College Raipur (C.G.).

Period of study: 18 months

Data collection: 12-month Selection of patients:

Sampling method - Random.

Inclusion Criteria-

- Those who were admitted to the Surgery Department with a Diagnosis of Necrotizing Fasciitis.
- Diabetes.
- Patient age must be above 18 years.

Exclusion Criteria-

- Those who are not willing to participate in the study.
- Those with peripheral vascular disease, IHD, CVA.
- Those who underwent wound debridement outside our hospital.

Major Variable-

- Age
- Sex
- Dietary habits
- Duration of symptoms
- Common set of involvement
- Duration of diabetes
- Causative organism
- Duration of hospital stay
- Size of wound
- Malnourished

e) Confounding Factors

- Malignancy.
- Immunosuppressant medication.
- Chronic cardiac and renal disease.
- Malnutrition.
- Addiction history.
- Gangrene.

j) Hypothesis-

- **Null Hypothesis:** There is no difference in the clinical, pathological profile of necrotizing fasciitis in diabetic and non-diabetics and its outcome.
- **Alternate Hypothesis:** There is a difference in clinical, and pathological profile of necrotizing fasciitis in diabetic and non-diabetics and its outcome.

Outcome measure-

- Incidence of Necrotizing Fasciitis is more common in which group.
- More affected groups and gender.
- Precipitating factors in both groups.
- Most common affected limb.
- Average hospital stays
- Mortality.
- Amputation and split skin graft.
- Complications after management.

Sample Size – 226 (113 in each group)

- P1= LRINEC score in Diabetic Group
- P2= LRINEC score in non-diabetic group

RESULT**Table 1: Distribution of cases according to age**

Age	DiabetesmellitusPresent		DiabetesmellitusAbsent		Total		
	No	%	No	%	No	%	
≤40	19	16.8%	56	≤40	19	16.8%	
41– 50	23	20.4%	18	41–50	23	20.4%	
51– 60	31	27.4%	18	51–60	31	27.4%	
> 60	40	35.4%	21	> 60	40	35.4%	
Total	113	100%	113	Total	113	100%	
Mean ±SD	54.81±15.33	44.09±15.77		Mean± SD	54.81±15.33	44.09±15.77	
Pvalue	0.00						

Table 2: Distribution according to Predisposing Factor

Predisposing Factor	Diabetes Mellitus						
	Present		Absent		Total		
	N	%	N	%	N	%	
Animal Bite	1	0.90%	1	0.90%	2	0.90%	
Burn	1	0.90%	0	0%	1	0.40%	
Idiopathic	46	40.70%	32	28.30%	78	34.50%	
Insect Bite	1	0.90%	1	0.90%	2	0.90%	
Trauma	63	55.80%	71	62.80%	134	59.30%	
Snake Bite	0	0%	1	0.90%	1	0.40%	
Idiopathic/CLD	0	0%	1	0.90%	1	0.40%	
Ca Breast	0	0%	1	0.90%	1	0.40%	
RTA	0	0%	1	0.90%	1	0.40%	
Minor Trauma	0	0%	2	1.80%	2	0.90%	
Infected Burn	0	0%	1	0.90%	1	0.40%	
Needle Prick	1	0.90%	0	0%	1	0.40%	
Old Infected Electric Burn	0	0%	1	0.90%	1	0.40%	
Total	113	100%	113	100%	226	100%	
P Value	0.37						

Table 3: Distribution according to Microorganism growth on culture

Microorganism	Diabetes Mellitus					
	Present		Absent		Total	
	N	%	N	%	N	%
Clamidiya	3	2.70%	5	4.40%	8	3.50%
Klabsella	12	10.60%	10	8.80%	22	9.70%
Pneumococcus	12	10.60%	7	6.20%	19	8.40%
PS	1	0.90%	0	0%	1	0.40%

Pseudomonas	3	2.70%	2	1.80%	5	2.20%
SP	43	38.10%	45	38.80%	88	38.90%
ST	39	34.50%	35	31%	74	32.70%
SP/PS	0	0%	3	2.70%	3	1.30%
ST/PS	0	0%	2	1.80%	2	0.90%
ST/SP	0	0%	1	0.90%	1	0.40%
Gonococcus	0	0%	1	0.90%	1	0.40%
Maningococcus	0	0%	1	0.90%	1	0.40%
No Growth	0	0%	1	0.90%	1	0.40%
Total	113	100%	113	100%	226	100%
P Value						0.41

