

Original Research Article

An observational prospective study of microbiological profiling in necrotizing fasciitis patients at tertiary care centre

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ABSTRACT

Background: Necrotizing fasciitis (NF) is described as the most aggressive form of skin and soft tissue infections. NF requires prompt diagnosis and urgent surgical procedure along with appropriate antibiotic coverage. Still NF has high morbidity and mortality. The aim of the study was to provide microbiological profile in necrotizing fasciitis patients and discover the appropriate antibiotics regimen to treat them early and appropriately.

Methods: This observational prospective study was done of patients of necrotizing fasciitis between June 2016 to June 2018 in the department of plastic surgery in the central area of India.

Results: In this study monomicrobial culture was positive in 66.7%, polymicrobial culture was positive 16.7% and no organism was found in 16.7% of patients. In our study most commonly, used antibiotic was colistine followed by tigecycline.

Conclusions: Microbiological profiling and early use of sensitive antibiotic is a key to treat the necrotizing fasciitis. It renders the progression of disease and decreases the morbidity and mortality in necrotizing fasciitis.

Keywords: Necrotizing fasciitis, Microbiological profile, Monomicrobial, Polymicrobial

INTRODUCTION

Necrotizing fasciitis (NF) is described as the most aggressive form of skin and soft tissue infections.^{1,2} This infection may have either an indolent or fulminant presentation and their course is unpredictable.³ It involved all layers of skin and underlying soft tissue. Necrotizing fasciitis rapidly and progressively break down the fascia and subcutaneous layers. Most frequently NF involves lower extremity, trunk and perineum. The common aetiologies of NF are minor trauma and surgery but in some cases the aetiology remains uncertain. NF is more prevalent in low immunity patients for examples diabetics.^{4,5} NF is classified by bacteriological features or layers of tissue involved, to stratify and manage them better.^{6,7} NF have been described according to their anatomical locations (Fournier gangrene), the depth of

infections (cellulitis, adipositis, fasciitis, and myositis), and the associated microbiological organisms.

The bacterial aetiology of NF is important clinically, as it does alter clinical presentation and true adjunctive treatments. NF was first classified by Giuliano and colleagues⁸. Type I infections are classically polymicrobial with various species of gram-positive cocci, gram-negative rods, and anaerobes including clostridial species.^{9,10,11} Patients with type I NF are typically older, with more medical co morbidities such as diabetes, and often have no history of trauma.

Type II infections commonly involves with group A β -hemolytic streptococci (GAS) and staphylococcal species. When compared with type I NF, patients with type II infections tend to be younger, healthier, and more

commonly have a history of trauma, surgery or IV drug use.^{12,13} Initial features of NF are very similar to cellulitis or abscesses potentially making the correct diagnosis difficult. In patients of NF erythema, odema and fever are the most common findings on physical examination. Several 'hard' clinical signs are more suggestive of NF but occur late in the course of the disease. These include (a) blister formation; (b) skin erythema and necrosis; (c) presence of gas in the tissues by examination or radiographic evaluation; (d) cutaneous anaesthesia; (e) severe pain; (f) swelling and induration; (g) systemic toxicity; (h) progression of infection despite antibiotic therapy; and (i) subcutaneous emphysema.

In contrast to patients with severe cellulitis or abscesses or both, the symptoms and signs of NF usually progresses very rapidly. This makes early diagnosis critical and becomes vitally important to clinicians making treatment decisions.^{14,15} However, diagnosis at the initial disease stage is difficult and NF may be misdiagnosed in more than half of patients.¹⁶⁻¹⁸ Early recognition of pathogens and aggressive debridement of all necrotic fascia and subcutaneous tissue are major prognostic determinants, and delay in that has been shown to increase mortality rate.¹⁸⁻²¹

The diagnosis of NF was made by surgery.²² In questionable cases, a small skin incision can be made with dissection carried down to the fascia to see the non-adherence of fascia to underlying soft tissue. Microbiologic diagnosis is optimally established by gram stain and culture of deep specimen taken during surgical exploration.

The standard treatment of NF consists of culture sensitive antibiotics, wide surgical debridement, and supportive care.²² Multiple surgical debridement's requires in most of the patients, and survivors often have large and complex wounds requiring soft tissue coverage and long duration hospitalization.

