

# Necrotizing fasciitis

## *Role of early surgical intervention*

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### ABSTRACT

**Objective:** To evaluate our experience of management of necrotizing fasciitis (NF) particularly the role of early and aggressive surgical intervention.

**Methods:** This is a retrospective review of the cases affected by this disease and managed at Riyadh Medical Complex, Riyadh, Kingdom of Saudi Arabia, during 5 calendar years from 1996 through to 2000 (1416-1420 A.H). The preoperative and operative data was collected, and postoperative morbidity and mortality were analyzed.

**Results:** A total of 25 cases of NF were treated during the 5-year period, 18 were males and 7 female. The majority of patients had perianal suppuration as the primary lesion, followed by groin area in drug addicts

and only 2 cases were primarily in the upper limbs. Diabetes and drug addiction were the main predisposing factors. All but 3 infections were polymicrobial, with *streptococci* and *acinobacter* being the most frequent organisms. The mainstay of treatment depends on a high index of suspicion, aggressive early and repeated debridements and adequate antibiotic coverage. The overall mortality was 24% but the drastic reduction in mortality was observed with early surgical intervention.

**Conclusion:** The results highlight the role of early diagnosis; prompt and aggressive surgical debridements are critical for improved survival.

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Necrotizing fasciitis (NF) is an uncommon but serious soft tissue infection characterized by extensive necrosis of fascia and subcutaneous tissue with relative sparing of skin and muscle, but if prompt surgical treatment is not instituted, the necrotizing process will involve these structures as well. It is allied with severe systemic toxicity and a fulminant course (spreads at a speed of 4cm/hour) resulting in high morbidity and mortality.<sup>1,2</sup> It has a mortality of >50% in diabetics. Confusing terminology had been used to differentiate between the different presentations or different parts of body involved by the same disease,<sup>3</sup> such as acute streptococcal gangrene, gangrenous erysipelas, necrotizing erysipelas, Fournier's gangrene, and hospital gangrene were given to it, but "NF" is the preferred and widely used terminology which best

explains its pathology as well. The common belief now is that it is a spectrum of one disease initiated by  $\beta$ -hemolytic micro-aerophilic *streptococci* which prepares the favorable medium for other organisms by its enzymatic activity.<sup>2,4,5</sup> Other organisms are either anaerobic species such as *Bacteriodes* or *Peptostreptococcus* or in combination with aerobic bacteria such as *Staphylococcus aureus* or obligate aerobes such as *Pseudomonas aeruginosa* will complete the picture of NF.<sup>1,2</sup> This dreadful infection usually occurs after operations, minor trauma, or inadequate treatment of mundane infections such as perianal abscesses or cutaneous ulcers.<sup>1-3</sup> The perineal area is the most frequent site followed by groin, abdomen, and extremities but no part of the body is immune. Due to very high

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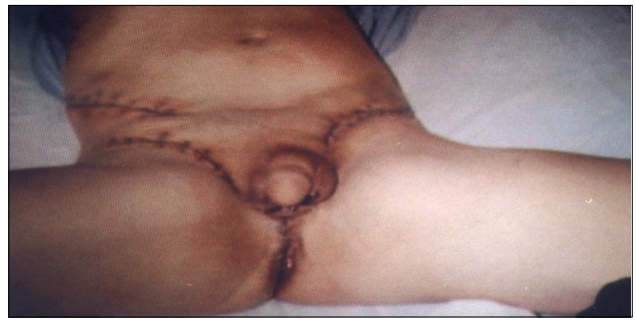
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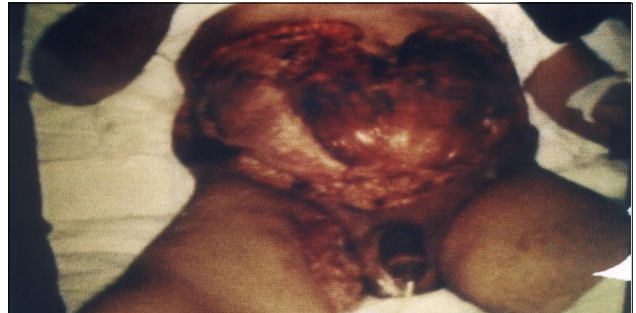
reported mortality rates and lack of uniform management protocol in such cases, we retrospectively reviewed our institutional experience. The special emphasis was paid to the relationship with co-morbid diseases and delay in treatment on the outcome of therapy.

