ORIGINAL ARTICLE

BACTERIOLOGY AND ANTIBIOTIC SUSCEPTIBILITY OF WOUND INFECTIONS IN A TEACHING HOSPITAL, BENGALURU

Sakolkar Shalmali¹, Naveen S², Prakash R³, Sangeetha S⁴

HOW TO CITE THIS ARTICLE:

Sakolkar Shalmali, Naveen S, Prakash R, Sangeetha S. "Bacteriology and Antibiotic Susceptibility of Wound Infections in a Teaching Hospital, Bengaluru". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 74, September 14; Page: 12824-12829, DOI: 10.14260/jemds/2015/1849

ABSTRACT: Breach in the skin with exposure of subcutaneous tissue due to trauma, surgeries, burns, diabetic ulcers, etc. is known as a Wound. Successful invasion and proliferation by either one or more species of microorganisms will result in the infection of wound which may result in formation of pus. Infection can be due to either endogenous or exogenous bacteria. **AIMS:** To find the pattern of the bacterial isolates and their susceptibility patterns from the wound samples. **METHODS AND MATERIALS:** A total of 420 patients with wound infection were included in the study. All the bacterial isolates were isolated and identified according to the standard microbiological techniques. Antimicrobial susceptibility testing was done by Kirby Bauer disc diffusion method. **RESULTS:** 327 bacterial isolates were isolated and identified from 442 specimens from 420 patients. Gram negative bacteria were predominant followed by gram positive bacteria. Staphylococcus aureus was predominant in gram positive organisms. Escherichia coli were predominant in gram negative organisms. Meropenem was the most sensitive antibiotic for gram negative bacteria and linezolid was the most sensitive antibiotic for gram positive bacteria. **CONCLUSION:** The successful management of wound infection depends on the knowledge of the most prevalent organisms and their antibiotic susceptibility profile along with infection control practices.

KEYWORDS: Antimicrobial susceptibility, Escherichia coli, Gram positive organisms, Gram negative organisms, Staphylococcus aureus, Wound infection.

INTRODUCTION: Breach in the skin with exposure of subcutaneous tissue due to trauma, surgeries, burns, diabetic ulcers, etc is known as a Wound. Microbial colonization and proliferation will be seen due to the moist, warm and nutritive environment in the wounds.⁽¹⁾

Successful invasion and proliferation by either one or more species of microorganisms will result in the infection of wound which may result in formation of pus. Infection can be due to either endogenous or exogenous bacteria.⁽²⁾ The endogenous organisms usually originate from the respiratory, urogenital and gastro-intestinal tracts. The commonest gram positive organisms are Staphylococcus aureus and Staphylococcus epidermidis and the commonest gram negative organisms are Pseudomonas aeruginosa, Escherichia coli, Klebsiella species and Proteus species.⁽³⁾

Wound infections are one of the most common hospital associated infections which results in prolonged hospital stay, increased trauma care, increased treatment cost and morbidity,^(4,5) Despite the advances in infection control practices, the control of wound infections is still an uphill task due to development of drug resistance,^(6,7) Treatment with an effective and appropriate antimicrobial agent for the wound infection to prevent the drug resistance requires knowledge of the most common microorganisms responsible for the infection and its susceptibility pattern,⁽⁸⁾ Hence this present study was conducted to find the pattern of the bacterial isolates and their susceptibility

ORIGINAL ARTICLE

patterns from the wound samples for the improvement in treatment and reduction of the drug resistance.

MATERIALS AND METHODS: A prospective study was done in Rajarajeswari Medical College, Bengaluru over a period of one year from January to December 2015. A total of 422 patients with wound infections were included into the study from both in-patients and out-patients of the surgery department. Institutional ethical committee was approved.

