Prevalence and antibiotic sensitivity pattern of wound bacteria from the samples collected in and around Chennai, South India

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Abstract

In the present study, accidental wound samples were collected from clinical laboratories and Government hospitals in and around Chennai city, Tamil Nadu for the prevalence of culture positive bacteria and their antibiotic sensitivity pattern. A total of 752 wound samples were collected from the patients attending the clinical laboratories and Government hospitals in Chennai, Kanchipuram and Tiruvallur regions of Tamil Nadu, India during the period of 2017-2018. Among the total number of samples, 61.04% were found to be culture positive. The region wise culture positive samples were: Chennai=53.01%, Kanchipuram=57.45% and Tiruvallur=74.66%. The present study shows that *Pseudomonas aeruginosa* and *Staphylococcus aureus* were more predominant wound bacteria. The percentage-wise distribution of positive samples with respect to their total numbers was recorded in the age group of 51-60 years followed by 31-40 years>41-50 years>61-70 years. Antibiotic sensitivity assay revealed that

Staphylococcus aureus, *Enterococcus faecalis*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* were found to be resistant to a maximum of five different antibiotics.

Keywords: Accidental wound, drug resistance, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, antibiotic sensitivity.

Introduction

Wound infections are responsible for human morbidity and mortality throughout the world (Sisay et al., 2019). Infectious bacteria in wounds delay in healing process and cause economic loss to the patients, hence given much attention in recent days. Drug resistance is a growing public health threat with pathogenic organism quickly bearing to cope with the challenges posed by therapeutic agents. When the antibiotic penicillin was discovered some fifty years ago, it was considered as a miracle drug of the century. This scene has suddenly changed with the development of resistance among bacteria and we are now confronted with new penicillin resistant type of bacteria (Prasad et al., 1995). As a result, resistance to antibiotic treatment is a common phenomenon among bacteria of every possible infection. At a standstill, the indiscriminate and extensive uses of drugs have developed multidrug resistance among microorganisms (Ait-Sidi-Brahim et al., 2019). The prevalence studies are essentially required to know the current distributional patterns of wound infecting bacteria and their antibiotic sensitivity patterns so as to prevent wound infections and to protect human lives. Hence in the present study, an attempt has been made to study the prevalence and antibiotic sensitivity patterns of accidental wound bacteria from the wound samples collected from patients attending

clinical laboratories and Government hospitals in three different regions in and around Chennai, South India.

Materials and methods

Isolation of bacteria from accidental wounds

The clinical samples from the patients with accidental wounds from medical laboratories and Government hospitals in three different study locations, Chennai, Kanchipuram and Tiruvallur were collected aseptically using sterile swabs, stored and transported to the laboratory for further studies. The bacteria in the samples were isolated using specific media and subjected morphological and biochemical tests for the identification. After 24h, cultures were used as inoculated on Thioglycolate Broth and plates of Nutrient agar, Blood Agar, Mannitol salt agar and Eosin-Methylene Blue Agar with incubation at 37ºC during a period ranged from 18 to 24 h.Each sample was labeled with the needed particulars such as name, age and chemotherapy if under taken and the sample was brought to laboratory within 6 hours (Cheesbrough, 1984**;** Murray *et al.,* 1999; Cappuccino *et al.,* 2004). Six common wound bacteria, *Staphylococcus aureus*, *Enterococcus faecalis*, *Escherichia coli*, *Klebsiella pneumoniae, Proteus vulgaris* and *Pseudomonas aeruginosa* were considered for further studies. The number of positive samples was categorized age group-wise, <10, 11-20, 21-30, 31-40, 41-50, 51-60 and 61-70 years to know the distribution pattern of the bacterial isolates.

Antibiotic sensitivity tests

Kirby-Bauer disc diffusion technique was used to test the sensitivity of wound isolated bacteria to different antibiotics and to different solvent-leaf extracts individually and in combination with standard antibiotics (Bauer *et al.,* 1966).

