



Necrotizing fasciitis: Identification and characterization of causative organisms in patients of Himalayan region

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Abstract

Background: Necrotizing fasciitis (NF) is a potentially fatal infection of the skin and soft tissues that spreads quickly via the deep fascia. If treatment is delayed, it has a significant risk of developing into a fatal soft tissue infection. A better knowledge of the pathophysiology of NF may help reduce morbidity and death.

Methods: The protocol was approved by the institutional scientific review protocol committee and the institutional ethical review protocol committee. Additionally, written informed permission was obtained from the patient. The research included all patients hospitalized to the department of general surgery at Dr. Rajendra Prasad Govt. Medical College & Hospital,

Tanda with a diagnosis of necrotizing fasciitis for a period of one year, from June 2018 to May 2019. During debridement or amputation, samples for culture and sensitivity were taken from the infected site and sent to the laboratory for microbiological analysis. A better knowledge of the pathophysiology of NF may help reduce morbidity and death.

Results: Out of 60 patients, 41 (68.3 %) had type II NF (monomicrobial) and 8 (13.3 %) had type I NF (Polymicrobial). 11 (18.3 %) patients were sterile. No organism was found associated with type III or IV NF. A better understanding of the pathophysiology of NF may help reduce morbidity and death.

Conclusion: According to our findings, 68.3 % of 60 patients had type II NF (monomicrobial), with

Staphylococcus aureus being the most frequently isolated organism; 13.3 % had type I NF (polymicrobial), with Klebsiella being the most frequently isolated organism; and 18.3 % were sterile. No organism was found to be consistent with type III or IV NF.

Keywords: necrotizing fasciitis, pathogenesis, infection, causative organisms

Introduction

Necrotizing fasciitis is uncommon, yet it is a very aggressive and deadly infection. Necrotizing fasciitis is described as an infection of any of the skin and soft tissue layers, including the subcutaneous layer, the superficial fascia, and the deep fascia, that is accompanied with necrotizing alterations. Jones initially reported these illnesses in 1871, coining the name "hospital gangrene" [1]. In 1951, Wilson coined the term "necrotizing fasciitis" to describe a group of infections [2].

In the case of necrotizing fasciitis, no single organism is responsible [3, 4]. The majority of cases, necrotizing fasciitis is caused by a polymicrobial infection that includes both aerobic and anaerobic bacteria. This disease is frequently deadly as a result of the bacteria's combined activity [5]. Necrotizing Fasciitis is categorized according to the bacteria that cause it. Around 80% of infections are classified as type I and are mostly polymicrobial in nature, caused by both aerobes and anaerobes [6]. Type II infections are caused by a single bacterium, generally Streptococcus or Staphylococcus aureus. They typically account for 20-30% of all NF and typically occur as a result of a mild injury [7]. Infections of type III are mostly caused by gram-negative, frequently marine-related vibrio

species. Fungal infections, primarily candida and zygomycetes, produce type IV infections [8].

Material and method

The protocol was approved by the institutional scientific review protocol committee and the institutional ethical review protocol committee. Additionally, written informed permission was obtained from the patient. The research included all patients hospitalised to the department of general surgery at Dr. Rajendra Prasad Govt. Medical College & Hospital, Tanda with a diagnosis of necrotizing fasciitis for a period of one year, from June 2018 to May 2019.

The diagnosis of necrotizing fasciitis was made by intense pain, swelling, erythema, bluish or purplish discoloration, blisters, bullae, necrosis of skin and multiple patches expanded to the large area of gangrenous skin.

Culture and sensitivity samples were taken from the infected site during the debridement or amputation, and these samples were sent for microbiological investigations. At the time of admission, the patient was given amoxicillin with clavulanic acid. Antibiotics were subsequently adjusted according to the culture and sensitivity report.

Results

Causative organisms

Out of 60 patients, 41 (68.3 %) had type II NF (monomicrobial) and 8 (13.3 %) had type I NF (Polymicrobial). 11 (18.3 %) patients were sterile. No organism was found associated with type III or IV NF.

Figure 1: Causative Organisms

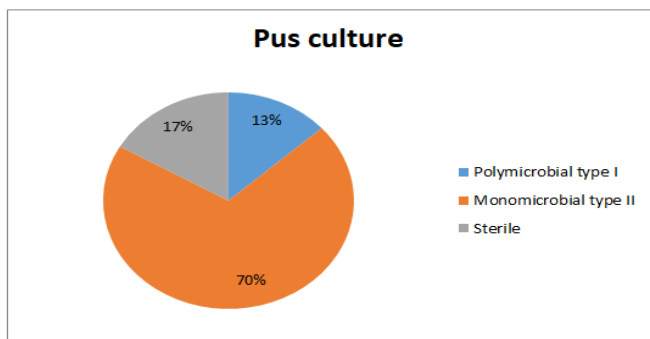


Table 1: Causative Organisms (n=60)

Organisms	Number	Percentage
Polymicrobial type I	8	13.3
Monomicrobial type II	41	68.3
Type III	0	0
Type IV	0	0
Sterile	11	18.3
Total	60	100

(n= total patient in the study)

Aerobic culture of wound site fluid was performed on all patients. Anaerobic culture was not carried out due to limitations. Klebsiella was the most often isolated organism in NF of type I (polymicrobial). The most

