

Clinical Features and Microbiological Profile of Necrotizing Fasciitis at a Tertiary Care Centre

Sweta Muni^{1,2}, Deepak Pankaj³, Aninda Sen⁴, Udayan Ganguly⁴

¹Senior Resident, Department of Microbiology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India, ²Ex-Assistant Professor, Department of Microbiology, Katihar Medical College, Katihar, Bihar, India, ³Senior Resident, Department of General Surgery, Katihar Medical College, Katihar, Bihar, India, ⁴Professor, Department of Microbiology, Katihar Medical College, Katihar, Bihar, India

Abstract

Introduction: Necrotizing fasciitis (NF) is a major global surgical emergency and still considered as a social disease in India reflecting the standards of living in a community.

Aim: The aim of the present study was to study microbiological profile of NF along with surgical features.

Materials and Methods: About 50 cases of NF were studied over a period of 9 months in Katihar Medical College between 2015 and 2016 with emphasis on the mode of presentation and microbiological profile.

Results: Maximum 36% of the cases were in the age group of 51-60 years. The sex incidence revealed a male to female ratio of 11.5:1 showing a male preponderance particularly affecting those who were engaged in outdoor activities such as farming. Diabetes mellitus was the most common risk factors in these patients. *Streptococcus*, *Pseudomonas*, and *Escherichia coli* were the most common organism isolated in wound cultures. Organisms were mostly sensitive to aminoglycosides such as amikacin, gentamicin, and fluoroquinolones.

Conclusion: NF has varied presentations as shown by this study with predominant symptoms of tenderness and edema. Good results can be obtained by adopting a multidisciplinary approach along with prompt diagnosis and surgical care in hospital settings, health education, and awareness about dreaded complication of this disease.

Key words: Culture, Diabetes mellitus, Necrotizing fasciitis, *Pseudomonas*, Wound

INTRODUCTION

Necrotizing fasciitis (NF) is a rapidly progressing infection of the skin and soft tissues that has been known since the days of Hippocrates.¹ Early diagnosis and surgical intervention is of utmost importance in reducing mortality and amputation rates resulting from NF as it causes extensive necrosis of the fascia and subcutaneous tissue leading to severe systemic toxicity. Its rarity and the paucity of early pathognomonic signs make NF a major diagnostic challenge. The term "Necrotizing fasciitis" was coined by Wilson in 1952, for he observed that

cutaneous gangrene is not only the clinical diagnostic sign, but also fascial necrosis is a constant feature.² It is usually accompanied by the systemic inflammatory response syndrome and needs prolonged intensive care treatment.³ The overall incidence of NF has been estimated as 0.24-0.4/100,000 adults. In South East Asian countries, it is associated with 30-70% mortality despite advancement in therapy.^{4,5} According to the microbiological characteristics, NF is classified as follows: Type 1 (polymicrobial) and Type 2 (monomicrobial), the former being more common. Type I NF also known as synergistic NF is a mixed infection caused by anaerobic, aerobic, and facultatively anaerobic Gram-positive and Gram-negative bacteria. Most of the pathogens originate from the bowel flora e.g., *Escherichia coli*, *Pseudomonas* spp., *Bacteroides* spp., and *Vibrio* spp. Risk factors include immune compromise, recent surgery, and underlying abdominal pathology including malignancy.⁶ Type II NF is usually monomicrobial and due to Gram-positive organisms. The most common pathogen causing Type II

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Corresponding Author: Dr. Deepak Pankaj, Senior Resident, Department of General Surgery, Katihar Medical College, Katihar - 854 105, Bihar, India. Phone: +91-9431060340. E-mail: drdeepakpankaj@gmail.com

NF is Group A β -hemolytic *Streptococcus* either alone or in combination with other species, usually *Staphylococcus aureus*. Cases of NF without a recognized precipitating factor are more likely to be due to streptococcal infection or, more recently, due to community-acquired methicillin-resistant staphylococcal infection.⁷ The earliest clinical feature common to all types of NF is exquisite pain, often out of proportion to any visible skin changes. This is due to the occlusion of perforating nutrient vessels with resultant nerve infarction.⁸ Pain progresses until the nerves supplying the skin are destroyed resulting in anesthesia of the affected areas. Early clinical suspicion and surgery are the keys to improving survival, and patients with necrotizing infections need an integrated multidisciplinary approach to management. It is adjusting with the infecting organism, the site of infection, and the effects from any toxins produced, and incorporating various clinical and laboratory parameters.