Results and discussion

In this study, a total of 752 wound samples were collected from three different study locations, Chennai, Kanchipuram and Tiruvallur, Tamil Nadu, India during the period of 2017-2018 (Fig. 1) among which 459 (61.04%) samples were culture positive. A maximum of 282 wound samples were collected from Kanchipuram followed by Chennai (249) and Thiruvallur (221). Out of six species of bacteria, *Staphylococcus aureus* and *Pseudomonas aeruginosa* recorded a maximum of 110 and 123 numbers of culture positive samples respectively followed by *Proteus vulgaris* (76), *Escherichia coli* (70), *Enterococcus faecalis* (42) and *Klebsiella pneumoniae* (Table 1). Similar to the present study findings, Bessa et al. (2015) reported that the most common bacterial isolates in infectious wounds were *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus mirabilis* and *Escherichia coli*. Mohammed et al. (2017) reported that *Staphylococcus aureus* was the more dominant bacteria in the wound infections followed by *Klebsiella* species and *Pseudomonas aeruginosa*. These studies reveal that the prevalence of bacteria with drug resistance has increased the prophylactic risks in wound infected patients.

The percentage-wise distribution of positive samples was 53.01, 57.45 and 74.66% respectively in Chennai, Kanchipuram and Tiruvallur in terms of total number of samples collected (Fig. 2). Though the total number of wound samples collected from Tiruvallur was lower than that of the other study locations, Chennai and Kanchipuram, the number of positive samples was higher (221 samples with 74.6% positive cases). Among the age group-wise samples, the age group between 51-60 years showed maximum number of positive cases of 173 out of 216 total samples followed by the age group 41-50 years with 151 positive cases out of 276 total wound samples. The percentage-wise distribution of positive samples with respect to their total numbers was recorded in the age group of 51-60 years followed by 31-40 years>41-50

years>61-70 years (Table 2). The lowest percentage of 28.57 of positive cases was recorded for the age group, <10 years where the total number of wound samples collected was 21 with 6 positive cases. The number and drug resistant isolates are highly variable depending on the locality and antibiotic therapy used. Also wound infections are the major cause of delay in wound healing. In the present study, number of positive cases was higher in higher age groups, while Pondei et al. (2013) reported that age group and sex did not exert any effect on prevalence, aetiological agent or antimicrobial resistance pattern of wound samples. The present study findings fall in line with Shalmali et al. (2015) who reported that majority of the specimens 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. The age group-wise distribution of positive wound samples collected from three different regions have shown a maximum of 21% in 51-60 years age group followed by 31-40 years>41-50 years = 61-70 years (Fig. 3).

The antibiogram of bacterial species isolated from the wound samples are given in Table 3. The results reveal that the antibiotic sensitivity pattern was variable among the bacterial isolates. Out of ten antibiotics tested, *Staphylococcus aureus, Enterococcus faecalis, Klebsiella pneumoniae* and *Pseudomonas aeruginosa* showed resistant to a maximum of five different antibiotics (Table 3). The isolates of *Staphylococcus aureus* were found to be resistant to penicillin-G, chloramphenicol, methicillin, ciprofloxacin and vancomycin. Among Gram positive bacterial isolates, *Klebsiella pneumoniae* was found to be resistant to ciprofloxacin, gentamycin, kanamycin, amikacin and ofloxacin; while *Pseudomonas aeruginosa* showed resistance to ciprofloxacin, gentamycin, amikacin, ofloxacin and streptomycin. In the present study, all the test bacteria were susceptible to nitrofurantoin. The findings of the present study indicate that the

bacterial isolates were multidrug resistant. Previous studies conducted world-wide also showed that wound isolated predominant bacteria are multidrug resistant in nature (Bessa et al., 2015; Mohammed et al., 2017; Shalmali et al., 2015). In conclusion, the present study shows that *Pseudomonas aeruginosa* and *Staphylococcus aureus* were more predominant wound bacteria. With reference to culture positive samples, Tiruvallur region recorded higher percentage of culture positive samples. The percentage-wise distribution of positive samples with respect to their total numbers was recorded in the age group of 51-60 years followed by 31-40 years>41-50 years>61-70 years. Antibiotic sensitivity assay revealed that *Staphylococcus aureus*, *Enterococcus faecalis*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* were found to be resistant to a maximum of five different antibiotics.

