

ORIGINAL ARTICLE

A Clinicopathological Study of Necrotizing Fasciitis

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Abstract: *Background:* Necrotizing fasciitis is a relatively common infection with high morbidity and mortality, as they often present late in their clinical course. Quick and aggressive surgical treatment improves survival and decreases hospital stay. *Methods:* A prospective study of 50 consecutive patients of necrotizing fasciitis who were admitted in our hospital over a period of 342 days between May 2007 and April 2008. The study includes clinical presentation, biochemical parameters, bacteriology, predisposing factors, associated co-morbid conditions, time interval between admission and first surgical intervention and outcome of this life threatening infection. *Results:* 50 patients of necrotizing fasciitis were studied over a period of 342 days. The mean age of the patients were 44.5 ± 8.36 years and male: female ratio was 3.17 : 1. Diabetes mellitus was the most common co-morbid condition (42%). Alcoholism was the commonest addiction (34%). Regarding predisposing conditions majority (48%) of the cases were idiopathic. History of trivial trauma was present in (38%) patients. Mean duration of symptoms was 5.16 ± 0.902 days. Perineum was the commonest site involved (52%) followed by the lower extremity (40%). The commonest bacteria isolated was E.coli (42%). The culture was polymicrobial in (78%) patients. Mean number of surgical debridement were 3.84 ± 0.809 . Secondary surgical procedures included mobilization and suturing (48%) and skin grafting (42%). Average duration of hospital stay was 33.04 ± 7.99 days. Mortality was 10%. *Conclusions:* Necrotizing fasciitis is more common in middle aged males. Diabetes mellitus is the most common co-morbid condition associated with necrotizing fasciitis. The perineum is commonly affected. The presence of multiple co-morbid conditions reduces the survival. Early diagnosis and aggressive surgical debridement reduces mortality.

Key words: Necrotizing fasciitis, Clinico-pathological study, Surgical debridement, Outcome

Introduction

Necrotizing fasciitis, commonly known as “flesh eating disease”, is an infection of the subcutaneous tissue and deep fascia. It is a life threatening surgical emergency characterized by rapidly spreading necrosis of the subcutaneous fat and fascia with thrombosis of cutaneous micro-circulation [1-2]. Although the syndrome of necrotizing fasciitis was originally described by Meleney in 1924, the term necrotizing fasciitis was first used by Wilson in 1952 [3]. Early recognition and aggressive debridement is the main determinant of prognosis.

Patients and Methods

This is a prospective study of 50 consecutive patients of necrotizing fasciitis who were admitted in our teaching hospital over a period of 342 days. Data collected for

each patients included the age, sex, associated co-morbid conditions, site of involvement, predisposing factors, addiction, clinical parameters (pyrexia, duration of symptoms, presence of hypotension), laboratory parameters (haemoglobin, total leucocyte count, blood sugar, serum albumin, serum creatinine), number of major debridements, bacteriology, secondary surgical procedures, duration of hospital stay and final outcome. The diagnosis of necrotizing fasciitis was based on clinical findings, operative finding of the presence of dull grey, necrotic superficial fascia and subcutaneous tissues with serosanguinous fluid and microscopic demonstration of extensive polymorphonuclear cell infiltration in the dermis and underlying fascia with obliterative thrombosis of arteries and veins. The patients were initially administered intravenous fluids and antibiotics followed by aggressive surgical debridement. Definitive wound coverage was performed after the patients were free of infection and when the wound appeared healthy.

Results

Age Group	No. of cases	Males	Females	M.F. ratio
20-29	1	1	-	-
30-39	10	10	-	-
40-49	25	20	5	4 : 1
50-59	11	7	4	1.75 : 1
60-69	2	-	2	-
70-79	1	-	1	-

50 patients of necrotizing fasciitis were treated during the study period. The age ranged from 22-71 years, the mean age being 44.5 ± 8.36 years. Maximum (50%) cases were between 40-49 years. Patients aged between 30-59 years comprised 92% of the total. There were 38 males and 12 females, the male : female ratio being 3.17 : 1 (Table 1). Diabetes mellitus was the most common associated co-morbid condition comprising of 21 (42%) patients. The associated co-morbid conditions are shown in (Table 2). Alcoholism was the most common addiction in 17(34%) patients followed by intravenous drug abuse in 6(12%) patients. According to the history given intravenous drug abuse was through the forearm veins in 2 cases, but in all the six cases the affected site was the inferior extremity.

