

A clinico-pathological study and management of necrotising fasciitis

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Abstract

Aims and objectives: The objective of this study was to evaluate our experience with the diagnosis and management of necrotizing fasciitis. The study also describes the clinical presentation and microbiological characteristics of this condition as well as the determinants of mortality associated with this common surgical emergency. **Materials and methods:** The data for the study was obtained from patients (in patient basis) who were provisionally diagnosed to have necrotizing fasciitis and myonecrosis by clinical evaluation and who were admitted at Kurnool General Hospital, Kurnool from November 2018 to October 2020 in this cross sectional observational study. All patients were studied and clinically analysed, necessary investigations were done and appropriate treatment was given. All cases were followed up to discharge and subsequently for a follow up on one month. **Results and conclusion:** The incidence of necrotizing fasciitis was seen highest in age group 41 to 60 years Male to female ratio was 4: 1. Most common site of involvement was lower extremity (62%). Most common predisposing factor was minor trauma (46%) followed by snake bites (22%) and idiopathic cause (22%). Average duration between onset of symptoms and first surgery was sentence missing. Klebsiella was the most common microorganism grown on aerobic culture media. Diabetes (38%) was the common co morbid condition come across in this study. Duration of hospital stay was approximately 8 to 61 days with an average around 29 days. Mortality rate was 14%

Keywords: Necrotizing fasciitis, myonecrosis, septicemia, wound debridement, split skin grafting, amputations.

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Introduction

Necrotizing fasciitis (N.F) is an uncommon, hazardous bacterial disease portrayed by quickly spreading inflammation and Necrosis of the skin, subcutaneous tissue, and superficial fascia[1,2]. Necrotizing soft tissue infections (N.S.T.I.s) are more uncommon than subcutaneous abscesses and cellulitis; however, they are significantly more genuine conditions whose seriousness may at first be unrecognized[3,4,5], even with fast acknowledgment and intervention, current death rates remain around 30 to 50%[6].

N.S.T.I.s have been depicted by a wide range of marks, including gas gangrene, Meleney's synergistic gangrene, quickly spreading cellulitis, gas gangrene, and necrotizing fasciitis, among others have likewise been portrayed. A generous number of characterizations dependent on anatomic area, microbiology, and depth of infection, among others, have additionally been described. Today it appears best to portray these genuine diseases dependent on the soft tissue layer(s) of involvement (e.g., skin and superficial soft tissue, deep soft tissue, and muscle) and the pathogen(s) that cause them[3] Around 70 to 80% of such infections are polymicrobial, the rest of brought about by a single organism, for example, Pseudomonas aeruginosa, Clostridium perfringens, or Streptococcus species[6,7,8,9].

In advanced stage phases of the ailment, patients, for the most part, have overt signs of systemic compromise and septic physiology. Nearby discoveries incorporate tense and tender soft tissues related to ecchymoses or blistering of the skin, or both[3].

Treatment of N.S.T.I. consistently incorporates debridement, and extra help is given by broad-spectrum antibiotics, checking and, monitoring, and systemic support[3,4].

Here we intend to study the various modes of clinical presentation of necrotizing fasciitis and myonecrosis in our hospital. Also, to study

the various comorbid conditions associated with it and use the available treatment and surgical options in our set up for the management of necrotizing fasciitis and myonecrosis. To study the residual morbidity and mortality after effective management.

Aim & Objectives

1. To study the incidence of different predisposing factors of necrotizing fasciitis.
2. To study different causative organisms and sensitivity to various antibiotics.
3. To study complications associated with the condition.
4. To study various modalities of management and prognosis

Materials and methods

Source of data

Fifty patients with necrotizing fasciitis getting admitted to the surgical ward in Kurnool General Hospital., Kurnool, from November 2018 to October 2020.

Method of collection

Data collected by meticulous history taking, careful clinical examination, appropriate radiological, blood, and serological examination. Aggressive surgical debridement, culture of pus, tissue biopsy, antibiotic therapy, treatment of complication, amputation, or skin grafting.

