Original Article

Bacterial Isolation from Wound Swab and Pus with their Antibiotic Susceptibility Pattern in a Tertiary Care Hospital of Bangladesh

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Abstract:

Background: Wound infection is a global health problem, plays an important role in development of chronicity, delaying wound healing associated with long hospital stay.

Objective: This study was aimed to identify the bacterial pathogens present in infected wounds and characterize their resistance profile to the most common antibiotics used in the therapy.

Methods: This observational study was conducted from January, 2023 to June, 2023 in a tertiary care hospital in Dhaka, Bangladesh. A total of 220 wound swabs and pus samples were collected from the outpatient and inpatient department of this hospital with skin and soft tissue infection. Samples were inoculated on appropriate media and cultured and the isolates were identified by standard procedure as needed. Antimicrobial susceptibility testing was done by disc diffusion method according to 'The Clinical Laboratory Standard Institute Guidelines'.

Results: Out of 220 cases 165(75%) were Male and 55(25%) were female. Majority of the patients 77(35%) were in the age group of 21-31 years. Of the total 220 isolates, 156(70.91%) were culture positive cases. Among the isolated organisms, predominant bacteria was Pseudomonas spp 76(48.22%) followed by Klebsiella 27(17.31%), Escherichia coli 19(12.18%), Proteus 13(8.33%), Staphylococcus aureus 12(7.69%) and Acinetobacter 9(5.77%). Among the gram negative isolates, Pseudomonas was highly sensitive to colistin(88.15%), followed by piperacillin-Tazobactam(77.63%)and Imipenem(50%) and low sensitivity found in ceftriaxone(14.47%), Amoxiclav(13.16) and Clotrimoxazole (13.16%). Klebsiella found sensitive to colistin (90.47%), Piperacillin-Tazobactam (85.71%), Imipenem (76.19%), Gentamycin (71.43%). Escherichia coli shows low sensitivity to almost all the drug except Imipenem (94.74%), Piperacillin-Tazobactam (84.21%) and colistin(84.21%). Stapylococcus aureus show sensitivity to linezolid (100%), vancomycin (91.67%) and Ciprofloxacin (61.67%).

Conclusion: Antibiotic sensitivity pattern of various isolates will guide for appropriate selection of the antibiotic against wound infection and reduce the spread of resistance bacteria.

Keywords: *Antibiotic susceptibility, Resistance, Wound swab.*

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Introduction:

Wound infections adversely affect morbidity and mortality, delay wound healing, cause wound breakdown and are also associated with longer hospital stay and increased the cost of health care.[1] Wound infection is one of the most common and serious complications among the hospital acquired infections.[2] Microbial colonization or

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infection of wounds is an important factor in poor wound healing. In the United States, chronic wounds affect 6.5 million patients and the care costs over 25 billion dollars, In the United Kingdom, the prevalence of wounds was about 3.55/1000 population, Wound prevalence in India was 15.03/1000 of the population .[3] The prevalent organisms that have been associated with wound infection include Staphylococcus aureus 20-40% and Pseudomonas aeruginosa 5-15% of the nosocomial infection, Other pathogens such as Enterococci and members of the Enterobacteriaceae have been implicated.[4]

Indiscriminate use of anti-microbials, the spread of antimicrobial resistance is now a global problem.[5] Antimicrobial prophylaxis (AMP) is one of the most important methods for preventing surgical site infections.[6] Emergence of resistance to multiple antimicrobial agents in pathogenic bacteria has become a significant public health threat as there are fewer, or even sometimes no effective antimicrobial agents available for infections caused by these bacteria. Gram-positive and Gram-negative bacteria are both affected by the emergence and rise of antimicrobial resistance.[7]

There is need for a more rational approach to the use of antibiotics based on microbial prevalence and antibiotic susceptibility. Hence the present study was carried out to identify the causative agent of wound infection and antibiotic susceptibility pattern of the isolates, which will be beneficial as guidance for clinician to select empirical antimicrobial therapy and on the implementation of infection control measures that play an important role in reducing the emergence rate of antimicrobial resistance.

