

Necrotizing fasciitis and diabetes mellitus

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INTRODUCTION: Necrotizing fasciitis is a rare, potentially fatal, rapidly progressing necrotizing infection of subcutaneous tissue and superficial fascia with secondary necrosis of overlying skin. It is perhaps the most severe form of soft-tissue infection and is potentially limb and life threatening.

AIM: This retrospective study was conducted to analyze necrotizing fasciitis; its presentation; predisposing factors, particularly diabetes mellitus; type of infection. The study also emphasizes medical, surgical management and prognosis of this condition.

METHODOLOGY: Medical records of patients with necrotizing fasciitis admitted to surgical intensive care unit of our hospital between January 1995 and February 2005 were retrospectively reviewed.

RESULTS: Ninety-four patients with necrotizing fasciitis were treated in our surgical intensive care unit during the review period. As many as 56.4% of the cases had diabetes mellitus, 75.5% of the cases were males and 24.5% were females. Mean age of diabetic patients was 55 and that of nondiabetic patients was 40.2 years. Type 1 necrotizing fasciitis was more common in diabetic patients, whereas type 2 necrotizing fasciitis was more common in nondiabetic patients. The study showed that 63.4% of cases had type 2 necrotizing fasciitis. *E. coli* was the commonest bacterium isolated from necrotic tissue of diabetic patients, and streptococcus was the commonest cause of necrotizing fasciitis in nondiabetic patients. Necrotizing fasciitis of perineum and genitalia was more common in diabetic patients (30.2%), while leg and foot necrotizing fasciitis was more common in nondiabetic patients (35.8%). The overall mortality was 16%. In diabetic patients, it was 15.1%; and nondiabetic patients, 17.1%.

DISCUSSION: Diabetic patients were older; type 1 necrotizing fasciitis was more common in them. There was no significant difference in mortality between

diabetic and nondiabetic patients with necrotizing fasciitis.

KEY WORDS: Diabetes mellitus, foot, leg, necrotizing fasciitis, perineum

Necrotizing fasciitis is a pathological descriptive term applied to a life-threatening soft-tissue infection. Previous synonyms of necrotizing fasciitis were hospital gangrene, suppurative fasciitis and Fournier's gangrene.^[1] Necrotizing fasciitis is an uncommon, potentially life-threatening infection that involves soft tissue and causes progressive destruction of fascia and adipose tissue. Because of its rapid progression and high mortality, it continues to be a dire emergency as it was when Meleney first described the disease in 1924 in China.^[2] These patients usually have comorbid diseases that cause immunocompromised status in affected patients. Diabetic patients have an increased propensity to develop soft-tissue infections. Recent review of necrotizing fasciitis showed up to 25% of the cases had diabetes mellitus as a comorbid disease.^[3] The purpose of the present study was to analyze association of diabetes mellitus with necrotizing fasciitis and to study presentation; type of infection; surgical, medical management; and outcome of this uncommon surgical emergency.

Methodology

Hamad Medical Corporation is a 1,444-bedded tertiary medical care center with 12-bedded surgical intensive care unit (SICU). Medical records of patients treated with necrotizing fasciitis at our SICU between January 1995 and February 2005 were retrospectively reviewed. Only those patients with diagnosis confirmed by histopathology were included in the study.

The variables that were examined, documented and analyzed in this study included age, gender, location

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of infection, predisposing factors, leukocytic count and temperature at admission to hospital, duration of symptoms, surgical and resuscitative management, SOFA (sequential organ failure assessment) score at admission to SICU, type of infection, ICU stay and outcome of these patients. Patients were divided into two groups according to the presence of diabetes mellitus.

The statistical analyses were performed with the use of SPSS statistical software. Bivariate analysis was performed with Chi-square test or Fisher's Exact probability test for comparing between the groups and Student's t test to compare continuous variables. A '*P*' value of <0.05 was considered to be 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 admission to the SICU. Diabetes mellitus was a comorbid disease in 56.4% of the patients. Diabetic patients and necrotizing patients were significantly older (55 years) compared to nondiabetic patients (40.2 years); 75.5% of patients were male and 24.5% were female. Of the predisposing factors, 11.7% had history of operation, 10.6% had history of trauma, 2.1% of cases had history of insect bite. As many as 48.9% of the patients had history of taking nonsteroidal anti-inflammatory drugs (NSAID). There was significant difference regarding the type of necrotizing fasciitis that both groups had; diabetic patients had type 1 necrotizing fasciitis more commonly (71.7%), while nondiabetic patients had type 2 necrotizing fasciitis (64.4%) [Table 1].