Inclusion criteria

All patients presenting with necrotizing fasciitis

Exclusion criteria

1. Patients of pediatric agegroup.
2. Pregnant woman.

Management

- All patients managed in the emergency ward or I.C.U.
- Aggressive fluid resuscitation

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- Early and prompt debridement in all patients
- Crystalline penicillin, aminoglycoside, and metronidazole were started empirically and later changed according to the C/Sreport.
- Multiple debridement's daily dressings
- General condition improvement of anemia, hypoalbuminemia, and other nutritional support
- Skin graftings
- Amputations

- Proper management of Multiorgan failures, ARDS, Septicemia I.C.U.s.

Observations and results

Sex ratio

A number of 50 patients were studied in this series, out of which 38 were males and 12 were females.

Table 1: Sex ratio

Sex	Number Of Cases	Percentage
Male	38	76 %
Female	12	24 %

Table 2: Age

Age In Years	Number Of Cases	Percentage
<20	3	6 %
21-40	12	24 %
41-60	26	52 %
>60 years	9	18 %
Total	50	100 %

Site of involvement

In this series of 50 patients with necrotizing fasciitis, the lower limbs (62%) were the commonest involvement, left leg (36%) being affected more commonly. The next most common site of involvement is the perineum, which is also referred to as Fournier's gangrene. The least common site of involvement in the back (2%) and the trunk (2%)

Table 3: Site of Involvement

Site Of Involvement	Number Of Patients	Percentage
Left Leg	18	36 %
Right leg	13	26 %
Left upper limb	0	0 %
Right upper limb	3	6 %
Perineum & Genitalia	12	24 %
Abdomen	1	2 %
Gluteal Region	2	4 %
Back	1	2 %

Predisposing factor

In this series of 50 patients, the predominant predisposing factor for developing necrotizing fasciitis was minor trauma (46%). Minor trauma accounting for many cases of lower limb N.F. and idiopathic cause accounting for most cases of perineal NF

Table 4: Predisposing Factor

Predisposing Factor	Number of Patients	Percentage
Minor trauma	23	46 %
Idiopathic	11	22 %
Snakebite	11	22 %
Abscess	5	10 %

Comorbid conditions

In this series of 50 patients, the most common comorbid condition associated with N.F. was diabetes mellitus type 2 (38%) followed by hypertension (16%), chronic liver disease due to the alcoholic cause was seen in 5 cases (10%). Patients with the above-said complications developed more morbidity and mortality.

Table 5: Comorbid Conditions

Comorbid Conditions	Number Of Patients	Percentage
Diabetes	19	38 %
Hypertension	8	16 %
Chronic liver disease	5	10 %
Immunosuppression	2	4 %

Microbiology

The most common organism grown on aerobic culture was Klebsiella in 15 cases (30%) followed by staphylococcus coagulase-positive in 10 cases (20%). Polymicrobial infection was seen in 4 cases (8%). Citrobacter was found in 1 patient (2%).

Table 6: Microbiology

Organisms	Number Of Cases	Percentage
Citrobacter	1	2 %
E-Coli	7	14 %
Klebsiella	15	30 %
Polymicrobial	4	8 %
Proteus	4	8 %
Pseudomonas	7	14 %

Staphylococcal Positive	10	20 %
Staphylococcal negative	2	4 %

Antibiotic sensitivity

The most common antibiotic found to be sensitive was Amikacin in 17 cases (34%), followed by Cefotaxime in 11 cases (22%), Ciprofloxacin in 9% cases (18%), ceftriaxone in 6 cases (12%), gentamycin in 4 cases (8%) and imipenem in 2 cases (4%), Amoxicillin in 1 case (2%)

Table 7: Antibiotic Sensitivity

Antibiotics	Number Of Patients	Percentage
AMIKACIN	17	34 %
CEFOTAXIME	11	22 %
CIPROFLOXACIN	9	18 %
CEFTRIAZONE	6	12 %
GENTAMYCIN	4	8 %
IMIPENEM	2	4 %
AMOXICILLIN	1	2 %