Table 4: Outcome Variable In-between Diabetes & Non-Diabetes

Outcome	Diabetes Mellitus					
	Present		Absent		Total	
	N	%	N	%	N	%
Death	62	54.90%	43	38.10%	105	46.50%
Improved	51	45.10%	70	61.90%	121	53.50%
Total	113	100%	113	100%	226	100%
P Value						0.021

Table 5: Distribution according to Affected Parts

Affected part	Diabetes Mellitus					
	Present		Absent		Total	
	N	%	N	%	N	%
Abdomen	2	1.80%	0	0%	2	0.90%
B/L Foot	3	2.70%	0	0%	3	1.30%
B/L Lower Limb	7	6.20%	3	2.70%	10	4.40%
Ft Face	1	0.90%	0	0%	1	0.40%
Lower Abdomen wall	0	0%	1	0.90%	1	0.40%
Lt Breast	1	0.90%	0	0%	1	0.40%
Lt Face	0	0%	2	1.80%	2	0.90%
Lt Foot	8	7.10%	2	1.80%	10	4.40%
Lt Hand	0	0%	1	0.90%	1	0.40%
Lt Leg	1	0.90%	0	0%	1	0.40%
Lt Lower Limb	15	13.30%	38	33.60%	53	23.50%
Lt Thigh	1	0.90%	1	0.90%	2	0.90%
Lt Upper Limb	0	0%	3	2.70%	3	1.30%
Nape of Neck	1	0.90%	0	0%	1	0.40%
Perineum	16	14.20%	25	22.10%	41	18.10%
Rt Breast	1	0.90%	0	0%	1	0.40%
Rt Chest wall	0	0%	1	0.90%	1	0.40%
Rt Face	2	1.80%	0	0%	2	0.90%
Rt Foot	10	8.80%	3	2.70%	13	5.80%
Rt Hand	3	2.70%	1	0.90%	4	1.80%
Rt Leg	1	0.90%	1	0.90%	2	0.90%
Rt Leg & Thigh	1	0.90%	0	0%	1	0.40%
Rt Lower limb	0	0%	2	1.80%	2	0.90%
Rt Lower Limb	33	29.20%	23	20.40%	56	24.80%
Rt Lower Limb & Perinium	0	0%	1	0.90%	1	0.40%
Rt Thigh	4	3.50%	0	0%	4	1.80%
Rt Thigh with Leg	0	0%	1	0.90%	1	0.40%
Rt Upper Limb	2	1.80%	4	3.50%	6	2.70%
Total	113	100%	113	100%	226	100%
P value						0.002

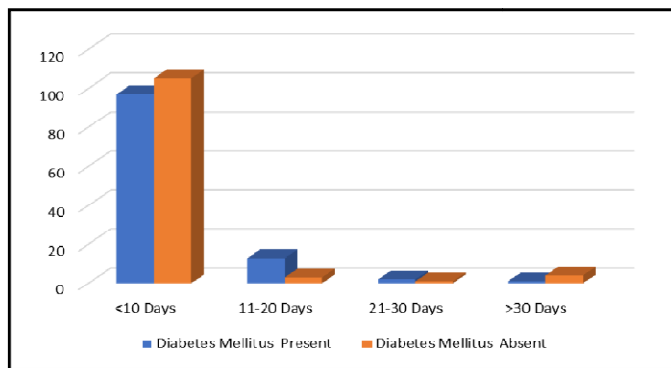


Figure 1: Distribution regarding Onset of Symptom and Hospital Presentation

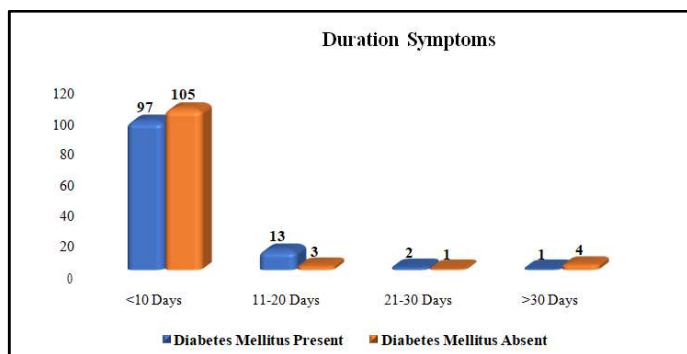


Figure 2: Distribution regarding Onset of Symptom and Hospital Presentation

A maximum number of cases were in the age group below 40 years in Non-Diabetics (56%) whereas in Diabetics it was more than 60 years (40%). The mean age was 54.81 ± 15.33 years in Diabetics and 44.06 ± 15.77 years in Non-Diabetics P Value $0.00 < 0.5$ is statically significant there is a difference in age distribution in Diabetes and Non-Diabetes.

