

DEMOGRAPHIC CHARACTERISTICS AND BACTERIAL FLORA OF NECROTISING FASCIITIS: A TERTIARY CARE CENTRE EXPERIENCE

Shivani Sinha¹, Alok Ranjan², Bhavesh Khandelwal³, Atul Kumar⁴ Neelam R Charles⁵

¹Demonstrator, Department of Microbiology, Government Medical College, Ratlam, Madhya Pradesh, India.

²Assistant Professor, Department of Surgery, Patna Medical College, Patna, Bihar, India

³Assistant Professor, Department of Surgery, Government Medical College, Ratlam, Madhya Pradesh, India.

⁴Associate Professor, Department of Surgery, Government Medical College, Ratlam, Madhya Pradesh, India.

⁵Professor and HOD, Department of Surgery, Government Medical College, Ratlam, Madhya Pradesh, India.

Received : 09/06/2022
Received in revised form : 24/07/2022
Accepted : 02/08/2022

Keywords:
Necrotizing fasciitis,
Soft tissue infection,
LRINEC score.

Corresponding Author:
Dr. Atul Kumar,
Email: dratul1705@gmail.com
ORCID: 0000-0001-5915-8994

DOI: 10.47009/jamp.2022.4.4.136

Source of Support: Nil. Conflict of Interest: None declared

Int J Acad Med Pharm,
2022; 4 (4); 688-691



Abstract

Background: Necrotizing fasciitis is a rapidly progressive infection primarily involving the fascia and the subcutaneous tissue. It is an acute, life threatening soft tissue infection caused by a variety of aerobic and anaerobic bacteria. The aim of this study was to analyse the demographic pattern, microbial flora associated with necrotising fasciitis and their antibiogram. **Materials and Methods:** All patients aged 18 or more admitted in the hospital with diagnosis of necrotising fasciitis with LRINEC score 6 or more and bacteria isolated on culture during the study period of one year were included in this prospective observational study. Microflora and their antibiotic sensitivity pattern were analysed. All the patients who were operated in other institutes or on parenteral antibiotics for more than 48 hrs were excluded. **Result:** The median age of the patients was 46.2 years, out of which 28 patients were male and 14 patients were female. The most common infection site was the perineal region (38 %) followed by lower limb (28.5%), thigh (19%) and lower abdomen (14.2%). The most common organism isolated was a group A streptococci (28.5%) followed by Klebsiella (23.8%) and Staphylococcus aureus (14.2%). Carbenepenam and Piperacillin+ Tazobactam were found to be highly sensitive antibiotics (100% and 95.2%) while resistance was maximum with Ampicillin (57.2) followed by amoxicillin+clavulanic acid (50%) and Ciprofloxacin (46.7%). **Conclusion:** Although surgical debridement is the ideal treatment modality for patients with necrotising fasciitis antibiotics, identification of the microflora along with its resistance pattern should also be determined for more effective antibiotic therapy and to decrease the development of multi drug resistance.

INTRODUCTION

Necrotising fasciitis is one of the most common skin infections leading to significant level of morbidity and mortality in India. It remains a challenge for surgeons to diagnose it early due to its nonspecific pattern of involvement of skin and underlying tissue. Necrotizing fasciitis is a potential lethal bacterial disease usually involves the fascia and subcutaneous tissue along with skin may lead to severe toxemia and death.^[1] The clinical course is unpredictable and its presentation may mimic from low grade cellulitis to a fulminant necrosis of skin, subcutaneous tissue and fascia in severe cases.^[2] It can lead to sepsis, shock and organ failure. Apart

from high risk of mortality, life-long morbidity like amputation of limb and other disabilities are also not uncommon.

Early diagnosis and emergency surgical intervention along with administration of appropriate antibiotics have been found to be the cornerstones of necrotizing fasciitis treatment. Prognosis for the patient with necrotizing fasciitis is heavily dependent on initiation of appropriate empiric antibiotic treatment. The aim of this study was to determine the demographic pattern and analyse the microbial flora associated with necrotising fasciitis and their antibiogram.