Treatment

In the present study, a total number of 50 patients were studied. All cases were treated in general with wound debridement as the first procedure followed by regular dressings and antibiotics except 2 (4%) cases who underwent direct major amputation without prior wound debridement. Split skin grafting was done as the final procedure in 28 (56%) patients. Out of the 7 (14%) patients who underwent amputation, five patients underwent wound debridement as the initial procedure followed by major amputation for the control of infection, out of 12 cases of Fournier's gangrene, 11 cases healed by secondary intention, and 1 case by split skin grafting. Secondary suturing was done in 2 (4%) cases of necrotizing fasciitis.

Table 8: treatment

Final Procedure	Number of Patients	Percentage
SPLIT SKIN GRAFTING	28	56 %
SECONDARY INTENTION	13	26 %
SECONDARY SUTURING	2	4 %
AMPUTATION	7	14 %

Duration of hospital stay

The average duration of hospital stay was 29.4 days. The longest stay was for 61 days; the shortest stay was for eight days. 30% of patients stayed for a duration of 21 to 30 days.

Table 9: Duration of hospital stay

Duration Of Hospital Stay	Number Of Patients	Percentage
<=10 Days	5	10 %
11-20 Days	9	18 %
21-30 Days	15	30 %
31-40 Days	10	20 %
41-50 Days	4	8 %
>50 Days	7	14 %

Complications

In this study, a total of 16 patients (28%) developed complications, the most complication being Septicemia with Mods seen in 7 cases (14%), followed by chronic renal failure seen in 6 cases (12%). Bedsores developed in 2 patients (4%) who had associated chronic renal failure. osteomyelitis was seen in one patient (2%).

Table 10: Complications

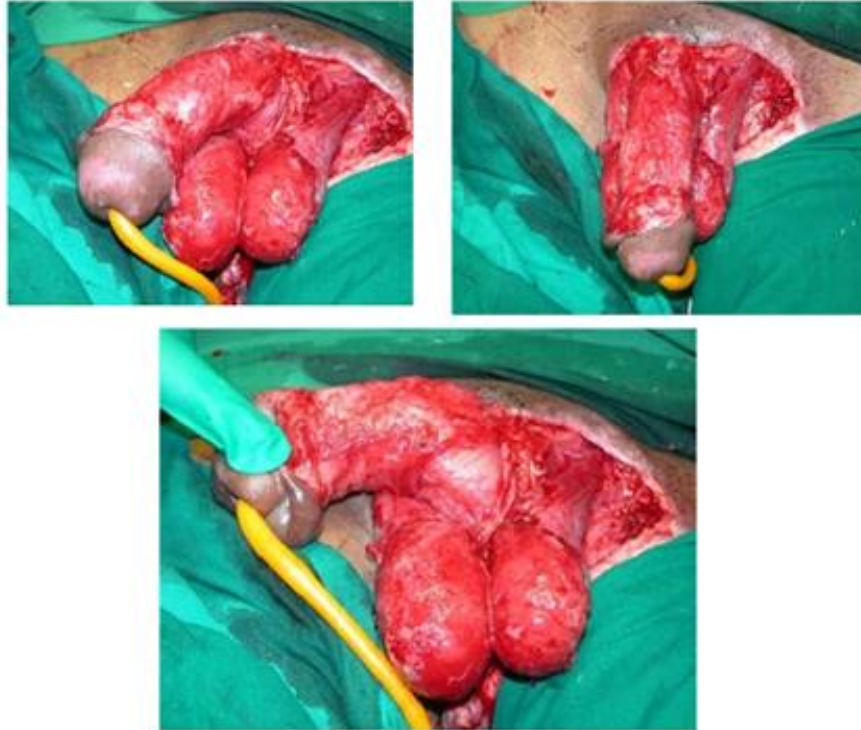
Complications	Number Of Patients	Percentage
CRF	6	12 %
Bedsores	2	4 %
Osteomyelitis	1	2 %
Septicemia	7	14 %

Outcome (Mortality)

In this study of 50 patients, 43 (86%) patients recovered from the disease, and 7 (14%) patients expired. The mortality rate is 14%.

