

Necrotizing Fasciitis: A Clinical and Microbiological Study

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ABSTRACT

Objective: Necrotizing fasciitis (NF) is a prolong inflammation of the soft tissue and prevalent with higher morbidity and mortality. The treatment would be based on the surgical debridement and antibiotic therapies.

Methods: All cases of Necrotizing fasciitis admitted in Sree Balaji Medical College & Hospital, Chennai-44 between the period of November 2014 and October 2016 were included in the study. The diagnosis was made by combination of clinical and gross anatomical findings, biochemical characterization, and microbiological evaluation.

Results: The male predominance was found among the patients. The pain was presented as most common symptom (95%) and mean duration was 10.08 days. Trauma contributed as most common etiological factors (30%) and Diabetes mellitus was the most common associate comorbid condition (38.3%) in patients, followed by hypertension in 18 patients (30%). The culture was monomicrobial in 37 (61.7%) patients, polymicrobial in 22 (36.7%) patients and sterile in 1.7% of patients. 86.7% of isolates were aerobic and 13.3% were anaerobic in nature. *E. coli* was the commonest bacteria among the patients.

Conclusions: In severe cases the combination of necrotic skin and soft tissue gas facilitates the correct diagnosis, which should than be followed by immediate - and most often-repeated debridement. The anaerobes are isolated an early and aggressive second look is necessary. The finding of the study would be especially useful for therapeutic planning.

Key words: Necrotizing fasciitis, Soft tissue infection, Diabetes mellitus, Comorbid condition, Trauma

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INTRODUCTION

Necrotizing fasciitis is a progressive, quickly spreading inflammatory infection located in deep fascia usually occurring in skin and subcutaneous tissue and could spread over to adjacent soft tissues such as muscles (i.e., necrotizing myositis). It propagates to other sites via the blood vessels and resulting in severe shock, organ failure and death. Its prevalence is higher in adults than the children (0.4 and 0.08/100,000 for adults and children respectively). The incidence is seemed to be increased in recent years due to altered physiology such as immuno deficiency, diabetes mellitus, complement C4 deficiency, AIDS, malignancies, and drugs etc.,

The diabetic patient usually faces complications such as large vessels atherosclerosis, micro vascular disease of diabetes and diabetic neuropathy. The patients with vasculopathy and neuropathy are more prone to predispose for foot ulceration. Prolonged ulcers lead to the microbial contamination at the sites and eventually resulting in deep site necrosis and complex infectious process. The diabetic neuropathy leads to neuron loss, pressure ulceration and inadequate cutaneous blood supply. These change the net results for higher secondary invasive infection. These lesions enter into the deep spaces of the leg; true limb-threatening circumstance exists. Each factor that influences the health and integrity of the skin or mucus membranes can result in penetration of infection. Primary infection can penetrate due to skin trauma, infected needle in intravenous drug abusers or previous dermatological diseases such as psoriasis and Bed sore. Mucosal

membranes in gastrointestinal or genitourinary systems are the other routes of infection [1-9].

The present study aimed to identify the frequency of Necrotizing Fasciitis in Sree Balaji Medical College and Hospital, Chrompet, Chennai for determining the effective therapeutic strategy on necrotizing fasciitis.

To analyze the clinical presentation in patients with Necrotizing fasciitis. To determine the predisposing factors related to Necrotizing fasciitis. To define the relationship of Co morbid diseases with Necrotizing fasciitis. To analyze the microbiological parameters on Necrotizing fasciitis. To analyze the Surgical and resuscitative management.

MATERIALS AND METHODS

The present study is a kind of descriptive study on Necrotizing fasciitis and involved a single group of patients admitted in Sree Balaji Medical College & Hospital, Chennai between the period of November 2014 and October 2016. The study was conducted after the proper ethical approval.

Inclusion criteria

All cases of Necrotizing fasciitis admitted in Sree Balaji Medical College & Hospital, Chennai-44 between the period of November 2014 and October 2016.

Exclusion criteria

All patients with necrotizing fasciitis leaving before the completion of the treatment.

