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A study on central line associated bloodstream infections (CLABSI) in hemodialysis patients at a Tertiary care Hospital

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Abstract

Central line catheters are the main source of vascular access in the initial stages of hemodialysis for most of the chronic kidney disease patients. Their immunocompromised state makes them more vulnerable for catheter associated nosocomial infections. The present study was aimed to determine the incidence, causative organisms, antibiogram and the role of bundle care in the prevention of these infections. It is a cross sectional study carried out over a period of 6 months in a tertiary care hospital which included 70 adults (18-60 years) undergoing hemodialysis and suspected of septicaemia. Two blood samples 5ml each were collected from each patient, one from peripheral line and other from central line, transported and processed by standard bacteriological methods. Antibiotic susceptibility was determined by Kirby Bauer disk diffusion method. Incidence of CLABSI was 22.5% with rate being 11. 49 episodes per 1000 catheter days. Incidence was more in adults between the age of 30 to 39 and there was male predominance. *S. aureus* was the predominant isolate. The other isolates were *Klebsiella* species*, Acinetobacter and Pseudomonas*. Gram positive organisms were sensitive to teicoplanin, linezolid, Clindamycin, Vancomycin and resistant to Azithromycin. Gram negative organisms were 100% sensitive to Imipenem and Cefepime and 100% resistant to Ampicillin. CLABSI are a major cause of hospitalization and mortality in hemodialysis patients. Since CVCs are increasingly being used every dialysis unit should have an infection surveillance program to facilitate identification of catheter related infections and timely interventions to reduce infection rates and improve patient clinical outcomes.

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Introduction

Chronic kidney disease (CKD) patients comprise a major percentage of patients in the country. Most of these patients land up in hemodialysis atleast once a week. A significant percentage of these patients resort to temporary/permanent central venous catheters for vascular access as they are less likely to have functional native AV fistula at the time of initiation of hemodialysis as mentioned in a study done by Chandra *et al.,* 2016 and Jaar BG *et al.,* 2000. It is stated that in Chandra *et al.,* 2016 that the relative risk of bacteremia is substantially increased in dialysis catheter use compared to native arteriovenous fistulas. As most of these patients have comorbidities like diabetes, old age etc. they are more prone to infectious complications among which catheter related blood stream infection (CRBSI) is the leading cause increasing the length of hospital stay and morbidity in hemodialysis patients. The risk of blood stream infection increases tremendously with duration of the catheter use. Hemodialysis patients with catheter have 2-3 fold increased risk of hospitalization and death compared to patients with AV fistula and graft as mentioned by Miller *et al.,* 2016. By several analyses by Rello Ochagavia, Sabanes *et al.,* 2000 and Deepti *et al.,* 2014 the cost of central venous catheter (CVC) associated bloodstream infections (BSIs) is substantial, both in terms of morbidity and in terms of financial resources. Hospital infection control practices along with surveillance programmes have reduced the device associated infections tremendously. The device-associated infections are kept under surveillence by expressing them as the number of device-associated infections per 1000 device days as per the guidelines stipulated by Centre for Disease Control and Prevention, USA, 2019. Very few published studies reporting rate of BSI related to CVC in hemodialysis units are available in the Indian literature like Chopdekar *et al.,* 2011. Systemic antibiotic therapy guided by antibiograms act as effective management of these infections (R. Vanholder *et al.,* 2010). However, very little information is available on reported antibiograms in this group of patients. Hence the present study was undertaken to study the incidence of CLABSI and antibiogram in hemodialysis patient.

Materials and methods

A cross sectional study carried out in tertiary care hospital with a well-established hemodialysis unit in Southern India over a period of six months. The study included all hemodialysis patients > 18 years with central line i. e either subclavian, jugular or femoral line admitted in Department of Nephrology. The study excluded the hemodialysis patients with age< 18yrs and patients with existing AV fistula and AV grafts. The patients with non-functional AV fistula or graft with central line as portal of hemodialysis were included in the study.

These patients were kept under surveillance as per CDC guidelines 2019[f] and bundle care provided to them is monitored along with signs and symptoms of septicaemia which included:

- Fever with chills (>38^{0}C)
- Bradycardia
- Hypotension

Bundle care checklist as per NHSN guidelines 2019, Wasserman S et al., 2018 and Ling et al., 2016:

	Central line bundle	
1.	Hand hygiene	✓
2.	Daily dressing at insertion site	✓
3.	Use of semipermeable dressing	✓
4.	Hand wash after procedure	✓
5.	Any local signs of infection	No
6.	Date of insertion data	✓

BSI (Blood Stream Infection) was confirmed based on following criteria (as per CDC guidelines 2019):

LCBI criteria 1 (Lab Confirmed Blood Stream Infection)

- Patient of any age has a recognized bacterial or fungal pathogen not included on the NHSN common commensal list, identified from one or more blood

specimens obtained by a culture or non-culture based microbiologic testing methods and

• Organism (s) identified in blood is not related to an infection at another site.