The objectives of this study were to make a microbiological profile in necrotizing fasciitis patients and discover the appropriate antibiotics to treat them early and appropriately.

METHODS

This observational prospective study was conducted between June 2016 to May 2018 in the department of plastic, aesthetic and reconstructive surgery of Medanta the Medicity Hospital Gurgaon, Haryana. For statistical analysis SPSS software (version 20.0) was used. Inclusion criteria of study was all patients admitted in the department of plastic surgery with necrotizing fasciitis age range 18-85 years. Exclusion criteria for study was chronic wounds and non-healing wounds. Informed consent was taken from each and every patient before participating in the study. Ethical approval was taken from the hospital ethical committee.

Thorough history and clinical examinations were done. Patients were admitted in inpatient department of plastic surgery. Informed consent for surgical debridement was taken. After necessary blood examinations and pre-anaesthetic check-up, patient was taken up for surgery. Liberal debridement was done. Deep wound tissue was obtained for pus culture sensitivity and histopathological examinations.

RESULTS

Age

Out of 36 cases studied, the youngest patient was of 28 years old and the oldest was of 84 years. The maximum numbers of patients were seen in 4th and 5th decade of their life.

Sex

There were 28 male (77.7%) and 8 females (22.3) as shown in Figure 1.

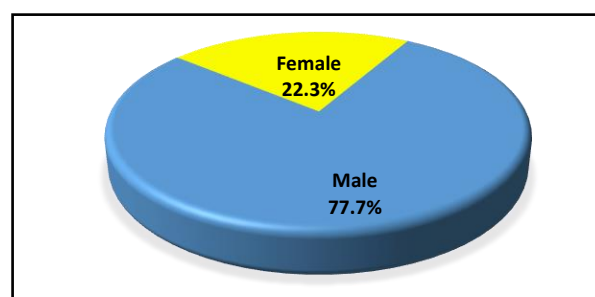


Figure 1: Gender wise distribution.

Co-morbidity

In this study 61.1% patients (22 out of 36) were diabetics as shown in Figure 2.

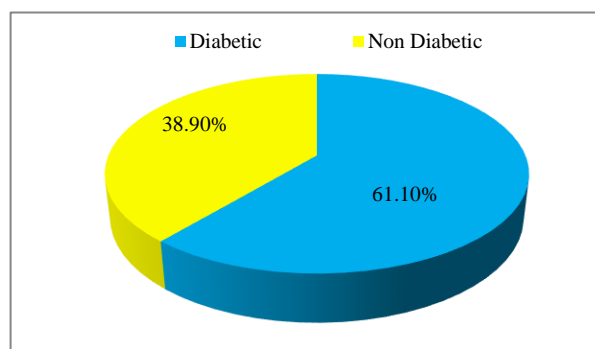


Figure 2: Diabetic vs non-diabetic.

Most common site involved

The most common site involved in this study was lower limb 58.5% followed by trunk 24.3% of patients as shown in Figure 3.

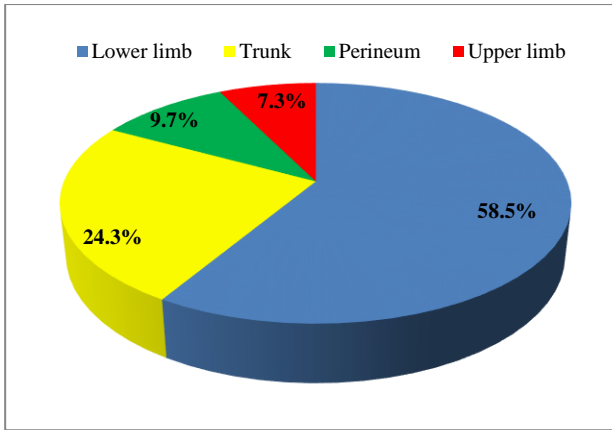


Figure 3: Most common site involved.

Total mortality and morbidity in this study

In this study total mortality was 13.9% (5 out of 36 patients) and total morbidities (above knee amputation or below knee amputation) were 11.1% (4 out of 36 patients) as shown in Figure 4.

