The Egyptian Journal of Hospital Medicine (January 2023) Vol. 90 (2), Page 3703-3711

Hemodialysis Catheter Infections and The Role of Health Education Program Implementation in Benha University Hospital

Mohamed E. Ibrahim[1], Rehab Salah Fathy Zaki[1], Reham Salom Mohammed Abd El-Aziz*[1], Abeer E. AbdElmaksoud[2]
Departments of [1]Internal Medicine, [2]Community Medicine, Environmental and Occupational Medicine, Faculty of Medicine, Benha University, Egypt
***Corresponding author:** Reham Salom Mohammed Abd El-Aziz, Mobile: (+20) 01062311101,
E-mail: rehamsalom171@yahoo.com

ABSTRACT

Background: A bloodstream infection that has been proven by a laboratory within 48 hours after the installation of a central line and is unrelated to an infection at another location is known as a "central line-associated bloodstream infection" (CLABSI).

Objective: To improve the safety of patients with Central Venous Catheter (CVC) via decreasing the incidence of Catheter–Related Blood Stream Infection (CRBSI) in hemodialysis patients at Benha University Hospital.

Patients and Methods: This study was a prospective interventional study conducted at Hemodialysis Center in Benha University Hospital on 45 patients with CVC inserted more than 48 h and followed up for CRBSI during the period from the beginning of February 2021 till the end of April 2021, followed by educational program during May 2021 about general infection control measures and to preventive bundles of CLABSI, then reassessment was done during the period from the beginning of June 2021 till the end of September 2021.

Results: 45 patients, males and females were equally distributed before and after intervention educational program, whose median age was 62 years old, the incidence of infection in the pre–intervention was 40 % which was significantly decreased after intervention to 13.3 %. The intervention had significantly decreased the incidence of the participants, fever, chills, discharge and tenderness (P< 0.05), comparison between infection control practices (pre-intervention versus post- intervention) showed that the intervention had significantly improved the infection control practices.

Conclusion: The catheter related infection (CRI) among dialysis patients is due to prolonged duration of CVC usage and difficult insertion have been found as risk factors of infection. Patient role (Keep the catheter dressing clean and dry), catheter type and CVC insertion duration was the significant predictor of presence of infection.

Keywords: Hemodialysis, Catheter infections, Health education program, Implementation.

INTRODUCTION

CVC is an implanted medical device that is placed in a central vein. A particular kind of CVC used for individuals who require hemodialysis is a hemodialysis catheter (HD line). These catheters' bigger lumens enable the processing and return of huge amounts of blood to the patient. CVCs compromise the skin's barrier function, increasing the risk of bacterial and/or fungal infection. If an infection spreads to the circulation, it may result in severe sepsis, which can be fatal [(1)]. The term "CLABSI" refers to a bloodstream infection that has been verified in a lab, appears within 48 hours of central line placement, and is unrelated to any previous infections [(2)].

One of the leading global causes of morbidity and mortality is end-stage renal disease (ESRD), is becoming more prevalent in society, posing significant health care issues [(3)].

The frequency of ESRD increased to 483 patients per million people in Egypt, according to the 9th Annual Report of The Egyptian Renal Registry published by the Egyptian Society of Nephrology and Transplantation (ESNT) [(4)].

International recommendations state that delaying the referral of patients in stage 4 of chronic renal disease (pre-dialysis) to a nephrologist for the implantation of an arteriovenous graft or fistula leads to the urgent need for hemodialysis and an increased risk of problems down the road. The right antibiotic selection and avoiding catheter salvage efforts can reduce infection-related death [(2)].

Bacteria entering the bloodstream by invasive central venous and arterial catheters, tunneled catheters, peripherally implanted central lines, and intravenous lines are risk factors for CRBSI. Moreover, a number of variables, such as a head injury, drowsiness, starvation, immunosuppression, mechanical ventilation, and surgery, can cause a primary infection with subsequent bacteremia [(5)].

