RESEARCH PAPER | Medical Science | Volume : 2 | Issue : 2 | November 2012 | ISSN - 2249-555X

Necrotising Fasciitis :- Determinants of Mortality and Management Strategy

KEYWORDS: Necrotising fasciitis, risk factors, debridement

Dr.Chakane Milind
Dept. of Surgery, Smt. Kashibai Navale Medical College & Hospital, Narhe, Dist. Pune, Maharashtra

Dr.Kshirsagar Vinayak
Dept. of Surgery, Smt. Kashibai Navale Medical College & Hospital, Narhe, Dist. Pune, Maharashtra.

ABSTRACT *Necrotising fasciitis is a serious infection of skin, subcutaneous tissue and fascia. It easily spreads across the fascial plane within the subcutaneous tissue. Necrotising fasciitis is rapidly progressing disease and delay in diagnosis and treatment is associated with high mortality. Treatment includes early surgical debridement along with broad spectrum antibiotics. This prospective study included 46 patients of necrotizing fasciitis treated at a rural hospital in last three years. There was slight male preponderance,29 cases(63.04%). 18 patients (39.13%) were in age group of 41 to 50 years. The extremities were most commonly involved site,29(63%) cases. Diabetes mellitus was the most common associated comorbidity,26 (56.56%) cases. Mean time of first debridement from time of admission was 10.13 hours. In 31 (67.39%) patients infection was polymicrobial. Mortality due to necrotizing fasciitis in study was 21.74% (10 patients). Risk factors for mortality were advanced age, more than 2 associated co-morbidity, and delay in first operative debridement.*

INTRODUCTION

The skin is the largest and most visible organ that protects us against microbial and non-microbial challenges. Factors that exert its protective function include its structural integrity, generally dry state, low pH and its pilosebaceous secretions that inhibit microbial growth. Disruption of this layer renders the underlying soft tissues susceptible to infections. The most soft tissue bacterial infections are usually superficial and are readily treated by antibiotics given orally. Necrotizing soft tissue infections are at the other end of the spectrum and involve rapid and extensive tissue destruction that progresses to systemic sepsis, and are fatal if not treated promptly and vigorously.[1]

Although necrotizing fasciitis has received much recent attention, it remains a relatively uncommon disease with serious complications. Not a recent disease, it was well described in the Fifth Century BC by Hippocrates. In modern times, necrotizing fasciitis was first described by Joseph Jones, a Confederate Army Surgeon in the civil war, who termed the infection hospital gangrene in which "the skin of the affected part melts away."[2]

Necrotizing fasciitis is a clinical entity that have been given various other eponyms, including hemolytic streptococcal gangrene, suppurative fasciitis, acute dermal gangrene, acute infective gangrene and progressive bacterial gangrene. Site specific names such as Fournier's gangrene have also been used. The term necrotizing fasciitis was first used in 1952 by Wilson.[3]These entities, however, all seem to be variations of same disease process. All these entities require a common approach—an aggressive management protocol, to reduce mortality.

The aim of this study was to determine risk factors and to evaluate best possible management strategy for patients with necrotizing fasciitis.

Material and Methods

A prospective study of 46 patients with a diagnosis of necrotizing fasciitis treated at a rural hospital over a period of three years were selected for study. Necrotising fasciitis was defined by the presence of necrosis of subcutaneous tissue and fascia with or without involvement of skin. Diagnosis of necrotizing fasciitis was made by clinical examination, microbiological profile and intra-operative findings. The operative findings used for definitive diagnosis were, 1) The presence of grayish necrotic fascia, 2)demonstration of a lack of resistance of normally adherent muscular fascia to blunt dissection, 3)lack of bleeding of the fascia during dissection.

Patients with pyaemic abscesses, cellulitis and clostridial or non-clostridial myonecrosis were excluded from this study. All patients were treated according to a uniform protocol. After detail history and complete clinical assessment, resuscitation of patients was initiated. After an assessment about the extent of the infection, patients were taken to the operating room expeditiously for aggressive debulking of infected tissue. All necrotic skin, subcutaneous tissue and fascia were removed and sent for microbiological examination. In cases of necrotising fasciitis involving limbs, amputation was performed to contain infection whenever necessary. Intensive care was provided when necessary and included mechanical ventilation, invasive monitoring, and inotropic support as indicated by the condition of the patient. Broad spectrum antibiotics were administrated to cover gram positive cocci, gram negative rods and anaerobic flora. The antibiotics were modified as per sensitivity of bacteria.

