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ORIGINAL ARTICLE

Aerobic Micro-Organisms In Post-Operative Wound Infections And Their Antimicrobial Susceptibility Patterns

AMRITA SHRIYAN*, SHEETAL R, NARENDRA NAYAK*****

ABSTRACT

Purpose: Post-operative wound infections have been an important cause of morbidity and cost burden for the patients. [1] The objective of this study was to evaluate the antimicrobial susceptibility pattern among the most common bacteria which are associated with post-operative wound infections.

Method: 84 isolates were obtained from 100 pus samples / wound swabs which were collected from clinically suspected post-operative wound infections. The bacteria were cultured on Blood agar, Mac Conkey's agar and Nutrient agar, followed by the identification of the isolates based on their cultural characteristics and their reactions in standard biochemical tests. All the isolates were tested for antimicrobial susceptibility by the disk diffusion technique according to the Clinical and Laboratory Standards Institute (CLSI) guidelines on Muller Hinton Agar. The screening for extended spectrum beta lactamase (ESBL) production was done by the phenotypic confirmatory test by using ceftazidime discs in the presence and absence of clavulanic acid.[2],[3],[4]

Result: *Staphylococcus aureus* was the most frequently isolated pathogenic bacteria from post-operative wounds. A majority of the isolates were resistant to ampicillin and amoxicillin. 1.8 % of the *Staphylococcus aureus* isolates were methicillin resistant *Staphylococcus aureus* (MRSA). Most of the gram-negative bacteria which were isolated, ie *Escherichia coli*, *Proteus mirabilis, Klebsiella* species and *Pseudomonas aeruginosa* were sensitive to quinolones and aminoglycosides, but were resistant to cephalosporins (40%). ESBL production was noted in 64.2 % of the isolates which were tested. ESBL production was detected in 60% strains of *Escherichia coli* and in 75 % strains of *Klebsiella* species. All the extended spectrum beta lactamase (ESBL) producer isolates were found to be sensitive to the beta-lactam and beta lactamase inhibitor combinations.

Conclusion: This study has shown that a majority of the isolates were gram positive bacteria and that there was an increase in the incidence of ESBL producing *Escherichia coli* and *Klebsiella* strains. Tests for the detection of ESBL producing bacteria should be carried out routinely and the use of third generation cephalosporins should be restricted. Hence, there is a need for continuous monitoring to determine the susceptibility pattern of the common isolates which are found in the hospital. To emphasize precise empiric therapy, policies on prescription patterns should be reviewed, which will ensure reduced patient stay, morbidity and cost per day in the hospital.

Keywords: post-operative wound, common pathogens, antimicrobial susceptibility pattern, antibiotic policy.

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Introduction

Micro-organisms which are responsible for wound infections depend on the surgical site, the study population and antimicrobial use within the hospital. [5] Post-operative wound infections can be caused through two major sources: exogenous and endogenous bacteria. The probability of wound infections largely depends on the patients' systemic host defenses, local wound conditions and microbial burden. The conditions of antimicrobial therapy, both prophylactically and therapeutically, can only be defined when these factors are under control.

Hence, an ongoing surveillance could play a significant role in the early recognition of a problem and hence, there is a need for early intervention for better management of post-operative wound infections. The most frequent co-resistances which are found in ESBL producing organisms are aminoglycosides, fluoroquinolones, tetracyclines, chloramphenicol and sulfamethoxazole-trimethoprim. [6],[7],[8],[9] The present study was conducted with an objective to evaluate the antimicrobial susceptibility pattern among the most common bacteria which are associated with post-operative wound infections.

Material and Methods

A cross-sectional study was designed to determine the distribution of the bacterial pathogens and their susceptibility pattern from suspected cases of post-operative wound infections. A total number of 84 isolates which were obtained from 100 pus samples / wound swabs were collected with aseptic precautions and were transported to the laboratory without delay.