Evidence-based methods for lowering CLABSI washing hands with soap and water, using maximum barrier procedures during sterile insertion (cap, mask, sterile gown, sterile gloves and full sterile drape). The use of 2% chlorhexidine solution with adequate air drying before insertion, avoiding the femoral site for catheterization, and early removal of superfluous catheters resulted in a sustained decrease in infection incidence, highlighting the importance of these essential procedures in preventing CRBSI. The most likely organism, host variables, and the overall clinical picture should all be taken into consideration when empiric treatment is used when CLABSI is suspected. Quickly starting empiric therapy should be done while cultures are being obtained. Coverage for typical Gram-positive and Gram-negative species is often required. It is

Received: 27/10/2022
Accepted: 30/12/2022

important to consider the regional prevalence and antimicrobial susceptibility trends in institutional antibiograms [6].

The aim of this study is to improve the safety of patients with Central Venous Catheter (CVC) via decreasing the incidence of Catheter–Related Blood Stream Infection (CRBSI) in hemodialysis patients at Benha University Hospital, through **the following objectives,** achieved through the implementation of a health education programme for hemodialysis health care providers: calculation of the incidences of CRBSI in hemodialysis patients over the course of three months before and after intervention education programme about the infection control practices; evaluation of the level of knowledge of health care providers to general infection control measures and to preventive bundles of CLABSI to decrease the incidence of CRBSI in hemodialysis.

PATIENTS AND METHODS

This study was a prospective interventional study, which was conducted on 45 patients with CVC inserted more than 48 h and followed up for CVC-related infection during the period from the first of February 2021 till the end of April 2021 followed by educational program during May 2021 then reassessment was done during the period from the first of June 2021 till the end of September 2021 at Hemodialysis Center in Benha University Hospital.

The Target groups: (A) All patients with CVC in (3 months before and 3 months after intervention). (B) Assessment of knowledge of general infection control measures and to preventive bundles of CLABS of the study included all healthcare professionals (nurses and doctors) who worked in the examined units and were involved in the insertion, maintenance, and care of CVC during the study period.

Operational design:

A. Data collection: 3 phases

1st phase (Pre-intervention): Duration: 3 months from the first of February 2021 till the end of April 2021.

A- Sociodemographic characteristics of patients in studied hemodialysis cases (age, sex, comorbidity, education and income [7], and patient role keep the catheter dressing clean and dry [8].

B- Knowledge about bundles for prevention CVC infection through a constructed questionnaire that covers the following areas hand hygiene betadine before inserting catheter, cutaneous disinfection before CVC insertion, usage of a mask, usage of a sterile gloves, usage of sterile drapes, usage of a sterile gown, spare it by appropriate sanitizer, usage of a sterile bandage every 48 hours or when contaminated or wet, closure of valves, adherence to the closed cycle of solutions, commitment to disinfecting the valves and taps with 70% alcohol before and after handling the catheter, commitment to washing hands before and after handling the catheter [9].

C- Active monitoring to determine the occurrence of CRBSI [10]. This indicates that the infection was looked for during the patient's stay by screening a range of data sources, including:

1. Clinical notes for patients (sign of infection) fever, chills, a discharge, and discomfort at the CVC site [11].
2. Lab identification: empirical antibiotic use before culture result, microorganisms' identification, antibiotic susceptibility.

***Specimen collection:**

For cases of clinically suspected CRBSI, the catheter's distal 5 cm were severed and the central line was aseptically removed before being cultured using a standardised semi-quantitative technique. A second blood sample from a peripheral vein was also collected and placed in blood culture bottles before being subcultured on blood agar plates. A central venous catheterized patient has a recognised microbe that was isolated from another peripheral vein blood cultures after at least 48 hours after central venous catheterization and was unrelated to an infection at another location. This condition is known as a laboratory-confirmed CRBSI [12]. At Benha University Hospital's Clinical Pathology Department, laboratory tests were conducted.

2nd phase (Intervention phase): Duration: 1 month, and activities: The on set by the CDC and the Ministry of Egyptian Health were distributed to all medical staff working in dialysis facilities as Arabic booklets and posters.