All wounds were inspected within 24 hours after debridement and a decision made regarding further debridement. Wounds were cleaned twice daily with providone-iodine solution. The raw areas were covered with split skin grafts once they were healthy and granulating. Enteral hyper-alimentation was instituted in all patients as soon as they were stabilized after debridement and continued till patient was discharged from the hospital. The hospital course and mortality were recorded for all patients.

The variables that were examined in the present study include age, gender, duration and type of symptoms, portal of entry of infection, location of infection, number and type of associated co-morbidities; vital parameters and physical, radiographic, laboratory findings at the time of admission; time from hospital admission to first operative treatment; microbiology of tissue samples obtained at the time of first debridement, number of debridement, need for amputation, the duration of hospitalization and in-hospital mortality. All data was analyzed statistically.

Results

In this study 46 patients of necrotizing fasciitis were treated. Out of this male patients were 29(63.04%), and female were 17(36.96%) .Minimum age of presentation was 11 years, and maximum of 82 years, with a mean age of 48.97 years. Mean duration of symptoms was 4.32 days with a range of 2-8 days. Aetiologic factors were boil in 13(28.26%), trauma 19(41.3%), ulcer 1(2.18%), and idiopathic in 13(28.26%) cases. Extremities were involved in 29(63.04%) patients. Co-morbidities associated were diabetes mellitus in 26(56.52%) cases, chronic obstructive pulmonary disease in6(13.04%), chronic liver

Volume : 2 | Issue : 2 | November 2012 | ISSN - 2249-555X

disease 4(8.69%), peripheral vascular disease 2(4.35%),coronary artery disease 1(2.17%),renal failure 6(13.04%), intravenous drug abuse 1(2.17%), steroid abuse 2(4.35%) and no co-morbidity was found in 15(32.60%) cases. The most common presenting symptoms were pain in 37(80.43%) patients, local swelling in 33(71.74%), fever in 23(50%) patients. The most common findings on admission were tachycardia in 32(69.57%), skin erythema in 28(60.87%) patients. The most common operative finding was subcutaneous tissue and fascial necrosis in43(93.48%)cases. In 33(71.74%) patients first surgical debridement was done within 8 hours of admission and in 13 (28.26%) cases it was done after that. Polymicrobial infection was present in 31(67.39%)cases, and monomicrobial in 15(32.61%) cases. The mean duration of hospital stay in this study was 26.85 days with a range of 4 to 68 days. In this prospective study mortality was found in 10 patients(21.74%). Seven variables were analyzed for association with mortality, that were age, gender, presence of diabetes mellitus, number of co-morbidities, duration of symptoms, site of infection, and delay in first debridement. Statistically significant risk factors for mortality were 1)Age >50 years($P<0.001$), 2) Presence of >2 co-morbidities($P<0.001$), and 3)Delay in first debridement of >24 hours($P<0.001$).

DISCUSSION

The treatment of infections such as necrotizing fasciitis may induce dread and trepidation among surgeons. This reaction results from the belief that necrotizing fasciitis require hours of arduous and unrewarding surgery followed by a prolonged downward course in the intensive care unit; and a slow, unavoidable death. However this study and other recent reports point out that this is not necessarily the case. To the contrary, if the diagnosis is made early and treatment instituted promptly, prognosis is good.

Necrotising fasciitis is a rare soft tissue infection characterized by widespread fascial necrosis with relative sparing of skin and underlying muscle. The clinical course of necrotizing fasciitis had not changed since Meleney[4] described the disease in 1924. Necrotising fasciitis is frequently associated with severe systemic toxicity and is unusually rapidly fatal, unless promptly recognized and aggressively treated. The difficulty of making an early diagnosis is due to the paucity of cutaneous findings early in the course of the disease. A suspicion of necrotizing fasciitis should be entertained in patients presented with atypical cellulitis, when the pain is disproportionate to the area involved and there is no early response to antibiotics. The presence of risk factors (Diabetes mellitus, Chronic liver disease, Peripheral Vascular Disease) in a patient with "simple cellulitis" should alert the clinician to the possibility of necrotizing fasciitis. Early exploration on the basis of suspicious may help in early diagnosis with a subsequent reduction in mortality. (Figure no.1)

Figure No. 1
Necrotising Fasciitis of Left Leg and Foot with blisters and Skin Necrosis

In this study, 46 patients were studied. Although no age group is exempted, Necrotising fasciitis is more common in middle-aged. This is comparable with other studies[5,6]The present study shows that there is slight male preponderance. But there is no significant difference in mortality rate in both sex.