MATERIALS AND METHODS

Source of Data

This study was conducted comprising 50 patients of NF in Department of General Surgery and Microbiology at Katihar Medical College, Katihar (Bihar) for a period of 9 months between 2015 and 2016.

Inclusion Criteria

1. Patient has organisms cultured from tissue or discharge from affected site
2. Patient has purulent drainage at affected site
3. Patient has an abscess or other evidence of infection seen during surgical debridement
4. Patient has at least 2 of these signs or symptoms at the affected site with no other recognized cause: Localized pain or tenderness, redness, swelling, or heat.

Collection and Processing

Wound swab from all patients diagnosed to have NF was collected after surgical debridement. Blood culture (2 sets preferably) were done if there was any signs of bacteremia. The tissue was homogenized under sterile conditions and was cultured on blood and McConkey agar. The culture plates were incubated overnight at 37°C for aerobic growth. Bacterial growth was identified by the biochemical test and the resistance pattern by disc diffusion method according to Clinical and Laboratory Standards Institute guidelines. The tissue sample or the wound swab was inoculated immediately after collection in Robertson's cooked meat media for further anaerobic culture and identification. Variables that were examined included age, sex, mode of presentation, site/location

of infection, co-morbid illness, etiological factors, admitting diagnosis, investigations, microbiological characteristics, antibiotic sensitivity, and the treatment outcome.

Methods of Collection of Data

- Detailed history taking
- Clinical examination
- Investigations (routine laboratory investigation)
- Relevant special investigations
- Conservative management with meticulous dressing and if needed major surgical interventions with its outcome.

RESULTS

Age

Out of 50 cases studied, the youngest patient was 30 years of age and oldest was 79 years. The highest number of cases was found in the age group 51-60 years (36%), followed by 41-50 years (28%) (Table 1).

Sex

Out of the 50 cases studied under this series, the majority of the patients were male 46 (92%) and the contribution of female patients was 4 (8%) (Table 2).

Sites of Involvement and Number of Patients Affected

Lower limb was the most common site of involvement which was predominantly seen in calf region followed by involvement of both calf and foot (Table 3).

Risk Factors

Diabetes mellitus was the most common risk factor present in majority of the cases of NF (44%), followed by increasing age more than 60 years (24%). Hypertension was present in 10% of the cases. No identifiable risk factor was present in 12% of the cases (Table 4 and Figure 1).

Clinical Features

Tenderness was present in majority of the patients (94%) followed by edema (74%). Other features present were erythema of skin, woody hard texture of skin, skin vesicles and bullae, hypotension, fever, tachycardia, and altered mental status.

Culture

Culture in 38 patients (76%) showed positive growth, while no growth was present in 12 patients (24% of cases). Among culture positive patients, monomicrobial growth was present in 46% cases which were slightly more than patients with polymicrobial growth (30%) (Figure 2).

Table 1: Age distribution among 50 presenting cases of NF

| Age (in years) | Number of patients | Percentage |
|----------------|--------------------|------------|
| 0-10 | - | - |
| 11-20 | - | - |
| 21-30 | 1 | 2 |
| 31-40 | 5 | 10 |
| 41-50 | 14 | 28 |
| 51-60 | 18 | 36 |
| 61-70 | 10 | 20 |
| 71-80 | 2 | 4 |

NF: Necrotizing fasciitis

Table 2: Sex distribution among 50 presenting cases of NF. Ratio of males was higher than females

| Sex | Number of patients | Percentage |
|--------|--------------------|------------|
| Male | 46 | 92 |
| Female | 4 | 8 |

