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BACTERIOLOGICAL PROFILE AND ANTIBIOGRAM OF INDWELLING CATHETER TIPS IN POST OPERATIVE CARDIAC SURGICAL PATIENTS ADMITTED AT A MEDICAL COLLEGE IN KOLKATA

Microbiology

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ABSTRACT

Microbial testing and antibiotic sensitivity from central venous, arterial line and urinary catheter tips have a paramount importance in reduction of infection in post operative patients. Objectives were to find out the incidence of culture positive tips of central venous catheter, arterial line catheter and urinary catheter, and to identify the microorganisms along with their antibiotic sensitivity. Male participants were the majority with 21 to 40 years age group to be maximum affected and CABG to be the most common procedure involved. Samples were plated on blood agar and MacConkey agar, followed by performing gram stain and biochemical tests for microbial identification. Incidence of causative bacteria isolated from different catheter tips revealed gram negative bacilli to be more than gram positive organisms. Escherichia coli and Acinetobacter baumannii complex showed maximum sensitivity to Minocycline and partial sensitivity to aminoglycosides with other antibiotics to be predominantly resistant. Klebsiella pneumoniae showed maximum sensitivity to cotrimoxazole and partial sensitivity to aminoglycosides. Pseudomonas aeruginosa was pan resistant. MRSA was sensitive to linezolid, gentamicin, enterococcus faecium to vancomycin and staphylococcus saprophyticus to cotrimoxazole and linezolid. Antibiogram is thus an important tool in choosing selected antibiotics in order to prevent emergent bacterial resistance.

KEYWORDS

Antibiogram. Arterial. Central venous. Urinary, Catheter tip.

INTRODUCTION

Catheter related bloodstream infection (CRBSI) is an important cause of healthcare associated infection (HAI) of the blood stream, [1] related to increased risk of bacteraemia and sepsis. CRBSI may be caused by gram positive or gram-negative organisms but gram-negative bacilli are responsible for a higher number of infections [2] in intensive care unit (ICU) than in non- ICU patients [3].-Bloodstream infections (BSI's) are the third leading cause of HAI's [4] and also, catheter associated urinary tract infections (CAUTI) are a common postoperative complication in intensive care patients. Pathogenic organisms responsible for CAUTI and their antibiotic sensitivity pattern also vary with time and place.[5] Symptoms of UTI may not always be present in patients leading to complications and delay in diagnosis. Closed catheter system does not prevent bacteraemia. Due to extensive and improper use of antibiotics, there has been changes in the device associated infection causing organisms and their sensitivity profile over time[6]. Knowledge of CRBSI in a particular centre is the first step towards assessing the success of existing measures to prevent these infections and need for further corrective measures.[7,8]

Therefore, aim is to find out incidence of culture positive tips and to identify the microorganisms along with antibiotic sensitivity pattern.

Objectives are to find out the incidence of culture positive tips of central venous catheter, arterial line catheter and urinary catheter in post operative cardiac surgical patients, and also to identify the microorganisms along with their antibiotic sensitivity pattern.

METHODOLOGY:

After achieving IEC clearance and informed consent from the patients, this analytical cross-sectional study was conducted on postoperative cardiac surgical patients in a tertiary medical college and hospital, Kolkata over a period of 1 year. Postoperative cardiac surgical patients between 18 and 60 years of age with central venous catheter, arterial line and urinary catheter presenting with/without symptoms of septicaemia were included. Patients with HIV, Hepatitis B and Hepatitis C positive, established endocarditis and on antibiotic since last 1 month were excluded. Patient age, sex, type of surgery, culture sensitivity of central venous catheter tip, arterial catheter tip and urinary catheter tip were the study variables. On the second post operative day, when arterial line catheter and urinary catheter were removed, their tips were cut under aseptic precautions and sent immediately to the microbiology laboratory in sterile tubes. On third post operative day, central venous catheters were removed. At that time, approximately 5cm of catheter from the tips were cut under aseptic precautions and sent to the microbiology laboratory immediately in a sterile tube. On reaching the microbiology laboratory, all samples were plated immediately on blood agar and MacConkey agar and incubated at 37^0c. After overnight incubation, growth was identified by studying the colony morphology, gram staining and performing biochemical tests such as catalase, coagulase, arabinose fermentation tests for gram positive cocci and citrate utilization test, urease test, triple sugar iron test, indole test and oxidase test for gram negative bacilli. Antibiotic sensitivity tests were performed by Kirby Bauer disk diffusion method on Mueller Hinton agar and results were tallied according to 'Clinical Laboratory Standards Institute' (CLSI). Reports were collected on 5th day of sample submission. Data entry and statistical analysis were done using SPSS 23.0 statistical analysis software. Continuous variables were described by estimating mean standard deviation. Mann whitney U test, Pearson /Spearman correlation coaffinity, oneway analysis of variance (ANOVA) / Kruskal wallis ANOVA were used for continuous variables. Chi square test, ODDS ratio with 95% confidence interval was used in case of categorical variables. p value of < 0.05 was considered as statistically significant.

