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Original Research Article

Bacterial pathogens in wound infection and their antimicrobial susceptibility pattern in a medical college hospital, in Dhaka, Bangladesh

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ABSTRACT

Background: Wound infection is a major health problem that results in prolong hospital stay, increased treatment cost and are responsible for significant mortality and morbidity worldwide. The aim of the present study was to isolate and identify the bacterial pathogens causing wound infection and to determine their antimicrobial susceptibility profile.
Methods: This cross sectional study was conducted at the Department of Microbiology, Sir Salimullah Medical College, Dhaka from January 2016 to December 2016. Wound swab samples were collected and inoculated into appropriate media. The bacterial pathogens were identified by using standard microbiological methods. Antimicrobial susceptibility test were performed using disc diffusion technique following Kirby-Bauer method.
Results: Out of 239 wound swab samples analyzed 173 (72.4%) were culture positive. Majority (35.3%) of culture positive cases were in age group 16-30 years and 60.1% were male. *Staphylococcus aureus* (36.9%) was the predominant isolate, followed by *Escherichia coli* (35.8%), *Pseudomonas* spp. (17.3%) and Proteus spp. (5.8%). Bacterial isolates were highly resistant Amoxicillin (89-100%), Cephalosporin (60-100%), Ciprofloxacin (53-71%), while they were least resistant to Imipenem (0-14%) and Amikacin (17-30%).
Conclusions: In the present study most of the isolates showed high rate of resistance to commonly used antibiotics. Therefore regular monitoring and rational use of antibiotic should be practiced.

Keywords: Antimicrobial resistance, Bacterial pathogen, Wound infection

INTRODUCTION

A wound is the breach in the continuity of soft parts of body structures by an external agent.[1] Wound infection ensuing from the invasion and proliferation by one or more species of microorganisms, frequently characterized by pus formation, pyrexia, induration and pain.[2]

Development of wound infection depends on numerous factors including integrity and protective functions of skin, the number and types of organism and their synergy, pathogenicity and virulence of bacterial species, preexisting illness, nature and length of surgery, use of antibiotic, wound class and contamination.[3-5]

Wound infections are the third most frequent nosocomial infection. They are a major cause of morbidity and account for 70-80% mortality worldwide.[6] Wound infection is important because they can delay the healing process, lead to wound dehiscence, prolong hospital stay and increase the cost of treatment.[7] Furthermore, it is a major concern among the healthcare practitioners not only as a cause of increased trauma to the patient but also in view of its burden on financial resources and

increasing requirement for cost effective management within the health care system.[8,9]

Wound can be infected by a diverse group of microorganisms. The common wound pathogens include bacteria, fungi, protozoa and virus.[10] Common bacterial species associated with wound infection include *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Streptococcus pyogenes*, *Proteus* species, *Streptococcus* species and *Enterococcus* species.[11]

With the surge of multidrug resistant bacteria effective wound management and control of wound infection has become more challenging.[12] Knowledge about the causative agents of wound infection has proved to be useful in the selection of empirical therapy, planning infection control measures and in formulating rationales of antibiotic policy.[13]

Regional and local variations occur among causative microorganisms of wound infection. Thus clinician should be aware of causative agents and their antimicrobial susceptibility profile in their locality.[14]

This study therefore was carried out to identify bacterial pathogens associated with wound infection and to determine their susceptibility pattern to commonly used antibiotics among patients with wound infection attending a medical college hospital of Dhaka city.

METHODS

This cross sectional study was carried out in the in the department of Microbiology, Sir Salimullah Medical College, Dhaka from January 2016 to December 2016.

A total of 239 specimen consisting of wound swabs, pus, purulent exudates or wound discharge were collected from patients of various clinical wards and outpatient departments of Sir Salimullah Medical College and Mitford Hospital. Clinically diagnosed patients of all ages and of both sexes having wound infection with pus or discharge draining from infection site or wounds having any signs of infection (pain or tenderness, localized swelling, redness or heat) or the wound that has not healed within ten days after the injury were included in the study. Patient who received antibiotics within 24 hours or had wound dressed with antiseptic solution were excluded from the study.