NF: Necrotizing fasciitis

Table 3: Sites involved with number of patients affected

| Site | Number of patients | Percentage |
|-----------------------|--------------------|------------|
| Lower limb | | |
| Calf | 28 | 56 |
| Thigh+genitals | 5 | 10 |
| Foot | 7 | 14 |
| Calf+feet | 1 | 2 |
| Upper limb | 3 | 6 |
| Upper limb+trunk | 1 | 2 |
| Upper limb+lower limb | 2 | 4 |
| Bilateral lower limbs | 2 | 4 |
| Neck+chest | 1 | 2 |
| Total | 50 | 100 |

Table 4: Risk factors for NF

| Risk factors | Number of patients | Percentage |
|-------------------------|--------------------|------------|
| Diabetes mellitus | 22 | 44 |
| HIV | 1 | 2 |
| Hypertension | 5 | 10 |
| Age>60 years | 12 | 24 |
| Renal and liver disease | 4 | 8 |
| No identifiable factor | 6 | 12 |
| Totals | 50 | 100 |

NF: Necrotizing fasciitis

Microorganisms Isolated

Among the polymicrobial growth (30%), organisms isolated were a combination of Gram-positive organisms such as *S. aureus*, *Enterococcus faecalis*, and *Streptococcus pyogenes* and Gram-negative bacteria such as *E. coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, and *Proteus vulgaris*. *P. aeruginosa* (46.67%) was the most common organism isolated among polymicrobial growth. While among the monomicrobial growth (46%), the most common organism isolated was

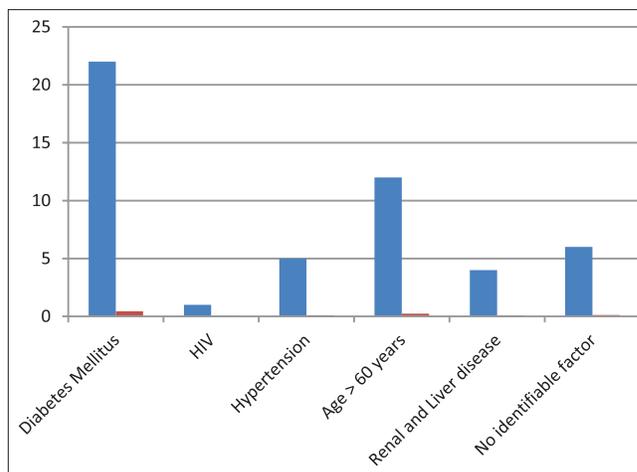


Figure 1: Bar diagram showing risk factors for necrotizing fasciitis

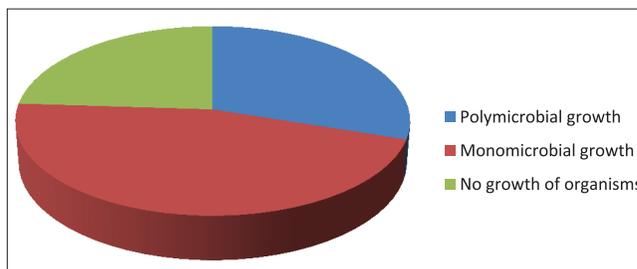


Figure 2: Pie diagram showing growth of microorganisms

S. aureus (43.48%), followed by *Klebsiella* (21.74%), while other organisms being *Pseudomonas*, *E. coli*, and *Streptococcus*. No growth was detected in 12 patients (24%).

Antimicrobial Sensitivity Testing

Among the antibiotic susceptibility pattern of isolates, maximum resistance pattern was found to cefixime and cotrimoxazole. Organisms were mostly sensitive to amikacin, gentamicin and ofloxacin. Also organisms were moderately sensitive to amoxicillin and clavulanic acid (Co-amoxycylav).