Table 11: Outcome

Outcome	Number Of Cases	Percentage
Recovered	43	86 %
Expired	7	14 %



POST SKIN GRAFTING



Fig. 1: Fourniers gangrene post debridement



Post Wound Debridement



Post skin grafting



Fig. 2: Necrotizing fasciitis of left leg following minor trauma

Post wound debridement



Post split skin grafting



Fig. 3: Necrotizing fasciitis of upper limb following snakebite



Blebs seen in NF of gluteal region



Post wound debridement

Fig.4: Necrotizing fasciitis of left gluteal region follow injection abscess

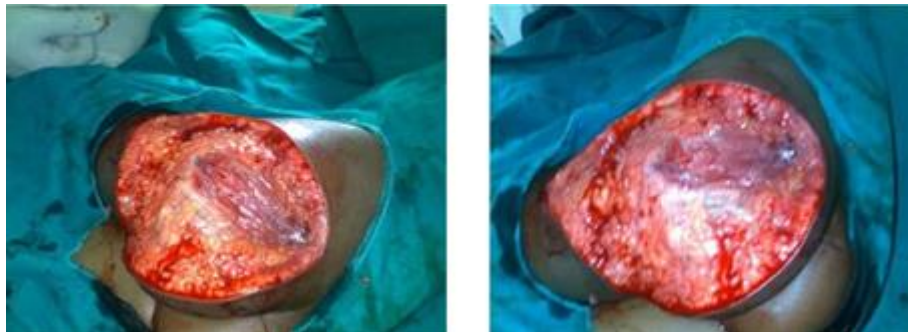


Fig 5: Healing wound ready for grafting or flaprepa

Discussion

Necrotizing fasciitis is an acute, life threatening infection of the superficial fascia and subcutaneous tissue caused by a variety of aerobic and anaerobic bacteria. The clinical process at first appears to be a low grade cellulitis, but fulminant infection develops rapidly in subcutaneous fascia, which may become liquefied with accompanying fat necrosis, thrombosis of subcutaneous vessels and occasional myositis and myonecrosis. As the blood supply to the skin is compromised, cutaneous erythema and oedema progress to cyanosis, bullae and gangrene. Cutaneous gangrene is associated with fever, shock and highmortality rate[5-6].

Necrotizing fasciitis tends to occur in diabetics, alcoholics, intravenous drug abusers, immunocompromised patients, and as a post operative complication.

A patient with necrotizing fasciitis usually presents with the clinical features of cellulitis, including erythema, swelling and local heat in the affected area. There is pain in the area concerned that is out of proportion to the severity of cellulitis.

Systemic features of toxicity, including fever, tachycardia and leucocytosis, are also out of proportion to the apparent severity. If left untreated the skin becomes shiny, hot and exquisitely tender

but discrete margins do not develop. The skin forms blisters and bullae that contain clear thin haemorrhagic fluid.

Soft tissue gas is an uncommon feature of necrotizing fasciitis but is seen when there is anaerobic infection. The diagnosis is difficult and rests on high index of suspicion in the clinical settings outlined above.

Radiological examination in the form of plain radiograph or computed tomographic scan may show gas in the tissues. The diagnostic test is a full thickness biopsy of the affected area or surgical exploration.

Although initiation of antimicrobial therapy is essential, these medications do not stop the progress of necrosis initiated by the organism released toxins. Surgery is mandatory.

Aggressive debridement of infected tissue is the only treatment option, which often leaves the patient with an extensive post operative wound.

Post operative care requires the patient to receive the appropriate intravenous antibiotics, an effective wound management regimen and adequate nutritional support.