**Methods.** A retrospective chart review was performed for all patients who were admitted or discharged with the diagnosis of NF and were treated in the Department of Surgery, Riyadh Medical Complex, Riyadh, Kingdom of Saudi Arabia (KSA), during 5-years starting from January 1996 through to December 2000 (1416-1420 A.H.). Diagnosis of NF was based on history and clinical evidence of necrotizing inflammation with signs of systemic toxicity such as high grade fever, tachycardia, tachypnea, and hypotension and associated with leucocytosis. X-rays of involved extremities were taken to detect osteomyelitis and air in the soft-tissue and in selected cases computerized tomography scan was performed. The operative evidence of necrosis of fascia and subcutaneous tissue that was finally confirmed on histopathology, lead to the diagnosis of NF. The majority of the patients presented within 2-7 days of onset of symptoms but much delayed presentations are not rare.

The initial management consisted of correction of fluid and electrolyte imbalance, broad spectrum antibiotic therapy (initial combination was Penicillin-G, Aminoglycoside and clindamycin which was later on changed according to culture and sensitivity results). The anemia and coagulation derangements were corrected by transfusion of blood and fresh frozen plasma, which was repeated as required with subsequent debridements. The surgical debridements was performed as soon as possible, usually on the day of admission, all dead necrotic subcutaneous tissue, fascia and skin was excised till healthy bleeding edges were encountered. Aerobic and anaerobic cultures samples were obtained, as well as tissue was sent for histopathology. The wounds were generously irrigated with saline solution and sterile saline dressing applied, which was changed every 6 hourly. We did not use any topical antibiotic or biological dressings, neither the hyperbaric oxygen. The wounds were observed for spreading cellulitis or necrotic tissue and repeated debridements were performed as needed. Once the infection was controlled, the wounds were closed either by secondary suturing (**Figure 1**) or by split-thickness skin grafts. The patients received general supportive care to promote wound healing and improve nutrition and also albumin infusion to correct hypoalbuminemia. The data were collected and analyzed in a tabular fashion for each patient



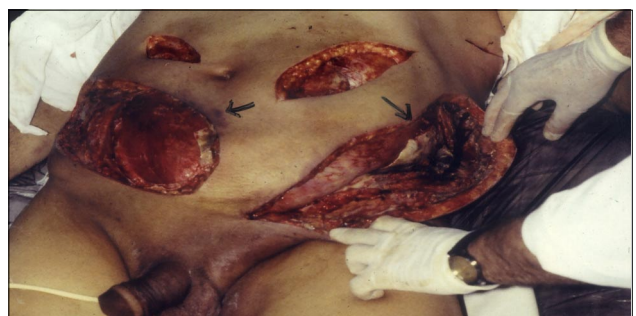
**Figure 1** - Necrotizing fasciitis (NF) starting as perianal infection and Fournier's gangrene spreading to the flanks. Figure showing closure of wounds after debridements.



**Figure 2** - Extensive nature of necrotizing fasciitis (NF) extending from perianal region to the thigh, abdomen and chest wall.



**Figure 3** - Necrotizing fasciitis (NF) in the upper limb caused by intravenous injection cannulation in a patient with uncontrolled diabetes mellitus.



**Figure 4** - Necrotizing fasciitis (NF) showing extensive debridement with preservation of intervening normal skin. Also arrows pointing the spreading edge of NF and necrotic fascia.

regarding the particulars of the study; only patients who were admitted or discharged with NF were included, whether admitted primarily in surgical department or other departments and referred during their hospital stay to the Surgical Department for management of NF.

**Results.** A total number of 25 patients comprised our study group, 18 were males and 7 females. No race or religion is immune to this disease but, Saudis (11), Eryterians and Pakistanis (3 each) predominates in this series. The age ranges between 25-85-years (Mean=39-years), the majority of the patients were in their most productive years of life and only 5 were above 50-years of age. The primary infection site was usually a perianal suppuration which was improperly drained (9), followed by groin abscess in drug addicts (7), diabetic foot and leg (5), thromboplebitis due to intravenous cannulae (2), post operative abdominal wound and a case of ischemia of lumbar vessels secondary to aortic aneurysm operation, but extension from initiating site to adjacent area was frequently observed. The extension to abdominal wall was noticed in 12 patients (**Figures 1 & 2**), it extended to the lower limbs in 11 patients and to chest in 2 patients. The majority of patients 18 (72%) had some underlying co-morbid disease. The most frequent among these predisposing conditions were diabetes in 7 (28%) and a similar number of drug addicts, followed by tuberculosis in 2 (8%), renal failure in 1 (4%) and a case of lymphoma.