Figure 1. Total number of wound samples positive for bacterial isolates in comparison with the total number of samples collected from three different study locations.

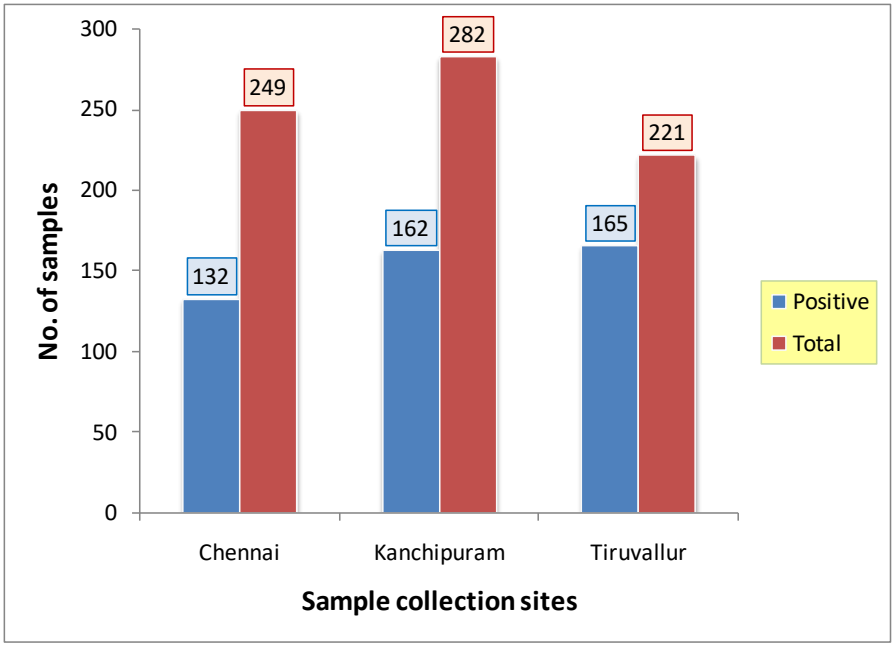


Table 1. Number of bacterial species isolated from wound samples collected from three different study locations during 2017-2018.

S. No.	Bacteria		Chennai	Kanchipuram	Tiruvallur	Total
1	Gram positive	*Staphylococcus aureus*	35	46	29	110
2		*Enterococcus faecalis*	19	9	14	42
3	Gram negative	*Escherichia coli*	15	30	25	70
4		*Klebsiella pneumoniae*	11	9	18	38
5		*Proteus vulgaris*	21	18	37	76
6		*Pseudomonas aeruginosa*	31	50	42	123

Figure 2. Percentage of wound samples positive for bacterial isolates from three different study locations.

