

The Distribution of Pathogens Causing Wound Infection and Their Antibiotic Susceptibility Pattern

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Abstract

Introduction Human skin acts as an excellent barrier to infection, provided it is not breached. Certain parasite (e.g. *Hookworm larvae*) and bacteria (*Treponema pallidum*) can penetrate intact skin.

Objectives To determine the distribution of pathogens causing wound infection and pattern of their antibiotic susceptibility.

Methods Pus was collected from wound with the help of sterile disposable cotton swab and immediately inoculated onto blood agar and MacConkey agar media incubated at 37°C for 24 hours. After incubation, identification of bacteria from positive culture plates was done with the standard microbiological technique which included colony morphology, staining reaction and biochemical reactions. The entire isolates antibiotic sensitivity test was performed by disc diffusion method.

Results A total of 200 pus specimens were cultured, of which 120 showed bacterial growth. Six different species of bacterial organisms and one fungus species was isolated. The commonest isolate was *Staphylococcus aureus* followed by *Escherichia coli*, *Pseudomonas aeruginosa*, *Streptococcus pyogenes*, *Klebsiella pneumoniae*, *Coagulase negative Staphylococcus species*, and *Proteus species*. In vitro antibiotic sensitivity test of different organisms was performed. *Staphylococcus aureus* was found equally sensitive to Ciprofloxacin, Ofloxacin, Cephalexin and Gentamicin followed by Norfloxacin, Ampicillin and Co-trimoxazole. *Escherichia coli* were found equally sensitive to Gentamicin, Ofloxacin, Cephalexin, Co-trimoxazole, and Ciprofloxacin followed by Ampicillin and Norfloxacin. *Pseudomonas aeruginosa* was equally sensitive to Ciprofloxacin and Ofloxacin followed by Gentamicin, Norfloxacin, and Co-trimoxazole. Ampicillin and Cephalexin was 100 percent resistant. 100 percent sensitive to all tested seven antibiotics was seen with *Streptococcus pyogenes*. Similarly *Klebsiella pneumoniae*, *Coagulase negative Staphylococcus species* and *Proteus species* was found to be sensitive to Ciprofloxacin, Ofloxacin, Cephalexin, Ampicillin, Gentamicin, Norfloxacin and Co-trimoxazole.

Conclusion *Staphylococcus aureus* was found commonest organism of wound infection. In vitro antibiotic sensitivity test; *Staphylococcus aureus* were found to be equally sensitive to Ciprofloxacin, Ofloxacin, Cephalexin and Gentamicin; however the correct choice of antibiotics should be made only after the antibiotic susceptibility testing of the isolate.

Keywords Antibiotic, *Staphylococcus aureus*, *Escherichia coli*

Introduction

Human skin acts as an excellent barrier to infection, provided it is not breached. Certain parasite (e.g. *Hookworm larvae*) and bacteria (*Treponema pallidum*) can penetrate intact skin, but certain primary skin infections like impetigo is caused by *Streptococcus pyogenes* or *Staphylococcus aureus*,

or both gains access to abrasions as minor trauma to skin is a part of everyday life. Boils and furuncles are the commonest lesions caused by *Staphylococcus aureus*. These are suppurative lesions with necrosis at the center and eventually discharges slough with pus. Carbuncle a large abscess usually occurs in thick collagenous

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tissue such as back of the neck. *Staphylococcus aureus* phage groups I and II are mainly responsible for boils, carbuncles, styes and sycosis barbae.

Infections due to gram-negative bacteria are rare on healthy skin except moist area of groin and axilla. Coliforms, *Bacteroides species* and *Proteus species* may be recovered from abscesses between thighs and waist probably related to a preceding trauma.