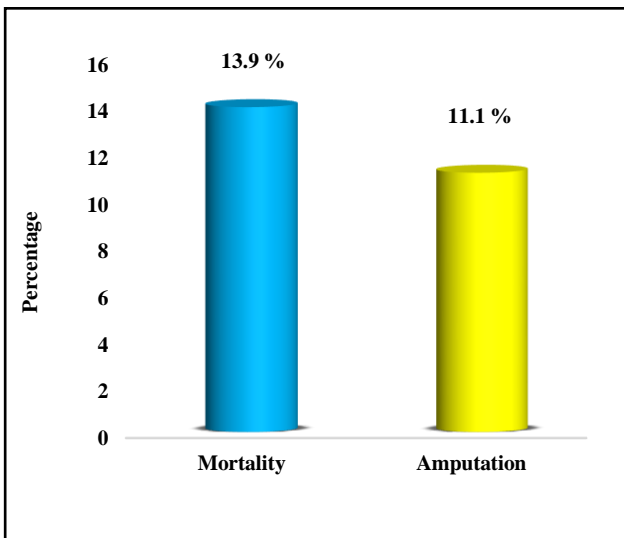


Figure 4: Total mortality and morbidity in this study.

Gender vs mortality

In this study there were 28 male and 8 female patients. The mortality rate among the male patients was 7.1% (2 out of 28 patients). The mortality rate among the female patients was 37.5% (3 out of 8 patients). P value was found significant 0.029* in female group of patients as shown in Figure 5.

Hospital acquired NF vs mortality

In this study 7 patients had hospital acquired NF and mortality rate among them was 42.9% (3 out of 7 patients). P value was found significant 0.014* as shown in Figure 6.

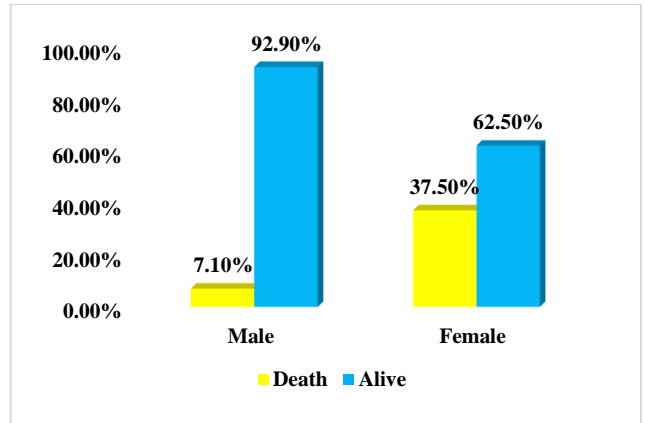


Figure 5: Gender wise mortality rate.

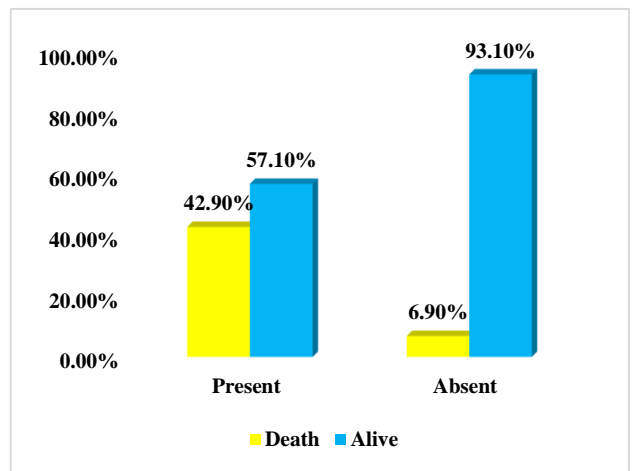


Figure 6: Hospital acquired NF vs mortality rate.

Types of NF and mortality rate

In this study 31 patients had unifocal NF and mortality rate among them was 9.7% (3 out of 31 patients). 5 patients had multifocal NF. Among them mortality rate was 40% (2 out of 5 patients). P value was not found significant 0.069 as shown in Figure 7.

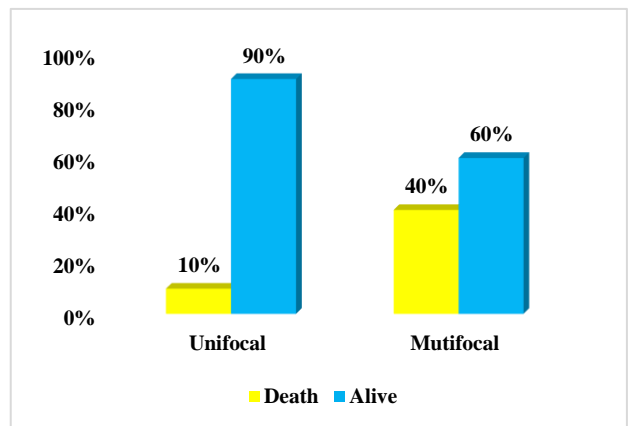


Figure 7: Types of NF vs mortality rate.