CVC (uses, precautions taken during insertion, replacement, timing, frequency of dressing changes, signs of catheter-related blood stream infection, and factors influencing its occurrence), infection control procedures (hand washing, protective gear use), and patient role in maintaining aseptic catheter [13, 14].

3rd phase (Post intervention): Duration: 3 months and the following activities: a) reevaluating healthcare professionals' understanding of bundles for preventing CVC infection; b) actively monitoring the incidence rate of CVC-related BSI following intervention; and c) reevaluating patient clinical records (sign of infection).

Ethical approval:

A formal authorization from the medical school at Benha University was used to enter the dialysis facilities. To ensure their participation, the title and goals of this study were explained to the participants. Also, written permission was obtained. The study was conducted out in line with the Helsinki Declaration.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 18 for Windows® (IBM SPSS Inc, Chicago, IL, USA).

Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test ($\chi 2$) to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean ± SD (Standard deviation). Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value < 0.05 was considered significant.

RESULTS

Table (1) shows that the study was done on 45 patients. Males and females were almost equally represented, whose median ages was 62.0 years old. The highest percentage of them (35.6%) was suffering from multiple comorbidities. Almost half of study group were read and write, primary. As regarding occupation, about two thirds of the participants were not working, while 60.0% of them claimed that their income was enough for daily needs exactly.

Table (1): Distribution of studied participants as regard personal criteria

Variable		N=45	
		N	%
Age	Median	62.0	
	IQR*	49.5-70.0	
Sex	Male	23	51.1
	Female	22	48.9
Comorbidity	No comorbidity	5	11.1
	Diabetes	12	26.7
	Hypertension	7	15.6
	Ischemic heart disease	1	2.2
	Atrial fibrillation	1	2.2
	Lymphoma	1	2.2
	Shrunken congenital kidney	1	2.2
	Polycystic kidney	1	2.2
	Fanconi syndrome	1	2.2
	Mental retarded	1	2.2
	Breast cancer	1	2.2
	Multiple comorbidities	16	35.6
Education	Read and write, primary	22	48.9
	Preparatory and secondary	16	35.6
	Higher education	7	15.6
Income	Not enough for daily needs	3	6.7
	Enough for daily needs exactly	27	60
	Exceeds daily needs	15	33.3
	Suitable for investment	0	0.0
Occupation	Working	16	35.6
	Not working	29	64.4

* IQR: Interquartile range (Percentile 25-Percentile 75)

Table (2) shows that the incidence of infection was 40.0% in 1st phase (Pre-intervention).

Table (2): Distribution of studied participants as regard presence of infection

		N	%
Presence of infection	Yes	18	40
	No	27	60

Table (3) demonstrates that more than half of the study population had applied the different infection control items including hand hygiene betadine before insert of catheter (55.6%), cutaneous disinfection before CVC insertion (66.7%), usage of a mask (51.1%), usage of a sterile gloves (64.4%), usage of a sterile drape (71.1%), recorded difficult insertion (68.9%), spare it by appropriate sanitizer (66.7%), usage of a sterile bandage every 48 hours or when contaminated or wet (60.0%), closure of valves (57.8%), adherence to the closed cycle of solutions (77.8%), commitment to disinfecting the valves and taps with 70% alcohol before and after handling the catheter (62.2%) and commitment to hand washing before and after handling the catheter (73.3%), while less than half of them (64.4%) used a sterile gown (46.7%).

Table (3): Distribution of studied participants as regard measures of infection control for insertion and spare on catheter before intervention

