FREQUENCY OF COMMON BACTERIA AND THEIR SENSITIVITY TO ANTIBIOTICS IN PATIENTS OF NECROTIZING FASCIITIS

Fazal Manan, Muhammad Asghar Khan, Ayaz Gul, Ahmad Faraz, Mohammad Atif Khan, Abdullah

Department of Surgery, Lady Reading Hospital, Peshawar - Pakistan

ABSTRACT

Objective: To determine the frequency of common bacteria and their sensitivity to antibiotics in patients of necrotizing fasciitis.

Material and Methods: The study was conducted in the whole Department of Surgery including Orthopaedic Unit, Government Lady Reading Hospital, Peshawar. Study design was descriptive case series while duration of study was 6 months, from January 2012 to December 2012. Culture reports of 145 patients were performed and analyzed using SPSS 14.0[R].

Results: In this study, 145 patients presenting with necrotizing fasciitis, female to male ratio was 1.46:1. Average age was 37.11 months $\pm$ 14.17SD. Distribution of common bacteria shows that Beta Hemolytic streptococci and Klebsiella was found in majority of cases which were 73(50.3%) each, followed by proteus in 60(41.4%), E Coli and pseudomonas in 55(37.9%) each while 58(40%) patients have Streptococcus Viridans and Staphylococcus Aureus were observed in 51(35.2%) of patients. Seventy-five percent of klebsiella were sensitive to commonly available, cost effective drug like ampicillin.

Conclusion: The key to overcoming the risk of this disease process is in rapid identification and prompt treatment of these lethal conditions associated with high morbity.

Key Words: Necrotizing fasciitis, Antibiotics, Bacteria, EColi, Staphylococcus Aureus.

INTRODUCTION

First described in 1871 by Joseph Jones, a Confederate Army surgeon in the American Civil War, necrotizing fasciitis is a rapidly spreading soft tissue infection characterized by progressive destruction of fascia and subcutaneous tissue[1]. Its histological patterns are large necrosis of the fascia, subcutaneous fat and skin with thrombosis of the microvasculature and sparing of the underlying muscles and bone[2]. Its worldwide incidence is estimated as 0.001%[3]. Other studies reported 0.4- 0.53 cases per 100,000[4] and carries a mortality rate of 17-34%[5]. However the actual incidence of NF is not well known[6] from a study conducted in Sudan as is the case in Pakistan.

There are a number of predisposing factors to NF such as diabetes mellitus (DM)[7] immunocompromised state, corticosteroid use, intravenous drug abuse, trauma, malnutrition, burns and atherosclerosis[8]. Early diagnosis and prompt treatment consisting of surgery and antibiotics are the key factors to improve patient outcome in NF2 and timely diagnosis can be challenging due to protean variability in this disease's symptoms, signs and bacteriology[9]. The current study is designed to determine the frequency of common bacteria with their antibiotic sensitivities among the patients presenting with necrotizing fasciitis. This study will provide us with fresh local statistics showing us the local magnitude of bacteriology of patients with NF.

Address for Correspondence:
Dr. Fazal Manan
Medical Officer
Surgical C Unit, Department of Surgery,
Lady Reading Hospital, Peshawar - Pakistan
Cell: 0302-8340703
E-mail: drmanan@hotmail.com

MATERIAL AND METHODS

The study was conducted in Surgical C Unit, Government Lady Reading Hospital, Peshawar from January 2012 to December 2012 as Case Series descriptive study. Sampling technique was consecutive sampling (non-probability) type. All patients with necrotizing fasciitis of the lower limbs having age 18 years and above of either gender were included while patients with malignancy (detected by past medical records and history), history of antibiotic use in the last one week were excluded from study.

Necrotizing fasciitis is classified into three types on the basis of bacteriology. The study was conducted after approval from hospitals ethical and research committee. Informed consent was taken from

all the patients. All the culture and sensitivity procedures were done under supervision of same consultant microbiologist having minimum of five years of experience. Data collected on performa was analyzed in SSPS version 14.0. That focused on categorical evaluation of bacteria and their sensitivities. Different bacteria with sensitivities to various broad and narrow spectrum antibiotics were compared and discussed based on gender and age.