The samples were obtained from those patients who were admitted to the hospital between June 2008 – 2010. The samples were cultured on Blood agar, Mac Conkey's agar and Nutrient agar, followed by the identification of the isolates based on their cultural characteristics and their reactions in standard biochemical tests. All the isolates were tested for antimicrobial susceptibility by the disk diffusion technique according to the Clinical and Laboratory Standards Institute (CLSI) guidelines on Muller Hinton Agar. The screening for ESBL production was done by the phenotypic confirmatory test by using ceftazidime discs in the presence and absence of clavulanic acid.

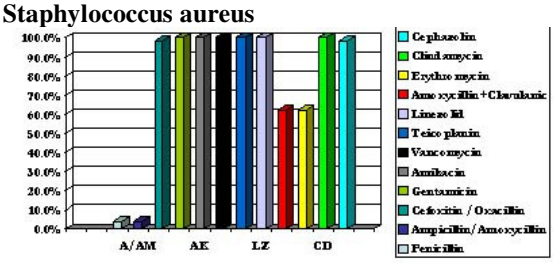
The antibiotic susceptibility of the isolates was determined against antibacterial agents by the Kirby Bauer disk diffusion method. They included Ampicillin (A-10 µg), amoxicillin (Am-10 µg), Amoxycillin-Clavulanic acid (-20/10 µg), Cefoxitin (CN-30 µg), Oxacillin (OX -1 µg), Vancomycin (VA-30 µg), Teicoplanin (TE-30 µg), Linezolid (LZ-30 µg), Cephazolin (CZ-30 µg)), Erythromycin(E-15 µg), Clindamycin (CD -2 µg), Ceftriaxone (CI-30µg), Cefotaxime (CE-30µg), Piperacillin (PC-100µg), Gentamicin (G-10µg), Amikacin (Ak-30µg), Ciprofloxacin (CF-5µg), Meropenem (MR-10 µg), Cefoperazone-sulbactam (CFS-75/15µg), Piperacillin-tazobactam (PT-100/10 µg) and Ticarcillin (TI-75µg); (Hi-Media, Mumbai). The results were recorded and interpreted as per the recommendations of the Clinical Laboratory Standards Institute (CLSI).

Results

A total number of 84 isolates were obtained from 100 pus samples / wound swabs which were collected from clinically suspected post-operative wound infections. Twenty-five per cent of the samples showed no growth. Among the 84 isolates, 53 (63 %) were *Staphylococcus aureus*, 10(12 %) were *Escherichia coli*, 8 (9.5%) were *Pseudomonas* species, 4(5%) were *Klebsiella* species, (3.5%) were *Proteus* species,

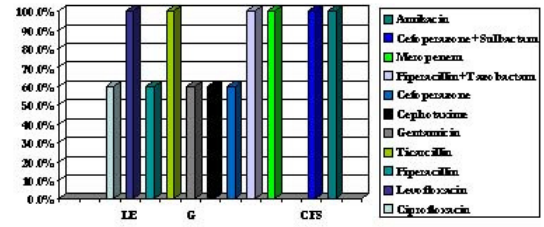
(3.5%) were Coagulase negative *Staphylococcus* species and (3.5 %) were others. *Staphylococcus aureus* was generally sensitive to Vancomycin(100%), Teicoplanin(100%) , Linezolid(100%), Clindamycin (100%) Gentamicin (98.2%) and Cephazolin (98.2%), but was resistant to Erythromycin (37.7%) and Ampicillin-Clavulanic acid (37.7%). A majority of the isolates were resistant to Ampicillin and Amoxicillin. 1.8 % of the *Staphylococcus aureus* isolates were MRSA, as shown in [Table/Fig 1].

[Table/Fig 1]: Drug susceptibility pattern Staphylococcus aureus



Most of the gram-negative bacteria which were isolated, ie Escherichia *coli*, *Proteus mirabilis*, Klebsiella and *Pseudomonas aeruginosa* were sensitive to quinolones and aminoglycosides, but were resistant to cephalosporins (40%), as shown in [Table/Fig 2].

