

Necrotizing fasciitis: A decade of surgical intensive care experience

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Abstract

Necrotizing fasciitis is a rare disease, potentially limb and life-threatening infection of fascia, subcutaneous tissue with occasionally muscular involvement. Necrotizing fasciitis is a surgical emergency with high morbidity and mortality. **Aim:** Aim of this study was to analyze presentation, microbiology, surgical, resuscitative management and outcome of this devastating soft tissue infection. **Materials and Methods:** The medical records of necrotizing fasciitis patients treated in surgical intensive care unit (SICU) of our hospital from Jan 1995 to Feb 2005 were reviewed retrospectively. **Results:** Ninety-four patients with necrotizing fasciitis were treated in the surgical intensive care unit during the review period. Necrotizing fasciitis accounted for 1.15% of total admissions to our SICU. The mean age of our patients was 48.6 years, 75.5% of the cases were male. Diabetes mellitus was the most common comorbid disease (56.4%), 24.5% patients had hypertension, 14.9% patients had coronary artery disease, 9.6% had renal disease and 6.4% cases were obese. History of operation (11.7%) was most common predisposing factor in our patients. All patients had leucocytosis at admission to the hospital. Mean duration of symptoms was 3.4 days. Mean number of surgical debridement was 2.1, mean sequential organ failure assessment (SOFA) score at admission to SICU was 8.6, 56.38% cases were type 1 necrotizing fasciitis and 43.61% had type 2 infection. Streptococci were most common bacteria isolated (52.1%), commonest regions of the body affected by necrotizing fasciitis were the leg and the foot. Mean intubated days and intensive care unit (ICU) stay were 4.8 and 7.6 days respectively. Mean fluid, blood, fresh frozen plasma and platelets concentrate received in first 24 hours were 4.8 liters, 2.0 units, 3.9 units and 1.6 units respectively. Most commonly used antibiotics were piperacillin with tazobactam and clindamycin. Common complication was ventricular tachycardia (6.4). 46.8% patients had multi organ dysfunction, 15 of them died giving a mortality of 16% in this study. **Conclusion:** Necrotizing fasciitis is more common in males, diabetes mellitus was the most common comorbid disease, type 1-necrotizing fasciitis was more common and the most common regions of the body affected by necrotizing fasciitis were the leg and the foot.

Key words: Foot, leg, necrotizing fasciitis, streptococci, type 1

Necrotizing fasciitis is a rapidly spreading and potentially devastating soft tissue infection. It is a

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progressive infectious process primarily involving fascia and subcutaneous tissue, with thrombosis of cutaneous microcirculation. Necrotizing fasciitis is a life and limb threatening surgical emergency that has been recognized for centuries dating back to Hippocrates in fifth century BC.^[1] Wilson first used the term necrotizing fasciitis in 1952 to describe the disease.^[2] A variety of

terms have been used to describe the same condition including hospital gangrene, progressive bacterial synergistic gangrene, Fournier's gangrene, streptococcal gangrene and flesh eating bacterial infection. Necrotizing fasciitis is an uncommon disease and prognosis hinges on accurate early diagnosis and immediate institution of appropriate treatment.

The purpose of present study was to analyze presentation, type of infection, predisposing and comorbid conditions, surgical and resuscitative treatment and outcome of this soft tissue infection.

Materials and Methods

Our hospital is a 1444 bedded tertiary medical care centre with a 12-bed surgical intensive care unit (SICU). The medical records of necrotizing fasciitis patients treated in SICU between Jan 1995 and Feb 2005 were reviewed retrospectively. Only those patients with histopathology confirming the diagnosis were included in the study.

The variables that were examined in the present study includes age, gender, location of necrotizing fasciitis, duration of symptoms, presentation, predisposing factors, comorbid disease, severity of the disease, surgical and initial resuscitation, complications, intensive care unit (ICU) stay and outcome of this surgical emergency.

Statistical analyses were performed with use of SPSS statistical software. Bivariate analysis was performed with Chi-square test or Fisher's exact probability test for comparisons of proportion between groups-*P* value < 0.05 was considered significant.

Results

Ninety-four patients with necrotizing fasciitis were treated at our SICU during the period under review, which accounts for 1.15% of total admissions to surgical intensive care unit during the said period. Mean age of our patients was 48.6±16.3 years [Table 1], 75.5% of patients were male. Non insulin dependent diabetes mellitus (NIDDM) was the most common comorbid condition (56.4%), 24.5% patients had hypertension (HTN), 14.9% had coronary artery disease (CAD), 9.6% had kidney disorders, 6.4% were obese, 5.3% had chronic obstructive pulmonary diseases (COPD) and 2.1% of these patients had bronchial asthma (Asthma).