RESULTS:

This study included a majority of male participants, number of participants $\leq$ 20 years age being 4, between 21and 40 years being 20 and between 41and 60 years being 18, among a total of 42. 15 (36%) participants underwent CABG, 9 (21%) experienced MVR. 7 (17%) underwent DVR, ASD was seen in 3 (7%) and VSD in 8 (19%) participants.

Table1: Distribution of participants according to type of pathogens present in Central Venous Catheter tip, Arterial Catheter tip and Urinary Catheter tip (n=42)

SL NO	SAMPLE	TYPE OF PATHOGEN	NUMBER	PERCENTAGE
01	CVC tip	Escherichia coli	01	2.38%
		Acinetobacter baumannii complex	02	4.76%
		Pseudomonas aeruginosa	01	2.38%

		Staphylococcus aureus	01	2.38%
		No growth	37	88.10%
		Total	42	100%
02	Arterial catheter tip	Escherichia coli	02	4.76%
		Staphylococcus aureus	02	4.76%
		No growth	38	90.48%
		Total	42	100%
03	Urinary catheter tip	Staphylococcus saprophyticus	01	2.38%
		Acinetobacter baumannii complex	01	2.38%
		Escherichia coli	02	4.76%
		Klebsiella pneumonia	02	4.76%
		Enterococcus faecium	01	2.38%
		No growth	35	83.34%
		Total	42	100%

Table1:Among 11.90% participants whose CVC tips were culture positive, 4.76% were infected with acinetobacter baumannii complex while 2.38% each were infected with escherichia coli, pseudomonas aeruginosa and staphylococcus aureus. 9.52% participants had culture positive arterial catheter tip where 4.76% each were infected with escherichia coli and staphylococcus aureus. Urinary catheter tip was culture positive for 16.66% participants where 4.76% each were infected with escherichia coli and klebsiella pneumoniae while 2.38% each were infected with staphylococcus saprophyticus, acinetobacter baumannii complex and enterococcus faecium.

Table 2: Distribution of participants according to antibiogram of E coli (n=5), Staphylococcus saprophyticus (n=1), Acinetobacter baumannii complex (n=3), Pseudomonas aeruginosa (n=1), Staphylococcus aureus (n=3), Klebsiella pneumoniae(n=2) and Enterococcus faecium (n=1).