Co-morbid condition	No of cases	Percentage
Diabetes	17	34
Diabetes and obesity	1	2
Diabetes and peripheral vascular disease	1	2
Diabetes and renal failure	1	2
Diabetes and tuberculosis	1	2
Tuberculosis	1	2
Leprosy	1	2

All the patients in this study were HIV negative.

No predisposing factor was present in 24 (48%) patients. Trivial trauma was the most common predisposing factor found in 19 (38%) patients (Table 3). The perineum (figure 1) was the most common site involved in 26 (52%) patients followed by the lower extremity in 20 (40%) patients and anterior abdominal wall in 4 (8%) patients. In the lower extremity, only the thigh was involved in 6 (12%) patients, the leg and foot were involved in 12 (24%) patients and the whole extremity was involved in 1 patient (2%) (figure 2).

Table-3: Predisposing factors for necrotizing fasciitis		
Predisposing factors	Number	Percentage
Trauma	19	38
Perianal abscess	3	6
Post operative	1	2
Insect bite	1	2
Injection	1	2
Scald	1	2
Idiopathic	24	48

The upper extremity or the head and neck region were not involved in any of the patients.

Fig-1: Necrotizing Fasciitis Involving The Scrotum



Fig-2: Necrotizing Fasciitis Involving The Lower Extremity



Table-4: Clinical Parameters at presentations	
Age:	
≤ 50 years	n = 42
> 50 years	n = 8
Sex:	
Male	n = 38
Female	n = 12
Duration of symptoms:	
≤ 5 days	n = 33
> 5 days	n = 17
Pyrexia:	
< 100.5 ⁰ F	n = 19
≥ 100.5 ⁰ F	n = 31
Systolic blood pressure:	
< 100 mmHg	n = 13
≥ 100 mmHg	n = 37
Body surface area:	
< 5 %	n = 14
≥ 5%	n = 36

Regarding clinical features, local erythema and swelling were present in all cases. Pain was present in 29 (58%) patients. Bullous lesion was present in 16 (32%) patients. 6 patients had features of shock at the time of admission. The clinical and laboratory parameters are given in table 4 & 5. It was seen that patients with age > 50 years, symptoms > 5 days duration, systolic blood pressure < 100 mmHg and affected body surface area > 5% at admission had longer hospital stay. Also patients with leucocytosis > 14000/cumm, blood sugar > 180mg/dl, serum albumin < 3gm/dl, serum creatinine > 1.5mg% had worse prognosis. Mean duration of symptoms was 5.16 ± 0.902 days. Number of debridements were 3.84 ± 0.809. Early debridement (within 24 hrs of admission) had a better prognosis. Only 1 patient expired among the 37 patients undergoing early debridement. Among the 13 patients who had their first debridement later than 24 hrs after admission, 4 patients expired making the mortality rate 30.8%. The average duration of hospital stay was 33.04 ± 7.99 days.

Haemoglobin :		
< 10gm%	n = 36	
≥ 10gm%	n = 14	
Total leucocyte count:		
< 14000 / mm ³	n = 42	
≥ 14000 / mm ³	n = 8	
Blood sugar:		
< 180 mg%	n = 31	
≥ 180 mg%	n = 19	
Serum albumin:		
< 3gm/dl	n = 16	
≥ 3gm/dl	n = 34	
Serum creatinine:		
< 1.5 mg%	n = 19	
≥ 1.5 mg%	n = 31	

The commonest bacteria isolated was E.coli in 26 (52%) patients followed by group A streptococcus in 18 (36%) patients (Table 6). The culture was polymicrobial in 38 (78%) patients, monomicrobial in 4 (8%) patients and sterile in 7 (14%) patients. In case of monomicrobial aetiology, all were streptococcus involving only the lower extremity. Patients were initially given broad spectrum antibiotic combination with second or third generation cephalosporine + aminoglycosides + metronidazole followed by culture based antimicrobials. Among the diabetic patients the mean age was higher. Polymicrobial infection was more common. Scrotum was most commonly affected (47.6%). The mortality rate was higher among the diabetic patients (14.3%).

