



ROLE OF MICROBIOLOGY IN TREATMENT OF NECROTIZING FASCIITIS –OUR INSTITUTION EXPERIENCE

General Surgery

Dr. Chris Thomas

Dr Shubha N Rao* *Corresponding Author

KEYWORDS

INTRODUCTION

Necrotizing fasciitis (NF) is a rare, potentially lethal bacterial infection characterized by widespread necrosis of the skin, subcutaneous tissue, and superficial fascia.^{1,2} Incidence - 0.4 and 0.53 cases per 100,000 population.^{3,5} Not only patients who present with pre-existing factors but also young individuals may be affected. Approximately half of the cases of streptococcal NF occur in young and previously healthy patients.⁶ NF may result from any injury to the skin or from hematogenous spread.¹ Any major or minor trauma compromising skin integrity such as needle puncture, insect bites, burns, lacerations, surgical wound, blunt trauma etc. may develop this insidiously advancing soft-tissue condition.^{1,2} A single species of bacteria, by itself, or a polymicrobial infection may be responsible for NF.¹

OBJECTIVES OF THE STUDY

- To identify the bacteria most commonly involved in the pathogenesis of necrotizing fasciitis
- To find the percentage of NF caused by polymicrobial infection vs NF caused by a single organism.
- To identify the sites most commonly involved in necrotizing fasciitis.

AETIOLOGY

Necrotizing soft tissue infections are caused by virulent bacteria with the ability to produce toxins and cause widespread necrosis of tissue. The soft tissues involved are usually subcutaneous, muscle and infrequently skin.¹ The fascia has a more tenuous blood supply than that of muscle or skin, thus making it more vulnerable to infection.²¹ Additionally, fluid tends to collect between the fascia and adjacent tissues, further weakening immune function by alteration of host clearance of causative pathogens a by reducing phagocytic function.

Although NF is rare, patients with certain conditions are predisposed to developing the disease. These include immunocompromised states such as diabetes, malignancy, AIDS, IV drug abusers and alcoholics.²² NF may also occur due to trauma, typically after burns. Even minor trauma, in the form of insect bites, snake bites and needle stick injuries can lead to NF. Patients having Peripheral vascular Disease and atherosclerosis are also at an increased risk. The entry of bacteria can take place from any break in the skin and can occur in patients with skin conditions like psoriasis, bed sores, boils, perianal abscesses.

Fournier's gangrene is the name given to Necrotizing fasciitis of the perineum. It can arise spontaneously or have its origin from a perianal abscess, Bartholin gland infection, scrotal infections, genitourinary procedures or with the use of a urinary catheter. The portal of entry is most of the times obscure.²⁴

CLASSIFICATION

Necrotizing fasciitis can be categorized as Type 1, type 2 and type 3 depending on the organisms cultured.

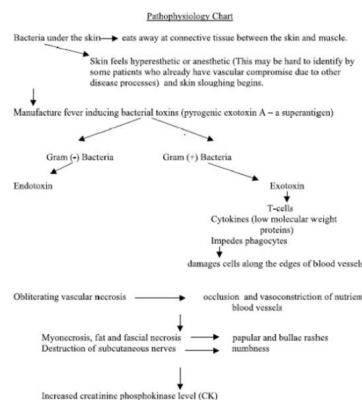
- Type 1 NF - Polymicrobial infection from aerobic and anaerobic bacteria such as Clostridium and Bacteroides species.
- Type 2 NF - Group A Streptococcus (*S. pyogenes*) with or without a coexisting Staphylococcal infection.
- Type 3 NF - Associated with *Vibrio vulnificus*, that enters the subcutaneous tissues via puncture wounds from fish or marine insects.

CLINICALLY - 3 groups based on the length and extent of the disease

- Fulminant NF** – These patient have rapid disease progression and present often with shock. The history of the onset of symptoms is

usually a few hours.

- Acute NF** – These patients have symptoms for several days and large areas of the skin get involved.
- Sub-acute NF** - These patients have symptoms for several weeks and the infection usually involves only a localized area of the skin.