Septic shock vs mortality

In this study 10 patients had septic shock and mortality rate among them was 40% (4 out of 10 patients). 26 patients were without septic shock. Among them mortality rate was 3.8% (1 out of 26 patients). P value was found significant 0.005*.

The most common microorganism

The most common microorganism was found in this study was E. coli (23.8%) followed by Klebsiella (19.04%) as shown in Figure 8.

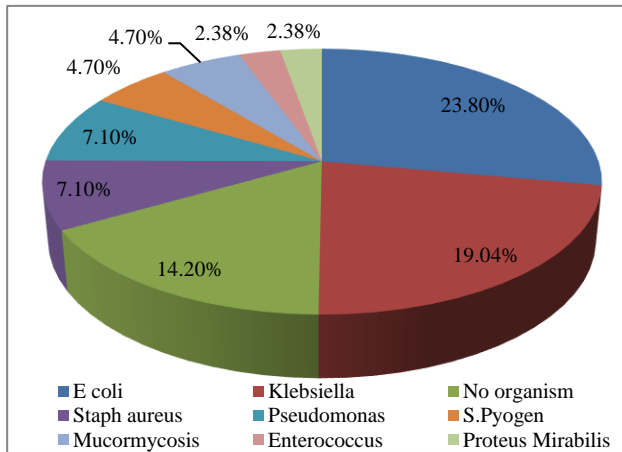


Figure 8: Commonly involved microorganisms.

Monomicrobial vs polymicrobial

In this study monomicrobial culture was positive in 66.7%. Polymicrobial culture was positive 16.7% and no organism was found in 16.7% of patients as shown in Figure 9.

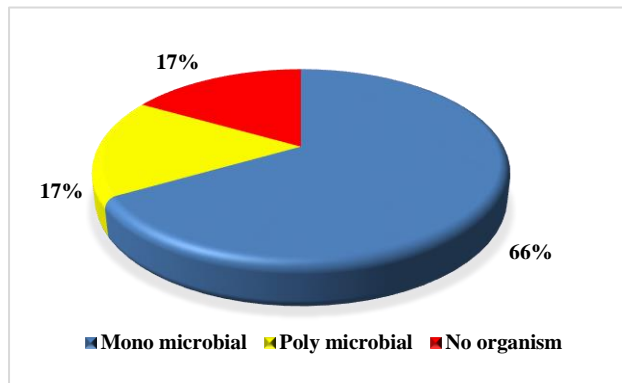


Figure 9: Monomicrobial vs polymicrobial microorganisms.

Commonly used antibiotics

In this study most commonly, used antibiotic was colistine 37.7% followed by tigecycline 26.2%. These antibiotics were used after the culture sensitivity as shown in Figure 10.

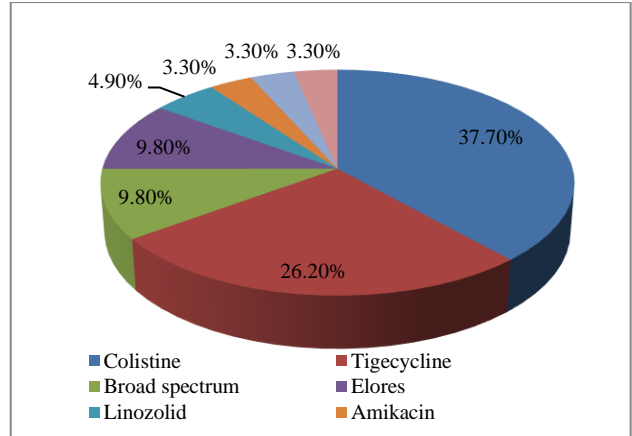


Figure 10: Commonly used antibiotics.