Methodology

Patients with Necrotizing fasciitis were included in the present study. The diagnosis was made by combination of clinical and gross anatomical findings during the surgery. Demographic data was collected and the pre medical history such as diabetes mellitus, antibiotic usage was recorded. The vital parameters and physical examination was performed to look for any bullae formation. The blood parameters such as Hemoglobin, Platelets, RBS, Urea, creatinine, Sodium and Potassium levels, Radiograph were done to analyze the subcutaneous gas formation. Treatment including hemodynamic stabilization, blood-spectrum antibiotics and aggressive wound debridement were given to the patients. The microbial culture and sensitivities were taken from the infected wound

during debridement or fasciotomy, particularly to test for aerobic and anaerobic organisms. The Microbial analyses were adopted from the CLSI (Clinical and Laboratory Standards Institute) guidelines. The tissue sample or the wound swab was inoculated in RCM (Robertson's Cooked Meat) media for further anaerobic culture and identification.

Statistical analysis

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

The present study was carried out with 60 patients diagnosed with Necrotizing Fasciitis admitted to Sree Balaji Medical College and Hospital, Chrompet. The age of the studied patients was ranged between 29 -81 years. There were 49 males and 11 females, the male: female ratio being 4:45:1. The mean age was 50.42 ± 17.31 years. Maximum cases were above the age of 50 years (Table 1 and Figure 1). The occupation plays a significant role in diseases. In the present study, out of the 60 patients, 17 (28.3%) were farmers by occupation. 10 (16.7%) were housewives (Table 2). The study showed that the disease severity could be correlated with the occupation.

The study showed that lower limb was the most common site involved in 32 (53.3%) patients followed by the perineum in 18 (30%) patients and trunk in 5 (8.3%) patients (Table 3 and Figure 2). Regarding symptoms, pain was present in most of the cases 57(95%). Fever and discharge was present in 37(61.7%) & 35(58.3%) respectively. Swelling in 27(45%) and blisters/skin vesicles in 11(18.3%) were also noted (Table 4 and Figure 3). 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 and Figure 4). Clinical signs of oedema and ulcer was present in 51(85%) & 46(76.7%) respectively (Table 6 and Figure 5). Trauma was the most common etiological factors comprising of 18(30%) patients. No predisposing factor was present in 4(6.7%) patients. The diversification of etiological factors is mentioned in Table 7 and Figure 6.

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

Age in years	Male		Female		Total	
	No	%	No	%	No	%
<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 ± SD	52.27 ± 17.1		42.18 ± 16.71		50.42 ± 17.31	

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

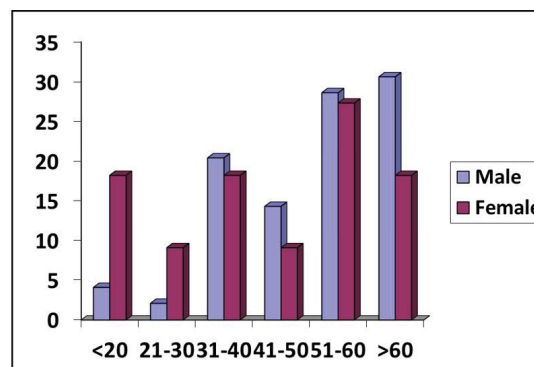


Figure 1: Age of the participated Patients in the study.

Table 2: Occupation of patients participated in the study.

Occupation	Number of patients	%
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

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	%	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	-

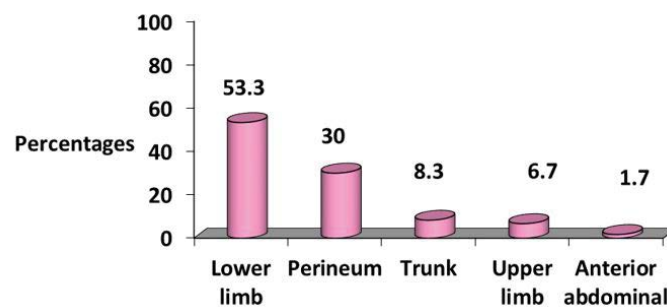


Figure 2: Site of infection in the patients.

