Original Article

Bacteria colonizing central venous catheter line and their Antimicrobial susceptibility pattern

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Objective: To determine the frequency of bacteria colonizing central venous catheter line and their antimicrobial susceptibility pattern.

Methodology: This cross sectional study was conducted in the department of pathology, Sahara Medical College, Narowal from January to June 20201. Sample size was calculated using WHO sample size calculator and we used non-probability consecutive sampling technique.Central venous catheter tip colonization was defined as bacterial colony count ≥15 CFU/ml by semi quantitative technique. Antibiotic susceptibility pattern of isolated bacteria was determined using Disc Diffusion Method as recommended by CLSI guidelines. Data were analyzed using SPSS version 17.

Results: A total 125 specimens were obtained from 125 patients. Micro-organisms growth was obtained on 110(88%) specimens. Gram-positive bacteria were isolated in 60(54.5%) specimens, gram-negative bacteria in 23(20.9%) specimens. Vancomycin and linezolid were most effective against gram positive bacteria while colistin and imipenem against gram negative organisms.

Conclusion: Bacteria colonizing central venous catheter line were very common. Most organisms were gram positive and sensitive to vancomycin and linezolid.

Keywords: Antimicrobial susceptibility, isolated bacteria, central venous catheter.

INTRODUCTION

Central venous catheter (CVC) are often used to give parenteral nutrition and drugs and are used for hemodialysis in the patients with renal failureand for hemodynamic monitoring among critically ill patients.[1,2]They can be associated with many mechanical complications and infections.[3] Neurovascular injury, hemothorax and pneumothorax are related complications.

A study from Sargodha reported that most commonly gram positive organisms were found in 54.3% bacterial samples followed by candida species found in 23.4% and gram negative organisms found in 17.1% bacterial samples.[4] Tribler et al found *Staphylococcus epidermidis* predominantly colonizing catheter tips in 62% bacterial cultures.[5] Patients with CVCs are at high risk of developing catheter related infection such as thrombophlebitis, catheter site infection, hematogenous infections, metastatic infections, bacteremia and sepsis.[6] If these infections are not treated immediately can lead to death.

These infections can increase morbidity and mortality rate among the patients and cast a huge burden on our healthcare system. It causes prolong stay of the patients in the hospital requiring critical care. Catheter related blood stream infection (CRBSI) is difficult to treat with high morbidity and mortality rate.[7] CRBSI risk is 64 times more in CVCs than peripheral catheters.[8] Surface of CVC immediately develop a coating of plasma protein called fibrin just after its insertion into the vein.[9] Bacteria having affinity for fibrin protein immediately attract and adhere to it. It leads to colonization of the bacteria on the catheter tips.[10]This study was conducted to determine frequency of various pathogens isolated from the central venous catheters and antibiotic susceptibly pattern of these bacteria help us to give suitable antibiotic in these patients.

METHODOLOGY

This is a cross sectional study conducted in the department of pathology, Sahara Medical College Narowal from January to June 20201. Sample size was calculated using WHO sample size calculator. Sample selection was done using non-probability consecutive sampling technique. Consent was taken from all the cases in study group. Approval was taken from the institutional Ethical Review Committee (Ref. IRB-801, dated: 16/6/2020).

All CVC tips (2-inches segment of the CVC in sterile tube or container) received in the laboratory were

processed, isolates taken and cultured. These samples were processed using Maki's semi quantitative roll plate method.[10] Tip of the catheter was removed using sterile forceps and rolled back and forth on the blood agar surface. Incubation of culture plates was done under aerobic conditions on 37 degree centigrade temperature. Examination of the culture plates was done after 24, 48 and 72 hours of incubation to see microbial growth.

CVC tip colonization was defined as bacterial colony count ≥ 15 CFU/ml by semi quantitative technique. Micro-organisms were further identified by colony forming morphology, gram staining and biochemical techniques. Antibiotic susceptibility pattern of isolated bacteria was determined using Disc Diffusion Method as recommended by CLSI guidelines (Clinical Laboratory Standard Institute).