Specimen were collected aseptically with sterile cotton tipped swabs without contaminating with skin commensals and then swab was taken in a sterile test tube and transported immediately to the microbiology laboratory.

The samples were inoculated into Blood agar media, MacConkey agar media and incubated aerobically at 37^0C for 24 hours. Isolation and identification of different bacteria were done by standard microbiological procedures, including colony morphology, Gram staining and biochemical tests.[15]

Antimicrobial susceptibility testing was carried out by Kirby-Bauer disc diffusion technique using Mueller Hinton agar media and zone of inhibition were measured as recommended by the Clinical and Laboratory Standard Institute. (CLSI) guidelines.[16]

The following antibiotic discs from Oxoid Ltd. UK, were used, Amoxycillin (10µg), Cefradin (30µg), Ceftriaxone (30µg), Ceftazidime (30µg), Cefixime (5µg), Ciprofloxacin (5µg), Cotrimoxazole (25µg), Tetracyclin (30µg), Gentamicin (10µg), Amikacin (30µg), and Imipenem (10µg).

Data were compiled and analyzed with SPSS version 20 statistical software. Before starting the study ethical clearance was obtained from the concerned authority of Sir Salimullah Medical College.

RESULTS

Among 239 samples from wound infection, 173(72.4%) yielded bacterial growth, and remaining 66(27.6%) were culture negative (Figure 1).

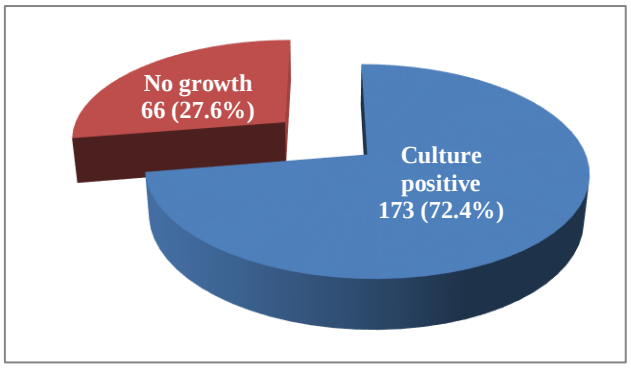

Figure 1: Distribution of sample on growth character (n=239).

Out of these culture positive cases, majority 61(35.3%) were in the age group of 16-30 years (Table 1), and males 104(60.1%) were more commonly affected than female 69(39.9%) patients (Figure 2).

Table 1: Age distribution of culture positive cases (n=173).

Age group (In years)	Frequency	Percent
≤15	35	20.2
16-30	61	35.3
31-45	26	15.0
46-60	35	20.2
≥60	16	9.2
Total	173	100

The most frequently isolated bacteria were *Staphylococcus aureus* 64 (36.9%), followed by *Escherichia coli* 62 (35.8%), *Pseudomonas* spp. 30 (17.3%) and *Proteus* spp. 10 (5.8%) (Table 2).

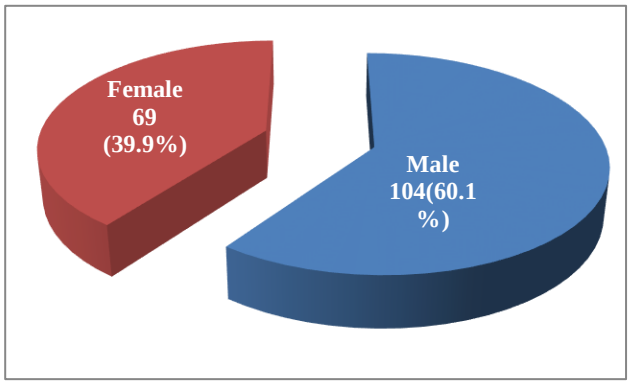

Figure 2: Sex distribution of culture positive patients (n=173).