Table 4: Symptoms at Presentation in the patients.

Symptoms	Number of patients (n=60)	%	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

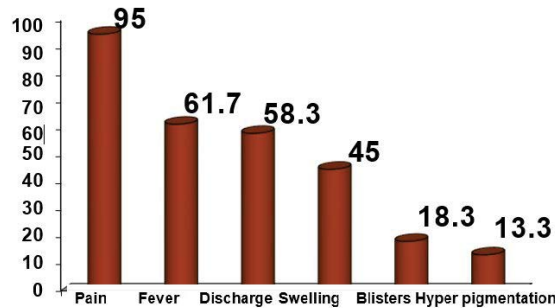


Figure 3: Symptoms at presentation in the patients.

Table 5: Duration of symptoms in the patients.

Duration of symptoms	Number of patients(n=60)	%
1-7 days	33	55
8-14 days	19	31.7
>14 days	8	13.3

Mean ± SD: 10.08 ± 10.09

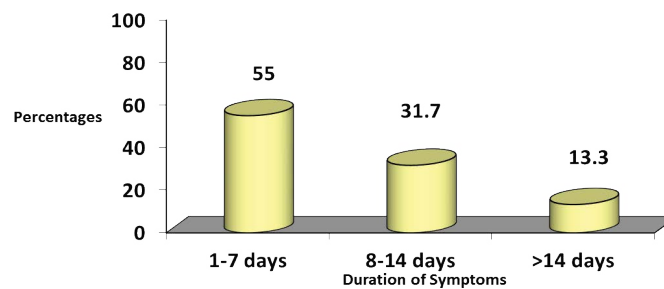


Figure 4: Duration of symptoms in the patients.

Table 6: Signs in the patients.

Signs	Number of patients (n=60)	%	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

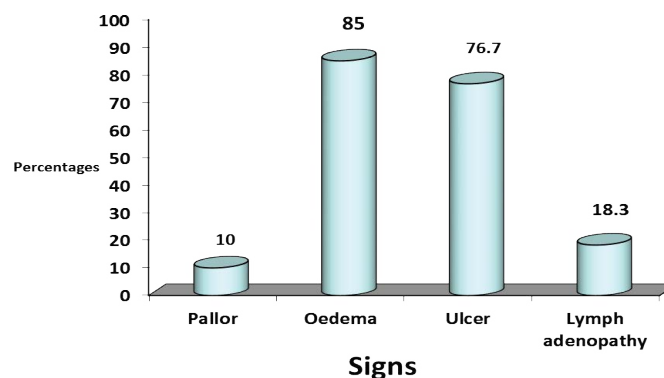


Figure 5: Signs in the patients.

Diabetes mellitus was the most common associate comorbid condition comprising of 23(38.3%) patients, followed by hypertension in 18 patients (30%). Two of the patients in this study were HIV positive (Table 8 and Figure 7). The laboratory parameters were evaluated. It was observed that 11(18.3%) patients had hemoglobin <10gm%, 18(30%) has RBS >180md/dl, 14(23.3%) had serum creatinine>1.6mg/dl and 9(15%) with sodium levels. <128mEq/l, which are all risk indicators as describes by a recently developed Laboratory Risk Indicator score for necrotizing fasciitis (LRINEC)by Wong et al. [6] (Table 9 and Figure 8).

The culture was monomicrobial in 37 (61.7%) patients, polymicrobial in 22 (36.7%) patients and sterile in (1.7%) patients. Among these

52 (86.7%) isolates were aerobic and 8(13.3%) were anaerobic. (Table 10 and Figure 9). The commonest bacteria isolated were *E. coli* in 21(35%) patients followed by *P. Aeruginosa* in 14(23.3%) patients and *L. Pneumonia* in 11(18.3%) patients (Table 11). Patients were initially given broad spectrum antibiotic combination with second or third generation cephalosporin +/- aminoglycosides+metronidazole followed by culture-based antimicrobials.