Statistical Analysis: The data were analyzed using SPSS version 17.Frequency and percentages were determined for qualitative data and means, standard deviation for quantitative data.

RESULTS

A total 125 bacterial specimens were obtained from 125 patients. Mean age of the patients was 52.7 ± 5.4 years (range 20-70). Out of 110 study cases, 74 (67.3%) were male and 36 (32.7%) were female patients. Micro-organisms growth was obtained on 110 (88%) specimens. Gram-positive bacteria were isolated in 60 (54.5%) specimens, gram-negative bacteria in 23 (20.9%) specimens (Fig. 1). *Coagulase negative Staphylococcus* bacteria were the most common bacteria found in 30 (27.3%) specimens followed by *Staphylococcus aureus* 25 (22.7%) and *Klebsiellapneumonae* 14 (12.7%), while *Escherichia coli* were the least common detected in 02 (1.8%) specimens.

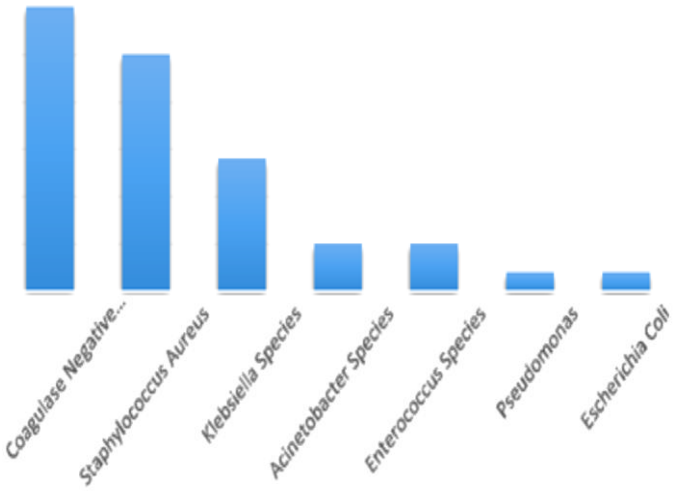

Fig. 1: Frequency of bacteria isolated from CVCs.

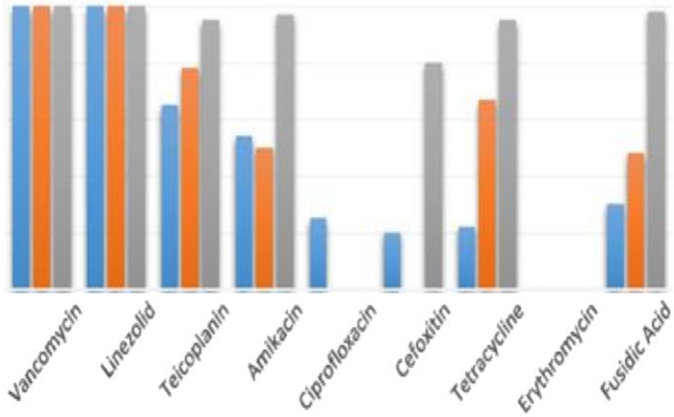

Fig. 2: Antibiotic susceptibility pattern of gram-positive bacteria.

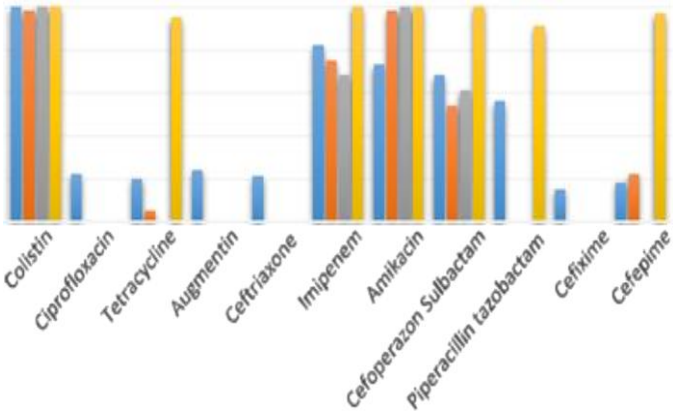

Fig. 3: Antibiotic susceptibility pattern of gram-negative bacteria.