A functional extremity can usually be salvaged in fasciitis, if not, amputation can be safely performed later. Immediate amputation is necessary when there is diffuse myositis with complete loss of

blood supply or when adequate debridement will leave a useless limb. When the viability of the remaining tissue is assured and the infection has been controlled, soft tissue deficits can be covered with skin grafts.

This study was done as a cross-sectional observational study to analyze the factors contributing to morbidity and mortality associated with necrotizing fasciitis and myonecrosis.

Age distribution

A number of 50 patients were studied in this series between the age group ranging from 5-75 years. The maximum incidence of necrotizing fasciitis was seen in the age group of 41 years to 60 years (52%). the youngest patient was nine years old, and the oldest was 72 years old.

Sex distribution

A number of 50 patients were studied in this series, out of which 38 were Males and 12 were females.

Site of involvement

In this series of 50 patients with necrotizing fasciitis, the lower limbs (62%) were the commonest involvement, left leg (36%) being affected more commonly. The next most common site of involvement is the perineum, which is also referred to as Fournier's gangrene. The least common site of involvement in the back (2%) and the trunk (2%)

Etiology

Although NF is rare, certain conditions can predispose patients to develop the disease, including immunocompromised states such as diabetes mellitus, AIDS, and malignancy and those with intravenous drug or alcohol problems.

Necrotizing fasciitis may also occur as a result of trauma, such as burns and lacerations. Even minor trauma, such as insect bites and

needle sticks, may lead to

N.F. Patients with peripheral vascular disease and atherosclerosis also have an increased risk.

However, previously healthy persons can also develop the disease. The use of nonsteroidal anti-inflammatory drugs (NSAIDs), with varicella infection, in particular, has recently been implicated as a risk factor for developing N.F., although the association is still being debated.

Simply put, the entrance of bacteria can occur from any break in the skin and can occur in patients with preexisting skin conditions such as psoriasis, pressure[5-7]. ulcers, boils, or perirectal abscesses.

Fournier's gangrene arises spontaneously or from a perineal abscess, an infection of a Bartholin's gland or the scrotum, or a genitourinary procedure, such as the use of a urinary catheter. However, the portal of entry is often obscure or unidentifiable.

Predisposing factor

Necrotizing soft tissue infections occur predominantly in patients predisposed by immune compromise, diabetes mellitus, or vascular insufficiency, and mortality from necrotizing soft tissue infections can be reduced by expeditious diagnosis and adequate early debridement.[6, 7].

Organism isolated

Necrotizing fasciitis is categorized as Type 1 or Type 2 depending on which organisms are cultured.

Type 1 N.F. is a polymicrobial infection from aerobic and anaerobic bacteria such as *Clostridium* and *Bacteroides* species.

Type 2 N.F. It consists of group A Streptococcus (*S. pyogenes*) with or without a coexisting *Staphylococcal* infection.

Type 3 N.F. is associated with *Vibrio vulnificus*, which enters the subcutaneous tissues via puncture wounds from fish or marine insects.

Necrotizing fasciitis classification.

Table 19: Organism isolated comparison

STUDY in %	PRESENT	Shah Etal [8]
STAPH. AUREUS	20	15-37
PROTEUS SPECIES	8	-
PSEUDOMONAS	14	9-10
KLIEBSIELLA	30	-
E.COLI	14	8-28
CITROBACTER	2	-

Organism and sensitivity

Broad-spectrum antibiotic coverage is needed, especially in type 1 N.F., until culture, Gram stain, and sensitivity results are available. A number of regimens are employed; a common one is a combination of penicillin for gram-positive cocci, an amino glycoside for gram-negative aerobes, a third-generation cephalosporin, and clindamycin or metronidazole for anaerobes.

Single antibiotic coverage with a broad-spectrum antibiotic such as

imipenem-cilastatin, which provides coverage against anaerobes and *Pseudomonas*, can be considered. Clindamycin also suppresses the production of both streptococcal toxin and M protein and is a preferred choice in the initial antibiotic therapy.