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 and Figure 10). Duration of hospital stay, 9 patients stayed for more than 30 days (Table 13 and Figure 11). The mortality rate was nil (0%).

Table 7: Etiology in the patients.

Etiology	Number of patients(n=60)	%	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

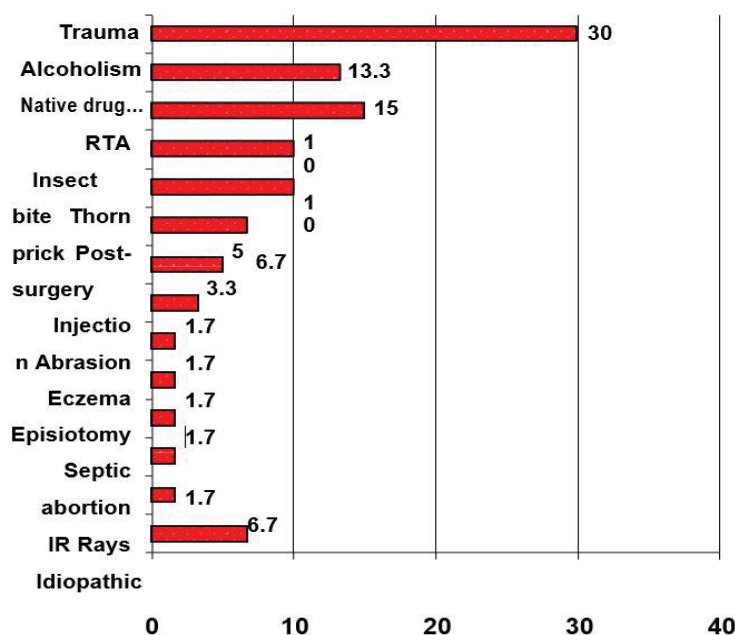


Figure 6: Etiology of necrotizing fasciitis.

Table 8: Associated co morbid conditions.

Associated Co morbid conditions	Number of patients(n=60)	%
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

