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Clinical profile and outcome of the patients with necrotising fasciitis in a tertiary care teaching hospital at rural Puducherry, India

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ABSTRACT

Introduction: Necrotising fasciitis is rapidly progressive inflammation with infection and secondary necrosis. The incidence of it is increasing recent times. The challenge associated with its treatment is identification of the process at an earlier stage to improve outcome and reduce the dreadful complications.
Aims: To study the socio-demographic, clinical, microbiological, risk factor profile and complications of patients diagnosed with necrotizing fasciitis.
Materials and Methods: It was a cross sectional descriptive study carried out in surgery ward of a tertiary care teaching hospital. Patients diagnosed with necrotising fasciitis were included in the study. After detailed clinical and laboratory evaluation appropriate surgical and medical interventions were administered and were followed to note the outcome. Epi Info software version 3.5.3 was used for data entry and statistical analysis.
Results: 82% of the study participants were more than 40 years old and 76% of them were males. All of them had fever, pain and tenderness, 76% of them had swelling and 50% of them had foul smelling discharge. The commonest site involved was lower extremity (36%). Diabetes mellitus as a predisposing factor was found in 52%. 84% of the infections were polymicrobial and E. coli was isolated from 74% among them. 34 % had developed complications during hospital stay.
Conclusion: Though it is a dreadful infectious condition prompt recognition decreases morbidity and mortality. The risk factors identified, complications occurred needs to be given importance to improve treatment outcome among patients admitted with necrotising fasciitis.

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1. Introduction

Necrotizing fasciitis (NF) represents a diverse disease process characterized by extensive and rapidly progressive inflammation and secondary necrosis. Necrotizing fasciitis usually involves the muscular fascia and subcutaneous tissue but can also affect the skin and muscle.[1,2] The nomenclature of NF can be confusing, as very different terms had been used to describe its variable presentations. Army surgeon, Dr Joseph Jones in 1871, originally described it as "hospital gangrene".[3] Additional terms used in the past included Fournier gangrene, acute hemolytic streptococcus gangrene, gas gangrene (clostridial myonecrosis), Meleney ulcer, acute dermal gangrene, suppurative fasciitis, and synergistic necrotizing cellulitis. The term "necrotizing fasciitis" was popularized by Wilson in 1952, and remains in use even today.[2]

The terminology of NF is of secondary concern as the disease presentation and progress is a real challenge to treating surgeon. The spectrum of the disease ranges from low grade necrosis of the skin to limb or life-threatening infections with systemic toxicity. The presentation can be

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fulminant and their clinical course is highly unpredictable.[4] The thickness of the subcutaneous layer determines the speed of spread of inflammation and necrosis and it moves along the fascial plane. A high index of suspicion is warranted for the early diagnosis of fatal complications.[5] Aggressive repeated surgical intervention and appropriate antimicrobial therapy is essential to reducing the morbidity and mortality associated with NF. Hence, primary emphasis must be focused on rapid recognition and appropriate aggressive treatment.

The incidence of NF is increasingly more common these days and it is associated with a fulminant course and high mortality rates.[5–7] They vary in triggering factors, predisposing and causative factors, anatomic location, offending bacteria, and tissue level of involvement. The current study was planned to study the socio-demographic, clinical, microbiological, risk factor profile and complications of patients diagnosed with necrotizing fasciitis.

2. Materials and Methods

2.1. Study design and setting

It is a descriptive analytical study. It was carried out at Surgery ward of a tertiary care teaching hospital at Puducherry. It is located in a village called Kirumampakkam which is almost 20 kilometres from the city of Puducherry. The hospital is a 540 bedded multispecialty centre comprising of 26 departments including accidents and emergency. Of these 120 beds are exclusively earmarked for general surgery department.