Patients of both groups had fever and leukocytosis on admission to the hospital [Table 2]. All the patients in both groups underwent surgical debridement twice. The mean SOFA score in diabetic patients was 8.6, whereas it was 8.5 in nondiabetic patients. Diabetic group received total fluid, 4.7 ± 2.1 liters; packed red blood cells (PRBC), 1.9 ± 1.9 units; fresh frozen plasma (FFP), 3.6 ± 3.8 units; platelet concentrate, 1.0 ± 4.1 units; while nondiabetic group patients received fluid, 5.0 ± 2.2 liters; PRBC, 2.2 ± 2.5 units; FFP, 4.2 ± 4.6 units; platelet concentrate, 2.4 ± 5.8 units in the first 24 h of admission to the SICU. Intubation days and ICU stay in diabetic group were 3.8 ± 3.5 and 5.9 ± 5.5 days respectively; while in the nondiabetic group, these were 6.2 ± 7.2 and 9.8 ± 12.9 days respectively. There was no significant difference in above variables in the two groups.

Table 1: Clinical presentation, progress and outcome in necrotizing fasciitis

Variables	Type 2 diabetes mellitus		Total
	Yes	No	
Age group			
<45	13 (24.5)	26 (63.4)	39 (41.5)
45-59	21 (39.6)	9 (22.00)	30 (31.9)
>=60	19 (35.8)	6 (14.6)	25 (26.6)
Sex			
Male	40 (75.5)	31 (75.6)	71 (75.5)
Female	13 (24.5)	10 (24.4)	23 (24.5)
Predisposing factors			
History of operation	4 (7.5)	7 (17.1)	11 (11.7)
History of trauma	3 (5.7)	7 (17.1)	10 (10.6)
History of insect bite	0 (0)	2 (4.9)	2 (2.1)
History of NSAID	22 (41.5)	24 (58.5)	46 (48.9)
Type*			
Type 1	38 (71.7)	15 (36.6)	53 (56.4)
Type 2	15 (28.3)	26 (63.4)	41 (43.6)
MODS			
Yes	23 (43.4)	21 (51.2)	44 (46.8)
No	30 (56.6)	20 (48.8)	50 (53.2)
Outcome			
Died	8 (15.1)	7 (17.1)	15 (16.0)
Survived	45 (84.9)	34 (82.9)	79 (84.0)

**P* ≤ 0.001, NSAID - Nonsteroidal anti-inflammatory drug

Figure 1 shows location of necrotizing fasciitis in both groups. In the diabetes group a significantly high number of patients had necrotizing fasciitis of perineum and genitalia (30.2%); while in the nondiabetic group, a significantly high number of necrotizing fasciitis of leg and foot was observed.

Figure 2 shows microbiological characteristic of these groups. *E. coli* was the most common bacterium isolated from the necrotic tissue in diabetic patients; but in the nondiabetic group, streptococci were the most common bacteria. This difference was statistically significant.

As many as 46.8% of the patients had multi-organ dysfunction syndrome [MODS]. Overall mortality was 16% (diabetic group, 15.1%; and nondiabetic group, 17.1%). The difference in mortality between the two groups was statistically insignificant.

Discussion

The 'soft-tissue infections' is a difficult-to-handle subject because of the complicated nature of these infections and lack of universal and useful terminology

to describe them. The term 'necrotizing fasciitis' represents a continuum of an uncommon infection of subcutaneous tissue that progressively spreads along fascial planes. Necrotizing fasciitis is a surgical and medical emergency. It is more common in males than in females.^[4] Necrotizing fasciitis can affect any age group, but the age of diabetic patients having the disease was higher; in a large study, the mean age of these patients was 55 years.^[5] This study also showed that diabetic patients were significantly older. Necrotizing fasciitis usually had some predisposing factors, such as trauma, surgery, insect bite and scratch.^[6]

Necrotizing fasciitis patients have a pre-existing disease that renders them susceptible to infections and immunocompromised status, such as old age, chronic renal failure, diabetes mellitus and drug misuse.^[7]

Diabetes mellitus is blamed to be commonly associated with necrotizing fasciitis. 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.^[8] Diabetes mellitus was the comorbid condition in 40–60% of cases with Fournier's gangrene patients.^[9] In our study, diabetes mellitus was the comorbid condition in 56.4% of the cases.