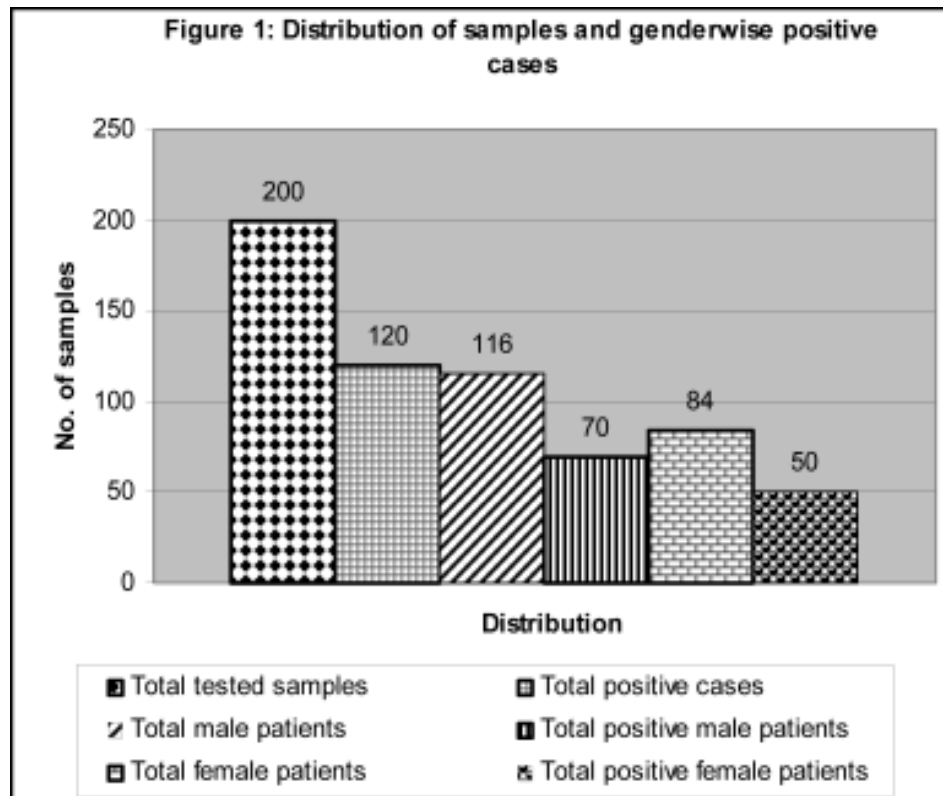
Wound infections may occur following accidental trauma and injections, but post-operative wound infections in hospital are most common. Some infections are endogenous in which infection occurs by patient's own bacterial flora such as *Staphylococcus aureus* from skin and anterior nares or coliforms. Many infections are exogenous, skin and anterior nares are important sources of *Staphylococci*, spread of organisms from hospital staffs and visitors occur by direct and indirect airborne routes. At present, more than 60 percent of hospital-acquired infections are due to gram-negative enteric bacilli and only in 30 percent cases gram-positive cocci are responsible. These gram-negative bacilli may be patient's own flora or in damp environment. The patient may have been colonised with antibiotic resistant organism from the

environment. Such organisms (e.g. *Pseudomonas aeruginosa*) can colonise traumatised skin such as wound, burns and bedsores¹.

Methods

This study included patients with acute and chronic wounds with purulent discharge or painful spreading erythema around a wound. This included cutaneous abscesses, traumatic wounds, foot ulcers and pressure ulcers. Total 200 patients of all the age groups attending Medicare National Hospital and Research Centre during May 2005 to April 2006 were included in the study. Pus was collected from wound with the help of sterile disposable cotton swab and immediately inoculated onto blood agar and MacConkey agar media and incubated at 37°C for 24 hours. After incubation, identification of bacteria from positive culture plates was done with the standard microbiological technique, which included colony morphology, staining reaction and biochemical reaction. The entire isolates antibiotic sensitivity test was performed by disc diffusion method on Muller Hinton agar or blood agar medium using antibiotic disc of HiMedia Laboratories Pvt. Limited A-406, Bhaveshwar Plaza, LBS Marg, Mumbai-400086, India.