CLINICAL FEATURES

- Definitive clinical signs are very specific to necrotizing fasciitis but occur late in the course of the disease.
- Presence of bullae
- Skin ecchymosis, which precludes skin necrosis
- Presence of gas by clinical or radiological examination
- Cutaneous anesthesia

Less specific signs include-

- Pain that is out of proportion to the signs
- Edema extending beyond the skin erythema
- Systemic toxicity
- Progressive disease despite antibiotic therapy

MANAGEMENT

- Early diagnosis
- Surgical debridement
- Amputation of extremity
- Wound care
- Antimicrobial therapy
- Intensive supportive care
- Hyperbaric oxygen

METHODOLOGY

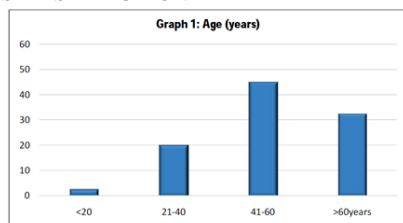
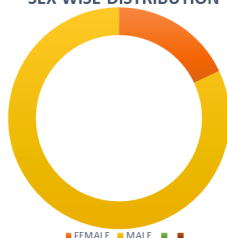
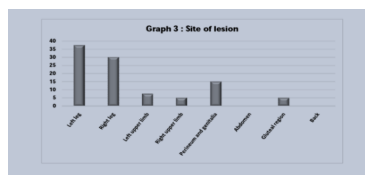
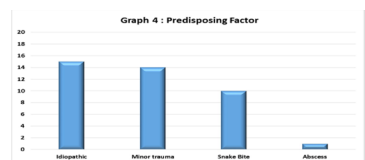
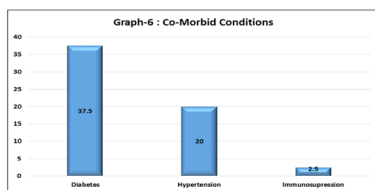
- The data was collected from patients admitted to Fr. Muller medical College Hospital, Mangalore with a provisional diagnosis of Necrotizing fasciitis based on clinical evaluation and intra-operative findings
- Time period October 2018 – October 2019
- Sample size -40
- Study design – Descriptive Study
- The presenting complaints and details were recorded in a chronological order. Data collection included history of trauma, insect bite, snake bite, burns, etc., history of comorbid conditions like diabetes mellitus, hypertension and immunosuppressive diseases, drug history including long term corticosteroid use or other immunosuppressants.

INCLUSION CRITERIA:

- Age 15-90 years
- Gender both (male and female)
- Clinically/ Intraoperatively diagnosed as necrotizing fasciitis

EXCLUSION CRITERIA

- Age 14 years and less
- Localized Subcutaneous infections.
- Patients with necrotizing fasciitis who have already undergone debridement or have received antibiotic therapy.

RESULTS**AGE WISE DISTRIBUTION****GENDER WISE DISTRIBUTION****SEX WISE DISTRIBUTION****SITE OF LESION****PREDISPOSING FACTOR****CO-MORBID CONDITIONS****ORGANISMS IDENTIFIED**

ORGANISMS	NUMBER OF CASES	PERCENTAGE (%)
Klebsiella	10	25
Staphylococcus aureus	12	30
Escherichia coli	7	17.5
Citrobacter	4	10
Pseudomonas	5	12.5
Acinetobacter	8	20
Enterococcus	5	12.5
Proteus	2	5
Streptococcus pyogenes	5	12.5
Bacteroides fragilis	3	7.5
Peptostreptococcus	3	7.5
Porphyromonas	1	2.5

POLYMICROBIAL VS MONOMICROBIAL

POLYMICROBIAL VS MONOMICROBIAL	NUMBER OF CASES	PERCENTAGE (%)
Polymicrobial	16	40
Monomicrobial	19	47.5
No growth	5	12.5

TYPE OF NECROTIZING FASCIITIS

Type of NF	Number of cases	Percentage (%)
Type 1	37	92.5
Type 2	3	7.5
Type 3	0	0

THIS TABLE SHOWS COMPARISONS OF PRESENT STUDY TO SIMILAR STUDIES CONDUCTED BY Elliot et al, Angoules et al and Bair et al

	Elliot et al. ⁴⁹	Angoules et al. ⁵⁰	Bair et al. ⁵¹	Present study
Sample Size	182	430	106	40
Mean age (yrs)	51.5	46	58	53.4
Male/ female	Male	Male	Male	Male
M C site	Perineal	Lower limbs	Lower limbs	Lower limbs
M C Comorbid condition	Diabetes	Diabetes	Diabetes	diabetes
M C organism	Bacteroides	Staphylococcus aureus	Streptococcus pyogenes	Staphylococcus aureus
Mean duration of hospital stay (days)	20	24.9	28	16.02
Mortality rate	25.3	21.9	17	5