2.2. Study subjects

Patients who were clinically and histopathologically confirmed case of necrotising fasciitis fulfilling the eligibility criteria were the study participants. Inclusion criteria were inpatients, adults more than 18 years, both genders, newly diagnosed, clinically confirmed case of necrotising fasciitis with histopathologically confirmed necrosis of either one of the following part that is skin, subcutaneous tissue, fascia and muscle. All patients fulfilling the eligibility criteria during the study period that was April 2007 to March 2010 were recruited for the study. Thus, totally 50 patients fulfilled the selection criteria.

2.3. Study variables and tool

The study variables were collected with the help of pretested proforma. The first author assessed the eligibility of the patients with help of predefined criteria. Information on socio-demographic variables, history of triggering and predisposing factors for the lesions were obtained through interview. Thorough clinical examination was carried out and presence of systemic toxicity was identified based on the presence of three of the following criteria.[8] Hypotension with systolic blood pressure less than 100 mmHg, temperature greater than 38 °C, heart rate greater than 110 beats/min, urine output less than 30 mL/h, mental confusion, disorientation regarding time, place, and person.

All eligible patients were subjected to baseline haematological and biochemical investigations, to identify the predisposing conditions and indicators of poor prognosis. In patients having hyperglycemia routine blood glucose profile with three readings per day and morning & evening urine examinations were done. Once the diagnosis of diabetes was made, effective glycemic control was achieved and maintained. Detailed microbiological investigation including culture and drug sensitivity was performed.

The following parameters and cut offs were used in this study:

1. Anemia: Hemoglobin level less than 10 mg/dL.
2. Leukocytosis: White blood cell count (WBC) greater than 10,000/mm^3
3. Hyperglycemia: Random blood glucose level greater than 120 mg/dL.
4. Renal dysfunction: serum creatinine level greater than 2 mg/dL.
5. Adult respiratory distress syndrome: radiological evidence of diffuse pulmonary edema.
6. Hepatic dysfunction: Serum bilirubin greater than 3 mg/dL.
7. Multiorgan system dysfunction: Acutely diminished function in two or more organ systems
8. Acquired immunodeficiency syndrome (AIDS): Post serological [enzyme-linked immunosorbent assay (ELISA)] test for AIDS antibodies
9. Blood urea nitrogen
10. Radiological evidence of soft-tissue gas

Aggressive treatment including resuscitation with intravenous fluid administration and inotropic support were provided to patients with shock and systemic toxicity. Upon clinically diagnosing the NF, all of them were started on intravenous antibiotics. The choice of antibiotics was adopted after reviewing the common organisms and the sensitivity reported in the institute. Whenever there was unsatisfactory progress, the antibiotics were changed as per the culture and sensitivity report. Preoperatively the wounds were cleaned with hydrogen peroxide and povidone iodine. Radical and aggressive debridement was done for every patient. In cases the wound showed fresh appearance of unhealthy or necrotic tissue repeated debridement was done.[9] Every case was followed up until the wound healed completely. Any resultant morbidity or mortality during the follow-up was recorded.

2.4. Data entry and statistical analysis

The collected information were entered and analysed in Epi Info software version 3.5.3. Study parameters were described using percentages for categorical variables and in median, inter quartile range for continuous variables which was not normally distributed. 95% confidence interval was found out for all proportions.

2.5. Ethical issues

The present study was approved by the institute research and ethics committee. Before recruiting the patient's informed written consent was obtained from the patients.

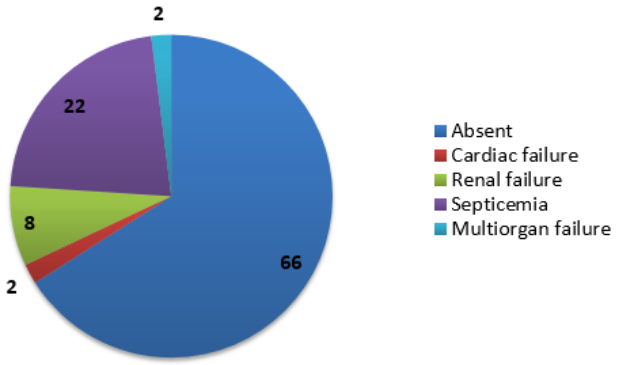

Fig. 1: Complications of necrotising fasciitis among the study participants

Table 1: Demographic details and treatment seeking behaviour of patients.