MATERIALS AND METHODS

This was a prospective observational study done at a tertiary care centre in Bareilly for a period of one year. A total of 42 patients were included in this study in the duration of 1 year. All patients of age groups between 18 to 60 years with the diagnosis of soft tissue necrotizing fasciitis with LRINEC score 6 or more and bacteria isolated on culture were included in this study. All the patients who were operated or primary debridement done before admission or were on parenteral antibiotics for more than 48 hrs before admission were excluded from this study. The detailed clinical history and clinical examination of these patients were done. All the routine laboratory investigation were done keeping in mind of parameters of LRINEC score i.e. CRP (C-reactive protein), Total white cell count (WBC), Hemoglobin, sodium (Na+), Creatinine. Relevant investigations were done as per associated comorbidities and clinical condition of the patients. Pus was collected in a sterile manner as per standard guidelines and sent for culture and sensitivity. Antibiotic sensitivity of isolates was done by the standard disc diffusion method as recommended by clinical and laboratory standard institute (CLSI) guidelines.

Statistical analysis- After getting the required information, the collected data were coded, tabulated and analyzed. The various statistical techniques i.e. the mean, standard deviation and test of significance (t-test and chi-square-test) were used for drawing valid conclusions. Statistical analysis was done using student t test. SPSS 15.0 software was used to calculate p value. $P < 0.05$ was taken as statistically A descriptive analysis was done on all variables to obtain a frequency distribution. The mean + SD and ranges were calculated for quantitative variables. Continuous variables were compared by the Student t test. Proportions were analyzed with the chi-square test.

RESULTS

The median age of the patients was 46.2 years, out of which 28 patients were male and 14 patients were female. The most common infection site was the perineal region (38%) followed by lower limb (28.5%), thigh (19%) and lower abdomen (14.2%). Severe pain at affected site along with fever for variable period was presenting symptom in all the patients (100 %). Swelling, tenderness and erythema were present in all the cases who presented early. Most infections were group A streptococci (28.5%). On blood investigations, WBC count was raised in 38 (90.4%) cases, within normal limits in 2 and decreased in 2 (4.7 %). Blood sugar was found to be elevated in 21(25 %) cases while 25 were known diabetic and 06 were diagnosed after admission in the hospital. Surgical debridement was done for all the patients with appropriate antibiotics covering

aerobes and anaerobes. Most of the patients required multiple debridement (95.2%). The average number of debridement required was 2.90.

Polymicrobial origin of necrotising fasciitis was found to be in 19 % in our study. The most common organism isolated was a group A streptococcal infections (28.5%) followed by Klebsiella (23.8%) and Staphylococcus aureus (14.2%). [Table 2] Carbepenam and Piperacillin+ Tazobactam were found to be highly sensitive antibiotics (100% and 95.2%) while resistance was maximum with Ampicillin(57.2) followed by amoxicillin+clavulanic acid (50%) and Ciprofloxacin (46.7%). [Table 3]

Table 1: Site of Necrotising Fasciitis

Site	Frequency	Percentage
Perineal region	16	38
Lower limb	12	28.5
Thigh	08	19
Lower abdomen	06	14.2

Table 2: Microflora identified in patients with Necrotising Fasciitis

Organism cultured	Number (n=42)	Percentage
Staphylococcus	06	14.2
E.coli	4	9.5
Polymicrobial	8	19
Klebsiella	10	23.8
Pseudomonas	2	4.7
Streptococcal	12	28.5

Table 3: Antibiotics sensitivity pattern of cultured bacteria

Antibiotics	Sensitivity	Percentage
Imepenam	42	100
Piperacillin+ Tazobactam	40	95.2
Ceftazidime	36	85.7
Ceftriaxone	30	71.4
Ampicillin	18	42.8
Amoxyclav	21	50
Amikacin	32	76.1
Ciprofloxacin	14	53.3

DISCUSSION

The incidence of necrotizing fasciitis has been rising. Necrotising fasciitis were reported to be more common in the middle-age group and majority were males.^[3,4] In our study 40 % cases were in the age group of 40-60 years. Males were more affected than female (2:1). Pediatrics age groups were least affected to this disease.^[4,5]