Results



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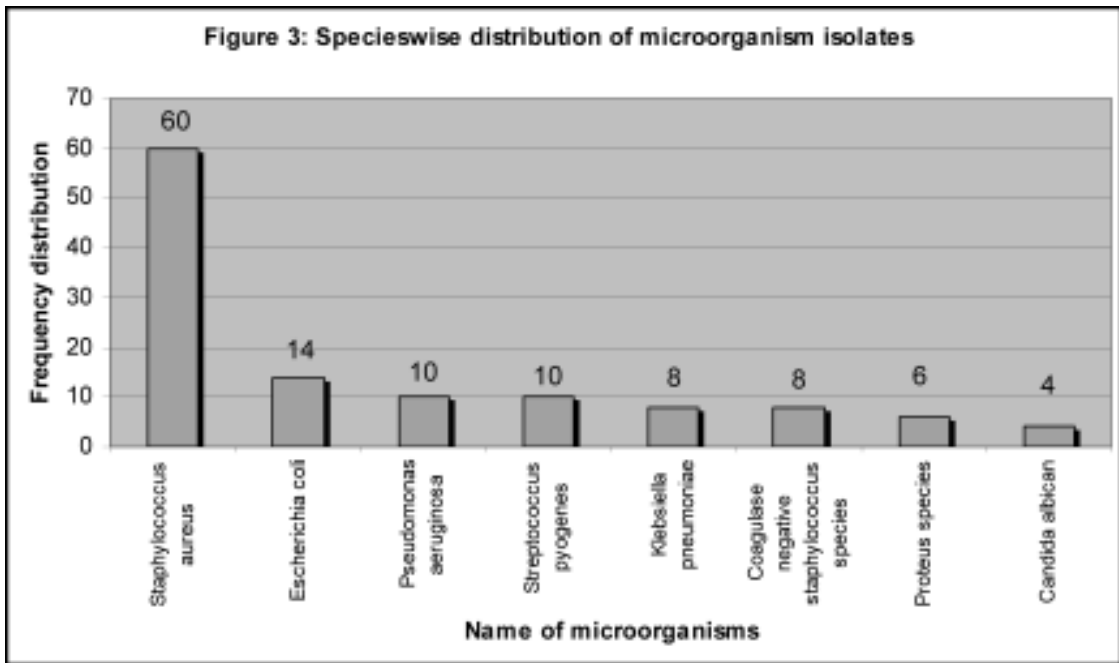
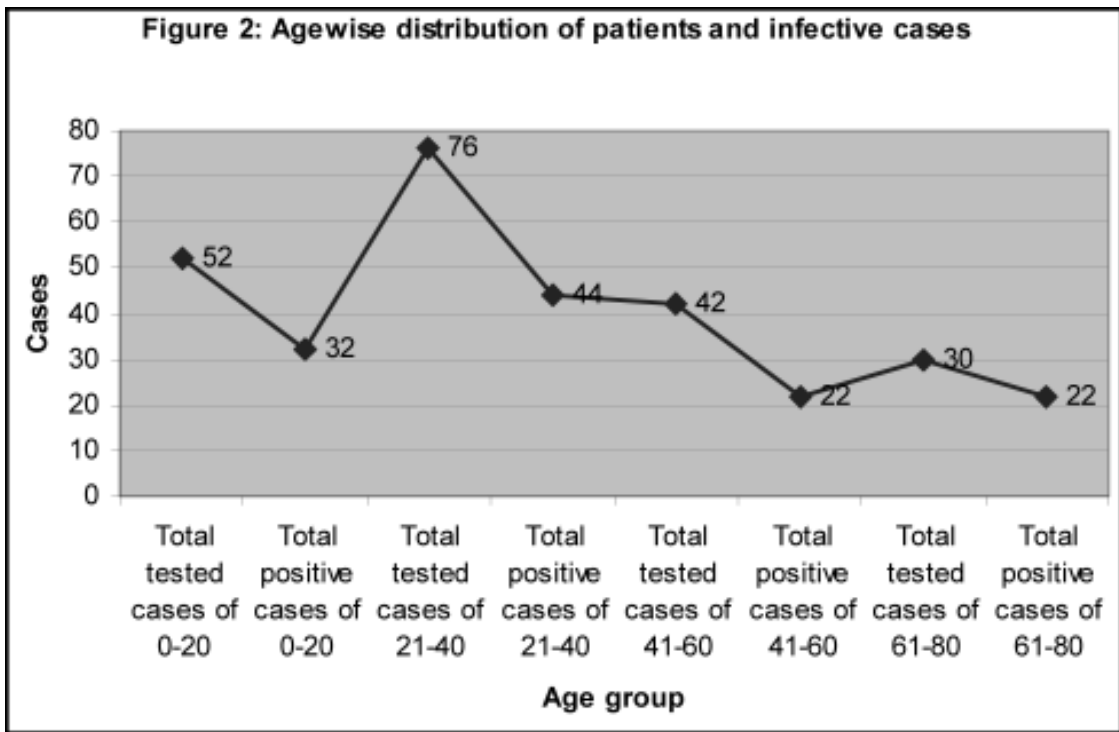


Table 1: Antibiotic sensitivity pattern of isolates

Antibiotics	<i>Staphylococcus aureus</i> 60		<i>Coagulase negative staphylococcus species</i> 8		<i>Escherichia coli</i> 14		<i>Klebsiella pneumoniae</i> 8		<i>Pseudomonas aeruginosa</i> 10		<i>Streptococcus pyogenes</i> 10		<i>Proteus species</i> 6	
	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant
8	0	10	0	10	0	6	0	0	6	4	10	0	6	0
Ofloxacin	56	4	6	2	8	6	8	0	6	4	10	0	6	0
Cephalexin	56	4	8	0	8	6	8	0	0	10	10	0	4	2
Ampicillin	46	14	8	0	6	8	6	2	0	10	10	0	4	2
Gentamicin	56	4	8	0	8	6	8	0	4	6	10	0	4	2
Norfloxacin	50	10	6	2	4	10	8	0	4	6	10	0	4	2
Co-trimoxazole	36	24	6	2	8	6	8	0	4	6	10	0	4	2