The samples were inoculated onto 5% Sheep Blood agar and MacConkey agar which was incubated at 37°C for 24 hours. All the bacterial isolates were identified by biochemical tests as per standard microbiological techniques.⁽⁹⁾ Antimicrobial sensitivity testing was performed on Mueller Hinton Agar plates by disk diffusion method and interpreted as sensitive, intermediate or resistant according to Clinical and laboratory standards institute (CLSI) 2014 guidelines.⁽¹⁰⁾

The data was processed with Microsoft Excel 2007 and were expressed as percentile. The chi-square test was used for assessment of association of variables and $p < 0.05$ was considered as statistically significant for all statistical analysis.

RESULTS: A total of 440 pus specimens from 422 patients were cultured. The age ranged from 12 to 85 years with a mean age of 46 years. The male: female ratio was 1.85: 1. The age and gender wise distribution of the wound infection is shown in Table 1.

Table 2 shows the percentage of isolation of bacteria from wound specimens. In our study, there was no growth seen in 148 specimens. Bacterial growth was seen in 292[66.3%]. Single bacterial growth was seen in 252(86.3%) specimens. Polymicrobial isolates were seen in 40(13.6%) cases. The organisms isolated in wound infections are shown in Table 3. The most common organism isolated was *Escherichia coli* 74(22.6%) followed by *Staphylococcus aureus* 68(20.7%) and *Klebsiella pneumoniae* 36(11%).

The antimicrobial susceptibility pattern of gram positive bacterial isolates is given in the table 4 and gram negative bacterial isolates in table 5. MRSA was seen in 16(23.5%) isolates out of 68 isolates. Multi drug resistant gram negative bacteria was seen in 45(20%) out of 224 isolates.

DISCUSSION: Wound infection is a challenging and a major concern to prevent or reduce the mortality and morbidity. The primary goal is to prevent the infection but once the infection has occurred then the wound management practices by either antibiotic treatment or wound dressing along with antibiotics would be the best practices. For this, antibiotic susceptibility testing should be done to treat with the appropriate antibiotic.

In this study, male patients (65%) were predominant when compared to female patients (35%). This correlates to Kranthi K et al,⁽⁵⁾ where 66% were males and 34% were females. On the contrary, studies by Gautam et al,⁽¹¹⁾ Mohammed et al,⁽¹²⁾ and Bessa LJ et al,⁽¹³⁾ showed female preponderance. Majority of the specimens were received from the patients in the age group of 51- 60 years followed by 41-50 years probably because of the co-morbid conditions like diabetes or other immunosuppressive conditions whereas Gautam et al,⁽¹¹⁾ study of 200 samples shows higher incidence in the age group of 21-30 years. Gram negative organisms (67.8%) were the predominant as compared to gram positive organisms (32.2%) in the wound specimens in our study. This finding correlates with kranthi K et al,⁽⁵⁾ Roel T et al.⁽¹⁴⁾ and Mohammed et al.⁽¹²⁾ but study of Gautam et al,⁽¹¹⁾ showed gram positive organisms as the predominant bacterial isolates recovered.

ORIGINAL ARTICLE

Staphylococcus aureus was the predominant organism in gram positive bacteria and *Escherichia coli* was the predominant in gram negative bacteria which correlates with the other studies,^(5,12,13,14) *Pseudomonas* species was predominant among gram negative bacteria in Gautam et al.⁽¹¹⁾ and Mehta M et al.⁽¹⁵⁾ studies.

Linezolid was the most sensitive antibiotic for the gram positive organisms followed by doxycycline, chloramphenicol, vancomycin and gentamicin. Gram positive organisms were least sensitive to penicillin G followed by ciprofloxacin and trimethoprim/sulfamethoxazole. Meropenem was the most sensitive antibiotic for gram negative organisms followed by imipenem, tobramycin and amikacin. Gram negative organisms were least sensitive to ampicillin followed by cephalexin and cefuroxime.

The organism's pattern and sensitivity of the organisms to different antibiotics varies from place to place according to the antibiotic prescription pattern in the surrounding areas, immunity of the patient, age and wound cleaning practices. The limitation of this study was that only aerobic organisms were studied, anaerobic or fungal etiology of the wound infection has not been studied.