DISCUSSION

Being a surgical emergency with a high degree of morbidity and mortality, NF requires early recognition and aggressive debridement to avoid sepsis and subsequent death from it. Most of the studies have reported a mortality rate of 30-70%.⁹⁻¹¹ NF has affected wide age group, but most commonly affected age of presentation was between age group 51 and 60 years (36%) and minimum in young age group of 21-30 years (2%) in our study. The incidence being more common male gender by far. The reason for male gender was most of them being agriculturist who used to work in field for long time and ignoring minor pricks and trauma leading to larger infected wound. Other associated

reason being lack of education, unhygienic environment, and lack of access to healthcare facilities in rural area. Among the sites involved, the most common site of involvement was the calf region (56%) followed by foot (14%). Diabetes mellitus was the most common risk factor present in majority of the cases of NF (44%), followed by increasing age more than 60 years (24%). These patients usually have a pre-existing disease which increases the susceptibility to infection. Most common ones are diabetes mellitus, age >60 years, hypertension, and chronic renal failure.¹² Other factors being chronic liver disease and HIV infection. A number of comorbidities are associated with NF. Clinicians should have a higher index of suspicion when patients with diabetes or liver cirrhosis present with cutaneous infection.¹³

Diabetes mellitus was the most common risk factor present in majority of the cases in our study of NF (44%), followed by increasing age more than 60 years (24%). The presence of diabetes mellitus as the most common predisposing risk factor in our study is also consistent with other studies.^{14,15}

Culture in 38 patients (76%) showed positive growth, while no growth was present in 12 patients (24% of cases). Among culture positive patients, monomicrobial growth was present in 46% cases, which was slightly more than patients with polymicrobial growth (30%). In a study conducted by Goh *et al.*, the overall positive wound culture rate was 76.5% which is very similar to our study.¹³

In this study, among the polymicrobial growth (30%), organisms isolated were a combination of Gram-positive organisms such as *S. aureus*, *E. faecalis*, and *S. pyogenes* and Gram-negative bacteria such as *E. coli*, *P. aeruginosa*, *K. pneumonia*, and *P. vulgaris*. *P. aeruginosa* (46.67%), was the most common organism isolated among polymicrobial growth. While among the monomicrobial growth (46%), the most common organism isolated was *E. coli* and *Streptococcus* (43.48%), followed by *S. aureus* (34.78%) and *Klebsiella* (13.01%) while other organisms being *Pseudomonas*. No growth was detected in 24% of cases. Organisms common in polymicrobial infections in other studies were: *Staphylococcus* spp., *Streptococcal* spp., *Bacteroides* and *E. coli*.¹⁶⁻¹⁸ Among monomicrobial infections, *S. pyogenes* was found in the study by Nisbet *et al.*;¹⁹ *S. aureus* was reported by Huang *et al.*²⁰ In a study conducted by Mathew *et al.*, 55.6% were monomicrobial and 44.4% were polymicrobial growth. Most common organism isolated was *P. aeruginosa* (23%) among polymicrobial growth followed by *K. pneumonia* (16%) and *S. aureus* (16%).²¹ *E. coli* and beta hemolytic *Streptococcus* is also reported to be an important cause of monomicrobial infection (45.6%) in NF in other studies.¹²

Among the antibiotic susceptibility pattern of isolates, maximum resistance pattern was found to cefixime and co-

trimoxazole. Organisms were mostly sensitive to amikacin, gentamicin and ofloxacin. Also organisms were moderately sensitive to amoxicillin and clavulanic acid (Co-amoxycylav). Control of diabetes with oral hypoglycemics and insulin, treatment of various co morbidities, use of appropriate antibiotics, and surgical debridement along with skin grafting and amputation wherever needed were the various modalities of treatment employed in these patients.

CONCLUSION

NF is a rapidly progressive disease with systemic toxicity and proves to be fatal if not treated. It is a surgical emergency, so requires aggressive approach. The presence of the infection should be determined by clinical findings and appropriate wound cultures and thus treatment should be based on culture reports. Sometimes culture reports are negative and in such cases molecular techniques may help in identifying microorganisms and thus helps in treatment. Patient education, proper care of feet, and a multidisciplinary approach is essential for patients with NF.