Table 1: Common gender wise distribution of bacteria

Common Bacteria		Gender	
		Male	Female
E Coli	Yes	32 (58.2%)	23(41.8%)
	No	54 (60.0%)	36(40.0%)
Staphylococcus Aureus	Yes	26 (51.0%)	25(49.0%)
	No	60 (63.8%)	34(36.2%)
Beta Hemolytic	Yes	42 (57.5%)	31(42.5%)
	No	44 (61.1%)	28(38.9%)
Streptococcus Viridans	Yes	30 (51.7%)	28(48.3%)
	No	56 (64.4%)	31(35.6%)
Klebsiella	Yes	44 (60.3%)	29(39.7%)
	No	42 (58.3%)	30(41.7%)
Proteus	Yes	41 (68.3%)	19(31.7%)
	No	45 (52.9%)	40(47.1%)
Pseudomonas	Yes	32 (58.2%)	23(41.8%)
	No	54 (60.0%)	36(40.0%)

RESULTS

In this study, 145 patients presenting with necrotizing fasciitis, in which 86 (59.31%) were male and 59 (40.69%) were female patients. Female to male ratio was 1.46:1. Age of the patients ranged from 20 up to 71 years. Average age was 37.11 years $\pm$14.17SD. Distribution of common bacteria shows that Beta Hemolytic streptococci and Klebsiella was found in majority of cases which were 73(50.3%). A significant peak of greater cases of E.coli infections were observed in patients of age group 31-50 years. This figure change to 30.5% for all other age groups.

A greater variety of bacteria other than for mentioned were observed in younger patients less than 30 years of age. The majority of males i.e. 32(58.2%) presented with necrotizing fasciitis have esherichia coli while 23(41.8%) Escherichia coli were found in female patients, (Table 1). The antibiotic sensitivity of common bacteria shows that Co-Amoxiclav was more sensitive while Salbactum+Cefperazone was more resistant in different micro-organism, Table 2.

DISCUSSION

Necrotising fasciitis (NF) is a rare soft tissue infection, primarily involving the superficial fascia and

Table 3: Antibiotic sensitivity of common bacteria

Antibiotics		E Coli	Staphylococcus Aureus	Beta Hemolytic streptococci	Streptococcus Viridans	Klebsiella	Proteus	Pseudomonas
		%	%	%	%	%	%	%
Co-Trimaxazole	S	34.5%	37.3%	34.2%	39.7%	41.1%	38.3%	98.2%
	R	65.5%	62.7%	65.8%	60.3%	58.9%	61.7%	1.8%
Ampicillin	S	58.2%	70.6%	71.2%	67.2%	75.3%	75.0%	69.1%
	R	41.8%	29.4%	28.8%	32.8%	24.7%	25.0%	30.9%
Co-Amoxiclav	S	72.7%	64.7%	89.0%	77.6%	61.6%	61.7%	67.3%
	R	27.3%	35.3%	11.0%	22.4%	38.4%	38.3%	32.7%
Ciprofloxacin	S	61.8%	62.7%	50.7%	58.6%	69.9%	58.3%	63.6%
	R	38.2%	37.3%	49.3%	41.4%	30.1%	41.7%	36.4%
Ceftriaxone	S	58.2%	60.8%	64.4%	63.8%	71.2%	66.7%	65.5%
	R	41.8%	39.2%	35.6%	36.2%	28.8%	33.3%	34.5%
Cefotaxime	S	60.0%	60.8%	60.3%	82.8%	58.9%	61.7%	61.8%
	R	40.0%	39.2%	39.7%	17.2%	41.1%	38.3%	38.2%
Cefixime	S	61.8%	56.9%	89.0%	72.4%	54.8%	41.7%	60.0%
	R	38.2%	43.1%	11.0%	27.6%	45.2%	58.3%	40.0%
Salbactem	S	47.3%	49.0%	50.7%	82.8%	50.7%	53.3%	50.9%
	R	52.7%	51.0%	49.3%	17.2%	49.3%	46.7%	49.1%

resulting in extensive undermining of the surrounding tissues. If untreated, it is invariably fatal, and thus a high index of suspicion for the diagnosis is required[10]. Mortality remains still high in NF despite use of modern powerful antimicrobial drug regimens and advances in the care of the critically ill patients. Overall mortality ranges from 25 to 73 percent in the published literature[11]. The figure reported in our study was remarkable higher that could be due to increased incidence of traumatic necrotizing fasciitis secondary to bomb blasts and fire armed injuries.

NF is traditionally classified into two distinct categories based on the causative microorganisms[12]. Type 1 NF is characterized by polymicrobial, synergistic infections that are caused by non-Group-A streptococci, aerobic and anaerobic organisms[13]. Type 2 NF involves Group A Streptococcus (GAS) with or without a coexisting staphylococcal infection[13]. While the clinical manifestations are similar, type 1 and type 2 NF tend to affect different subgroups of patients. Higher figures of resistant bacteria included E.coli and klebsiella in our study, similar was the figures of resistant strains of E.coli as mentioned in a study conducted by Miller et al. 22 (70%).