Monomicrobial			Polymicrobial			Polymicrobial according to site						
Name	No	%	Name	No	%	Name	Site	No	%			
Streptococcus (only lower extremity)	4	8	Escherichia coli	26	52	Escherichia coli	S	16	32			
							L.e	10	20			
							Abw	0	0			
			Streptococcus	18	36	Streptococcus	18	36	Streptococcus	S	7	14
										L.e	8	16
										Abw	3	6
			Staphylococcus	7	14	Staphylococcus	7	14	Staphylococcus	S	1	2
										L.e	3	6
										Abw	3	6
			Pseudomonas	9	18	Pseudomonas	9	18	Pseudomonas	S	1	2
										L.e	7	14
										Abw	1	2
Proteus	7	14	Proteus	7	14	Proteus	S	5	10			
							L.e	2	4			
							Abw	0	0			
Enterobacter	2	4	Enterobacter	2	4	Enterobacter	S	2	4			
							L.e	0	0			
							Abw	0	0			
Klebsiella	2	4	Klebsiella	2	4	Klebsiella	S	1	2			
							L.e	0	0			
							Abw	1	2			
Bacteroids	9	18	Bacteroids	9	18	Bacteroids	S	8	16			
							L.e	1	2			
							Abw	0	0			

S = Scrotum, Le – Lower extremity, Abw – Abdominal wall

Fig-3: Same Patient As In Figure 2, 1 Yr After Skin Grafting



Secondary surgical procedures included mobilization and suturing (48%) and skin grafting (42%) (figure 3). The over all mortality was 10%, among which 80% were males. 60% of the dead had age equal to or more than 50 years. Diabetes was present in 3 cases among which two were associated with other co-morbidities like renal failure and peripheral vascular disease. Streptococcus was more commonly isolated from the dead patients.

Discussion

Necrotizing fasciitis has been recognized for centuries dating back to Hippocrates in the 5th century BC [1]. Necrotizing fasciitis was first described in 1871 by Confederate Army Surgeon Joseph Jones during the American civil war as 'hospital gangrene' and then by Meleny as 'haemolytic streptococcal gangrene' [4]. In 1883, Fournier [5] described a fulminating genital gangrene affecting healthy men, and named the process 'idiopathic gangrene of the scrotum' [2]. In 1952, Wilson [6] used the term necrotizing fasciitis to describe the same disease in other parts of the body.

Necrotizing fasciitis is defined as a rapidly progressive tissue infection characterized by extensive necrosis of the subcutaneous fat and fascia [2]. Secondary necrosis of the overlying skin is common, but the underlying muscles are mostly spared [7]. The most frequent sites are the perineum and lower extremity, but any part of the body can be involved. Patients with necrotizing fasciitis present with local signs of infection and severe pain disproportionate to local findings. There may be associated with systemic toxic manifestations [8]. Systemic manifestations such as hypotension, fever, tachycardia, tachypnea and laboratory findings of leukocytosis and metabolic acidosis are indices of development of sepsis [9].

Necrotizing fasciitis is commonly seen in middle age males [1-3, 9-10]. In our study 50% of the patients were between 40-49 years. Diabetes mellitus was the most common co-morbid condition in our study (42%) which is correlated with that in other literatures [1-2, 11]. Higher blood sugar in these patients produces a good medium for bacterial growth and predisposes to an environment of low oxygen tension and rich substrate for bacterial growth [11]. Diabetes also causes defective phagocytosis, decreased cellular immunity and micro vascular disease with resultant ischemia. Among the diabetic patients in our study, the mean age was higher. Polymicrobial infection was more common and the scrotum was more commonly affected.

The mortality rate was higher among the diabetics (14.3%). Nissar Shaikh [11] in his study found similar results, except for the fact that in his study there was no significant difference in mortality between diabetic and non-diabetic patients with necrotizing fasciitis.

Co-morbid factors associated with necrotizing fasciitis include diabetes, 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 [9]. In our study 46% of the patients had one or more co-morbid factors. Necrotizing fasciitis is known to follow minor trauma, insect bite, pustule or minor operations, anorectal abscess, instrumentation, septic abortion, genitourinary infection [1,4]. In our study majority of the patients did not have a predisposing factor. Among those who died trivial trauma was the commonest predisposing factor.

In our study scrotum and perineum were the commonest site involved. Other studies have shown similar results [2]. There may be a difference in the primary site of infection due to a difference in the hygiene level [2]. In case of perineum, male to female ratio is approximately 10:1 [12]. Lower incidence in females may be caused by better drainage of the perineal region through vaginal secretions [12]. Some studies have shown the infection to be more common in the lower limbs [1,10].