Vancomycin, linezolid, teicoplanin and amikacin showed excellent response against coagulase negative staphylococci, *Staphylococcus aureus* and *enterococcus bacteria* (Fig. 2). Colistin showed 100% response against *Klebsiellapneumonae*, *Escherichia coli*, *Acinetobacter* and *Pseudomonas*, while imipenem, amikacin and cefoperazon sulbactam also showed very good response against gram negative bacteria (Fig. 3).

DISCUSSION

In our study catheter tip infection rate was 88%. Gram positive bacteria were found in 60 (54.5%) and gram negative bacteria in 23 (20.9%) samples. *Coagulase negative staphylococci* were most commonly found in 30 (27.3%) while overall frequency of staphylococci positive samples was 55 (50%). *Klebsiellapneumonae* found in 14 (12.7%), *Escherichia coli* in 02(1.8%) and pseudomonas in 02 (1.8%) isolates as well. Previous studies have shown catheter tip infection rate of 39.6%, 24.5%, 15% and 18%, respectively.[11-14]

A study done by Gominet et al reported coagulase negative staphylococcus (CoNS) bacteria main cause of nosocomial infections among the patients having CVC despite all aseptic measures taken during catheter insertion. CoNS colonize on catheter tip and causes dissemination of bacterial infection leading to early removal of catheter tip due to infection.[15]

Bacteria on the skin around catheter can move to catheter and colonize inside on catheter tips and causing infections. These infections are caused by those bacteria that have ability to adhere and colonize on the tip of catheter. A local study from Islamabad by Ali et al reported that *Staphylococcus epidermidis* was the most common bacteria isolated from the catheter tips in 24.6% specimens followed by *Escherichia coli* found in 21.7%, *Staphylococcus aureus* in 18.8% and *Klebsiellapneumonae* found in 14.3% specimens. Gram positive bacteria showed maximum sensitivity to linezolid (100%), minocycline (88%) and vancomycin (86%), while gram negative bacteria showed maximum sensitivity to amikacin (95 %) and imipenem (87%).[16]

A study conducted by Saliba et al reported *Acenitobacterbaumanni* (29%), *Klebsiella pneumonia* (14%), Staphylococcus aureus (19%) and E. coli (05%) common bacteria colonizing CVC tips. Other less common organisms included *pseudomonas* and *enterococcus*. Candida species were found in only 1% samples.[17] Bacterial colonization of central venous catheter tips can lead to disseminated blood stream infections which can be confirmed by culture of isolates from catheter tips and blood sample,after determining bacterial culture and sensitivity pattern causative organism and suitable antibiotics can be found and infection can be treated more effectively.[18]

Pichitchaipitak et al found *staphylococcus aureus*, *coagulase negative staphylococci* and yeast as the most common causative organisms of catheter related blood stream infectons.[19] Aseptic measures during insertion of CVC can reduce infection rate, morbidity and mortality due to catheter related blood infections.[20] Daily monitoring of the catheter, early detection of the infection is necessary. Determining culture and sensitivity pattern of bacterial isolates is very important for eradication of the infection successfully and to prevent development of antibiotic resistance due to improper use of antibiotics.[21]

CONCLUSION

Catheter tip related infections are very common among hospitalized patients and most commonly due to gram positive organisms. Staphylococcus species are leading cause of catheter related blood stream infections followed by gram negative organisms including Klebsiella, E.coli and pseudomonas. Vancomycin and linezolid proved to be the most effective against gram positive bacteria while colistin and imipenem were most effective against gram negative organisms in this study.

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Conception and design: Saeed Anabat-ul-Hassan, Sadia Zia, Usman Ali, Mahreen Mahmood.
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Drafting of the article: Sadia Zia.
Critical revision of article for important intellectual content:
Statistical expertise: Yasmeen Lashari.
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