Table 1: Age, severity, fluid, blood, blood products needed and intensive care unit stay

Variables	Mean	Std. Deviation
Age (years)	48.6	16.3
WBC on admission	22.0	33.0
Temperature C	37.8	1.7
Number of debridement	2.1	1.5
Sofa score	8.6	4.7
Duration of symptoms (days)	3.4	2.7
Fluid required for 1 st 24 hrs	4.8	2.2
Number of pack RBCs received for 1 st 24 hrs	2.0	2.2
Number of fresh frozen plasma received for 1 st 24 hrs	3.9	4.2
Number of platelets received for 1 st 24 hrs	1.6	4.9
Intubated days	4.8	5.5
intensive care unit stay (days)	7.6	9.6

The common predisposing factor for necrotizing fasciitis in this study was operative procedure (11.7%), four patients developed necrotizing fasciitis after incision and drainage of abscess, one each after hip surgery, dilatation and curettage, episiotomy, abdominal surgery, above knee amputation, dental extraction and emergency tracheostomy. History of trauma (10.6%) and 2.1% patient had history of insect bite. 48.9% of our patients received nonsteroidal anti inflammatory drugs (NSAID) [Table 2]. All our patients had fever and leucocytosis on admission to the hospital.

Mean duration of symptoms was 3.4 ± 2.7 days, number of debridement our patients had was 2.1 ± 1.5 times, Sequential organ failure assessment (SOFA) score at admission to SICU was 8.6 ± 4.7, fluid, packed red

Table 2: Co-morbidities, predisposing factors and complications

Variables	Frequency	Percentage
Sex		
Male	71	75.5
Female	23	24.5
Co-morbid conditions		
NIDDM	53	56.4
CAD	14	14.9
HTN	23	24.5
Kidney disease	9	9.6
COPD	5	5.3
Asthma	2	2.1
Obesity	6	6.4
Predisposing factors		
History of operation	11	11.7
History of trauma	10	10.6
History of insect bite	2	2.1
History of NSAID	46	48.9
Complications		
Compartment syndrome	5	5.3
Ventricular tachycardia	6	6.4
Tension pneumothorax	1	1.1
Acute renal failure	2	2.1

blood cell (PRBC), fresh frozen plasma (FFP) and platelet concentrate received were 4.8 ± 2.2 liters, 2.0 ± 2.2 units, 3.9 ± 4.9 units and 1.6 ± 4.9 units respectively in first 24 hours of admission to SICU. The intubated days were 4.8 ± 5.5 days and SICU stay was 7.6 ± 9.6 days [Table 1].

The common bacteria isolated from the necrotic tissue of these patients was streptococci (streptococci pyogenouseandstreptococci agalaectiace) (52.1%) then *Staphylococcus aureus* (39.4%) *E. coli* (*Escherchia coli*) 22.3%, *Pseudomonas aeroginosa* 14.9%, bacterioids 14.9%, *Klebsiella pneumonia* 5.3% and *Aeromonas sobori* in 1.1% of the patients [Figure 1]. The most common region affected by necrotizing fasciitis was the leg and the foot (33%) then the thigh (21.3%), the perinium and the genitalia 20.2%, the chest flank and axilla 8.5%, gluteal and hip 8.5%, arm, forearm and hand 7.5%, cervical 5.3% and the abdomen involved in 2.1% of the patients [Figure 2]. Eighty two percent patients received two antibiotics while 17% received three antibiotic combination, most commonly

used antibiotics were piperacillin with tazobactum and clindamycin [Table 3].

Total 56.38%patients had type 1 necrotizing fasciitis and 43.4% of them multi- organ dysfunction syndrome (MODS) whereas 43.61% patients had type 2 necrotizing fasciitis and 51.2% of these cases had MODS. Type1 infection was significantly higher in diabetic patients.

The overall mortality was 16%, in type 1 necrotizing fasciitis the mortality was15.1% while it was 17.1% in type 2 necrotizing fasciitis patients, the difference in mortality was not significant [Table 4].