The most common risk factor for both diabetics and non-diabetics was trauma. Idiopathic was the second most common predisposing factor. P value $0.370 > .05$ indicates that there is no statistically significant difference in predisposing factors between diabetes and non-diabetics. *Staphylococcus* was the most prevalent microorganism discovered in both groups (43% in diabetics and 45% in non-diabetics). *Streptococcus* was the second most prevalent microorganism (39 percent in diabetics and 35 percent in non-diabetics). *Klubsella pneumococcus* and polymicrobials were also discovered to be important microorganisms. P-value: $0.410 > 0.05$. There is no statistically significant difference in microorganism culture between diabetics and nondiabetics. In our investigation, the most common site of involvement was the left lower limb (38% in non-diabetics) and the right lower limb (33% in diabetics). The perineum was the second most common location of involvement, accounting for 16% of diabetics and 23% of non-diabetics.

In this study, the majority of patients in both groups were admitted to the hospital within 10 days (95.8% non-diabetics and 87.5% diabetics). Second, 11% of diabetics presented to the hospital in 10-20 days, while 3.5% of non-diabetics presented in more than 30 days.

P value $0.798 > 0.05$ indicates that there is no statistical significance. The mortality rate was high (46.5%) in both groups (54.9% Diabetics and 38.1% Non-Diabetics), although diabetic patients died at a higher rate than non-diabetics. P-value $0.021 < 0.05$ indicates statistical significance. Males accounted for 77.1% of deaths, with females accounting for 22.9%. More male deaths were caused by a higher number of males admitted to the hospital for NF, which was consistent with demographic statistics (73.9% of NF patients were male). P Value $0.363 > 0.05$, which is statistically insignificant.

DISCUSSION

In this study, 67.3% were Male and 32.7% were female in the Diabetic group whereas 80.5% were male and 19.5% were female in the non-diabetic group. In combining 73.9% were male and 26.1% female. The findings are similar to most of the studies as Nisar Shaikh (2010)[2] recorded 75.5% male and 24.5% female, Chen *et al* 2019 [3] found 64.4% were male and 35.6% female. Yogendra Gupta *et al* in 2016[4] also reported a similar finding, the mean age was 51.48 years and 69% were Male.

MODE

The most common cause of Necrotizing Fasciitis in this study was trauma 55.8% in Diabetics and 62.8% in Non-Diabetics. Similar findings were reported by Mittal *et al* (2017)[5], in their study 78% of them were due to trauma, and also Nai Chen Cheng (2015)[6] found 47% of diabetic patients having Necrotizing fasciitis was due to Trauma. Dilip Kumar Das *et al* (2010)[7] reported 35.2% of NF was due to Accidental Trauma.

MICRO-ORGANISM

Antibiotic therapy is the mainstay of Necrotizing fasciitis role of higher antibiotics is always their broad-spectrum antibiotics (penicillin for streptococcal species, metronidazole or clindamycin for anaerobes and third-generation cephalosporins or aminoglycosides for gram-negative aerobes) are usually recommended immediately before culture results and sensitivities are obtained (Tripathi FM *et al* 1978)[8]. A high dose of antibiotics must be needed before surgery. However, antibiotic therapy is no substitute for adequate operative debridement. Antibiotic therapy should be adjusted based on the results of intra-operative culture and antimicrobial sensitivity tests.

In this study, *Staphylococcus* and *Streptococcus* were the most common organisms found in culture 38% and 32% respectively. A similar result was shown by Yogendra Gupta *et al* (2016)[4] in their study where the most common organism isolated was *Staphylococcus* 27.7% and next was *Streptococcus* 16.9%. Dilip Kumar Das *et al* (2010)[7] also reported a similar finding which is 41.2% *Streptococcus* and 31.9% *Staphylococcus*. Armond Giuliano and colleagues (1977)[9] in their paper Bacteriology of Necrotizing Fasciitis also reported *Streptococcus* and *Staphylococcus* was the prominent organism grown in the culture of Necrotizing Fasciitis patients.

SITE OF LEASON

NF can affect all body parts but extremities are the main site of occurrence of Necrotizing fasciitis. It's the most exposed and working part of the body. This study shows Lower Limb was the most common site of involvement Right Lower Limb was 24.8% and 23.5% Left Lower Limb, and the second most common site was Perinium 18.1%. This report was comparable with the study of Konstantinos Ditsios *et al* (2022)[11] 2022 reported that extremities affected 45-74 % majority of them were lower extremities. Another study by Jinn-Ming Wong *et al* (2014)[12] reported 61% Lower Limb involvement (28% Rt, 38% Lt and 4% B/L Lower Limb). Nisar Shaikh (2010)[2] reported Necrotizing Fasciitis of the Perineum and Genitalia is more common in Diabetics Patients (30.2%).