In this study, diabetic patients had significantly higher incidence of type 1 necrotizing fasciitis, and literature also confirms that type 1 necrotizing fasciitis is common in diabetes mellitus patients.^[10] *E. coli* was the most common bacterium isolated from necrotic tissue of diabetic patients. Sharp *et al.* demonstrated that *E. coli* was one of the four common organisms isolated from

Table 2: Clinical features and progress of necrotizing fasciitis

Variables	Type 2 diabetes mellitus			
	Yes		No	
	Mean	SD	Mean	SD
Age (years)*	55.0	14.1	40.2	15.2
WBC on admission	25.0	43.0	18.1	10.2
Temperature C	37.7	2.0	38.1	1.2
Number of debridement	1.9	0.9	2.4	1.9
SOFA score	8.6	4.5	8.5	5.0
Duration of symptoms (days)	3.5	2.1	3.3	3.4
Fluid required for first 24 hrs	4.7	2.1	5.0	2.2
Number of pack RBCs received for first 24 hrs	1.9	1.9	2.2	2.5
Number of fresh frozen plasma received for first 24 hrs	3.6	3.8	4.2	4.6
Number of platelets received for first 24 hrs	1.0	4.1	2.4	5.8
Intubated days	3.8	3.5	6.2	7.2
Intensive care unit stay (days)	5.9	5.5	9.8	12.9

*P < 0.001

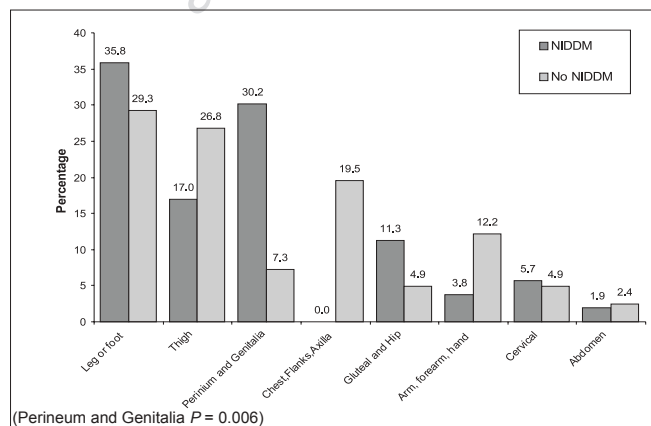


Figure 1: Incidence of necrotizing fasciitis in diabetics as compared to non-diabetics

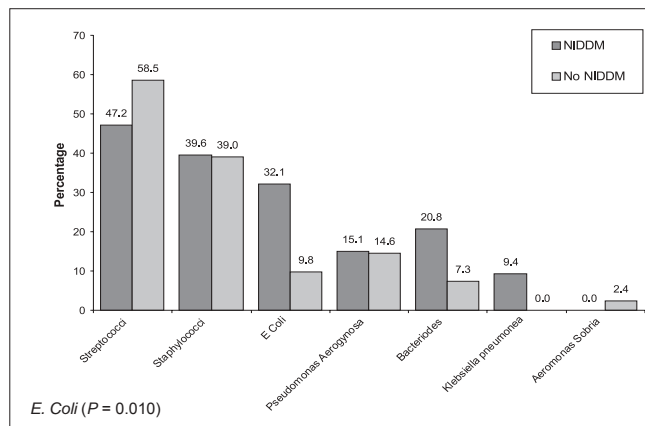


Figure 2: Bacteriology

type 1 necrotizing fasciitis patients.^[11]

Common area affected by necrotizing fasciitis in diabetic patients was perineum; and in nondiabetic patients, it was extremities. All our patients had fever and leukocytosis at admission to the hospital; these were systemic manifestations of the disease, recently published LRINEC (laboratory risk indicators for necrotizing fasciitis) score leukocytosis is one of the indicators by which we can diagnose the disease early and differentiate necrotizing fasciitis from other soft-tissue infections.^[12] Aggressive surgical debridement and aggressive fluid resuscitation are the cornerstones of management of this disease. Each of our patients underwent surgical debridement at least two times.

Mean SOFA score in both groups of patients was more than 8, which indicates severity of the disease, need for intensive care admission and aggressive resuscitation.^[13]

Necrotizing fasciitis patients need aggressive fluid and electrolyte therapy and hemodynamic stabilization. Large volume of extracellular fluid may be sequestered in the edematous wound, requiring large volumes of fluids. Hemolysis and coagulation disorders require blood and blood products.^[14] Both group patients received more the 4 liters of fluid, 2 units PRBC, 3 units FFP during the initial 24 h [Table 2].

Necrotizing fasciitis was associated with high mortality and morbidity – 46.8% of our patients had multiple-organ dysfunction; overall mortality was 16%. The reported mortality in literature varies from 6 to 76%.^[15] There was no significant difference in mortality between diabetic and nondiabetic patients, although it is often remarked that mortality is increased in the presence of diabetes mellitus, which is not always the case.

Conclusion

Diabetes mellitus is a common comorbid disease associated with necrotizing fasciitis. In this study,

diabetic patients were significantly older and suffered from type 1 necrotizing fasciitis of the perineum. There was no difference in mortality between diabetic and nondiabetic patients.

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