Discussion

Necrotizing fasciitis is a surgical emergency, early diagnosis, prompt and aggressive debridement and definitive therapy in the intensive care environment has been demonstrated to improve outcome.^[3,4] However since Meleney's time, the mortality associated with necrotizing fasciitis remained high, with a reported cumulative mortality of 34% ranging from 6 to76%.^[5] The difficulty in making early diagnosis is due to paucity of cutaneous finding in early course of the disease.^[6] These patients usually present with exquisite pain, swelling and

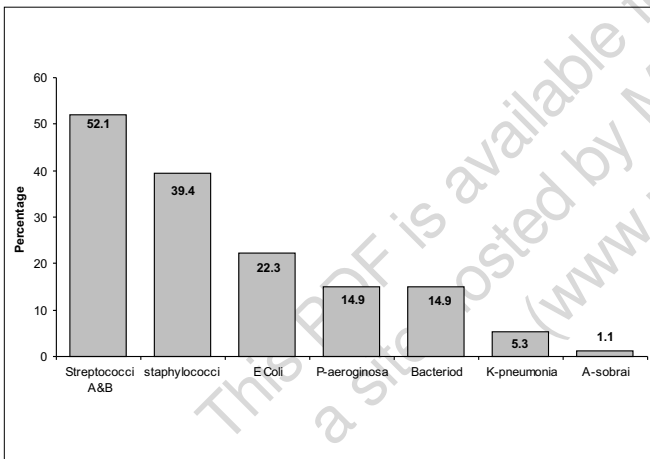


Figure 1: Bacteriology

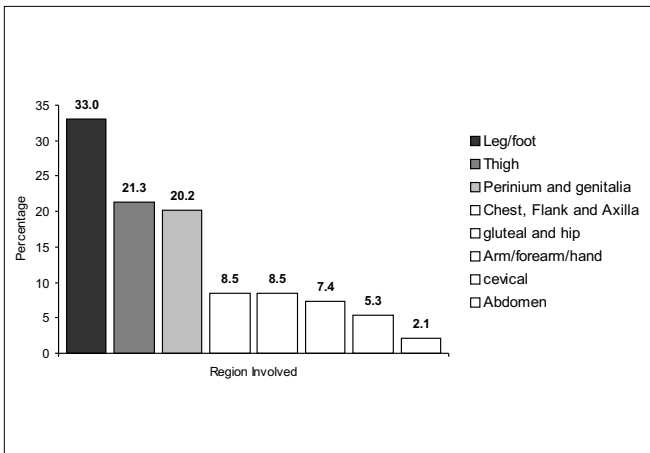


Figure 2: Region involved

Table 3: Antibiotics used and their frequency

	Count	Frequency
Tazocin (Piperacilin + tazobzctum)	69	73.4
Clindamycin	60	63.8
Rocephine (Ceftrixion)	11	11.7
Metronidazole	21	22.3
Meropenam	11	11.7
Ciprofloxacin	11	11.7
Amikacine	13	13.8
Gentamycin	4	4.3
Vancomycin	3	3.2

Table 4: Type of necrotizing fasciitis and their association with diabetes mellitus and their outcome

Variable	Type I	Type II	Total
MODS			
Yes	23 (43.4)	21 (51.2)	44 (46.8)
No	30 (56.6)	20 (48.8)	50 (53.2)
	53 (56.38)	41 (43.62)	94 (100)
NIDDM*			
Yes	38 (71.7)	15 (36.5)	53 (56.4)
No	15 (28.3)	26 (63.4)	41 (43.6)
OUTCOME			
Survived	45 (84.9)	34 (82.9)	79 (84)
Died	8 (15.1)	7 (17.1)	15 (16)

*P value <0.001

There was no significant difference in the type of necrotizing faciitis according to MODS and in hospital deaths. Only NIDDM was significantly higher among the Type 1 cases and $P<0.001$, Figures in parentheses are in percentage

fever. If these patients received NSAIDs, these agents may mask the manifestations of the disease, and the disease may still be progressing, leading to delay in diagnosis and management.^[7] In this study, 48.9% patients had history of receiving NSAIDs.

Patients with necrotizing fasciitis usually have some predisposing factors such as trauma, surgery, scratch or insect bite.^[8] In our patients, the most common predisposing factor was a surgical procedure.