PRESENTATION IN THE HOSPITAL

Mortality is quite high in diseases like Necrotizing Fasciitis. In this study, 89.4% of patients presented to the hospital within 7 days of symptom, the mean of the study was 7.55 days and 7.85 days for Diabetics and Non-Diabetics respectively. The findings are similar to the findings of a study by Alejandro GM *et al* (2009) [13] where the mean days of symptoms were 6.87 days. Late presenting to the hospital leads to increased morbidity and mortality in patients. Many patients delay hospital admission due to socio-economic conditions and many of them are treated locally by themselves.

MORTALITY

In this study mortality was 46.5% combined in both groups, separately Diabetics had 54.9% whereas non-diabetics had 46.5%. The mortality rate of NF has been observed to be 30-45%. The high mortality implies the aggressive nature of infection and the underlying debilitating situation. SanderVanStigt *et al* (2022)[14] published 31.7% mortality in Netherlands. Another study by Nai Chen Chang *et al* (2015)[6] found 29.7% mortality of them 28.6% were Diabetics and 30.9% in Non-Diabetics. The following study shows no difference in mortality in both the groups which is contrary to this study which has more mortality in the Diabetics group. The high mortality may be due to late presentation to the hospital which increases the severity of the disease.

OUTCOME CONCERNING AGE AND SEX

In this study Mortality among males was 77.1% in both groups, which was due to more males being admitted for Necrotizing fasciitis. The study also found 43.8% of deaths above 61 years of age group and next to 28.6% in-between the 51–60-year age group. This shows the aged person is more predisposed to mortality. Similar findings were reported where 61±16.4 was the mean age group among mortality and 71.4% were male.

PROCEDURE DONE

As time progresses mortality increases, and early and prompt intervention is the mainstay of the management of NF. The

goal of debridement is to remove all devitalized tissues and prevent the infectious process from spreading. In this study, 77% of patients underwent debridement and 19.5% of patients were Amputated. Findings are similar to the study by Mittal *et al* (2017)[5] where 60% of patients underwent Debridement and 20% were amputated. Debridement of the necrotic tissue as soon as possible is widely recommended. Laor *et al*. (1995)[15] found no significant difference between the onset time of symptoms, early surgical treatment, and mortality, but other studies from Korkut *et al*. (2003)[16] showed the time interval should be as short as possible. According to Wipf *et al* (2008)[17], the single most important determinant of survival is the amount of time elapsed between initial presentation and surgical debridement.

In this study 3.5% of patients undergone for skin grafting (STSG). Reconstructive operations should be considered only once the patients have been stabilized and the infection fully eradicated, healthy granulation tissues developed; this signifies the time to proceed to reconstruction. Surgical reconstruction has been advocated to shorten the time of hospitalization, hasten healing, and bring on a more esthetic result. This procedure was also used as a reconstruction surgery by Pizzorno R, *et al* (1997)[18] in their studies.

HOSPITAL STAY

In this study average hospitalization of patients was 16.58 days for Diabetics and 16.05 days for Non-Diabetics, most of the patients were discharged when they showed improvement and recalled on an OPD basis. Camille Windsor *et al* (2022)[19] reported 8-37 days of hospital stay in their study which is similar to this study. In 2009, Alejandro *et al* (2009) [20] reported 23.76 days of hospital stay.

CONCLUSION

In conclusion, the study reveals several key insights into necrotizing fasciitis, highlighting significant differences and similarities between diabetic and non-diabetic patients. Diabetic patients, typically over 60 years old, and non-diabetic patients, generally under 40 years old, both show a higher prevalence of necrotizing fasciitis among males, with trauma identified as the primary precipitating factor in both groups. *Staphylococcus* and *Streptococcus* were the predominant causative organisms in both categories. Lower extremities were the most frequently affected site, followed by the perineum. Early hospital presentation within 10 days of symptom onset was common, and debridement remained the principal surgical intervention for all patients. Notably, diabetic patients experienced higher mortality rates compared to non-diabetic patients, a finding that contrasts with some existing studies. Additionally, older age was associated with increased mortality. Despite similar average hospital stays of 11-20 days for both groups, these findings underscore the need for further research to better understand the variability in outcomes and improve management strategies for necrotizing fasciitis.

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