[Table/Fig 2]: Drug susceptibility pattern Gram negative organisms



Of these, 14 strains which were tested, 9(64.2 %) were found to be ESBL producers, out of which 60% strains of *Escherichia coli* and 75 % strains of *Klebsiella* were detected. The distribution of age and sex was as shown in [Table/Fig 3] and [Table/Fig 4] respectively.

[Table/Fig 3]: Age Distribution

age group	0 – 4	5 - 19	20 - 40	> 41
No. of patients	11	14	35	40

[Table/Fig 4]: Sex distribution

Male	Female
72	28

The sensitivity pattern of each isolate to various antibiotics which were used in our study, was different for Gram positive organisms as shown in [Table/Fig 1] from that for Gram negative organisms as shown in [Table/Fig 2]. The percentage of ESBL producers was as shown [Table/Fig 5]

[Table/Fig 5]: Detection of extended spectrum beta lactamase (ESBL) producers

Discussion

Post-operative wound infections have been found to pose a major problem in the field of surgery for a long time. The surveillance of nosocomial infections with an emphasis on antimicrobial audit will reduce the risk of post-operative wound infections. [10] Data from the past several years show an increasing resistance for drugs that were considered as the first line of treatment for post-operative wound infections. [11] There is a need to reduce the cost which is potentially associated with antibiotic misuse viz. use of high-end antibiotics ,multiple antibiotics / irrational combinations and the prolonged duration of treatment. Optimal antimicrobial prophylaxis in the appropriate dose, time and duration, which has been selected on the basis of the antimicrobial susceptibility pattern of the most common isolates in the hospital, would ensure a decreased rate of post-operative wound infections. [12],[13],[14]

As indicated in many previous studies, *Staphylococcus aureus* was the most frequently isolated pathogenic bacteria from post-operative wounds. Cephazolin can be the antibiotic of choice for the surgical prophylaxis of this organism. Most of the gram-negative bacteria which were isolated i.e. *Escherichia coli*, *Proteus mirabilis, Klebsiella* species and *Pseudomonas aeruginosa* were sensitive to quinolones and aminoglycosides. Hence, these antibiotics could be selected for cases which are likely to be infected with gram negative organisms. The primary source of infection could not be determined in the present study.

Extended Spectrum Beta Lactamase producing strains of *Escherichia coli* and *Klebsiella* species among the clinical isolates, have been steadily increasing over the past few years, resulting in limitations of therapeutic options. [15],[16],[17] ESBL producers are found to comprise about 6.6% to 68 % of the clinical isolates. The frequency (64.2 %) of ESBL producers which was found in our study, was comparable to that found in previous studies which were reported from India. The primary source of infection could not be determined in the present study. ESBL production was detected in 60% strains of *Escherichia coli* and 75 % strains of *Klebsiella* species. All the ESBL producer isolates were found to be sensitive to the beta-lactam and beta lactamase inhibitor combinations with 100% sensitivity to Carbapenems. With the spread of ESBL positive strains in hospitals, co-resistances can be found to Aminoglycosides, Fluoroquinolones, Tetracyclines, Chloramphenicol and Sulfamethoxazole-Trimethoprim. A therapeutic alternative has been recommended to prevent drug resistance among other organisms and hence, there is a need to formulate an antibiotic policy. Some policy changes are currently in progress, such as the Bill and Melinda Gates funded project on Global Antibiotic Resistance Partnership (GARP) by an NGO. In India, the Chairman for GARP is Professor N.K. Ganguly, the former Director General of ICMR.

Changes in the pattern of antibiotic use will result in different micro-organisms and their susceptibility patterns. The knowledge of the susceptibility patterns of the bacterial strains in a hospital will guide the clinicians to choose appropriate and judicious antibiotics for surgical prophylaxis. Updating the antibiogram periodically will further reduce the rate of post-operative wound infections to a considerable extent. [17],[18],[19]

References

[1] Franklin P Koontz ,Trends in post-operative infections by Gram-positive bacteria Journal of antimicrobial agents 2000; Volume 16(1): 35-37

[2] Arya M, Arya PK, Biswas D, Prasad R, Antimicrobial susceptibility pattern of bacterial isolates from post-operative wound infections, Indian J Pathol Microbiol.2005;48(2):266-9.