The frequently associated predisposing factors for necrotising fasciitis are blunt or penetrating trauma, insect bites, surgical incisions or indwelling catheters, intravenous drug use, cutaneous infections or ulcers and abscesses. However in about 10% of cases, no predisposing factors had been identified. Diabetes mellitus, alcohol abuse, peripheral vascular disease, steroids or cancer chemotherapy, renal failure, liver disease, human immunodeficiency virus/acquired immunodeficiency syndrome, heart disease, old age, obesity and malnutrition all had

significant effect on the final outcome. The most common co-morbidity associated with necrotising fasciitis in this study was diabetes mellitus. Many authors had reported higher incidence of necrotising fasciitis in patients with diabetes mellitus.^[4,6] Hyperglycemia, immunosuppressive environment along with microangiopathy altogether creates a perfect environment for bacteria to grow. Other factors which were found to be associated commonly with it were chronic liver dysfunction, chronic renal failure, hypoalbuminemia and thrombocytopenia.^[4,6]

Most of the studies found lower limb as a most common site for necrotising fasciitis.^[3] Higher chances of injury and insect bite along with poor hygiene may be the reason for this specially in developing countries like India. Prevalence of bidi smoking especially in rural areas in India is also a predisposing factors associated with it. In this study, the most common infection site was the perineal region (38 %) followed by lower limb (28.5%), thigh (19%) and lower abdomen (14.2%). Most of these perineal NF were secondary spread of delayed treatment of ischiorectal or scrotal infections predominantly in old debilitated patients with multiple co-morbidities.

No single organism is responsible for the fascial necrosis and systemic toxicity seen in necrotizing fasciitis. In fact, the synergistic action of facultative aerobic and anaerobic bacteria could be responsible for the often fulminant course of the disease. In 1924, Meleney in his study over necrotizing fasciitis reported beta hemolytic streptococcus as a causative organism and named this disease "acute hemolytic streptococcal gangrene."^[2] Afterwards Giuliano broadly classified it in two groups based on their bacteriological origin. Type 1 is polymicrobial and involves non-group A streptococci plus anaerobes and/or facultative anaerobes, often with involvement of enterobacteriaceae. In type 2, the pathogen is group A beta hemolytic streptococci.^[8] 70-80 % of necrotising fasciitis are from polymicrobial infections and 3-4 organisms were isolated frequently on culture. A synergistic relation between aerobes, anaerobes and fungi has been found in these infections leads to an unpredictable destruction of soft tissue which cannot be expected on the basis of their individual virulence. In recent past, monomicrobial infections were reported more than polymicrobial infections. Tsitsilonis S et al in their study reported predominance of monomicrobial necrotising fasciitis with haemolytic Streptococci of Gr A (25%) as a most common bacteria isolated followed by MRSA (20.8 %). They concluded that there is a shift of micro flora of this disease from polymicrobial towards monomicrobial infections along with development of higher level of antibiotic resistance in them. They also advised that along with aggressive surgical treatment combination of two antibiotics as per antibiotic sensitivity should be started in these patients.^[9] In

our study the most common organism isolated was a group A streptococci (28.5%) followed by Klebsiella (23.8%) and Staphylococcus aureus (14.2%). Polymicrobial infections were present only in 19% of the cases. Carbapenam and Piperacillin+Tazobactam were found to be highly sensitive antibiotics (100% and 95.2%) while resistance was maximum with Ampicillin (57.2%) followed by amoxicillin+clavulanic acid (50%) and Ciprofloxacin (46.7%). The predominant pathogens causing necrotizing fasciitis in the USA and Europe were Group A Streptococcus and S. aureus while in Asia Gram negative aerobic bacteria like E. coli, A. hydrophila, V. vulnificus were the most frequently isolated microorganisms. In the study done by Jinn-Ming Wang et, monomicrobial infections were found in 70 (61%) and polymicrobial infections in 20 (17%).^[10] Pre-existing chronic liver dysfunction, chronic renal failure, thrombocytopenia, hypoalbuminemia, and postoperative dependence on mechanical ventilation represent poor prognostic factors in monomicrobial necrotizing fasciitis.^[11,12] MRSA has emerged as a prominent causative pathogen in community acquired necrotizing fasciitis.^[13,14] Aeromonas and Vibrio species had been reported to be more associated with NF in patients with cirrhosis and exposure to sea water.^[15] However among fungi Candida, Aspergillus and Cryptococcus are commonly associated with Necrotising fasciitis.^[16]

Limitations

1. Small sample size
2. Chances of bias
3. Single center trial

CONCLUSION

Although surgical debridement is the ideal treatment modality for patients with necrotising fasciitis antibiotics, identification of the microflora along with its resistance pattern should also be determined for more effective antibiotic therapy and to decrease the development of multi drug resistance.