Most of the patients who are affected by necrotizing fasciitis have pre existing conditions that render them susceptible to infections. Conditions that result in immunocompromization in such patients include advanced age, chronic renal failure, peripheral vascular disease, drug abuse and diabetes mellitus.^[9] Diabetes mellitus was the common comorbid disease (56.4%) in our patients. In diabetic patients, high blood glucose levels act as a good medium for bacterial growth of low oxygen tension and rich in substance for bacterial growth.^[10]

Necrotizing fasciitis can affect any region in the body, but most commonly effects extremities, perineum and truncal areas of the body.^[11] Patients with necrotizing fasciitis present with local signs of infection but severe pain disproportionate to local findings and associated with systemic toxic manifestations.^[12] All our patients had fever and leucocytosis. Leucocytosis and fever at admission to the hospital; leucocytosis is one of the indicators in laboratory risk indicators for necrotizing fasciitis (LRINEC) score for early diagnosis and differentiating necrotizing fasciitis from other soft tissue infections with more than 90% sensitivity and specificity.^[13] Computerized tomography (CT scan) magnetic resonance imaging (MRI) help make an early diagnosis of necrosis. MRI can detect the extent of necrotizing fasciitis and it can identify soft tissue edema infiltrating the fascial planes, many hours prior to cutaneous signs of infection or local gangrenous changes allowing rapid diagnosis and treatment and improved outcome.^[14] But MRI is not available in many places and can delay the surgical procedure, secondly it can overestimate the extent of deep fascial involvement as the sensitivity of MRI exceeds its specificity.^[15] Other tests are needle biopsy or finger test, which can be performed at the bedside, in the ward.^[16] Patients included in our

study were admitted to the surgical intensive care unit before or after debridement (mean SOFA score 8.6). Patients with necrotizing fasciitis have large volumes of extracellular fluid sequestered the oedematous wound, or have capillary leak. They may also have hemolysis or a coagulopathy.^[17] These patients mat present to the hospital in toxic shock necessitating admission to an intensive care unit for aggressive management of their shock, infection, coagulopathy and other problems. In our unit during the first 24 hours of admission to SICU these patient received more then 4.8 ± 2.2 liters of fluid, 2.0 ± 2.2 units PRBC, 3.9 ± 4.2 unit FFP, 1.6 ± 4.9 units of platelet concentrate. Prompt and aggressive surgical debridement in corner stone of management of this soft tissue infection. Number of debridements in our patients was 2.1 ± 1.5 times. After diagnostic delay, the most common pitfall was inadequate surgical debridement. The debridement should be aimed to remove all necrotic tissue, may be on a daily basis until the local infectious processes have resolved.^[18]

Necrotizing fasciitis has been divided into two types on the basis of microbiological culture. Type 1 necrotizing fasciitis is polymicrobial, usually caused by aerobic and anaerobic organisms, while Type 2 necrotizing fasciitis is caused by streptococci alone or with staphylococci.^[19] In our study 56.38% patients had type 1 infection and 43.62% had type 2 necrotizing fasciitis, 71.7% of diabetic patients had type1 necrotizing fasciitis, it is learned from literature that type 1 necrotizing fasciitis was common in patients with diabetes mellitus.^[20] The toxic shock syndrome and multi organ dysfunction syndrome is commonly seen in Type II necrotising fasciitis and is associated with increased mortality.^[21] In this study, 46.8% patients went into multi organ dysfunction and 51.2% of type 2 necrotizing fasciitis had MODS. Neutralization of circulating streptococcal toxins by administrating intravenous immunoglobulin is a desirable goal when hypotension is present, but more studies are required to recommend its routine use as is the case with use of hyperbaric oxygen in treatment of this disease also needs clinical trail to justify it use.^[22] In our study, most of the patients received two antibiotics and the commonest were piperacillin - tazobactam and clindamycin. When necrotizing fasciitis was treated with high doses of penicillin alone, it was less effective than expected, while the initial therapy with combination with protein synthesis inhibiting antibiotics especially

clindamycin had a favorable outcome.^[23] Importance of the use of Clindamycin in the treatment of necrotizing fasciitis needs to be emphasized, as its use was associated with reduction in mortality in our study. Clindamycin is known to decrease the production of streptococcal toxins and enzymes even at sub inhibitory concentrations.^[24] When treating type 1 necrotizing fasciitis aminoglycosides have to be added to the therapy.

In this study our patients had a few unusual complications; 6.4% had ventricular tachycardia, 5.3% had compartment syndrome causing acute renal failure and one patient of staphylococcal necrotizing fasciitis had tension pneumothorax [Table 1].^[25] Overall mortality in our patients was 16%, which is lower than mentioned in literature.

Conclusion

Necrotizing fasciitis was more common in male and diabetic patients. Type 1 necrotizing fasciitis was common in our study and leg and foot was common region affected, overall mortality was lower, there was no significant difference in mortality in type 1 and type 2 necrotizing fasciitis patients.

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