The usual presentation was fever, severe pain in the inflamed area and soft tissue crepitus. Toxemia was marked in 19 patients (76%), of those 9 patients (46%) presented with septic shock. White blood count was always high (11,000-52,000 cells/cu mm), except in 2 patients. Most patients had hypoalbuminemia, mild to moderate impairment of liver function tests and blood urea nitrogen levels. The x-rays of involved area showed air in soft tissue in 11(44%) of the cases. Computerized tomography scan was performed in 9 cases, out of which it proved to be diagnostic in 6 cases. The wound cultures were performed in all cases at the time of initial debridements or admission, which was positive in all except in 3 cases. All but one had polymicrobial infections. *Streptococcus* group-D was the single organism isolated in one case and the remaining 21 cases, 2-3 organisms were cultured in various combinations. The most frequent initial organisms observed in the present study were, *Acinobactor*, *Streptococcus*, *Escherichia coli* and *Staph. aureus*, with or without anaerobes, such as *Bacteroides* or *Peptostreptococci*. The subsequent cultures were more variable and predominated by gram-negative organisms and methicillin resistant *staph. aureus*. The cultured organisms are shown in

**Table 1** - Isolated organisms.

Aerobes		Anaerobes	
<b>Gram positive</b>			
<i>Streptococci</i>	8	<i>Bacteroides Spp</i>	8
<i>Staphylococci</i>	4	<i>Peptostreptococci</i>	6
MRSA	3		
<i>Hemophilus Spp</i>	1		
<b>Gram Negative</b>			
<i>Acinobactor</i>	9		
<i>Pseudomonas</i>	8		
<i>E.coli</i>	7		
<i>Klebsiella Spp</i>	6		
<i>Providnetia Stewartii</i>	1		
MRSA - methicillin-resistant <i>Staphylococcus aureus</i> Spp- species E - <i>Escherichia</i>			

**Table 2** - Primary treating departments and outcome.

Department	Treated n=25	Died n (% age)
General surgery	11	1 (9.1)
Medical and allied	11	3 (27.2)
Other surgical departments	3	2 (66.6)
Overall mortality	25	6 (24)

**Table 1.** The most frequent antibiotics according to the culture and sensitivity were penicillin-G, gentamicin, cephalosporin, alizarin, metronidazole, clindamycin and piperacillin. Twenty-three patients underwent a total of 153 operations, on average 3-5 debridements for each patient and one patient had maximum of 28 sessions. One patient required amputation of leg and another one had colostomy. Two very toxic patients died during resuscitation before any surgical intervention was carried out. A total of 141 units of blood and 78 units of fresh frozen plasma were transfused to these patients, ranging from 2-8 units for each patient, depending upon the degree of hemolysis and blood loss during the repeated debridements. The mean hospital stay was 37 days ranging from 18-71-days. There were 6 deaths, yielding a mortality of 24%. The delay in debridements more than 48-hours directly affects the mortality.

**Discussion.** Nearly 2 centuries ago, Joseph Jones, a Confederate Army Surgeon in the civil war, stated, "The skin of an affected part melts away" and he named this condition as "Hospital Gangrene" this is probably the earliest description of NF in medical

literature.<sup>6</sup> In 1924, Meleney<sup>7</sup> reported the first series of this lethal disease from Peking, China. He called this infection as "Hemolytic *Streptococcus* Gangrene" for the simple reason that in most of cases this organism was obtained from tissue culture. The term NF was first used by Wilson,<sup>8</sup> in 1952, following realization of the fact that NF is not exclusively due to  $\beta$ -hemolytic *streptococci*, but can be caused by many different organisms. In spite of early appreciation of this dreadful entity, the literature is scanty and failure to recognize the disease at an earlier stage may increase the already prohibitive mortality allied with NF.<sup>1,9</sup> Diagnosis of NF is often difficult in the earlier stages of this disease when skin is spared.<sup>2,6</sup> The affected skin becomes progressively swollen, pale, warm and painful. The infection spread rapidly in subcutaneous tissue plane which results in thrombosis of nutrient subcutaneous blood vessels and, ultimately leading to secondary gangrene of the skin. The clinician should not confuse NF with other soft tissue infections such as erysipelas, lymphangitis and gas gangrene. Erysipelas produce spreading cellulitis and lymphangitis with raised sharply defined irregular reddish borders with slight edema of skin. In contrast in NF, the skin is pale red without distinct borders and massive edema of skin. The pale red areas progress to dusky discoloration with local blistering of the skin. In addition, severe toxemia and fever are usually out of proportion to local signs. Moreover, the presence of bullae over a painful area over a normal looking skin should alert a vigilant surgeon of the presence of subcutaneous necrosis much before the final picture of blackish gangrene of the skin.<sup>1,2,9</sup> The clostridial gas gangrene, although is an infection of muscular tissue but clinical picture, with exception of tetanus, may mimic NF. The excruciating local pain, foul odor, pus formation and crepitation are more marked in this condition as compared with NF. The differential diagnosis is not critical as both infections require same surgical debridements; however, the predominant area of involvement along with a gram's staining of pus or fluid should confirm the diagnosis.<sup>6</sup> Nevertheless, high index of suspicion, characteristic features during debridements and tissue biopsy are the corner stone for the diagnosis of NF.<sup>1,6,9,10</sup> Failure or improper treatment of minor soft tissue infection at first instance may initiate NF.<sup>6,11</sup> Even minor abrasions, lacerations, burns and injections can act as a triggering point of this serious disease, as shown in **Figure 3**. This was clearly demonstrated in present study, as 100% of cases followed an initiating factor. This highlights the need for proper care of these minor illnesses.<sup>1,2</sup> Furthermore, the host immunity has a definitive role to play in predisposition to NF. The NF is very common in