CONCLUSION

- Necrotizing fasciitis is a surgical emergency. Early diagnosis and swift surgical management of this rapidly progressing and life-threatening infection is vital for patient survival and relies on correct interpretation of clinical findings.
- The data for this study was collected from 40 patients admitted to our hospital during one-year period. The commonest age group being 41 to 60 years.
- Male to female ratio was 5:1
- The most common pre- disposing factor was minor trauma (37.4%)
- The commonest site of involvement was the lower limbs (67.5%) followed by the perineal region (15%).
- Commonest co- morbid condition associated with necrotizing fasciitis was Diabetes (37.5%)
- The most common bacterial isolate was Staphylococcus aureus (30%). Polymicrobial infection was seen in 16 cases (40%).
- Type 1 NF was seen in 92.5% of the patients.
- Mean duration of Hospital stay was 16 days
- Mortality rate was 5 %.

SUMMARY

- This study shows that necrotizing fasciitis is a polymicrobial infection caused most commonly by a type 1 infection and antibiotic therapy should be directed towards this type of NF.
- Appropriate antibiotics with early, extensive and repeated debridement's will ensure a good prognosis and a favorable outcome of necrotizing fasciitis.

REFERENCES

1. Kihiczak GG, Schwartz RA, Kapila R. Necrotizing fasciitis: a deadly infection. J Eur Acad Dermatol Venerol 2006;20(4): 365—9.
2. Salcido RS. Necrotizing fasciitis: reviewing the causes and treatment strategies. Adv Skin Wound Care 2007;20(5):288—93. quiz 94-5.
3. Tang S, Kwok TK, Ho PL, et al. Necrotizing fasciitis in a renal transplant recipient treated with FK 506: the first reported case. Clin Nephrol 2001;56(6):481—5.
4. Tang WM, Ho PL, Fung KK, et al. Necrotizing fasciitis of a limb. J Bone Joint Surg Br 2001;83(5):709—14.
5. Trent JT, Kirsner RS. Diagnosing necrotizing fasciitis. Adv Skin Wound Care 2002;15(3):135—8.
6. Cainzos M, Gonzalez-Rodriguez FJ. Necrotizing soft tissue infections. Curr Opin Crit Care 2007;13(4):433—9.
7. Stevens DL. Streptococcal toxic-shock syndrome: spectrum of disease, pathogenesis, and new concepts in treatment. Emerg Infect Dis 1995;1(3):69—78.
8. Fontes Jr RA, Ogilvie CM, Miclau T. Necrotizing soft-tissue infections. J Am Acad