DISCUSSION

NF is a life-threatening disease which requires early start of culture sensitive antibiotics and urgent surgical exploration, delay in diagnosis and surgical procedure lead to high morbidity and mortality. In the present study the age range was 28-84 years and mean age was 52.9 years. In the present study, there were 28 male (77.7%) and 8 female (22.3%) patients. Harikrishnan et al (2017) male patients were in majority of 90% while female were only 10%.²³ Similarly another study done by Zhao et al in 2017 there were 82% male and 18% female patients.²⁴ In this study most common co morbid condition was diabetes mellitus (61.1%). This data correlates well with other studies. Kalaivani et al in 2013 reported that 53.3% of patients in their study were diabetics.²⁵ While Hua et al in 2015 reported that 36% of patients in their study were diabetics.¹⁸ In this study the most common site involved was lower limb (58.5%). Similarly, Kalaivani et al in 2013 reported that most common site involved was lower limb (56.6%).²⁵ According to the literature, mortality rate resulting from necrotizing fasciitis ranges from 9.3 to 76% In the present study total mortality was 13.9% (5 out of 36 patients), and total morbidities (above knee amputation or below knee amputation) were 11.1% (4 out of 36 patients). Although mortality and amputation rate are quite low in our study but these are comparable to many studies done previously. A recent study done by Latifi al in 2018 mortality rate was 16.5%.²⁶ Similarly the overall mortality rate of the series was 17% in a study done by Kao et al in 2011.²⁷ Main reason of low mortality and low morbidity in the present study was due to quickly recognition of NF and early start of culture sensitive antibiotics and aggressive management in the form of debridement, meticulous wound management including VAC therapy, skin graft reconstruction and ICU care. In the present study there were 28 male and 8 female patients. The mortality rate among the male patients was 7.1% (2 out of 28 patients) while among the female patients it was 37.5% (3 out of 8 patients). According to the results, female patients of NSTI are more likely to have deaths in comparison to male patients in our study. It was comparable to some studies done in the past. In their study

Elliott et al in 1996 concluded that females were almost three times as likely as males to die in NF.¹⁵ Similarly Misiakos et al also reported in 2017 that female sex have significantly high mortality.²⁸

In these study 7 patients had hospital acquired NF and mortality rate among them was high 42.9% (3 out of 7 patients) in comparison to the patients having no hospital acquired NF (6.9% only). Hua et al in 2015 also concluded hospital-acquired NF as an independent risk factor of mortality.¹⁸ In this study 31 patients had unifocal NF and mortality rate among them was 9.7% (3 out of 31 patients). 5 patients had multifocal NF. Among them mortality rate was 40% (2 out of 5 patients). It correlates with the study done by Hua et al in 2015 who concluded that patients who had multifocal NF, a sign of an advanced disease, is an independent risk factor of mortality.¹⁸ In this study 10 patients had septic shock and mortality rate among them was 40% (4 out of 10 patients) which was very much high than the patients not having septic shock (3.8% only). Similarly, Hua et al in 2015 reported that patients with severe sepsis or septic shock during admission had a 14-fold increased mortality risk.¹⁸

The most common microorganism was found in the present study was *E. coli*. In this study monomicrobial culture was positive in 66.7%. Polymicrobial culture was positive in 16.7% and no organism was found in 16.7% of patients. It correlates well with the studies done previously. The study done by Kalaivani et al in 2013 reported that the most common microorganism was *E. coli* in their study.²⁵ Monomicrobial culture was positive in 63.3% and no organism was found in 18.49% of patients. Another study done by Park et al in 2016 *E. coli* was the most common organisms (57.1%).²⁹ Similarly in 9 out of 35 patients (25.7%) with a type 1 NF, Stigt et al in 2016 isolated a monoculture, mostly *E. coli*.³⁰

In our study most commonly, used antibiotic was colistin followed by tigecycline. In a study done by Menyar et al in 2017 commonly used antibiotics were tazocin, clindamycin, meropenem and agumentin.³¹

Limitations

This was a single tertiary care centre study with a small study group. The result from this study should be validated by a multicenter study in several centres.

CONCLUSION

Microbiological profiling and early use of culture sensitive antibiotics are a key to treat the necrotizing fasciitis. It renders the progression of disease and decreases the morbidity and mortality in necrotizing fasciitis. However, this study was single centre and small size study. In future we require the large size study which would help us to device prophylactic antibiotic regimen for these patients.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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