Variables		N=45	
		N	%
Hand hygiene betadine before insert of catheter	**Yes**	**25**	55.6
	No	**20**	44.4
Cutaneous disinfection before CVC insertion	**Yes**	**30**	66.7
	No	**15**	33.3
Usage of a mask	**Yes**	**23**	51.1
	No	**22**	48.9
Usage of a sterile gloves	**Yes**	**29**	64.4
	No	**16**	35.6
Usage of a sterile drape	**Yes**	**32**	71.1
	No	**13**	28.9
Usage of a sterile gown	**Yes**	**21**	46.7
	No	**24**	53.3
Recorded difficult insertion	**Yes**	**31**	68.9
	No	**14**	31.1
Spare it by appropriate sanitizer	**Yes**	**30**	66.7
	No	**15**	33.3
Usage of a sterile bandage every 48 hours or when contaminated or wet	**Yes**	**27**	60.0
	No	**18**	40.0
Closure of valves	**Yes**	**26**	57.8
	No	**19**	42.2
Adherence to the closed cycle of solutions	**Yes**	**35**	77.8
	No	**10**	22.2
Commitment to disinfecting the valves and taps with 70% alcohol before and after handling the catheter	**Yes**	**28**	62.2
	No	**17**	37.8
Commitment to hand washing before and after handling the catheter	**Yes**	**33**	73.3
	No	**12**	26.7

Table (4) discusses the relationship between occurrence of infection and some sociodemographic criteria of study group. There was no statistically significant difference in occurrence of infection as regard patients' gender, comorbidities, education, income nor occupation.

Table (4): Distribution of studied participants as regard personal criteria

		Presence of infection				P value
		Yes (N=18)		No (N=27)		
		N	%	N	%	
Sex	**Male**	**9**	50.0	14	51.9	0.903 (NS)*
	Female	**9**	50.0	13	48.1	
Comorbidity	**Yes**	**17**	94.4	23	85.2	0.634 (NS)**
	No	**1**	5.6	4	14.8	
Education	**Read and write, primary**	**9**	50.0	13	48.1	0.119 (NS)**
	Preparatory and secondary	**4**	22.2	12	44.4	
	High	**5**	27.8	2	7.4	
Income	**Not enough for daily needs**	**0**	0.0	3	11.1	0.228 (NS)**
	Enough for daily needs exactly	**10**	55.6	17	63.0	
	Exceeds daily needs	**8**	44.4	7	25.9	
	Suitable for investment	**0**	0.0	0	0.0	
Occupation	**Working**	**5**	27.8	11	4037	0.373 (NS)*
	Not working	**13**	72.2	16	59.3	

NS: Nonsignificant, *Chi square test, **Fisher's exact test

Table (5) illustrates that there was highly statistically significant difference in occurrence of infection as regard recorded difficult catheter insertion and the patient role in keeping catheter dry and clean. The majority of studied patients who developed infection (77.8%) claimed that they didn't keep the cleanliness and dryness of the catheter and the greater percentage of those who didn't develop infection (81.5%) claimed that they maintained the cleanliness of the catheter. There was statistically significant difference in occurrence of infection as regard catheter type. The majority of studied patients who developed infection (88.9%) had permanent catheter type.

Table (5): Relationship between difficult insertion, role of patient and catheter type regarding presence of infection

Variable		Presence of infection				P value*
		Yes (N=18)		No (N=27)		
Recorded difficult insertion		**N**	%	**N**	%	0.004
	Yes	**8**	44.4	**23**	85.2	**(HS)**
	No	**10**	55.6	**4**	14.8	
Patient role (Keep the catheter dressing clean and dry)	**Yes**	**4**	22.2	**22**	81.5	<0.001
	No	**14**	77.8	**5**	18.5	**(HS)**
Catheter type	**Temporary**	**2**	11.1	**19**	70.4	<0.001
	Permanent	**16**	88.9	**8**	29.6	**(HS)**

*Chi-square test was used.

Figure (1) identifies that the highest percentage of infected patients (33.3%) used vancomycin before results of culture and sensitivity appear. Staph aureus microorganism represented the most common microorganism identified (33.3%). While all patients were antibiotic susceptible**.**