Vancomycin is added in case methicillin-resistant *S aureus* is suspected or penicillin allergy is present. In immunocompromised patients, adequate coverage of *Pseudomonas* is important.

Table 20: Organism and sensitivity comparison

Study	Present	Sheik et al[11].
Staph. Aureus	Vancomycin, linezolid	Cefotaxime, amikacin
Proteus species	Gentamicin, Amikacin, ciplox	Gentamicin, amikacin
Pseudomonas	Netilmicin, imipenem	Amikacin, ampicillin
Kliebsiella	Gentamicin, amikacin	Ciplox, amikacin
E.coli	Gentamicin, amikacin	Gentamicin
Citrobacter	Imipenem, cefotaxime	-

Surgical debridement

Adequate surgical debridement is essential to the successful management of necrotizing fasciitis. This will require radical excision of all necrotic tissue, drainage of involved fascial planes, and extensive fasciotomy[7].

Careful re-evaluation of the wound and formal re-exploration in the operating theatre under general anesthesia is also required, often on two or three further occasions[8].

A surgical debridement is a form of mechanical debridement. Mechanical debridement, including sharp debridement, wet to dry dressings, and high-pressure irrigation or pulsed lavage, are well accepted therapeutic measures.

Thorough sharp debridement of all non-viable soft tissue and bone from the open wound is accomplished mainly with a scalpel, tissue nippers, and/or curettes[8].

Autolytic debridement occurs naturally in a healthily moist wound

environment with maintained arterial perfusion and venous drainage. Enzymatic debridement (using topical, proteolytic enzymes such as collagenase), however, is commonly used as adjunctive therapy in the management of wounds.

Wound management

Generally, a moist wound environment bandaged to protect it from trauma and local contamination has been shown to facilitate the healing process. The type of dressing depends upon factors such as size, depth, location, and the wound surface

Dressings

The types of dressings can be broadly divided into films, composites, hydrogels, hydrocolloids, alginates, foam, and other absorptive dressings, including NPWT- Negative Pressure Wound Therapy[8].

The choice of one over the other is made by considering the wound characteristics and treatment goals.

The amount and type of exudates that are present in the wound will direct the dressing used in wounds that have some degree of bacterial colonization.

In general, hydrogels, films, and composite dressings are best for wounds with light amounts of exudate; hydrocolloids are used in wounds with moderate amounts of exudate; and alginates, foams, and N.P.W.T. are best used for wounds with heavy volumes of exudate. 43 Wounds with large volumes of necrotic material should not be treated with dressing until a surgical debridement has been performed[8].

Duration of hospital stay

The average duration of hospital stay was 29.4 days. The longest stay was for 61 days; the shortest stay was for eight days. 30% of patients stayed for a duration of 21 to 30 days[9].

Mortality

In this study of 50 patients, 43 (86%) patients recovered from the Disease and 7 (14%) patients expired. The mortality rate is 14%.

The above study shows a comparison of the present study to a similar study conducted by Hefny et al., Wong et al., and Peer et al[10].

The mean age of appearance of necrotizing fasciitis in the present study was 48 years, which is similar to those found in Sheik et al [11]. and Peer et al. [10] studies.

The mean age of presentation in Shah et al [9] is 56 years, which is slightly higher than the present study.

The male to female ratio in the present study is approximately 4: 1, showing the higher incidence of this condition in males. Higher incidence of

N.F. in males may be due to increased outdoor activities of male-like working in fields where they are more prone to minor trauma and snake bites.

The most common site of involvement in our study was the lower limbs, which are similar in lines to those found in all the other studies. In peer et al[10] study, perineum (Fournier's gangrene) was the common site of involvement followed by lower limbs. Again lower limbs being exposed more often to trauma and snake bites becomes the most common site of involvement.

The mean duration of symptoms prior to first surgical debridement in the present study was 3.7 days, which when compared to Sheik et al[11]. study (5 days) and Peer et al.[10] study is low (4.1 days). This factor also contributes to lower morbidity and mortality in N.F. patients, mortality is higher in Hefney et al. (18%) and Elliot et al. (25.3%) studies

The mean number of debridements done on patients in the present study was 1.7 times which is comparatively low when compared to all the other studies – Sheik et al[11] (2 times).