Discussions

Inadequate anti-microbial treatment defined as ineffective treatment of infection is an important factor in the emergence of antibiotic resistant bacteria. Factors that contribute to inadequate anti-microbial treatment of hospitalized patients include the prior antibiotic use, broad-spectrum antibiotics, prolonged hospital stay and the presence of invasive medical devices. Other factors include the spread of resistant organisms through overcrowding and inadequate hospital infection control practices².

In the present study 60 percent of pus culture was found to be bacterial growth and most common organism isolated from wound was *Staphylococcus aureus* (50%) followed by *Escherichia coli* (11.7%), *Pseudomonas aeruginosa* (8.3%), *Streptococcus pyogenes* (8.3%), *Klebsiella pneumoniae* (6.7%), *Coagulase negative staphylococcus* (6.7%) and *Proteus species* (5%). In a similar study conducted in TUTH³ found that 82.5 percent of the samples cultured aerobically showed bacterial growth and 13 different bacterial species were isolated. *Staphylococcus aureus* was the most frequently isolated organism (57.7%), followed by *Escherichia coli* (11%), other organisms isolated were *coagulase negative staphylococci* (3%), *Klebsiella pneumoniae* (8%), *Beta haemolytic streptococci* group A and group G (2.5%), *Proteus vulgaris* (0.7%) and *P. mirabilis* (1.4%), *Citrobacter freundii* (0.7%), *Streptococcus faecalis* (0.7%) and *Bacillus species* (not anthracis) (4%)³.

Another study conducted by B.D. Sharma Post Graduate Institute of Medical sciences in Rohtok, India found that, the most common wound isolate was *S. aureus* (32.3%) followed by *K. pneumoniae* (22.0%), *Pseudomonas spp.* (18.7%) and *Escherichia coli* (17.4%)⁴.

In vitro antibiotic sensitivity test *Staphylococcus aureus* were found to be equally sensitive to Ciprofloxacin, Ofloxacin, Cephalexin and Gentamicin (96.5%) followed by Norfloxacin (83.3%), Ampicillin (76.7%) and Co-trimoxazole (60%). *Escherichia coli* was found to be equally sensitive to Gentamicin, Ofloxacin, Cephalexin Co-trimoxazole and Ciprofloxacin (57.1%) followed by Ampicillin (42.8%), Norfloxacin (28.8%). *Pseudomonas aeruginosa* was equally sensitive to Ciprofloxacin and Ofloxacin (60%), followed by Gentamicin, Norfloxacin and Cephalexin (40%). One hundred percent sensitive to all tested seven antibiotics was seen with *Streptococcus pyogenes*. Similarly, *Klebsiella pneumoniae* was 100 percent sensitive to Ciprofloxacin, Ofloxacin, Cephalexin, Gentamicin, Norfloxacin and Co-trimoxazole followed by Ampicillin (75%). *Coagulase negative and staphylococcus species* was found to be 100 percent sensitive to Ampicillin, Cephalexin and Gentamicin and equally sensitive to Ciprofloxacin, Ofloxacin, Norfloxacin and Co-trimoxazole (75%). *Proteus species* was found to be 100 percent sensitive to Ciprofloxacin and Ofloxacin and equally sensitive to

Cephalexin, Ampicillin, Gentamicin, Norfloxacin and Co-trimoxazole (66.7%). Similar study conducted by TUTH found that among the antibiotics used for susceptibility testing, Gentamicin and Ciprofloxacin (73%) were found to be most effective. Sensitivity towards other antibiotics used were Co-trimoxazole (59%) Cephalexin (65%) and Cefotaxime (31%) Erythromycin and Cloxacillin used for gram-positive isolates were effective in 67 percent and 73 percent cases respectively³.

Conclusion

Staphylococcus aureus was found most common organism of wound infection in this study. In vitro antibiotic sensitivity test *Staphylococcus aureus* were found to be equally sensitive to Ciprofloxacin, Ofloxacin, Cephalexin and Gentamicin (96.5%) followed by Norfloxacin (83.3%), Ampicillin (76.7%) and Co-trimoxazole (60%); however the correct choice of antibiotics should be made only after the antibiotic susceptibility testing of the isolate and further extensive study need to be done to understand the exact pattern of antibiotics for the treatment.

References

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