Material and Methods:

This observational study was conducted in the Department of Microbiology at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka from January 2023 to June 2023 for a period of six months. A total of 220 wound swabs and pus samples were collected from patients attending at outpatient and inpatient department of NITOR and transported to microbiology laboratory of this hospital. Socio-demographic and laboratory results which contain different bacterial isolates and antibiotic susceptibility patterns of patients were collected from the Hospital Microbiology Laboratory unit registration books by using standard data collection format. All the samples were cultured on Blood agar, MacConkey's agar media, Chromogenic media and incubated aerobically at 37^0c for 24 hours. Organisms were identified by standard microbiological procedures including colony morphology, Gram staining and biochemical tests like catalase test, Coagulase test, Oxidase test and reaction in TSI agar, MIU and Simmon's citrate agar media. Sensitivity was done using commercially available antibiotic disc (Oxoid, UK); Amikacin (30ìg), amoxyclav(20 ìg amoxycillin/10ìg clavulanic acid), ceftazidime (30 ìg), ceftriaxone (30ìg),ciprofloxacin (5ìg), Cotrimoxazole (1.25/23.75 ìg), colistin (10ìg)) gentamycin (10 ìg),imipenem (10ìg),piperacillin/tazobactum (100/10 ìg), vancomycin(30 ìg), linezolid (30ìg). The isolates were tested for antimicrobial susceptibility by the Kirby-Bauer disc diffusion technique according to the Clinical Laboratory Standard Institute (CLSI) guidelines.[8] Collected data were classified according to characteristics and various statistical methods and 'Microsoft Excel' software were used data for analysis.

Results:

Out of 220 cases 165(75%) were Male and 55(25%) were female and majority 77(35%) were in the age group of 21-30 years followed by 41 to 50 years and 31-40years which was 55(25%) cases and 37(16.82%) cases respectively (Table-I). A total number of 220 isolates, 156(70.91%) yielded growth and 64(29.09%) yielded no growth (Table-II).

Table-I

Age and gender distribution of the Participants (n=220)

Age group	Male(%)	Female(%)	Total(%)
21-30	57(34.55)	20(36.36)	77(35.00)
31-40	32(19.39)	5(9.09)	37(16.82)
41-50	43(26.06)	12(21.82)	55(25.00)
51-60	27(16.36)	7(12.73)	34(15.45)
61-70	6(3.64)	11(20.00)	17(7.73)
Grand Total	165(100)	55(100)	220(100)

Table-II

Culture characteristics of isolates(n=220)

Culture	Frequency	Percentage
No growth	64	29.09%
Growth	156	70.91%
Grand Total	220	100.00%

Among the isolated organisms Predominant bacteria was Pseudomonas 76(48.22%) followed by Klebsiella 27(17.31%) Escherichia coli 19(12.18%), proteus 13(8.33%), staphylococcus aureus 12(7.69%) and Acinetobacter 9(5.77%) (Table-3) and (Table-IV).

Table-III
Growth of bacteria in different samples

Culture	Wound swab(%)	Pus(%)	Total(%)	P value
Growth	105(66.88)	51(80.95)	156(70.91)	<0.05s
No growth	52(33.12)	12(19.05)	64(29.09)	<0.05s
Grand total	157(100.0)	63(100.0)	220(100.0)	

s-significant. Difference between growth of wound swab and pus are statistically significant

Table-IV
Organism isolated from wound swab and pus (n=220)

Organism name	Number	Proportion
Pseudomonas	76	48.72%
Klebsiella	27	17.31%
Escherichia coli	19	12.18%
Proteus	13	8.33%
Staphylococcus Aureus	12	7.69%
Acinetobacter	9	5.77%
Grand total	156	100.00%