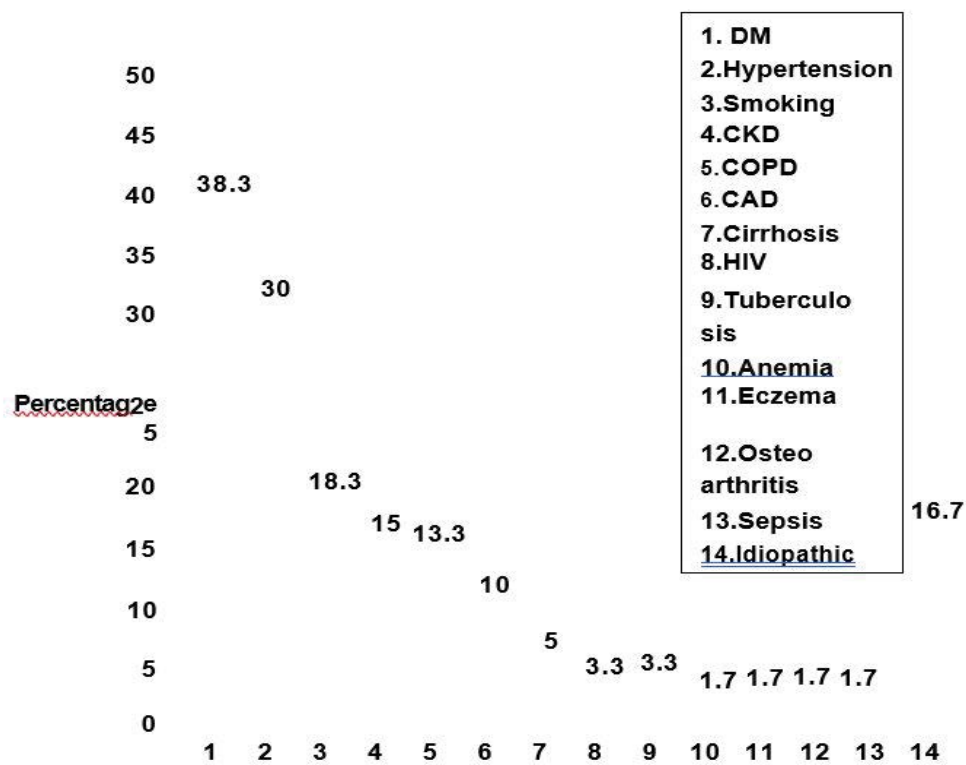


Figure 7: Associated Co morbid conditions.

Table 9: Laboratory investigations on admission.

Blood parameters	Number of patients (n=60)	%	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
Sodium mEq/L			
<128	9	15	8.10-26.11
>=128	51	85	73.89-91.90

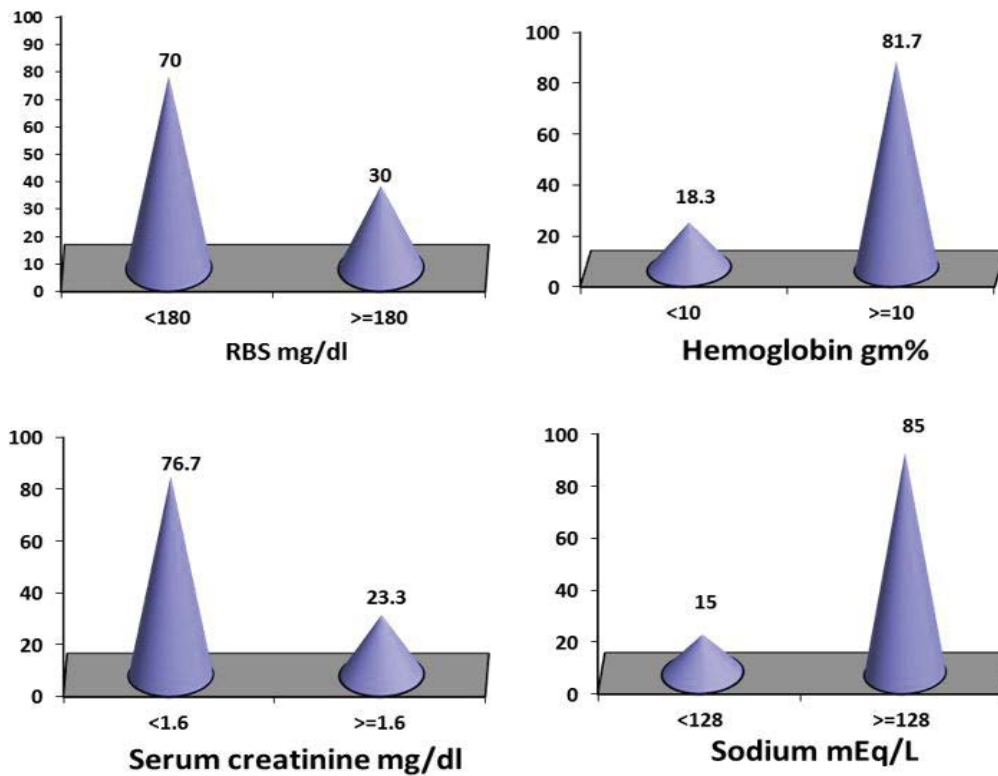


Figure 8: Laboratory investigations on admission.

Table 10: Bacteriological study of the specimen tissue.