SL NO	PATHOGENS	Antibiotic	Sensitive No. (%)	Resistant No. (%)
01	E coli	Amikacin (n1=4)	1 (25%)	3 (75%)
		Gentamicin (n2=4)	1 (25%)	3 (75%)
		Minocycline (n3=1)	1 (100%)	-
		Ciprofloxacin (n4=3)	-	3 (100%)
		Levofloxacin (n5=1)	-	1 (100%)
		Cefepime (n6=2)	-	2 (100%)
		Meropenem (n7=2)	-	2 (100%)
		Imipenem (n8=2)	-	2 (100%)
		Ampicillin (n9=2)	-	2 (100%)
		Amoxyclav (n10=1)	-	1 (100%)
		Cotrimoxazole (n11=1)	-	1 (100%0
		Piperacillin tazobactam (n12=1)	-	1 (100%)
		Cefixime (n13=1)	-	1 (100%)
		Ceftriaxone (n14=1)	-	1 (100%)
02	Staphylococcus sapro phyticus	Linezolid (n1=1)	1 (100%)	-
		Cotrimoxazole (n2=1)	1 (100%)	-
		Erythromycin (n3=1)	-	1 (100%)
		Nitrofurantoin (n4=1)	-	1 (100%)
		Novobiocin (n5=1)	-	1 (100%)
		Gentamicin (n6=1)	-	1 (100%)
		Ciprofloxacin (n7=1)	-	1 (100%)
		Levofloxacin (n8=1)	-	1 (100%)
		Clindamycin (n9=1)	-	1 (100%)
03	Acinetobacter baumannii complex	Minocycline (n1=3)	3 (100%)	-
		Cotrimoxazole (n2=3)	-	3 (100%)
		Amikacin (n3=3)	2 (67%)	1 (33%)
		Gentamicin (n4=2)	1 (50%)	1 (50%)
		Ciprofloxacin (n5=3)	1 (33%)	2 (67%)
		Levofloxacin (n6=2)	1 (50%)	1 (50%)
		Meropenem (n7=3)	1 (33%)	2 (67%)
		Cefepime (n8=2)	-	2 (100%)
		Piperacillin Tazobactam (n9=1)	-	1 (100%)
		Imipenem (n10=1)	-	1 (100%)
		Ceftazidime (n11=2)	-	2 (100%)
04	Pseudomonas aeruginosa	Meropenem(n1=1)	-	1 (100%)
		Amikacin (n2=1)	-	1 (100%)
		Gentamicin (n3=1)	-	1 (100%)
		Ciprofloxacin (n4=1)	-	1 (100%)
		Levofloxacin (n5=1)	-	1 (100%)
		Imipenem (n6=1)	-	1 (100%)
		Cefepime (n7=1)	-	1 (100%)
		Ceftazidime (n8=1)	-	1 (100%)
		Piperacillin Tazobactam (n9=1)	-	1 (100%)
		Aztreonam (n10=1)	-	1 (100%)
05	Staphylococcus aureus	Gentamicin (n1=2)	2 (100%)	-
		Ciprofloxacin (n2=3)	1 (33%)	2 (67%)
		Levofloxacin (n3=2)	1 (50%)	1 (50%)
		Erythromycin (n4=3)	-	3 (100%)
		Nitrofurantoin (n5=1)	1 (100%)	-
		Cefoxitin (n6=2)	-	2 (100%)
		Linezolid (n7=3)	3 (100%)	-
		Cotrimoxazole (n8=1)	-	1 (100%)
06	Klebsiella pneumoniae	Amikacin (n1=3)	1 (33%)	2 (67%)
		Gentamicin (n2=3)	1 (33%)	2 (67%)
		Meropenem (n3=2)	-	2 (100%)
		Imipenem (n4=1)	-	1 (100%)
		Ciprofloxacin (n5=2)	-	2 (100%)
		Levofloxacin (n6=1)	-	1 (100%)
		Cefepime (n7=2)	-	2 (100%)
		Ceftriaxone (n8=1)	-	1 (100%)
		Cotrimoxazole (n9=1)	1 (100%)	-
		Amoxyclav (n10=1)	-	1 (100%)
		Piperacillin Tazobactam (n11=1)	-	1 (100%)
		Nitrofurantoin (n12=1)	-	1 (100%)
07	Enterococcus faecium	Ampicillin (n1=1)	-	1 (100%)
		Ciprofloxacin (n2=1)	-	1 (100%)
		Levofloxacin (n3=1)	-	1 (100%)
		Nitrofurantoin (n4=1)	-	1 (100%)
		Tetracycline (n5=1)	-	1 (100%)
		Vancomycin (n=1)	1 (100%)	-
		Teicoplanin (n7=1)	1 (100%)	-
		Linezolid (n8=1)	1 (100%)	-

Table 2 : 1 participant (2.38%) with CVC, 2 participants (4.76%) each with arterial line and Urinary Catheter were infected with E. coli which showed 100% sensitivity to minocycline and 25% to amikacin and gentamicin each. staphylococcus saprophyticus was found in 1 participant (2.38%) with urinary catheter and was 100% sensitive to linezolid and cotrimoxazole. Infection with acinetobacter baumannii complex was seen in 2 participants (4.76%) with CVC and 1 participant (2.38%) with urinary catheter and was 100% sensitive to minocycline, 67% to amikacin, 50% to gentamicin and levofloxacin and 33% to ciprofloxacin and meropenem. Pseudomonas aeruginosa, being resistant to all antibiotics was found in 1 participant (2.38%) with CVC. 1 participant (2.38%) with CVC and 2 participants (4.76%) with arterial catheter were found to have infection with staphylococcus aureus which was 100% sensitive to gentamicin, nitrofurantoin and linezolid, 50 % to levofloxacin and 33% to ciprofloxacin. Klebsiella pneumoniae was found in 2 participants (4.76%) with urinary catheter have and was 100% sensitive to cotrimoxazole, 33% to amikacin and gentamicin each. Enterococcus faecium was present in 1 participant (2.38%) with urinary catheter which showed 100% sensitivity to

vancomycin, teicoplanin and linezolid.