LCBI criteria 2

• Patient of any age has at least one of the following signs or symptoms: fever (>38. 0 C), chills, or hypotension. and

• Organism (s) identified in blood is not related to an infection at another site.

• The same NHSN* common commensal is identified by a culture or non-culture based microbiologic testing method, from two or more blood specimens collected on separate occasions.

CLABSI (Central Line Associated Blood Stream Infection)

A laboratory confirmed bloodstream infection where an eligible BSI organism is identified and an eligible central line is present on the LCBI DOE (date of event) or the day before.

CLABSI is confirmed in a patient with confirmed BSI (blood stream infection) when the following criteria are fulfilled:

- The patient should have an eligible central line.
- The patients should be on central line for more than two consecutive days.
- The patient should be on central line on the day or day before the positive blood specimen collection.

Two blood samples (10ml each) one from central line and another from peripheral line was collected from patients with suspected signs and symptoms of septicaemia and on central line for more than two days.

Samples processed by conventional aerobic bacteriological method and antimicrobial susceptibility determined by Kirby Bauer disk diffusion method.

Results

Out of 70 subjects suspected with signs and symptoms of septicaemia 18 episodes of CLABSI have occurred in 17 subjects. One subject had 2 episodes of CLABSI. Out of 17 subjects 16 were on jugular central line and one subject was on permcath. Among 18 episodes 11 (61.11%) episodes were due to gram positive infections and 7 (38.8%) episodes were due to gram negative infections. *Staphylococcus aureus* was the most common gram positive bacteria isolated in 10 (55.55%) subjects. The other gram positive isolate was *Coagulase negative staphylococcus (CONS)*. *Klebsiella species* was the most common gram negative bacteria isolated in 3 (16.6%) subjects. The other gram negative isolates were *Acinetobacter species* and *Pseudomonas aeruginosa*. Organism wise distribution of CLABSI was shown in Fig. 1, Out of 18 episodes of CLABSI 10 episodes occurred in age group 30-39. The remaining CLABSI episodes occurred in age group 20-29 and 60-69. A major percentage (77.7%) of infections occurred in males. Two subjects had diabetes as comorbidity. Antibiotic sensitivity pattern of gram positive and gram negative isolates was shown in Fig. 2 and Fig. 3.

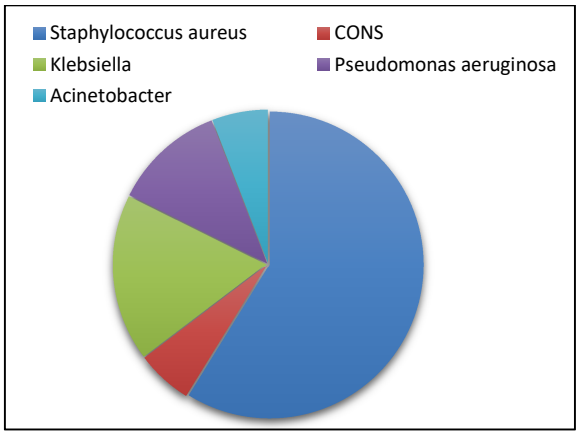

Fig. 1. Organism wise distribution of clabsi.

Discussion

In the developing countries the ICU CLABSI rate ranges from 1.6 to 44.6 cases per 1000 CL days as observed by Deepti *et al.,* 2014. National nosocomial infection surveillance system of the Centre for Disease Control and Prevention, Atlanta, USA, reports a CRBSI rate of 5.8 per 1000 catheter days. Since most of the Indian data has not been expressed in terms of device

utilization frequencies as the denominator, comparison with other studies in nosocomial infection surveillance becomes difficult (Chopdekar *et al.,* 2011). Our study showed an incidence of CLABSI in hemodialysis patient being 22.5% with rate being 11.49 episodes per 1000 catheter days which is similar to the study conducted by Chandra A. *et al* in India which showed a CRB rate of 11.87 episodes per 1000 catheter days. This is very high as compared to incidence in study conducted by Thompson *et al.,* 2017 in Canada which is 0.19 per 1000 catheter days. KDOQI guidelines suggest that incidence of CRB should be less than 10% at 3 months and 50% at 1 year.