Bacteriological Study	Number of patients(n=60)	%	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

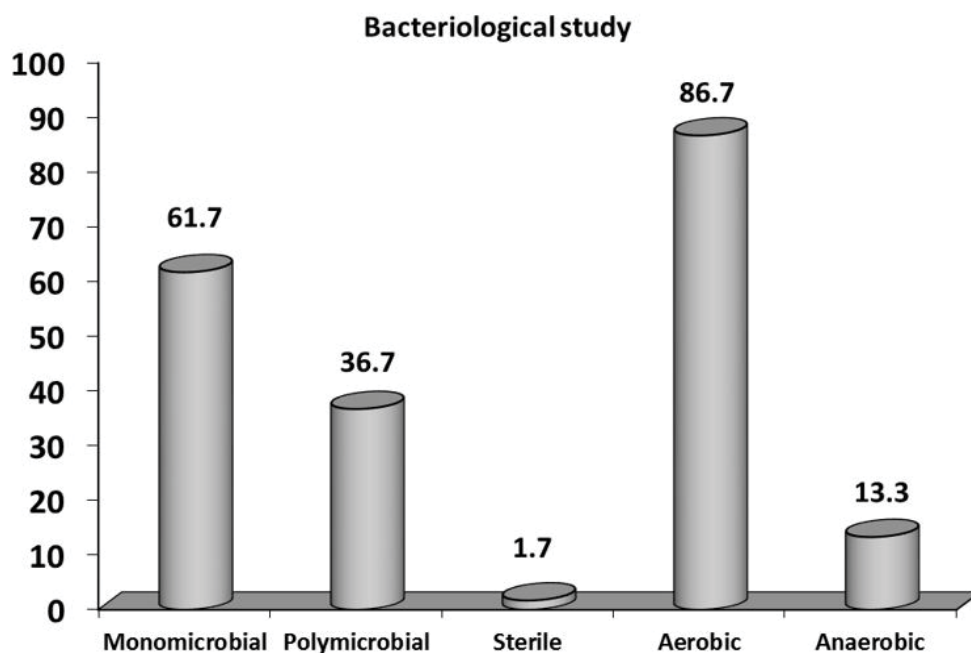


Figure 9: Bacteriological study of the specimen tissue.

Table 11: Commonly identified bacteria.

Commonly Identified Bacteria	Number of patients(n=60)	%
<i>E. Coli</i>	21	35
<i>P. Aeruginosa</i>	14	23.3
<i>K. Pneumoniae</i>	11	18.3
<i>P. Mirabilis</i>	7	11.7
<i>Cons</i>	6	10
<i>S. Aureus</i>	6	10
<i>MRSA</i>	5	8.3
<i>P. Vulgaris</i>	5	8.3
<i>Citrobacter</i>	4	6.7
<i>NFGNB</i>	4	6.6
<i>B.H. Streptococci (Gr. A)</i>	4	6.6
<i>Acinetococcus</i>	3	5
<i>Peptococcus</i>	3	5
<i>Fusobacterium</i>	2	3.3
<i>P. Species</i>	2	3.3
<i>Psuedomonas</i>	2	3.3
<i>Anaerobic cocci</i>	1	1.7
<i>Bacteriods</i>	1	1.7
<i>Citrobacter Freundii</i>	1	1.7
<i>Enterobacter</i>	1	1.7
<i>Enterococci</i>	1	1.7
<i>P. Streptococcus</i>	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*

Table 12: Treatment.

Treatment	Number of patients	%
Debridement	57	95
Fasciotomy	3	5
Split Skin Graft	2	3.5
Secondary Suturing	17	28.33

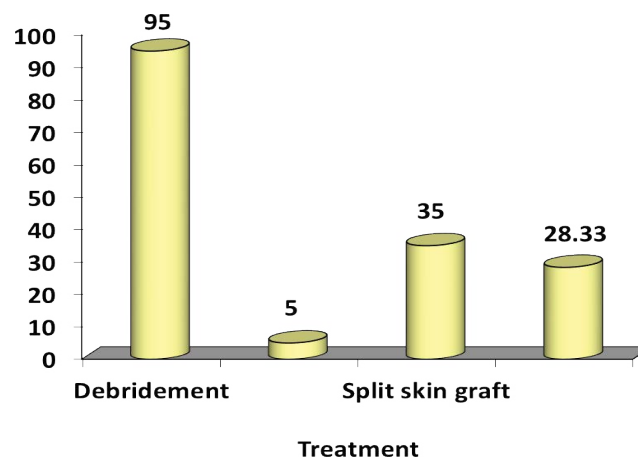


Figure 10: Treatment.