Sl. No.	Characteristics	Frequency	Percentage
1	Age group in years		
	1-14	1	2
	15-39	8	16
	≥ 40	41	82
2	Gender		
	Male	38	76
	Female	12	24
3	Median duration between symptom and treatment seeking (IQR)	8 (4-15) days	
4	Mean duration of hospital stay (standard deviation)	17 (6) days	

IQR-Inter quartile range

3. Results

The majority of the patients belong to the age group of more than 40 years that contributed to 82% of the total study subjects. Patient in the paediatric age group was very less (2%). 76 % of the study participants were males and only 12 of them were females. The median time taken by the patients to report to the hospital was 8 days and it ranged from 4 to 15 days (Table 1). Median number of debridement performed per patients was 3. One (2%) of the patient succumbed to the infection and 2 (4%) of them required amputation of lower limb as a sequelae of the infection. Mean duration of hospital stay of these patients was 17 days.

The commonest anatomical site of NF among the study subjects was lower extremity (36%) followed by upper extremity (14%) and the least site of presentation was over head, neck and back (4%). 5 (10%) of them had wounds over perineum and buttock. Majority of them gave no history of triggering factors for the development of wound. Among those who had a history of triggering factor, the commonest were due to trauma (32%) followed by infected pre-existed ulcer (20%). 2 (4%) of them revealed it was following administration of injections. Age (58%) and Diabetes mellitus (52%) were the commonly identified predisposing factor for the NF. 20 (40%) of them had a risk factor of chronic alcohol consumption (Table 2).

All patients had pain and fever as presenting complaints. 38 (76%) of them had swelling and 25 (50%) of them had foul smelling discharge. On local examination, all had tenderness, 40 (80%) of them had erythema, 30 (60%) of them had induration and 6 (12%) of them had crepitus. On intraoperative examination the level of infection was identified. 25 (50%) of them had level III infection and only 6 (12%) of them had level I infection. As per the operational criteria described above, 14 (24%) of them had systemic toxicity (Table 3).

Bio-chemical investigations revealed 48 (96%) of them had leukocytosis, 32 (64%) of them were anemic, 31 (62%) of them had hyperglycemia and only 9 (18%) of them had raised serum creatinine level. Microbiological examination revealed 42 (84%) of their wound had polymicrobial colonies and all of them had only aerobic organisms grown. The commonest bacteria grown in the culture material was E. coli (74%), followed by Streptococcal species (70%) and Staphylococcal infections (48%). The least grown organism was Proteus (4%) (Table 4). 34 % of the patients developed complications during the hospital stay following treatment. 22% of them developed septicaemia, 8% of them had renal failure and 2% of them developed cardiac failure and Multiorgan failure each (Figure 1).

4. Discussion

Of the 50 patients with NF, majority of them (82%) were more than 40 years that was during their middle age and other studies also have reported maximum incidence of the disease in the middle age group.[1–12] Majority (76%) of the patients were males in the current study and similar findings were found in other studies as well.[10–13] In the current study majority of them reported (44%) no triggering

Table 2: Site, triggering factors and risk factors of necrotising fasciitis among study participants