- Orthop Surg 2000;8(3):151—8.
9. Perry BN, Floyd III WE. Gas gangrene and necrotizing fasciitis in the upper extremity. *J Surg Orthop Adv* 2004;13(2):57—68.
10. Wong, Chin-HO, Wang, Yi-Shi. The diagnosis of necrotizing fasciitis. *Current Opinion in Infectious Diseases* April 2005; 18(2): 101-106
11. McGrath MH. "Infections of the hand". In: Chapter 135. May, Littler and McCarthy JG (eds). *McCarthy's Plastic Surgery*. Vol. 8, Part 2, W.B. Saunders Company; 1990: pp 5543
12. O'Rourke I, Carson P and Lum G. 'Surgery of Bacterial Disease'. In: Chapter 47.1, Morris PJ and Wood WC (eds). *Oxford textbook of Surgery*, 2nd edition, Vol. 3, 2000: pp 3226.
13. McGee, Emily J. Necrotizing fasciitis: Review of pathophysiology, diagnosis, and treatment. *Critical Care Nursing Quarterly* Jan/Feb/Mar 2005; 28(1): 80-84
14. Capson Dale RN. Topical negative pressure and Necrotizing Fasciitis. *Nursing Standard* October 22; 18 (6): 71-72.
15. Mundy LM, Doherty GM and Cobb PJ. 'Inflammation, infection and antimicrobial therapy'. In: Chapter 8. Doherty GM (ed). *Current Surgical Diagnosis and Treatment*, 12th ed, Lange Medical books, McGraw Hill Publishers; 2006:pp 108.
16. Descamps V, Aitken J, Lee MG. Hippocrates on necrotizing fasciitis, *Lancet* 1994; 344(8921):556
17. Green RJ, Dafoe DC, Raffin TA. Necrotizing fasciitis, *Chest* 1996;110(1):219-29
18. Kihiczak GG, Schwartz RA, Kapila R. Necrotizing fasciitis: a deadly infection. *J Eur Acad Dermatol Venereol* 2006;20:365-9
19. Chummy S. Sinnatamby, Introduction to regional anatomy. In : Chapter- 1, Last's anatomy, 11th Edn., ppl 1-3.
20. Keith L. Moore. Introduction to Clinical Anatomy. In: Chapter-1, Keith L. Moore, *Essentials of Clinical Anatomy*. 3rd Edn., pp5-7
21. Ronald F. Martin, Addison K. May. "Skin and soft tissue infections" *Surgical Clinics of North America*, April 2009; vol 89, pp 403-420
22. File TM, Tan JS, Dispersio JR. "Diagnosing and treating the "flesh eating bacteria syndrome." *Clev Clinic Journal of Medicine* 1998; 65:241-9
23. Ford LM, Waksman J. "Necrotizing fasciitis during primary varicella". *Pediatrics* 2000; 105:1372-5
24. Meltzer DL, Kabongo M. "Necrotizing fasciitis: a diagnostic challenge". *American Family Physician* 1997;27(1):29-34
25. Gonzalez MH. "Necrotizing Fasciitis and gangrene of the upper extremity". *Hand Clinics* 1998; 14:635-45
26. Bisno AL, Stevens DL. "Streptococcal infections of the skin and soft tissue" *North England Journal Of Medicine* 1996;334:240-5
27. Urschel JD. "Necrotizing Soft Tissue Infections". *Postgraduate Medical Journal* 1999; 75:645-9
28. Bessman AN, wagner W: Non Clostridial gas Gangrene. *JAMA* 233:958, 1975
29. Gorbach G, Thadepalli H: Isolation of clostridium in human infections: evaluation of 114 cases. *Journal infect diseases* 131 (suppl): 81s, 1975
30. Weinstein L, Barza MA: Gas Gangrene. *North England Journal Medicine* 289:1129, 1973
31. Trent JT, Kirsner RS. "Diagnosing Necrotizing fasciitis". *Advanced Skin Wound care* 2002; 15(3):135-8
32. Brantigan C, Senkowski J. "Group A beta haemolytic streptococcal necrotizing fasciitis". *Wounds* 1995;7(2):62-8
33. Kessenich CR, Bahl A. "Necrotizing fasciitis: understanding the deadly results of the uncommon flesh eating bacteria". *Americal Journal of Nursing* 2004; 104(9):51-5 34. Hackett SP, Stevens DL. "Superantigens associated with staphylococcal and streptococcal toxic shock syndrome are potent inducers of tumour necrosis factor beta synthesis". *Journal of Infectious Diseases* 1993; 168(1):232-5
35. Kotrappa KS, Bansal RS, Amin NM, "Necrotizing fasciitis". *American Family Physician* 1996; 53:1691-7
36. Bosshardt TL, Henderson VJ, Organ CH Jr. "Necrotizing Soft Tissue Infections". *Archives Surgery* 1996; 131:846-52
37. Wong CH, Chang HC, pasupathy S. et al. Necrotizing fasciitis: clinical presentation, microbiology and determinants of mortality. *Journal of Bone joint surgery America* 2003. 85-A: 1454-60
38. Stevens DL. "The flesh-eating bacterium: what's next?" *Journal of Infectious diseases* 1999; 179(suppl2):S366-74
39. Chapnick EK, Abter EI. "Necrotizing Soft Tissue Infections". *Infectious Disease Clinics Of North America* 1996; 10:835-55
40. Brenner BE, Vitullo M, Simon RR. Necrotizing Fasciitis. *Annals of emergency Medicine* 1982; 11:384-6
41. Tang WM, Ho P, Fung KK, Yuen KY, Leong JC. "Necrotizing fasciitis of a limb", *Journal of joint bone surgery Br* 2001;83:709-14