In the present study mean duration of symptoms prior to the first surgical debridement was 3.7 days, which is low compared to 5 days in the Sheik et al. study[11], which is probably the reason for less number of debridements done in the present study compared to Sheik et al[11] study. Early presentation, early diagnosis, and early aggressive surgical debridements

have a favorable outcome.

Conflict of Interest: Nil

Source of support: Nil

The mean duration of hospital stay in the present study was 29.4 days, which is low compared to all the other studies mentioned above.

In the present study, the predominant organism was Klebsiella seen in 15 cases (30%), followed by Staphylococcal aureus coagulase positive seen in 10 cases (20%). Polymicrobial infection was seen in 4 cases (8%).

Conclusion

Hence patients with a provisional diagnosis of necrotizing fasciitis and myonecrosis should be treated aggressively with wound debridements as early as possible, if necessary, with major amputations and broad-spectrum antibiotics.

The most sensitive antibiotic to the growth in the present study was Amikacin in 17 cases (34%), followed by Cefotaxime in 11 cases (22%).

The most common comorbid condition in this study was diabetes mellitus type 2 (38%). Diabetes as a comorbid condition contributed more towards complications associated with N.F. Out of the 14 patients who developed complications, nine patients were diabetic type 2 patients.

The most common complication that comes across in this study was Septicemia (7 cases) followed by renal failure (6 cases). Osteomyelitis developed in one patient. The complications seen in other studies mentioned above were in similar lines, with Septicemia with MODS being the most common and life-threatening complication.

The mortality rate in the present study is 14 %, which is comparatively low when compared to other studies.. Aggressive resuscitation and early aggressive surgical debridement has been the mainstay of our treatment and has contributed to the low mortality in the present study. Administration of antibiotics plays a supportive role but doesn't replace the extensive excision and removal of the source of sepsis.

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References

1. Shaikh N. Necrotizing fasciitis: A decade of surgical intensive care experience. Indian J Crit Care Med 2006; 10: 225-9
2. Kandil A. Necrotizing fasciitis: Study of 20 cases in Shifa Hospital. Palestine Medical Journal 2006; 2(3): 16-21
3. Hamad H, Al Mosleh A/W, Al Maslamani Y, Abu Nada M, Al Harami M. The outcome of surgical management of necrotizing fasciitis in Qatar: 8 years results. The Middle East Journal of Emergency Medicine. 2001; 1(1): 3-4
4. Deodhar SD, Shirahatti RG, Sareen AA, Bharucha MA, Bhawe GG. Necrotizing fasciitis (a report of 5 cases). J Postgrad Med 1985; 31: 170
5. Fournier AJ, Gangrene foudroyante de la verge. Semaine Med 1883; 3: 345-348
6. Wilson B. Necrotizing fasciitis. Am Surg 1952; 18: 416-431
7. Paya K, Hayek BF, Rebhandi W et al. Retroperitoneal necrotizing fasciitis in a 4 years girl. Journal of Pediatric Surgery 1998; 33 (5): 778-780
8. Mc Henry CR, Piotrowski JJ, Petrinic D, Malangoni MA. Determinant of mortality in necrotizing soft tissue infections. Ann Surg 1995; 221: 558-565
9. Shah AK, Kumar NB, Gambhir RPS, Chaudhry R. Integrated clinical pathway for managing necrotizing soft tissue infections. Indian Journal of Surgery 2009; 71: 254-257
10. Peer SM, Rodrigues G, Kumar S, Khan SA. A clinicopathological study of necrotizing fasciitis – An institutional experience, JCPSP 2007; 17(5): 257-260
11. Shaikh N. Necrotizing fasciitis and diabetes mellitus. Int J Diab Dev Ctries 2007; 27: 14- 17 12.