Sl. No.	Characteristics	N (%)	95% CI
1	Site		
	Lower extremity	28 (36)	22.9 – 50.8
	Upper extremity	7 (14)	5.8 – 26.7
	Perineum and buttock	5 (10)	3.3 – 21.8
	Head & Neck	2 (4)	0.4 – 13.7
	Chest/Breast	3 (6)	1.2 – 16.5
	Abdomen and back	2 (4)	0.4 – 13.7
	Multiple site	3 (6)	1.2 – 16.5
2	History of triggering factors		
	No such history (Idiopathic)	22 (44)	29.9 – 58.7
	Trauma	16 (32)	19.5 – 46.7
	Infected ulcer	10 (20)	10.1 – 33.7
	Following injections	2 (4)	0.4 – 13.7
3	Risk factors*		
	Chronic alcoholism	20 (40)	26.4 – 54.8
	Diabetes Mellitus	26 (52)	37.4 – 66.3
	Cardio-vascular disease	7 (14)	5.8 – 26.7
	Peripheral vascular deficiency	12 (24)	13.1 – 38.1
	Age >50 years	29 (58)	43.2 – 71.8

*Multiple response type, CI-Confidence interval

Table 3: Clinical picture (symptoms, signs and examination findings) of patients

Sl. No.	Characteristics	N (%)	95% CI
1	Symptoms*		
	Pain at affected site	50 (100)	NA
	Swelling / Edema	38 (76)	61.8 – 86.9
	Foul smelling discharge	25 (50)	35.5 – 64.4
	Wound	34 (68)	53.3 – 80.4
	Fever	50 (100)	NA
2	Local examination*		
	Tenderness	50 (100)	NA
	Erythema	40 (80)	66.2 – 89.9
	Induration	30 (60)	45.1 – 73.5
	Cutaneous gangrene	20 (40)	26.4 – 54.8
	Skin discolouration	26 (32)	19.5 – 46.7
	Bullae/vesicies	24 (48)	33.6 – 62.6
	Crepitus	6 (12)	4.5 – 24.3
	Level of infection		
	Level I	6 (12)	4.5 – 24.3
	Level II	10 (20)	10.1 – 33.7
	Level III	25 (50)	35.5 – 64.4
	Level IV	9 (18)	8.5 – 31.4
3	Systemic toxicity	14 (24)	13.1 – 38.1

*Multiple response type, CI-Confidence interval

factors for the wound formation. Other studies also have reported the same.[4–10,14–16] Among the triggering factors the commonest was trauma (32%) in the present study and study by Madhumita et al. also reported similar finding.[11]

The commonest predisposing factor in the present study was Diabetes Mellitus (52%) and previous studies also reported the same. Diabetes mellitus being an immune compromised state plays the role of predisposing susceptible people for infections. Moreover among hyperglycemic patients it causes micro vascular changes, neuropathy and vasculopathy, delay in wound healing process. All these ultimately lead to progression of infection.[17,18] The commonest addiction that leads to progression of infection in the present study was chronic alcoholism (40%), even other studies had mentioned chronic alcoholism as a major risk factor.[19] Liver cirrhosis due to any cause including chronic alcoholic intake can weaken the intestinal-portal route barrier, which facilitates

Table 4: Laboratory findings of study participants.

Sl. No	Characteristics	N (%)	95% CI
1	Bio-chemical tests*		
	Anaemia	32 (64)	49.1 – 77.1
	Leukocytosis	48 (96)	86.2 – 99.5
	Serum Creatinine>2mg/dl	9 (18)	8.5 – 31.4
	Hyperglycemia	31 (62)	47.1 – 75.3
2	Microbiological findings		
A	Pattern of microbes		
	Polymicrobal	42 (84)	70.8 – 92.8
	Monomicrobial	8 (16)	7.1 – 29.1
	Aerobic	50 (100)	NA
B	Type of organism grown*		
	Streptococci	35 (70)	55.3 – 82.1
	Staphylococci	24 (48)	33.6 – 62.5
	Escherichia coli	37 (74)	59.6 – 85.3
	Klebsiella	11 (22)	11.5 – 35.9
	Proteus	2 (4)	0.48 – 13.7
	Pseudomonas	10 (20)	10.1 – 33.7

*Multiple response type, CI-Confidence interval

the entry of bacteria into the systemic circulation and renders patients prone to various infectious diseases such as NF, spontaneous bacterial peritonitis, respiratory infections or urinary tract infections.[20] Many reports have shown that liver cirrhosis is a common underlying disease in patients with NF.[21,22] However, it remains unknown whether liver cirrhosis can increase the occurrence of NF.