The antimicrobial susceptibility pattern of bacterial isolates has been shown in Table 3. The predominant isolate, *S. aureus* were highly resistant to Amoxycillin (92.2%), Cefradine (87.5%) and Cefixime (84.4%). Resistance was also high for third generation Cepahlosporins like Ceftriaxone (76.6%) and Ceftazidime (71.9%). While they were least resistant to Imipenem (7.8%), Amikacin (17.2%) and Gentamicin (21.9%). *E. coli* isolates were mostly resitant to Amoxycillin and Tetracycline (88.7% each), Cefixime (87.1%) and Cefradine (82.3%). High level of resistance was observed for Cotrimoxazole (75.8%), Ceftazidime (74.2%) and Ceftriaxone (70.9%). All *Pseudomonas* spp. were resistant to Cefradine (100%). They were highly resistant to Amoxycillin (93.3%), Cefixime (96.7%), Ceftriaxone (86.7%), Ceftazidime and Cotrimoxazole (80% each). Resistance was low (53.3%) for Gentamicicn. *Proteus* spp. showed high degree of resistance to Amoxycillin (100%), Cefradine and Cotrimoxazole (90% each), While resistance was lower for Cefixime, Ceftazidime, Ciprofloxacin (70% each) and Ceftriaxone (60%). All bacterial isolates from wound infections were highly sensitive to Imipenem (86-100%) and Amikacin (70-83%).

Table 2: Distribution of bacterial isolates of wound infection (n=173).

Bacterial isolates	Number	Percent
Staphylococcus aureus	64	36.9
Escherichia coli	62	35.8
Pseudomonas spp.	30	17.3
Proteus spp.	10	5.8
Others*	7	4.1
Total	173	100

***** Others in the table represents, *Klebsiella* spp. *Citrobacter* spp. Acinetobacter spp. and Coagulase negative *Staphylococci*.

Table 3: Antimicrobial resistance pattern of bacterial isolates from wound infection (n=173).

Antibiotic	Number (%) of isolates resistant to				
	***S. aureus* (n=64)**	***E.coli* (n=62)**	***Pseudomonas* spp. (n=30)**	***Proteus* spp. (n=10)**	**Others (n=7)**
Amoxycillin	59 (92.2)	55 (88.7)	28 (93.3)	10 (100)	7 (100)
Cefradin	56 (87.5)	51 (82.3)	30 (100)	9 (90)	6 (85.7)
Cefixime	54 (84.4)	54 (87.1)	29 (96.7)	7 (70)	6 (85.7)
Ceftriaxone	49 (76.6)	44 (70.9)	26 (86.7)	6 (60)	6 (85.7)
Ciprofloxacin	43 (67.2)	40 (64.5)	16 (53.4)	7 (70)	5 (71.4)
Cotrimoxazole	41 (64.1)	47 (75.8)	24 (80)	9 (90)	6 (85.7)
Ceftazidime	46 (71.9)	46 (74.2)	24 (80)	7 (70)	7 (100)
Gentamicin	14 (21.9)	15 (24.2)	16 (53.4)	2 (20)	3 (42.9)
Amikacin	11 (17.2)	17 (27.4)	7 (23.3)	3 (30)	2 (28.6)
Tetracycline	44 (68.8)	55 (88.7)	23 (76.7)	3 (30)	3 (42.9)
Imipenem	5 (7.8)	8 (12.9)	4 (13.3)	0 (0)	1 (14.3)

* Figure within parentheses indicate percentage

DISCUSSION

Wound infection remain an important concern among health care practitioners throughout the world owing to associated morbidity and mortality.[17] It is an important cause of illness resulting in prolongation of hospital stay, increased treatment cost and are likely to have an important role in development of antimicrobial resistance.[18] Therefore proper identification of organism and determination of antimicrobial susceptibility pattern is crucial for appropriate management of wound infection.

In the present study, bacterial pathogens were isolated from 173 (72.4%) samples. Almost similar isolation rate was reported by Azene et al, (70.5%), Sultana et al,

(70.3%) and Abraham et al, (70.5%).[5,19,20] In contrast to this study higher isolation rate was reported by Mohammed et al, (83.9%) and the rate was lower (61.8%) in study by Khanam et al.[11,21] This difference in bacterial isolation rate may be due to difference in quality of wound swab specimen and microbiological techniques used. Rest of the samples (27.6%) showed no growth of organism. The reasons may be, patients had been treated with antibiotics either systemic or topical or both prior to sample collection or there was anaerobic bacterial infection, the culture of which was not done.