Patients with age between 29-39 years showed maximum prevalence with male predominance in our study. This is in contrast to most study where >50 years is the common age group to have HAIs. But our study correlated with Indian study (Chandra A. *et al.,* 2016). Lately HAIs have been occurring in adult population which is explained by increase in comorbid conditions (CKD, diabetes) among adults in India.

Our study showed a dominance of gram positive organisms (61.11%) followed by gram negative organisms which is similar to most of other studies including Deepti *et al.,* study conducted in India among ICU patients, except that there is an increase in trend of gram negative organisms (38.8%) which is similar to Chandra A *et al.,* 2016 (40%) and Deepti *et al.,* 2014. Our study did not show any fungal isolates which is in contrast to other studies.

Most common organism isolated in our study was *Staphylococcus aureus* which is in correlation with Deepti *et al.,* 2014 study, in contrast to Chandra A. *et al.,* 2016 observed *CONS* as the most common organism isolated.

There has been tremendous changes occurring in AST pattern over years because of emerging resistant organisms most commonly gram negative. Our study showed an increase in resistant pattern for macrolides and fluoroquinolones (40% susceptibility) with emerging resistance to meropenem (60% susceptibility) among gram positive organisms. This is not seen in other studies Deepti *et al.,* 2014. This can be explained by inadvertent use of carbapenems without proper indication prior to culture. Gram negative organisms were 66% sensitive to fluoroquinolones and 0% sensitive to penicillin antibiotics but 66.6% sensitivity to aminopenicillins which is also seen in other studies like Chandra A. *et al.,* 2016. Even though there is an increase in trend of gram negative organisms, cautious use of higher antibiotics when suspecting HAIs will help us in reducing emergence of resistance strains.

Other correlated comorbid conditions like diabetes, showed insignificant increase in risk of CLABSI in our study, although these co-morbidities in adults increased their chances of being catheterised and hence increases in chances of infection. But the risk accessed is insignificant when compared to study done by Thompson *et al.,* 2017.

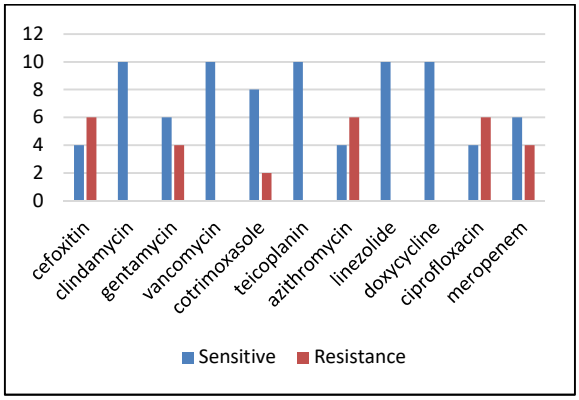

Fig. 2. Antibiotic sensitivity pattern in gram positive organisms.

Site of insertion of central line did not appear to influence CLABSI rate in our study since insertion bundle was appropriately followed in all patients. Maintenance bundle care seemed to be important as the risk of infection increased in patients with improper bundle care.

Another important risk factor is prolonged duration of catheter use which is directly related to increase in risk and prevalence of CLABSI in our study.

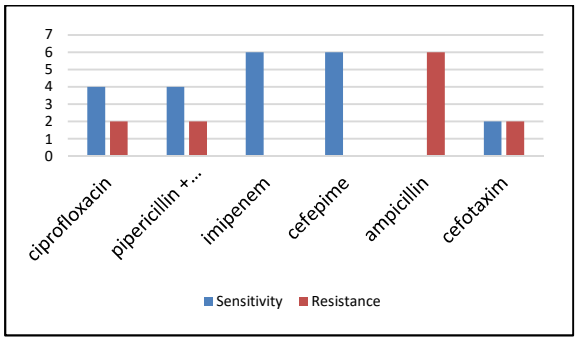

Fig. 3. Antibiotic sensitivity pattern in gram negative organisms.

Conclusion

The incidence of CLABSI is 22. 5%, rate being 11. 49 episodes per 1000 catheter days. The dominance of gram positive organisms (61.11%) over gram negative organisms (38.8%). The predominant gram positive organism is *Staphylococcus aureus* and predominant gram negative organism is *Klebsiella* species. Prolonged duration of catheter and inadequate practice of catheter bundle care was the predominant risk factor in the present study.

Conflict of interest: None

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