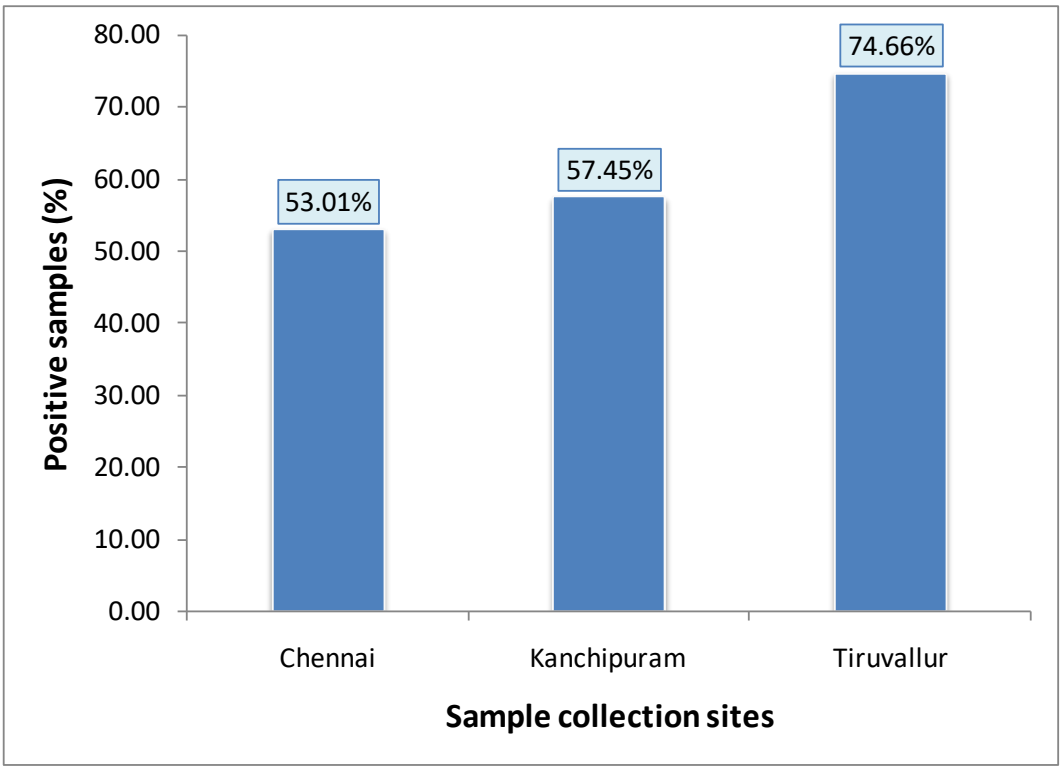
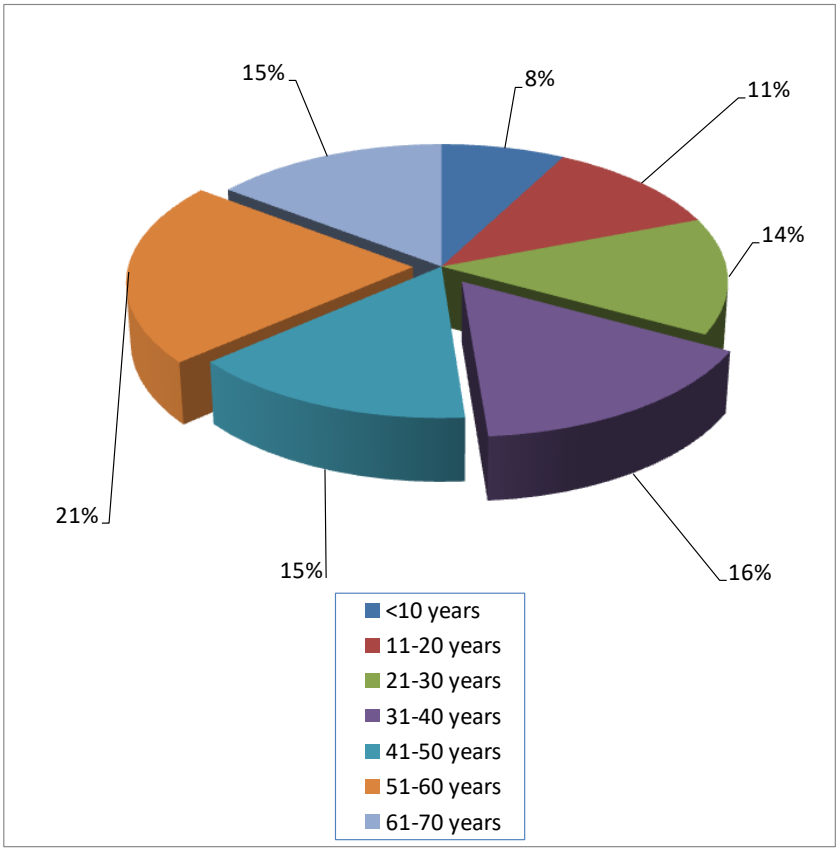


Table 2. Age group-wise distribution of wound samples and bacterial isolates collected from three different study locations.

Age group (Years)	Total no. of samples	No. of positive samples	% positive samples
<10	21	6	28.57
11-20	26	11	42.31
21-30	69	35	50.72
31-40	109	64	58.72
41-50	276	151	54.71
51-60	216	173	80.09
61-70	35	19	54.29

Figure 3. Age group-wise distribution of positive samples for bacterial isolates with reference to total number of samples.



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