In this study, majority (35.3%) of wound infection cases were within the age group of 16-30 years. This is in agreement with other studies, where it was reported that people in their second to fourth decades of life being more prone to wound infection.[2,11] Since this is the most productive age range, people are involved in different types of work and so have a higher risk of exposure to variety of wounds.

Higher rate of wound infection was recorded in male (60.1%) than in female (39.9%). Similar male predominance was also reported in other studies.[11,19,22] This might be attributed to the fact that, male employment is more in this country. They are involved in occupations such as construction works, farming, transportation and industry works, where likely exposure to trauma is common or it might be due to males are getting priority in hospital treatment than female, from where study cases were selected.

S. aureus (36.9%) was the predominant bacteria isolated from wound infection in this study. This is consistent with reports from other studies.[2,5,19,22] The high prevalence of *S.aureus* in wound infection may be because of its endogenous source of infection. It forms the bulk of the normal flora in skin and its appendages. With the disruption of natural skin barrier, *S.aureus* easily find their way into wounds and cause infection. It may also due to contamination of wound from the environment or other sources. In contrast to this study Pondei et al, and Basu at al reported *Pseudomonas aeruginosa* as the most common wound pathogen.[23,24] This difference may be due to difference in study population or due to locality variation. *E. coli* was the next common organism followed by *Pseudomonas* spp., and *Proteus* spp. The pattern of isolation of wound pathogens is in agreement with studies published elsewhere recently.[5,11,21,22]

Antibiotic susceptibility pattern of isolates revealed that, resistance to the selected antimicrobials was very high. Bacterial isolates were mostly resistant to Amoxycillin (89-100%) and Cefradine (82-100%). Similar results were also reported in other studies.[2,5,11] Widespread and non-judicious use of these antibiotics without sensitivity testing and abuse of these drugs by self-medication to treat all kind of infections due to low cost, may have promoted development of resistance to these antibiotics. Similarly resistance to third generation Cephalosporins like Cefixime (70-97%) Ceftriaxone (60-87%) and Ceftazidime (70-100%) was high. These findings corroborate with reports of Sultana et al.[5] This may be due to the fact that third generation Cephalosprins have been used for long period in this country. So due to indiscriminate and overuse of these drugs over this time organisms have developed resistance. High resistance rate was also observed for Ciprofloxacin. Similar studies by Khanam et al, and Sultana et al, supports this findings.[5,21] But in contrast, several other studies reported higher sensitivity to Ciprofloxacin.[11,19,22] This reduced sensitivity in the present study may be the result of very extensive use of this antibiotic in clinical practice without susceptibility testing. The most effective antibiotics in this study were Imipenem, Amikacin and Gentamicin. Bacterial isolates were fairly sensitive to these antimicrobial agents, which is in agreement with other studies.[2,11,19] This may be attributed to the fact that, these antibiotics are less commonly prescribed for empirical treatment and they are used only in hospitalized patients according to susceptibility report.

Sensitivity pattern of pathogens is changing radically. This prominent and significant increase in resistance of organisms to commonly used antibiotics is alarming. Clinician should look for recent trends of susceptibility pattern, specially of that locality while choosing a treatment regimen to prevent emergence of antibiotic resistance.

CONCLUSION

From the present study it may be concluded that, the predominant isolate from wound infection was *S. aureus*, followed by *E. coli*, *Pseudomonas* spp. and *Proteus* spp. Alarmingly high rate of resistance to commonly used antibiotics was observed.

The isolates were highly resistant to Amoxycillin, Cephalosporins, Ciprofloxacin, Tetracycline and Cotrimoxazole. While they were fairly sensitive to Imipenem, Amikacin and Gentamicin. Continuous monitoring and surveillance will help the clinician in appropriate antibiotic selection and proper management of wound infection. Judicial and rationale use of antibiotic should be sought to prevent the emergence of resistant pathogen.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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