Table 13: Hospital stay in days of studied patients.

Hospital stays in days	Number of patients(n=60)	%
<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

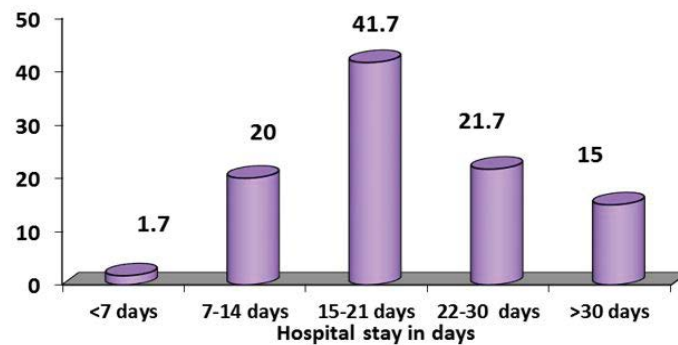


Figure 11: Hospital stay in days of studied patients.

DISCUSSION

The present aimed to analyze the incidence and prevalence of Necrotizing fasciitis in hospitalized patients. Necrotizing fasciitis usually associated with hypotension, fever, tachycardia, tachypnea and laboratory findings of leukocytosis and metabolic acidosis are indices of development of sepsis. Our study showed that age was one of the main factors to determine the severity of the disease. The results also revealed the male predominance, and it might be due to increased incidence of trauma and outdoor activity. Our results coinciding with the previous studies by Wilkerson et al. [10] and Childer et al. [11]. Necrotizing fasciitis is known to follow minor trauma, insect bite, pustule or minor operations, anorectal abscess, instrumentation, septic abortion, genitourinary infection. In our study majority of the patients had a predisposing factor and majority (30%) was due to trauma. No etiological factor was present in the patients. Primary or idiopathic Necrotizing fasciitis occurs in the absence of a known or identifiable etiologic factor. The underlying pathogenesis of idiopathic Necrotizing fasciitis is still unknown.

These findings were coincidence with Mukhopadhyay et al. [12]. In our study, lower limb (53.3%) and perineum (30%) were the commonest site involved. Other studies did not show similar results, perineum being the most common site. There may be a difference in the orinary site of infection due to a difference in the hygiene level. But Tian et al. [13] had shown the infection to be more common in the lower limbs, similar to our study. Diabetes mellitus was the most common co-morbid condition in our study (23%) which is co-relating with the previous report 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.

In our study majority of the patients (61.7%) had mono microbial infection. This does not correlate with other studies which showed that polymicrobial infection as the main flora. Among these 52 (86.7%) isolates were aerobic and 8(13.3%) were anaerobic. In our study *E. Coli* was the commonly identified and *E. Coli* was the most common bacterium isolated from necrotic tissue of diabetic patients. Others also demonstrated that *E. Coli* was one of the four common organisms isolated from Type I necrotizing fasciitis. *Pseudomonas aeruginosa* can be a fatal cause of necrotizing fasciitis. According to other studies *P. aeruginosa* was the most frequently isolated bacteria which represented 85% of 39 patients with necrotizing fasciitis. Broad spectrum antibiotics against gram positive, gram negative and anaerobic bacteria should be started early during treatment before culture reports are available. According to Wipf et al. [15] the single most important determinant of survival is the amount of time elapsed between initial presentation and surgical debridement. The present study had revealed the incidence and precaution measures for effective treatment on Necrotizing Fasciitis.

CONCLUSION

Necrotizing Fasciitis is a life-threatening soft tissue infection, characterized by severe necrosis and require critical diagnosis is critical to the survival of the patient and must rely on the clinical picture. The present study systematically analyzed the demographic relations, comorbidities, and related pathogenesis. This study showed that effective management of diabetes could be a suitable way to reduce the severity. Further, it showed the role debridement in eradicating the disease. These findings will be useful in treatment of NF.

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