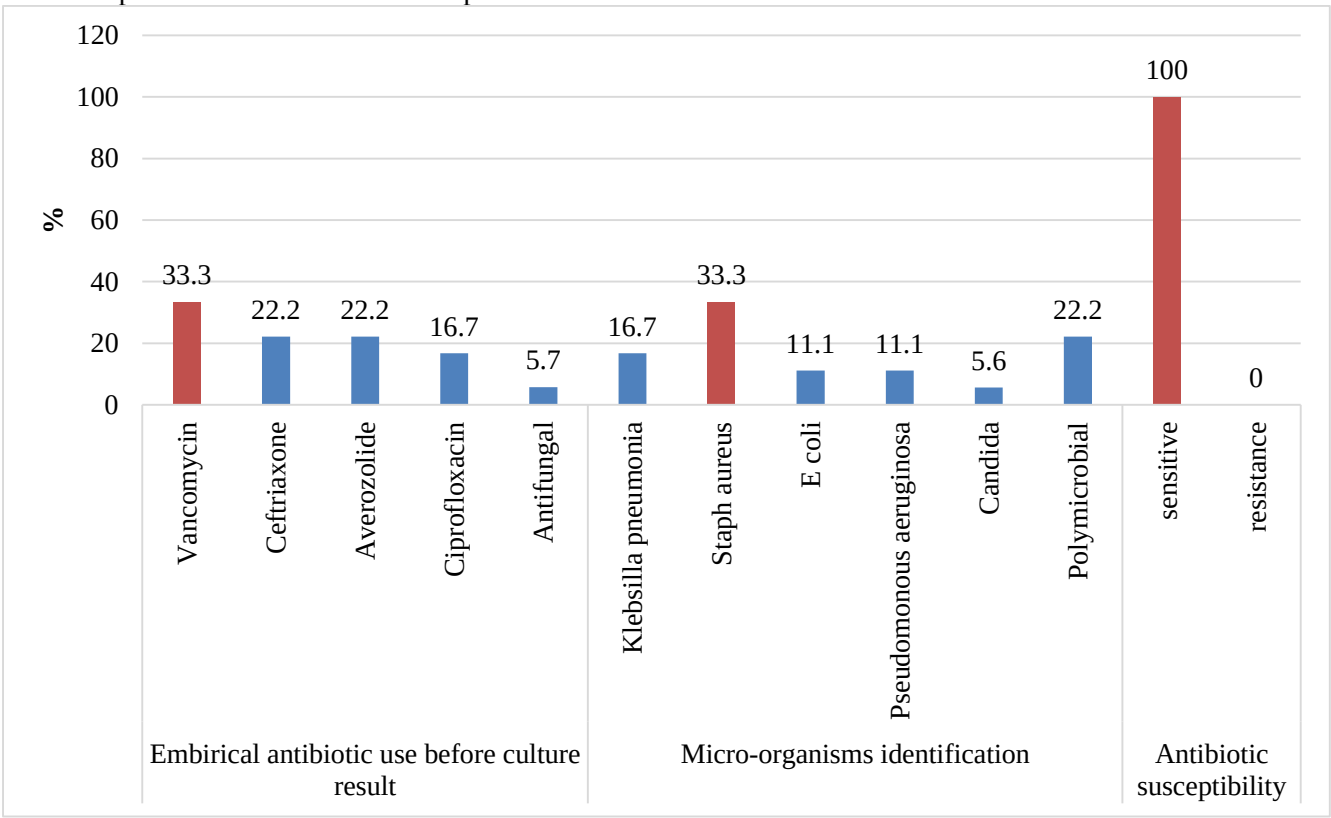

Figure (1): Distribution of studied participants as regard lab identification (27 participants who didn't have infection were excluded)

Table (6) demonstrates that incidence of infection in the pre-intervention significantly decreased after intervention**. Table (7)** displays that the intervention had significantly decreased the incidence of participants' fever, chill, discharge and tenderness.