[3] Anguzu JR, Olila D, Drug sensitivity patterns of bacterial isolates from septic post-operative wounds in a regional referral hospital in Uganda, Afr Health Sci. 2007;7(3):148-54.

[4] Wayne PA , Clinical and Laboratory Standards Institute Performance Standards for antimicrobial Disc tests; Approved Standards, 2006 9th ed CLSI vol. 26 No.1: 2006.

[5] Document M2-A9

[6] Andhoga J, Macharia AG, Maikuma IR, Wanyonyi ZS, Ayumba BR, Kakai R, Aerobic pathogenic bacteria in post-operative wounds at Moi Teaching and Referral Hospital. East Afr Med J.2002 ;79(12):640-4.

[7] T Menon, D Bindu, CPG Kumar, S Nalini, MA Thirunarayan, comparison of double disc and three dimentional method to screen for ESBL producers in a tertiary care hospital. Indian J Med Microbial 2006;Vol (24): 2.

[8] Kamat U, Ferreira A, Savio R, Motghare D, Antimicrobial resistance among nosocomial isolates in a teaching hospital in Goa , Indian J Community Med. 2008 ;33(2):89-92.

[9] Datta P, Thakur A, Mishra B, Gupta V .Prevalence of clinical strains resistant to various ß lactamase in a tertiary care hospital in India. J Infect Dis 2004; 57:146-9.

[10] Khorvash F, Mostafavizadeh K, Mobasherizadeh S, Behjati M, Naeini AE, et al., Antimicrobial susceptibility pattern of microorganisms involved in the pathogenesis of surgical site infection (SSI); A 1 year of surveillance, Pak J Biol Sci 2008;11(15):1940-4.

[11] Ghosh A, Karmakar PS, Pal J, Chakraborty N, Debnath NB, Mukherjee JD, Bacterial incidence and antibiotic sensitivity pattern in moderate and severe infections in hospitalised patients, J Indian Med Assoc2009 ;107(1):21-2, 24-5.

[12] Petherick ES, Dalton JE, Moore PJ, Cullum **N,** Methods for identifying surgical wound infection after discharge from hospital: a systematic review**.** *BMC Inf Dis* 2006, **6:**170.
[13] Robert H Rubin, Surgical wound infection: epidemiology, pathogenesis, diagnosis and management , *BMC Infectious Diseases* 2006, **6:**171
[14] Mathur P, Tatman A, Das B, Prevalence of extended beta lactamase producing gram negative bacteria in a tertiary care hospital, Indian J Med Res 2002; 115:153-57.
[15] Dobardzić R, Dobardzić A, Occurrence of surgical pathogens and their antimicrobial susceptibility patterns , Med Arh. 2000; 54(1):13-6.
[16] 15. Uçkay I, Harbarth S, Peter R, Lew D, Hoffmeyer P, Pittet D, Preventing surgical site infections, Expert Rev Anti Infect Ther 2010;8(6):657-70.
[17] Heymann DL. Control of Communicable Diseases Manual, 18th ed. Washington (DC): American Public Health Association. 2004:501-4.
[18] Okonkwo II, Soleye FA, Amusan TA, OgunAA, Incidence of multidrug resistance organisms in Abeokuta Southwestern Nigeria, Global journal of pharmacology, 2009; Vol 3(2):69-80
[19] 18.Choi WS, Song JY, Hwang JH, Kim NS, Cheong HJ, Appropriateness of antibiotic prophylaxis for major surgery in Korea, Infect Control Hosp Epidemiol 2007; 28:997–1002
[20] 19. Tourmousoglou CE, Yiannakopoulou ECH, Kalapothaki V,Bramis J, St Papadopoulos J, Adherence to guidelines for antibiotic prophylaxis in general surgery: a critical appraisal, J Antimicrob Chemother 2008 61:214–218