DISCUSSION:

Previously done study of Leonardo Lorente and co-workers [3] revealed on 2005 that incidence of CRBSI was 2.79 infections per 1000 catheter days, among which CVC was responsible for 2.09% of total cases. Another research done by S Singh and coworkers.[7.] in 2010 showed that the overall infection rate for CRBSI was found to be 0.48 per 1000 device days. Ramanathan Parameswaran and coworkers.[1] in the year 2011 showed that the incidence of CRBSI was 8.75 per 1,000 catheter days. Present study revealed that the incidence of culture positive tips of central venous catheter is 11.90% of total participants, of arterial line catheter is 9.52% and of urinary catheter is 16.66% of total participants.

Study of FJ Mansur and co-workers [8] detected pseudomonas as the most common colonizing bacteria on catheter tips. According to study by P. Sharma et al,[2] 89% samples showed culture positivity, with gram negative bacilli being the major cause (64%). Escherichia. coli was the most common organism isolated followed by Klebsiella pneumonia. Ramanathan Parameswaran and co-workers [1] stated coagulase negative staphylococci (CONS) to be the most common organisms causing central venous catheter tip infection. Present study revealed that 4.76% of participants with central venous catheter were infected with Acinetobacter baumannii complex while 2.38% each were infected with escherichia coli, pseudomonas aeruginosa and staphylococcus aureus. 88% participants showed no growth. Regarding pathogens present in arterial line, 4.76% infection each were due to escherichia coli and staphylococcus aureus. 91% participants had no growth. Participants with urinary catheter showed 4.76% infection to be due to escherichia coli and klebsiella pneumoniae while 2.38% each due to staphylococcus saprophyticus, acinetobacter baumannii complex and enterococcus faecium. Here 83% participants showed no growth.

M S Tullu and coworkers [5] found escherichia coli as the commonest organism causing CAUTI with maximum susceptibility to nitrofurantoin and amikacin. Acinetobacter was the most common organism on central venous catheter tips with maximum susceptibility to ciprofloxacin. Among gram positive bacteria, staphylococcus aureus was most common where vancomycin and linezolid were the most sensitive antibiotics. Antibiogram of present study revealed that escherichia coli was 100% sensitive to minocycline and 25% sensitive to amikacin and gentamicin each. Staphylococcus saprophyticus analysis revealed 100% sensitivity to linezolid and cotrimoxazole. Acinetobacter baumannii complex was found to be be 100% sensitive to minocycline, 67% to amikacin, 50% to gentamicin and levofloxacin, 33% to ciprofloxacin and meropenem. Pseudomonas aeruginosa was found to be pan-resistant. 100% resistance was seen with meropenem, amikacin, gentamicin, levofloxacin, ciprofloxacin, imipenem, ceftazidime, cefepime, piperacillin tazobactam and aztreonam. Staphylococcus aureus was found to be 100% sensitive to gentamicin, nitrofurantoin and linezolid, 50% sensitive to levofloxacin and 33% to ciprofloxacin. Klebsiella pneumoniae showed 100% sensitivity to cotrimoxazole 33% to amikacin and gentamicin. Enterococcus faecium showed 100% sensitivity to vancomycin, teicoplanin and linezolid.

Empirical antibiotics are usually administered in post cardiac surgical ITU patients with intravenous cloxacillin and ceftazidime. Currently, antibiograms are available along with microbiology laboratory service. As the trend of bacterial sensitivity and resistance is changing frequently, antibiogram is being reviewed on a timely manner, thus preventing sepsis and bacteraemia.

Incidence of CRBSI from the Johns Hopkins University[4] was shown as the third leading cause of hospital-acquired infections with attributable mortality rate from 12% to 25%. Several interrelated factors have been proposed to participate in the pathogenesis of CRBSI. Resistance to antibiotic therapy due to biofilm formation also has an important role in development of bacteraemia. However, due to extensive and improper use of antibiotics, there has been changes in the resistant organisms and their sensitivity profile with time. Also, knowledge of resident microbial flora and their antibiotic susceptibility pattern is necessary for formulating a rational antibiotic policy for postoperative cardiac ICU patients. Thus, an attempt was made to study the current trend of causative organisms and their antibiotic susceptibility in postoperative patients after cardiac surgery.

CONCLUSION:

This study concluded with increased incidence of gram-negative organisms in CRBSIs in postoperative cardiac surgical patients where antibiogram is an important tool in choosing selected antibiotics in order to increase chance of successful treatment and to prevent emergent bacterial resistance. Hence, each institution is strongly urged to have their own antibiogram in the management of CRBSIs. For providing a better representation of national infection patterns, data from multicentre studies can be incorporated.

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