Type 1 NF has a propensity to affect diabetic and immunocompromised individuals, whereas type 2 NF tends to occur in individuals with no underlying comorbidities. Both type 1 and type 2 NF are considered surgical emergencies; appropriate management requires comprehensive surgical debridement combined with targeted antimicrobial therapy and physiologic support[14]. Group A β-hemolytic streptococcus has been the most frequently incriminated agent since Meleney's findings. Many other bacteria may be involved. Fungi such as aspegillus, mucoraceae, and candida albicans are rare etiologic agents.<5% Pseudomonas has been implicated as an important causal agent in patients with neutropenia. In our series, pseudomonas was the main causal agent, always in association with other bacteria. The results of gram stain should not be used as a guide to therapy because of the poly microbial nature of necrotizing fasciitis[15]. Instead culture was used that varies between laboratories. Thus only one microbiologist was selected to avoid bias.

Type 2 NF is rarer, making up only 10% of NF patients. The media has nicknamed Type 2 NF as the "flesh-eating bacterial infection." It is a more dangerous infection, usually affecting the upper or lower extremities. It involves Group A β-hemolytic streptococcus, with or without Staphylococcus aureus. This is the same streptococcus that is responsible for streptococcal pharyngitis, impetigo, cellulitis, and toxic shock syndrome. Type 2 NF may affect healthy individuals at any age[16]. These findings were consistant in our study although higher numbers of Type-II were reported.

Because of the importance of targeted antibiotic therapy in the treatment of NF, awareness of the spectrum of microbes that might be associated with NF is imperative. This way its management is cost effective. Microbes commonly associated with NF include: Group A Streptococcus, Clostridium perfringens, methicillin-sensitive Staphylococcus aureus, Enterobacteriaceae, E. coli, Pseudomonas spp., Klebsiella spp., V. vulnificus, A. hydrophila, and anaerobic Streptococcus spp.[14]. While these microbes comprise most of all cases, other pathogens such as MRSA and Group B Streptococcus (GBS) have also been associated with NF on rare occasions. S. aureus is thought to be an uncommon agent for this disease. However, rare cases of rapidly progressing, necrotizing fasciitis have been described in diabetic patients[17,18] and patients with chronic use of steroid-containing medications[19]. Miller et al recently described 14 cases of necrotizing fasciitis disease due to Panton-Valentine leukocidin (PVL)-producing community associated methicillin-resistant S. aureus (CA-MRSA) in a retrospective study of 843 MRSA cases from 2003 to 2004 in Los Angeles[19].

Staphylococcus with a pathogenicity and virulence is more similar to Staphylococcus Aureus than to other coagulase-negative Staphylococcus spp. In fact, these organisms are frequently misidentified as S. aureus because of their morphologic appearance with yellow pigmentation and complete hemolysis when cultured on blood agar. Even so, appropriate identification of S. lugdunensis is imperative as misidentification may result in inadequately treated, prolonged, and persistent infection[20].

Moreover, because only about 20% of isolates are beta-lactamase positive, it is often possible to use penicillin for treatment of infections caused by these organisms. In addition, S. lugdunensis is also usually susceptible to gentamicin, rifampicin, vancomycin, oxacillin, and cefoxitin, and <10% of isolates are found to be resistant to clindamycin or fusidic acid[21]. Today, the recommended initial antibiotic regimen has changed because of the emergence of resistant microbes and relative decrease in the incidence of clostridial infection. Vancomycin, linezolid, daptomycin, or quinupristin/dalfopristin are recommended for empiric coverage of gram-positive organisms because of concern for MRSA infection, especially in IV drug users[22,23,24]. The figure of MRSA infections was less than 1/3 of the total staph-aureus infections in our study. Where as study conducted by Maltezor et al.[24] has been reported at 26.2% much higher than our study. In their study Type-II necrotizing fasciitis was also reported higher than other western studies (33.8).

CONCLUSION

Necrotizing fasciitis is a lethal condition, its prompt diagnosis and treatment that the healthcare professional can reduce the morbidity and mortality of this infection.