Table 2: Causative Organisms

Poly Microbial (Type I)		Mono Microbial (Type II)		Type III	Type IV
Organism	Present	Organism	Present	Present	Present
Staph. Aureus, E.coli, MRSA	1	Staph. Aureus	10	Nil	Nil
Staph. aureus, Acinetobacter	1	E.coli	6		
E.coli, Acinetobacter	1	MRSA	1		
E.coli, Klebsiella	2	Acinetobacter	3		
Acinetobacter, Klebsiella	2	Klebsiella	6		
Klebsiella, Pseudomonas, Citrobaacter	1	a Haemolytic streptococci	4		
		Pseudomonas aeruginosa	5		
		Proteus mirabilis	4		
		Citrobacter	1		
		Enterococcus	1		
	8	Total	41	0	0

prevalent pathogen in type II (monomicrobial) NF was Staphylococcus aureus.

In monomicrobial (type II) NF, organism isolated was staphylococcus aureus in 10 (16.7%) patients, E.coli in 6 (10%) patients, Klebsiella in 6 (10%) patients, Pseudomonas aeruginosa in 5 (8.3%) patients, Proteus mirabilis in 4 (6.7%) patients, alpha haemolytic streptococci in 4 (6.7%) patients, Acinetobacter in 3 (5%) patients, MRSA in 1(1.7%) patient, Enterococcus in 1 (1.7%) patient and Citrobaacter in 1 (1.7%) patient.

In a polymicrobial type of NF organism isolated were Staphylococcus aureus, E.coli, MRSA in 1 (1.7%) patient. Staphylococcus aureus, Acinetobacter in 1 (1.7%) patient. E.coli, Acinetobacter in 1 (1.7%) patient. E.coli, klebsiella in 2 (3.3%) patients. Klebsiella, Acinetobacter in 2 (3.3%) patients, and Klebsiella, Citrobaacter, Pseudomonas aeruginosa in 1 (1.7%) patient. In 10 (16.7%) patients no organism was isolated. No anaerobic, marine and fungal organisms were detected in this study.

Discussion

NF is a significant surgical emergency with a high death risk, even with adequate care, with documented fatality rates ranging from 6% to 36%. The majority of instances of necrotizing fasciitis occurred as a result of a small injury caused by trauma, which might be blunt or penetrating. Inadequate wound care following minor trauma is the primary cause of necrotizing fasciitis [9]. The foreign body that may become lodged or the deep inoculation caused by trauma, thorn prick, and other causes creates an ideal incubator-like environment for the organisms to thrive, which, when combined with impaired host defence caused by alcoholism or diabetes, results in fulminant local infection and necrotizing fasciitis [10].

Gauzit R. in his study observed microbiological diagnosis in 75% of cases of NF [11]. Ozalay M. et al reported positive culture in 91% of the patients of his study [12]. In our study 81.7% of culture were positive and 18.3% were sterile.

NF has been classified into several categories based on microbiological cultures. Type I infections are polymicrobial synergistic infections that are typically caused by organisms other than group A streptococci, either aerobic or anaerobic. The most common cause of type II infections is beta hemolytic streptococci or staphylococcus aureus. Type III NF is caused by marine vibrio and is most frequently related with exposure to seawater or marine animals. Fungal organisms are responsible for type IV NF [13].

Type II NF tends to occur in immunocompromised hosts whereas type I occur in individuals with no underlying morbidity. Type I (polymicrobial) are the most common type of NF which occur in 70-80%

followed by type II (20-30%). Type III and type IV are rare types of NF [13, 14]. Contrary to these studies, in our study, the majority of the NF were of type II i.e. monomicrobial type in 68.3% patients, followed by type I i.e. polymicrobial type in 13.3% patients. There was no case of type III and IV. Anaerobic organism cultures were not performed because of the limitation of the culture process. Ozalay M et al has also reported that the majority of the cases of NF were of type II which was to the tune of 59% [15]. Jinn-MingWang in his study has also reported that 61% of patients had monomicrobial isolates [16].

In our study most common isolated organism in type II (monomicrobial) was Staphylococcus aureus in 10 (16.7%) patients, followed by E.coli in 6 (10%), Klebsiella in 6 (10 %), Pseudomonas aeruginosa in 5 (8.3%), Proteus mirabilis in 4 (6.7%), Alpha haemolytic streptococci in 4 (6.7%) and Acinetobacter in 3 (5%) patients. Among aerobic groups, staphylococcus was the common isolate in various other studies [14, 17, 18, 19].

Klebsiella was the most prevalent isolate in our study within the polymicrobial group, which was detected in 13.3 % of the isolates, i.e. type I NF. Whereas Divakra et al. and Wong C et al. found beta-hemolytic streptococcus as the most prevalent pathogen in type I [14, 20]. There were 11 (18.3 %) sterile cultures in our study.

Conclusion

In our study, 68.3 % of 60 patients had type II NF (monomicrobial), with Staphylococcus aureus being the most frequently isolated organism; 13.3 % had type I NF (polymicrobial), with Klebsiella being the most frequently isolated organism; and 18.3 % were sterile.

No organism was found to be consistent with type III or IV NF. There were 11 (18.3 %) sterile cultures in our study.

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