The mean duration of symptoms in this study was 4.32 days. The mean duration of symptoms in study by Elliott D C, et al.[7] (1996) was 4.1 days and by Miller L G, et al[8] (2005) it was 6.2 days. This shows the acute nature of the infection. The most common cause of necrotising fasciitis in this study was trauma of varied nature and severity. In a study by Brook I, et al.[9] (1995), trauma as an aetiology was found in 34% patients. Gurpreet Singh, et al.[1] (2002) found it in 52% patients. The extremities were the most common sites involved. The upper and lower limbs were involved in 11 (23.91%) and 18 (39.13%) patients respectively. This result is comparable with other studies[1,10].Various co-existing co-morbidities were seen in patients in this study. The most common associated co-morbidity was diabetes mellitus in 26 patients (56.52%). More than 2 co-morbidities were found in 6 patients (12.04%). Diabetes mellitus as a most common co-morbidity was also reported by Elliott D C, et al[7]and Wong C H, et al[10].The presence of diabetes mellitus may have an adverse effect on the survival of the patients[11], although this result was not borne out in this study. Presence of more than 2 co-morbidities were associated with a significantly increased risk of mortality ($P<0.001$)

In cellulitis, infection begins at the junction between the dermis and superficial fascia, but in necrotising fasciitis, it starts at the level of subcutaneous fat and deep fascia; and the epidermal and dermal layers are spared in the early stage.[12] Edema of the epidermal and dermal layers (Peau d'orage) and erythema of skin are, therefore, not initially obvious. Exquisite pain without obvious skin signs, more usually described as pain out of proportion to the physical findings may, therefore, be the only early indication of necrotising fasciitis. Thrombosis of the vessels to the skin will lead to necrosis and the severe pain fade away as nerves die. Therefore, anesthesia is present in the most necrotic area, while the surrounding tissues remain very tender. The operative findings, including necrosis of the subcutaneous fat (brownish) and fascial plane (grayish), loss of normal resistance of the tissue plane and 'dish-water' pus are the results of liquidative enzymatic necrosis. (Figure no.2)

Figure No. 2
Necrotising Fasciitis after debridement showing necrotic Fascia and necrotic pus

In present study, patients usually presented with the triad of exquisite pain: 37 patients (80.43%); swelling: 33 patients (71.74%); and fever: 23 patients (50%). In this study, an intermediate stage characterized by the formation of small bullae: 18 patients (39.13%) were noted as the condition progressed. The presence of bullae filled with serous fluid is an important diagnostic clue and should raise the suspicion of his condition. Weiss and Laverdiere[13] (1997) in their study also noted the formation of bullae early in the course of this disease.

Mean time of first debridement from admission was 10.13

Volume : 2 | Issue : 2 | November 2012 | ISSN - 2249-555X

hours. Delay in operative debridement of more than 24 hours from time of admission was adversely affecting survival of patients with NF (P < 0.001). The microbiology of necrotising fasciitis in this study was characterized by a wide variety of organisms, cultured from affected wounds. The most cultures in this study were poly microbial: 31 patients (67.39%). The polymicrobial nature of necrotising fasciitis was also observed by McHenry C R, et al.[6] (1995), Elliott D C, et al.[7](1996) in their studies. In this study, mortality was found to be 21.74% (10 patients). Mortality, as high as 76% has been reported world wide.[14] Mortality rate in this study is comparable with other studies. (Table No. 1)

Study	Year	No. of Death	No. of Patients	Percentage
McHenry C R, et al[6].	1995	19	65	29
Tang W M, et al.[15]	2001	8	24	33.3
Gurpreet Singh, et al.[1]	2002	20	75	27
Wong C H, et al.[10]	2003	19	89	21.3
Present study	2012	10	46	21.74

Table No. 1 :Mortality in other studies

The statistical analysis of the potential determinants for mortality due to necrotising fasciitis revealed four factors to affect survival adversely:

a) Advanced Age (> 50 years) P <0.001
b) Presence of more than 2 co-morbidities P <0.001
c) Delay of more than 24 hours between time of admission and first debridement P <0.001

The non modifiable risk factors (age, co-morbidities) may affect survival but one modifiable factor that adversely affects survival is how quickly the patient undergoes operative debridement. (Table No. 2)