REFERENCES

1. Lee JW, Immerman SB, Morris LGT. Techniques for early diagnosis and management of cervicofacial necrotising fasciitis. J Laryngol Otol. 2010; 124(7): 759-65.
2. Yildiz1 B, Karakoc D, Hamaloglu E, Ozdemir A, Ozenc A. What changed in necrotizing fasciitis in twenty-five years? Afr J Microbiol Res. 2011; 5(16): 2229-33.
3. Byrnes JM. Necrotizing fasciitis: A common problem in Darwin. Int J Low Extrem Wounds. 2006; 5: 271-76.
4. Angloues AG, Kontakis G, Drakoulakis E, Vrentzos G, Granick MS, Giannoudis E. Necrotising fasciitis of upper and lower limb: A systematic review. Injury. 2007; 38: 18-25.
5. Chen IC, Li W, Hong Y, Shie S, Fann W, Hsiao C. The microbiological profile and presence of bloodstream infection influence mortality rates in necrotizing fasciitis. Critical Care. 2011; 15: 152-57.
6. Musa MT, Khair RZA, Ibrahim EM. Necrotizing Fasciitis in Khartoum Teaching Hospital. Khartoum Med J. 2009; 02(2): 211-14.
7. Salcido RS. Necrotizing fasciitis: Reviewing the causes and treatment strategies. Adv. Skin Wound Care. 2007; 20(5): 288-93.
8. Anaya DA, Dellinger EP (2007). Necrotizing soft-tissue infection: diagnosis and management. Clin Infect Dis. 2007; 44(5): 705-10.
9. Krenk L, Nielson HU, Christensen ME. Necrotizing fasciitis of the head and neck region: an analysis of standard treatment effectiveness. Eur Arch Otorhinolaryngol. 2007; 264: 917-22.
10. Catena F, La Donna M, Ansaloni L, Agrusti S, Taffurelli M. Necrotizing fasciitis: a dramatic surgical emergency. Eur J Emerg Med. 2004; 11: 44-48.
11. Taviloglu K, Cabioglu N, Cagatay A, Yanar H, Ertekin C, Baspinar I, et al. Idiopathic necrotizing fasciitis: risk factors and strategies for management. Am Surg. 2005, 71: 315-20.
12. Shimizu T, Tokuda Y. Necrotizing fasciitis. Internal Med. 2010; 49(12): 1051-57.
13. 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. 2003; 85(8): 1454-60.
14. Anaya DA, Dellinger EP. Necrotizing soft-tissue infection: diagnosis and management. Clinical Infectious Diseas. 2007; (44)5: 705-10.
15. Addison WA, Livengood CH, Hill GB, Sutton GP, Fortier KJ. Necrotizing fasciitis of vulvar origin in diabetic patients. Obestet Gynecol. 1984; 63: 473-79.
16. McGee E. Necrotizing fasciitis: Review of pathophysiology, diagnosis, and treatment. Critical Care Nursing. 2005; 28(1): 80-84.
17. Lee YT, Chou TD, Peng MY, Chang FY. Rapidly progressive necrotizing fasciitis caused by Staphylococcus aureus. J Microbiol Immunol Infect. 2005; 38: 361-64.
18. Wong CH, Tan SH, Kurup A, Tan AB. Recurrent necrotizing fasciitis caused by methicillin-resistant Staphylococcus aureus. Eur J Clin Microbiol Infect Dis. 2004; 23: 909-11.
19. Miller LG, Perdreau-Remington F, Mehdi RS, Perlroth J, Bayer AS, Tang AW, et al. Spellberg. Necrotizing fasciitis caused by community-associated methicillin-resistant Staphylococcus aureus in Los Angeles. N Engl J Med. 2005; 352: 1445-53.
20. Seifert H, Oltmanns D, Becker K, Wisplinghoff H, Von Eiff C. Staphylococcus lugdunensis pacemaker-related infection. Emerging Infect Diseas. 2005; 11(8): 1283-86.
21. Hellbacher C, Tornqvist E, Soderquist B. Staphylococcus lugdunensis: clinical spectrum, antibiotic susceptibility, and phenotypic and genotypic patterns of 39 isolates. Clin Microbiol Infect. 2006; 12(1): 43-49.
22. Miller LG, Perdreau-Remington F, Rieg G. Necrotizing fasciitis caused by community-associated methicillin-resistant Staphylococcus aureus in Los Angeles. N Engl J Med. 2005; 352: 1445-53.
23. Lee TC, Carrick MM, Scott BG. Incidence and clinical characteristics of methicillin-resistant Staphylococcus aureus necrotizing fasciitis in a large urban hospital. Am J Surg. 2007; 194: 809-12.
24. Maltezou HC, Giamarellou H. Community-acquired methicillin resistant Staphylococcus aureus infections. Int J Antimicrob Agents. 2006; 27: 87-96.

The Journal of Medical Sciences, Peshawar is indexed with WHO IMEMR (World Health Organisation Index Medicus for Eastern Mediterranean Region) and can be accessed at the following URL.

http://www.who.int/EMRJorList/details.aspx?docn=4468