REFERENCES

- Descamps V, Aitken J, Lee MG. Hippocrates on necrotising fasciitis. *Lancet* 1994;344:556.
- Wilson B. Necrotizing fasciitis. *Am Surg* 1952;18:416-31.
- Levine EG, Manders SM. Life-threatening necrotizing fasciitis. *Clin Dermatol* 2005;23:144-7.
- 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-A:1454-60.
- Rangaswamy M. Necrotizing fasciitis: A 10 - year retrospective study of cases in a single university hospital in Oman. *Acta Trop* 2001;80:169-75.
- Stevens DL, Bisno AL, Chambers HF, Everett ED, Dellinger P, Goldstein EJ, *et al.* Practice guidelines for the diagnosis and management of skin and soft-tissue infections. *Clin Infect Dis* 2005;41:1373-406.
- Miller LG, Perdreau-Remington F, Rieg G, Mehdi S, Perloth J, Bayer AS, *et al.* Necrotizing fasciitis caused by community - Associated methicillin - resistant *Staphylococcus aureus* in Los Angeles. *N Engl J Med* 2005;352:1445-53.
- Morgan MS. Diagnosis and management of necrotizing fasciitis: A multiparametric approach. *J Hosp Infect* 2010;75:249-57.
- Anaya DA, Dellinger EP. Necrotizing soft-tissue infection: Diagnosis and management. *Clin Infect Dis* 2007;44:705-10.
- Sentochnik DE. Deep soft-tissue infections in diabetic patients. *Infect Dis Clin North Am* 1995;9:53-64.
- Elliott D, Kufera JA, Myers RA. The microbiology of necrotizing soft tissue infections. *Am J Surg* 2000;179:361-6.
- Demirag B, Tirelioglu AO, Sarisözen B, Durak K. Necrotizing fasciitis in the lower extremity secondary to diabetic wounds. *Acta Orthop Traumatol Turc* 2004;38:195-9.
- Goh T, Goh LG, Ang CH, Wong CH. Early diagnosis of necrotizing fasciitis. *Br J Surg* 2014;101:e119-25.
- Shaikh N, Ummunissa F, Hanssen Y, Al Makki H, Shokr HM. Hospital epidemiology of emergent cervical necrotizing fasciitis. *J Emerg Trauma Shock* 2010;3:123-5.
- Salvador VB, San Juan MD, Salisi JA, Consunji RJ. Clinical and microbiological spectrum of necrotizing fasciitis in surgical patients at a Philippine university medical centre. *Asian J Surg* 2010;33:51-8.

16. Elliott DC, Kufera JA, Myers RA. Necrotizing soft tissue infections. Risk factors for mortality and strategies for management. *Ann Surg* 1996;224:672-83.
17. Frazee BW, Fee C, Lynn J, Wang R, Bostrom A, Hargis C, *et al.* Community - acquired necrotizing soft tissue infections: A review of 122 cases presenting to a single emergency department over 12 years. *J Emerg Med* 2008;34:139-46.
18. Dworkin MS, Westercamp MD, Park L, McIntyre A. The epidemiology of necrotizing fasciitis including factors associated with death and amputation. *Epidemiol Infect* 2009;137:1609-14.
19. Nisbet M, Ansell G, Lang S, Taylor S, Dzendrowskyj P, Holland D. Necrotizing fasciitis: Review of 82 cases in South Auckland. *Intern Med J* 2011;41:543-8.
20. Huang KF, Hung MH, Lin YS, Lu CL, Liu C, Chen CC, *et al.* Independent predictors of mortality for necrotizing fasciitis: A retrospective analysis in a single institution. *J Trauma* 2011;71:467-73.
21. Mathew A, Mridula M, Vishwanath S, Mukhopadhyay C, Rodrigues G. Clinico-microbiological profile of necrotizing fasciitis secondary to diabetes mellitus in a tertiary care hospital. *WebmedCentral GENERAL SURGERY* 2010;1:WMC001399

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