Author's contribution

First author: Dr. Shivani Sinha: Concept, Microbiology and Culture part, data analysis and discussion

Second author: Dr Alok Ranjan: Concept, methodology and data analysis

Third author: Dr. Bhavesh Khandelwal: Manuscript preparation and drafting of paper

Fourth author: Dr. Atul Kumar: Concept, data collection and manuscript preparation.

Fifth author: Dr. Neelam R Charles: Final drafting of the paper.

REFERENCES

1. Kotrappa KS, Bansal RS, Amin NM. Necrotizing fasciitis. Am Fam Physician. 1996;53(5):1691-7.

2. WILSON B. Necrotizing fasciitis. *Am Surg.* 1952;18(4):416-31.
3. Kaiser RE, Cerra FB. Progressive necrotizing surgical infections--a unified approach. *J Trauma.* 1981;21(5):349-55. doi: 10.1097/00005373-198105000-00003.
4. Singh G, Bharpoda P, Reddy R. Necrotizing Fasciitis: A Study of 48 Cases. *Indian J Surg.* 2015;77(Suppl 2):345-50. doi: 10.1007/s12262-013-0835-2.
5. Goldberg GN, Hansen RC, Lynch DJ. Necrotising fasciitis in infancy: Report of three cases and review of the literature. *Pediatr Dermatol.* 1984;2:55-63.
6. Halbhavi SN, Reddy R, Kalburgi EB, Poulouse A, Gowd YCV. Clinical and microbiological profile of necrotizing fasciitis. *Int Surg J.* 2018;5:2119-26.
7. Meleney FL. Hemolytic streptococcal gangrene. *Arch Surg.* 1924;9:317-64.
8. Giuliano A, Lewis F Jr, Hadley K, Blaisdell FW. Bacteriology of necrotizing fasciitis. *Am J Surg.* 1977;134(1):52-7. doi: 10.1016/0002-9610(77)90283-5.
9. Tsitsilonis S, Druschel C, Wichlas F, Haas NP, Schwabe P, Bail HJ, et al. Necrotizing fasciitis: is the bacterial spectrum changing? *Langenbecks Arch Surg.* 2013;398(1):153-9. doi: 10.1007/s00423-012-0983-z.
10. Wang JM, Lim HK. Necrotizing fasciitis: eight-year experience and literature review. *Braz J Infect Dis.* 2014;18(2):137-43. doi: 10.1016/j.bjid.2013.08.003.
11. Lee CY, Kuo LT, Peng KT, Hsu WH, Huang TW, Chou YC. Prognostic factors and monomicrobial necrotizing fasciitis: gram-positive versus gram-negative pathogens. *BMC Infect Dis.* 2011;11:5. doi: 10.1186/1471-2334-11-5.
12. Krieg A, Röhrborn A, Schulte Am Esch J, Schubert D, Poll LW, Ohmann C, Braunstein S, Knoefel WT. Necrotizing fasciitis: microbiological characteristics and predictors of postoperative outcome. *Eur J Med Res.* 2009;14(1):30-6. doi: 10.1186/2047-783x-14-1-30.
13. Miller LG, Perdreau-Remington F, Rieg G, Mehdi S, Perlroth J, Bayer AS, et al. Necrotizing fasciitis caused by community-associated methicillin-resistant *Staphylococcus aureus* in Los Angeles. *N Engl J Med.* 2005;352(14):1445-53. doi: 10.1056/NEJMoa042683.
14. Young LM, Price CS. Community-acquired methicillin-resistant *Staphylococcus aureus* emerging as an important cause of necrotizing fasciitis. *Surg Infect (Larchmt).* 2008;9(4):469-74. doi: 10.1089/sur.2007.052.
15. Vinh DC, Embil JM. Severe skin and soft tissue infections and associated critical illness. *Curr Infect Dis Rep.* 2007;9(5):415-21. doi: 10.1007/s11908-007-0064-6.
16. Elliott D, Kufera JA, Myers RA. The microbiology of necrotizing soft tissue infections. *Am J Surg.* 2000;179(5):361-6. doi: 10.1016/s0002-9610(00)00360-3.