The major anatomical site involved in the current study was lower extremity (36%). Studies at various parts of India also reported the same finding.[12,13,17–23] Whereas few studies carried out in the foreign countries found that NF was commonly seen in the region of perineum.[8–13,15,16] In the present study only 5% of them had Fournier's gangrene. However the reason for this difference is yet to be explored.

In the current study 84% of the wounds were polymicrobial in nature. Almost all studies carried out previously also revealed the similar finding. Giuliano and colleagues classified the NF into three types as per different microbial etiologies, as well as potential differences in patient populations and typical presentation.[24] Type I infections are classically polymicrobial with various species of gram-positive cocci, gram-negative rods, and anaerobes. Type II are monomicrobial mainly infected with group A streptococcal and Type III is called as gas gangrene, or infection with clostridial myonecrosis. In the current study 74% infection was due to E. coli infection. Harikrishnan et al and Madhumita et al. studies also had isolated E.coli as the commonest organism in NF patients.[1,11] Other commonest organisms isolated from these patients were S.aureus and S.pyogenes.

Survival rate in the current study was quite higher (98%). The early recognition of patients, prompt identification and control of predisposing factors like hyperglycemia and septicaemia played a major role. Anaerobic coverage is quite important for type 1 infection; metronidazole, clindamycin, or carbapenems (imipenem) are effective antimicrobials. Type 2 disease is treated with antibiotics against S. pyogenes and S. aureus, which usually coexist with the former. Hence, first or second generation of cephalosporins are used for the coverage of methicillin-sensitive Staphylococcus aureus (MSSA). Type 3 NF should be managed with clindamycin and penicillin, which cover the Clostridium species.[6,10]

Surgical debridement is the main stay of treatment, and must be performed as early as possible and aggressively.[25,26] Delay in debridement when the patient is in septic shock results in near mortality. General anaesthesia is considered best to perform debridement and non-necrotic tissue should be left out, it requires thorough excision. When finger dissection of subcutaneous tissue from its fascia is not possible then only debridement is considered adequate. If necessary parallel counter incisions may be made to exclude additional spread of infection. Amputation may be required for massive involvement of an extremity that limits the development of septic shock and further complications.[9] The wound is kept moist with saline or 0.25% Dakin's solution and packed open. Repeated debridement may be required based on the assessment of operated area every 24 hours or even earlier if indicated until the progression of the necrosis comes down. Postoperatively, patients are monitored in the intensive care unit. Once sepsis has resolved, early initiation of nutritional support and physical therapy helps speedy recovery. Only when the infection is clinically controlled and healthy granulation tissue starts appearing, the wound can be covered.[27] Depending on the level of involvement either split thickness skin grafts or a flap procedure may be required. But most of the times split thickness skin grafts founds to be adequate.

5. Conclusion

Necrotizing fasciitis though a rare infectious disease, it is a life-threatening condition with a high mortality rate that is nearly 100% without appropriate surgical and medical intervention. Numerous predisposing conditions are associated with this pathology, such as diabetes mellitus, immunosuppression, chronic alcohol disease, chronic renal failure, and liver cirrhosis, which can be conductive to the rapid spread of necrosis, and increase in the mortality rate. The diagnosis of NF is difficult and it should be aimed at identifying at the earliest to avoid complications. However, the clinician should have an utmost degree of suspicion to secure the diagnosis of NF, as a delay in diagnosis can be fatal, and septic shock is inevitable if the disease remains untreated.

6. Source of Funding

None.

7. Conflict of Interest

None.

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