All the bacterial isolates were tested for antimicrobial susceptibility. Pseudomonas was highly sensitive to colistin(88.15%), followed by piperacillin-Tazobactam(77.63%)and Imipenem(50%) and low sensitivity found in ceftriaxone(14.47%), Amoxiclav(13.16) and Clotrimoxazole (13.16%). Klebsiella found sensitive to colistin (90.47%), Piperacillin-Tazobactam (85.71%), Imipenem (76.19%), Gentamycin (71.43%), Amikacin(71.43%), Ciprofloxacin(66.67%). Escherichia coli shows lowest sensitivity to almost all the drug except Imipenem(94.74%), Piperacillin-Tazobactam(84.21%), colistin(84.21%) and Amikacin(57.89%).Proteus found 92.31% sensitive to Piperacillin-Tazobactam, 69.23% sensitive to Imipenem, 53,84% sensitive to Ceftriaxone, 46.15% sensitive to Ciprofloxacin and Gentamycin.100% Staphylococcus aureus were sensitive to Linezolid. Staphylicoccus aureus were also sensitive to Vancomycin(91.67%), Ciprofloxacin(61.67%), Clotrimoxazole (61.67%).(Table-V)

Table-V
Antibiotic sensitivity pattern of bacterial isoltes from wound swab and pus samples of study participants

	Sensitivity pattern of bacterial isolates n (%)					
Antibiotics	Pseudomonas (n=76)	Klebsiella (n=21)	Escherichia (n=19)	Proteus (n=13)	Staphylococcus (n=12)	Acinetobacter (n=9)
Amikacin	33(43.42)	15(71.43)	11(57.89)	5(38.46)	4(33.33)	3(33.33)
Amoxiclav	10(13.16)	3(14.28)	4(21.05)	5(38.46)	0(0.0)	11(11.11)
Ceftazidime	16(21.05)	1(4.76)	0(0.00)	0(0.00)	0(0.0)	0(0.0)
Ceftriaxone	11(14.47)	11(52.38)	6(31.58)	7(53.84)	0(0.0)	0(0.0)
Ciprofloxacin	27(35.53)	14(66.67)	7(36.84)	6(46.15)	5(61.67)	0(0.0)
Cotrimoxazole	10(13.16)	6(28.57)	3(15.79)	1(7.69)	5(61.67)	2(22.22)
Colistin	67(88.15)	19(90.47)	16(84.21)	2(15.38)	0(0.0)	7(77.78)
Gentamycin	26(34.21)	15(71.43)	8(42.10)	6(46.15)	4(33.33)	1(11.11)
Imipenem	38(50.0)	16(76.19)	18(94.74)	9(69.23)	0(0.0)	1(11.11)
Piperacillin-tazobactam	59(77.63)	18(85.71)	16(84.21)	12(92.31)	0(0.0)	2(22.22)
Vancomycin	0(0.0)	0(0.0)	0(0.0)	0(0.0)	11(91.67)	0(0.0)
Linezolid	0(0.0)	0(0.0)	0(0.0)	0(0.0)	12(100.0)	0(0.0)

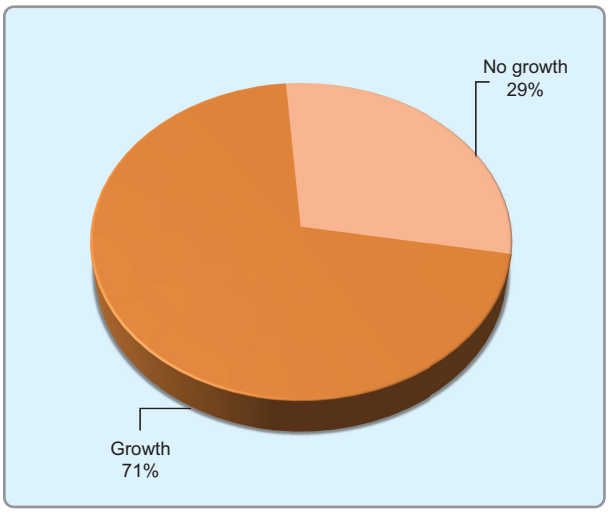

Fig.-1: *Culture pattern of bacterial isolates*

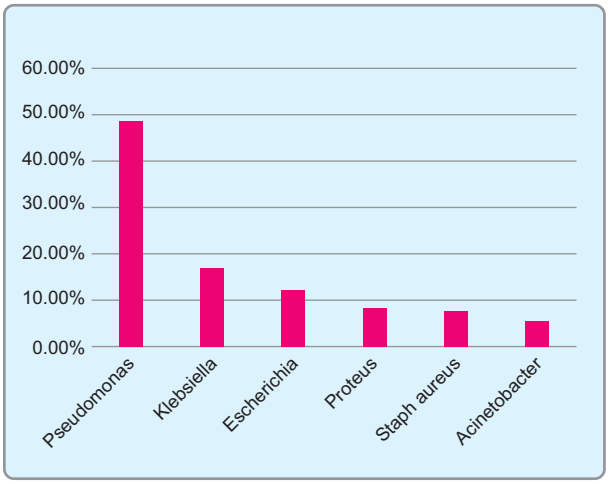

Fig.-2: *Percentage of isolated organism from patients of infected wound*

Discussion:

Wound infection is one of the health problems that are caused and aggravated by the invasion of pathogenic organisms. Patients who develop wound infection, require proper identification of the organisms for appropriate management. A changing pattern of isolated organism and their antimicrobial sensitivity which varies from hospital to hospital is usual feature. Antibiotic resistant bacterial infections have become a threat, in particular in developing countries, but to obtain an effective treatment plan, it is vital to have an overview of the current resistance level.

In the present study, about three fourth samples showed growth of bacteria on culture which was similar to other studies.[9,10] The incidence of wound infection was higher in males (75%) than in females (25%) in the present study which was consistent with another study[11] which could be explained by the fact that males were more prone to develop wound infection perhaps due to study area was an orthopaedic hospital and males were mostly attacked by accidental injury by road traffic accident than female.

In the present study majority of the cases was reported in the age group of 21-30years (35%) which coincides of the results of previous study.[12] In the present study 2nd most common age group was reported (25%) in 41-50 years and the lowest (7.76%) in 61-70 years age group.

Among Gram negative bacteria Pseudomonas (48.72%) was the most commonly isolated organism in this study followed by klebsiella (17.31%), Escherichia coli (12.18%), Proteus (8.33%). In another study in Belgian[13], Pseudomonas was found to be the most common gram-negative bacteria which was consistent with this study. This higher rate of Pseudomonas infection might be due to the fact that Pseudomonas was found the common predominant bacterial cause of nosocomial infection in many studies. [14,15] As the study area is an orthopaedic hospital, patients stay long duration in hospital and aquire nosocomial infection.

In the present study, staphylococcus aureus was found (7.69%) which was lower than the other study.[16] The discrepancy of the isolation rate may be due to infection caused by bacteria from hospital to hospital differ as different hospital deals with different type of infection.

Pseudomonas showed lower sensitivity to ceftriaxone (14.47%), Amoxiclav (13.16%) and Clotrimoxazole (13.16%) and highly susceptable to colistin (88.15%), followed by piperacillin-Tazobactam (77.63%) and Imipenem (50%) which was incosistant with the other study in China.[17]

Klebsiella was found sensitive to colistin (90.47%), Piperacillin-Tazobactam (85.71%), Imipenem (76.19%), Gentamycin (71.43%), Amikacin (71.43%), Ciprofloxacin (66.67%) which was higher than the another study.[18]

Staphylococcus aureus was highly sensitive to Linezolid (100%), Vancomycin (91.67%) which was higher than another study.[1919] Iyamba JM, Wambale JM, Lukukula CM, za Balega Takaisi-Kikuni N. High prevalence of methicillin resistant staphylococci strains isolated from surgical site infections in Kinshasa. Pan Afr Med J. 2014 Aug 21;18:322. doi: 10.11604/pamj.2014.18.322.4440. PMID: 25478043; PMCID: PMC4250016

Conclusion

The findings of the study showed that Pseudomonas was found to be the predominant among all of the isolates of wound infections and most of the gram negative isolates showed highest sensitivity to colistin, piperacillin-tazobactam followed by imipenem. Staphylococcus aureus were highly sensitive to linezolid, vancomycin followed by amikacin. So this knowledge of the most likely causative organisms and prevailing drug susceptibility pattern of this study may be helpful in deciding empirical therapy to reduce mortality and morbidity in wound infections. Therefore, periodic monitoring of the bacteriological profile and antibiotic susceptibility pattern should be done at regular intervals to identify resistant bacteria for infection control and to preserve the effectiveness of antibiotics.

Conflict of interest : None

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