S.No.	Study	Year	Risk Factor for Mortality
(a)	McHenry C R, et. al.[6]	1995	Delay in 1st operative debridement
(b)	Elliott D C, et al.[7]	1996	Advanced age, Female gender, High serum creatinine level, Blood lactate level, Delay in first debridement, Extent of infection, Degree of organ system failure on admission
(c)	Wong C H et al.[10]	2003	Advanced age, >2 co-morbidities, Delay in first debridement.
(d)	Present study	2012	Advanced age, >2 co-morbidities, Delay in first debridement

Table No. 2 : Risk Factors for Mortality in other Studies

CONCLUSION

Necrotising fasciitis represents a potentially lethal, rapidly progressive bacterial disease. . Early diagnosis and aggressive surgical debridement is the cornerstone principle in the treatment of Necrotising fasciitis. The paucity of cutaneous findings early in the course of the disease makes early diagnosis difficult. A high index of suspicion is important and when intravenous antibiotics fail to adequately control the effective process within twenty-four hours after admission, emergent operative debridement should be seriously considered. While doing so, may subject some patients to surgery who would otherwise have responded to non-operative therapy. This approach may ultimately reduce the mortality associated with this dreaded condition.

Other therapeutic measures include fluid resuscitation, correction of systemic acidosis and electrolyte abnormalities, blood transfusion, and intravenous antibiotics. Repeated examination of the area involved, should be performed to ensure adequacy of debridement.

To conclude:

1. Advanced age, more than 2 associated co-morbidities increase the risk of dying due to Necrotising fasciitis.
2. Trauma, presence of Diabetis mellitus and other immunocompromised state are the high risk factors for development of Necrotising fasciitis .
3. Survival from Necrotising fasciitis is enhanced by early adequate debridement and repeated debridement.
4. Early diagnosis, aggressive resuscitation, early surgical debridement and intensive care result in favourable outcome in patients presenting with Necrotising fasciitis .

REFERENCE 1.Gurpreet Singh,Sinha SK,Adhikary S,Babu S,Ray P,Khanna SK. Necrotizing Infections of soft tissues-A clinical profile. Eur J Surg. 2002; 168: 366-371 | 2.Jones J:Investigation upon the nature,causes,and treatment of Hospital Gangrene as it prevailed in the Confederate armies,1861-1865. In:Hamilton FH,ed.United States Sanitary Commission, Surgical Memoirs of the war of the Rebellion.New York:Riverside Press;1871:146-170. | 3.Wilson B.Necrotizing fasciitis.Am Surg. 1952;18:416-431. | 4. Meleney FL.Hemolytic streptococcus gangrene.Arch Surg.1924;9:317-364. | 5. Singh G,Chawla S.Aggressiveness-The key to a successful outcome in necrotizing soft tissue infection.MJAFI.2003;59:21-24. | 6. McHenry CR,Piotrowski JJ,Petrinic D,Malangoni MA.Determinants of mortality for necrotizing soft tissue infections.Ann Surg.1995;221:558-565 | 7. Elliott DC,Kufera JA,Myers RAM.Necrotizing soft tissue infections:Risk factors for mortality and strategies for management.Ann Surg.1996;224 :672-683. | 8. Miller LG,Remington FP,Reig G,Mehdi S,Perlroth J,Bayer AS,et al.Necrotizing fasciitis caused by community-associated methicillin-resistant staphylococcus aureus in Los Angeles.N Eng J Med.2005;352:1445-1453. | 9. Brook I,Frazier EH.Clinical and microbiological features of necrotizing fasciitis.J Clin Microbiol.1995;33:2382-2387. | 10. Wong CH,Chang HC,Pasupathy S,Khin LW,Tan JL,Low CO.Necrotizing fasciitis:Clinical presentation,microbiology and determinants of mortality.J Bone Joint Surg[Am].2003;85:1454-1460. | 11. Pessa ME,Howard RJ.Necrotizing fasciitis. Surg Gynecol Obstet.1985;161:357-361. | 12. Green RJ,Dafoe DC,Raffin TA.Necrotizing fasciitis.Chest.1996;110:219-229. | 13. Weiss KA,Laverdiere M.Group A streptococcus invasive infections: A review.Can J Surg.1997;40 :18-25. | 14. Stone HH,Martin JD.Synergistic necrotizing cellulitis.1972;175:702-711. | 15. Tang WM,Ho PL,Fung KK,Yuen KY,Leong JCY.Necrotizing fasciitis of a limb.J Bone Joint Surg [Br].2001;83:709-714.