CONCLUSION: The successful management of wound infection depends on the knowledge of the most prevalent organisms and their antibiotic susceptibility profile along with infection control practices. Early treatment with the appropriate antibiotic may reduce the rate of antibacterial resistance and also reduce the morbidity and hospital stay of the patient. Gentamicin and ofloxacin are the antibiotics of moderate sensitivity against both gram positive and gram negative organisms in our study.

Age Group (years)	Male	Female	Total
11 - 20	17	12	29
21 - 30	49	22	71
31 - 40	40	20	60
41 - 50	54	33	87
51 - 60	60	32	92
61 - 70	40	21	61
71 - 80	14	7	21
81 - 90	0	1	1
Total	274(65%)	148(35%)	422(100%)

Table 1: Age and Gender wise Distribution of wound infection

Sl. No.	Authors	No. of Wound Samples	Percentage of Bacterial Isolates
1.	Gautam et al, ⁽¹¹⁾	200	75%
2.	Mohammed et al, ⁽¹²⁾	150	81.3%
3.	Bessa LJ et al, ⁽¹³⁾	312	69.5%
4.	Kranthi K et al, ⁽⁵⁾	500	85%
5.	Roel T et al, ⁽¹⁴⁾	614	75.9%
6.	Present study	440	66.3%

Table 2: Percentage of bacterial isolates from various studies

ORIGINAL ARTICLE

Organisms	Total Isolates	Percentage
Escherichia coli	74	22.6
Staphylococcus aureus	68	20.7
Klebsiella pneumoniae	36	11
Pseudomonas aeruginosa	29	8.8
Proteus mirabilis	23	7
Non-fermenting gram negative bacilli	19	5.8
Other pseudomonas species	16	4.9
Klebsiella oxytoca	11	3.4
Enterococcus species	10	3.1
Coagulase Negative Staphylococcus	9	2.8
Proteus vulgaris	8	2.5
Streptococcus species	8	2.5
Diphtheroids	8	2.5
Morganella morganii	3	0.9
Citrobacter species	3	0.9
Enterobacter species	2	0.6
Total	327	100

Table 3: Distribution of bacterial isolates in wound infection

Sl. No.	Antibiotics	No. of Isolates Tested	Sensitivity %
1.	Penicillin G	97	11.3
2.	Ampicillin	105	60
3.	Amoxicillin/Clavulanic acid	105	75
4.	Gentamicin-High	10	90
5.	Gentamicin	97	85.7
6.	Ciprofloxacin	97	32.2
7.	Ofloxacin	97	66.7
8.	Trimethoprim/Sulfamethoxazole	87	53.1
9.	Clindamycin	105	90
10.	Erythromycin	105	72.1
11.	Linezolid	105	100
12.	Vancomycin	105	100
13.	Teicoplanin	105	100
14.	Chloramphenicol	87	93.8
15.	Doxycycline	87	94.2

Table 4: Antimicrobial sensitivity pattern of gram positive wound isolates

ORIGINAL ARTICLE

Sl. No.	Antibiotics	No. of Isolates Tested	Sensitivity %
1.	Ampicillin	155	13.5
2.	Piperacillin	124	62.5
3.	Amoxicillin/Clavulanic acid	168	29.6
4.	Piperacillin/Tazobactam	153	75.2
5.	Cefuroxime	168	19.7
6.	Ceftazidime	159	74
7.	Ceftriaxone	168	50
8.	Cefotaxime	167	40.7
9.	Cefepime	168	56.8
10.	Cephalexin	169	15.9
11.	Aztreonam	189	56.8
12.	Ertapenem	222	59.7
13.	Imipenem	222	95.9
14.	Meropenem	222	98.3
15.	Amikacin	193	79.3
16.	Gentamicin	196	64.8
17.	Tobramycin	64	80
18.	Ciprofloxacin	195	39.2
19.	Ofloxacin	195	65
20.	Trimethoprim/Sulfamethoxazole	143	42

Table 5: Antimicrobial sensitivity pattern of gram negative wound isolates

REFERENCES:

1. Bowler PG, Duerden BI, Armstrong DG. Wound Microbiology and Associated Approaches to Wound Management. Clin. Microbio. Rev 2001; 14:244-69.
2. Bhatt CP, Lakhey M. The distribution of pathogens causing wound infection and their antibiotic susceptibility pattern. J Nepal Health Res Council 2007; 5(1): 22-26.
3. Nagoba BS. Clinical Microbiology. Chapter 16. BI publications, New Delhi 2005; pp. 142-44.
4. Dionigi R, Rovera F, Dionigi G. Risk Factors in Surgery. J Chemother 2001; 13:6-11.
5. Kranthi K, Rao RDVMVS, Manasa D, Swamy GCh. A study on bacterial pathogens in wound infections at Ganni Subba Lakshmi Medical College. International Journal of health Sciences and Research 2013; 3(11):44-50.
6. Topley and Wilson - Microbiology and Microbial infections, Arnold publishers, 9th edition, Volume 3; 1998. P. 131.
7. Thomas KH. Surgical Wound Infection, an Overview. Am J Med 1981, 70: 712-718.
8. Kelwin WS. Anti-microbial therapy for diabetic foot infections. Post Grad. Med. 1999; 106: 22-28.

ORIGINAL ARTICLE

9. Collee JG, Miles RS, Watt B. Tests for the identification of bacteria. In: Collee JG, Fraser AG, Marmion BP, Simmons A (eds.), Mackie & MacCartney Practical Medical Microbiology, 14th ed. Churchill Livingstone: London; 1996. p. 151-79.
10. Clinical and Laboratory Standards Institute: Performance standards for antimicrobial susceptibility testing: twenty fourth informational supplements. In Wayne, PA: Clinical and Laboratory Standards Institute; 2014:M100-S24.
11. Gautam R, Acharya A, Nepal HP, Shrestha S. Antibiotic susceptibility pattern of bacterial isolates from wound infection in Chitwan Medical College Teaching Hospital, Chitwan, Nepal. International journal of biomedical and advance research 2013; 4(4):248-52.
12. Mohammed A, Adeshina GO, Ibrahim YK. Incidence and antibiotic susceptibility pattern of bacterial isolates from wound infections in a Tertiary hospital in Nigeria. Tropical journal of pharmaceutical research 2013; 12(4):617-21.
13. Bessa LJ, Fazii P, Di Giulio M, Cellini L. Bacterial isolates from infected wounds and their antibiotic susceptibility pattern: some remarks about wound infection. Int wound J 2013; 12:47-52.
14. Roel T, Devi S, Devi M, Sahoo B. Susceptibility pattern of aerobic bacterial isolates from wound swab. Indian Medical Gazette 2014; 355-59.
15. Mehta M, Dutta P, Gupta V. Bacterial isolates from burn wound infections and their antibiograms: a eight-year study. Indian J Plast Surg 2007; 40(1):25-28.

AUTHORS:

1. Sakolkar Shalmali
2. Naveen S.
3. Prakash R.
4. Sangeetha S.

PARTICULARS OF CONTRIBUTORS:

1. Post Graduate, Department of Microbiology, Rajarajeswari Medical College and Hospital, Kambipura, Bangalore.
2. Professor, Department of Surgery, Rajarajeswari Medical College and Hospital, Kambipura, Bangalore.
3. Associate Professor, Department of Microbiology, Rajarajeswari Medical College and Hospital, Kambipura, Bangalore.

FINANCIAL OR OTHER

COMPETING INTERESTS: None

4. Professor, Department of Microbiology, Rajarajeswari Medical College and Hospital, Kambipura, Bangalore.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sakolkar Shalmali,
Post Graduate,
Department of Microbiology,
Rajarajeswari Medical College and Hospital,
Kambipura, Bangalore-560074.
E-mail: docshalmali@gmail.com

Date of Submission: 04/09/2015.
Date of Peer Review: 05/09/2015.
Date of Acceptance: 09/09/2015.
Date of Publishing: 11/09/2015.