individuals suffering from chronic debilitating diseases which lower the host resistance to infection such as, diabetes, chronic renal failure, malignancy, chronic infections, intravenous drug abusers and immunocompromised states.<sup>10-12</sup> This phenomenon was observed in 72% of cases in present study, which is consistent with others.<sup>1,6,9</sup> The bacteriology of NF has changed significantly from earlier reports which implicated that hemolytic *streptococci* but now the polymicrobial etiology with frequent finding of anaerobes has been established.<sup>4,13,14</sup> This change is merely as of improved culture techniques and availability of anaerobic cultures. Although, in the present study cultures result were somewhat similar as *Streptococci* and *Staphylococci* were common aerobes and, *Bacteroides* and *Peptostreptococcus* being the most frequent anaerobes. Acinobacter has not been implicated frequently but was also equally common in this report. This does not conform to other reports, probably due to different habitat or culture techniques or due to non standardized methods, ways of specimen collection or the predominant organisms available in the community or the hospital, their virulence, host resistance and the antibiotic policy. There is no such study available for comparison, as to our knowledge this is first of its kind in KSA. But, this difference as well as sample size is too small to draw a final conclusion and need further evaluation in larger simple size. The mainstay of treatment of NF is early aggressive surgical debridement after initial resuscitation.<sup>1,2,6,9-11,15</sup> The primary debridement is crucial and should be very extensive. All necrotic tissue; skin, subcutaneous tissue, fascia and muscle if involved has to be excised. The fascial involvement is much more extensive than the skin; one should try to preserve the healthy overlying skin when possible, as shown in **Figure 4**, but without compromise in excising the dead and necrotic tissue. Radical excision including intervening healthy tissue should be avoided at the same time, as it will lead to unnecessary loss of viable tissue.<sup>16</sup> However, it should be appreciated that, as a result of rapidly progressive nature of pathology, recognition of all critically ischemic tissue at any single session of debridement may not be possible and in spite of aggressive initial debridement, multiple debridements will be required to control progressive wound necrosis and systemic sepsis.<sup>10,11</sup> Failure or delay in debridement leads to an increase in number of operations necessary to control infection, prolongation of hospital stay and risk of loss of limb or life.<sup>13,15,17</sup> Along with debridement, the adequate antibiotic cover is essential component of the treatment. It should be started empirically to cover all possible pathogens of NF, which later on modified according to the culture and sensitivity. The high dose penicillin plus aminoglycosides and

flagyl or clindamycin were the most useful antibiotics in present series.<sup>9,13,14</sup> There is no established role of topical antibiotics and hyperbaric oxygen therapy in NF, as was observed in present study.<sup>12,17</sup> Although the mortality of NF is significantly reduced than the past, perhaps due to better understanding of pathology and early surgical intervention, but the reported mortality (30-80%) is still very high.<sup>2,6,10,13</sup> Many contributory factors has been propagated which increase the risk of mortality such as old age, diabetes, renal failure, other associated chronic illnesses and delayed presentation but majority of the studies are small in size, so is present to depict a definite conclusion.<sup>1,11-13</sup> However one factor in present study is significant enough to draw attention that is role of early surgical intervention. The failure in recognition of this deadly disease, delay in aggressive surgical intervention and lack of a focused plan of treatment had a significant impact on ultimate outcome.<sup>2,9-11</sup> This aspect is demonstrated clearly in cases that were primarily admitted to other departments and than later on referred to general surgery leading to delay in treatment with significant increase in mortality rate, as shown in **Table 2**. The overall mortality in present study was 24%, which is not appreciably better than reported figures, but, 9% mortality in cases that were primarily treated by general surgery looks very attractive, which highlights the role of proper and early surgical therapy.<sup>1,2,6,9-15</sup> Hence, it is concluded that NF is a grave disease carrying very high mortality and only the prompt and aggressive surgical debridements can avert the devastating outcome.

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