Necrotizing fasciitis has been divided into two types on the basis of microbiological culture [1]. Type I describes a polymicrobial infection, where as type II describes a monomicrobial infection. In our study majority of the patients (78%) had polymicrobial infection. This correlates with other studies [1-2,11,13]. Many types of bacteria can cause necrotizing fasciitis (e.g. group A streptococcus, Staphylococcus aureus, Clostridium, Pseudomonas aeruginosa, Escherichia coli, Bacteroids fragilis). Historically, group A streptococcus made up most cases of type II infection. However, since 2001, another serious form of monomicrobial necrotizing fasciitis has been observed due to MRSA (Methicillin Resistant Staphylococcus aureus). In our study all the monomicrobial infections were caused by streptococcus and affected only the lower extremity. In our study, streptococcus was most commonly found in the patients who died.

Imaging studies are more likely to detect gas within the soft tissues than physical examination [12]. An initial imaging study includes a plain radiograph, which may show moderate to large amounts of soft tissue gas. Ultrasonography can be used to detect fluid or gas within the soft tissues [14]. In addition ultrasonography can assess the blood flow to the testis if testicular torsion is the differential diagnosis. Computerized tomographic scan can detect smaller amounts of soft tissue gas than plain radiography and can demonstrate fluid collections that track along the deep fascial planes. Near infrared spectroscopy is a newer, less available modality that can diagnose necrotizing fasciitis in the lower limbs by measuring tissue hypoxia secondary to microvascular thrombosis and necrosis. At a tissue oxygen saturation reading of less than 70%, the test is 100% sensitive and 97% specific for necrotizing fasciitis [15]. However, these investigations are costly and not available to the poor patients in the developing countries.

Wong et al [16] developed the Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) scoring system for accurately identifying necrotizing fasciitis based on laboratory values at the time of hospital admission. This score considers the laboratory values for C-reactive protein, total white cell count, hemoglobin, sodium, serum creatinine and glucose. For patients whose score was greater than 6 points (range 0-13), the LRINEC score had a positive predictive value of 92% and a negative predictive value of 96%.

The mainstay of treatment of necrotizing fasciitis is rapid surgical debridement followed by appropriate antibiotic therapy after initial resuscitation with fluid and electrolyte replacement and / or blood transfusion [17]. According to Wipf et al [17], the single most important determinant of survival is the amount of time elapsed between initial presentation and surgical debridement. McHenry et al [8] reported the average time from hospital admission to operation in non-survivors to be 90 hrs, while in survivors the elapsed time was only 25 hrs. ($p = 0.0002$). In a retrospective review of 68 patients, Bilton et al [18], reported 4.2% mortality for patients undergoing early surgical debridement and 38% mortality for those with delayed treatment ($p = 0.0007$). According to Paty R et al [19] in case of fournier's gangrene, a 24 hour delay in radical debridement increases the mortality rate by 11.5%; a 6 day delay is associated with a mortality rate of 76%. Broad spectrum antibiotics against gram positive, gram negative and anerobic bacteria should be started early in the course of treatment before culture reports are available.

Mortality in necrotizing fasciitis varies from 3.7 – 46% [20-21]. Higher mortality has been reported among patients over 50 years of age and among those having atherosclerosis and diabetes [4]. Ahmed Kandil [2] in his study had 13 patients with diabetes mellitus among which 8 died (61.5%). Fischer et al [22] found no increase in mortality in patients with diabetes. According to Elliot et al [23] the presence of diabetes did not affect mortality unless it occurred in conjunction with certain other diseases. In our study the mortality rate was 10%. Among them 80% had ages equal to or greater than 50 years. Diabetes was present in 3 patients among whom 2 patients had associated co-morbidities like renal failure and peripheral vascular disease.

Conclusion

Necrotizing fasciitis is more common in middle aged males. Diabetes mellitus is the most common co-morbid condition associated with necrotizing fasciitis. Type I infection is more common. The presence of bullae and blistering and discoloration of the skin should raise the suspicion of necrotizing fasciitis. Findings at surgical exploration and skin biopsy are reliable method of diagnosis. The presence of multiple co-morbid conditions reduces the survival. Early diagnosis and aggressive surgical debridement reduces mortality.

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