Table (6): Comparison between incidence of infection before and after the intervention

		Pre-intervention (N=45)		Post-intervention (N=45)		P value*
		N	**%**	**N**	**%**	
Presence of infection	**Yes**	**18**	40.0	**6**	13.3	**0.008 (HS)**
	No	**27**	60.0	**39**	86.7	

*** Mc-Nemar's test was used**

Table (7): Comparison between participants' clinical sign of infection (Pre-intervention versus post-intervention)

		Pre-intervention (N=45)		Post-intervention (N=45)		P value*
		N	%	N	%	
Participants' fever	**Yes**	**18**	73.3	**6**	13.3	**<0.001 (HS)**
	No	**27**	62.7	**39**	86.7	
Participants' chill	**Yes**	**13**	55.6	**6**	13.3	**<0.001 (HS)**
	No	**32**	44.4	**39**	86.7	
Participants' presence of discharge	**Yes**	**16**	62.2	**6**	13.3	**<0.001 (HS)**
	No	**29**	37.8	**39**	86.7	
Participants' presence of tenderness	**Yes**	**13**	71.1	**4**	8.9	**<0.001 (HS)**
	No	**32**	28.9	**41**	91.1	

*** Mc-Nemar Test was used**

Table (8) displays that the intervention had significantly increased incidence of infection control practices. Multivariate analysis didn't find any significant predictors for presence of infection, while Univariate logistic regression showed that permanent catheter type and patient role (N) were the significant predictors of presence of infection in **table (9).**

Table (8): Comparison between infection control practices (Pre-intervention versus post-intervention)

Variables		Pre-intervention		Post-intervention		P value
		N	%	N	%	
Hand hygiene betadine before insert of catheter	**Yes**	**25**	55.6	**44**	97.8	**<0.001 (HS)**
	No	**20**	44.4	**1**	2.2	
Cutaneous disinfection before CVC insertion	**Yes**	**30**	66.7	**42**	93.3	**0.002 (HS)**
	No	**15**	33.3	**3**	6.7	
Usage of a mask	**Yes**	**23**	51.1	**43**	95.6	**<0.001 (HS)**
	No	**22**	48.9	**2**	4.4	
Usage of a sterile gloves	**Yes**	**29**	64.4	**41**	91.1	**0.004 (HS)**
	No	**16**	35.6	**4**	8.9	
Usage of a sterile drape	**Yes**	**32**	71.1	**40**	88.9	0.077 (NS)
	No	**13**	28.9	**5**	11.1	
Usage of a sterile gown	**Yes**	**21**	46.7	**43**	95.6	**<0.001 (HS)**
	No	**24**	53.3	**2**	4.4	
Recorded difficult insertion	**Yes**	**31**	68.9	**42**	93.3	**0.007 (HS)**
	No	**14**	31.1	**3**	6.7	
Spare it by appropriate sanitizer	**Yes**	**30**	66.7	**42**	93.3	**0.004 (HS)**
	No	**15**	33.3	**3**	6.7	
Usage of a sterile bandage every 48 hours or when contaminated or wet	**Yes**	**27**	60	**41**	91.1	**0.003 (HS)**
	No	**18**	40	**4**	8.9	
Closure of valves	**Yes**	**26**	57.8	**38**	84.4	**0.017 (S)**
	No	**19**	42.2	**7**	15.6	
Adherence to the closed cycle of solutions	**Yes**	**35**	77.8	**39**	86.7	0.454 (NS)
	No	**10**	22.2	**6**	13.3	
Commitment to disinfecting the valves and taps with 70% alcohol before and after handling the catheter	**Yes**	**28**	62.2	**41**	91.1	**0.004 (HS)**
	No	**17**	37.8	**4**	**8.9**	
Commitment to hand washing before and after handling the catheter	**Yes**	**33**	**73.3**	**42**	**93.3**	**0.022 (S)**

NS: Nonsignificant, S: significant, HS: Highly significant

Table (9): Univariate logistic regression analysis for the predictors of presence of infection before the intervention

Variable	Univraiate logistic regression			Multivraiate logistic regression		
	Crude OR	95%CI	P	Adjusted OR	95% CI	P
Patient role (N)	15.4	3.52-6736	**<0.001 HS**	17.37	0.0-19.7	0.998 (NS)
Catheter Type (Permanent)	19.0	3.52-102.58	**0.001 (HS)**	20.69	0.0-25.2	0.998(NS)
CVC duration	0.99	0.97-1.01	0.484 (NS)	1.0	0.7-1.0	0.912 (NS)

NS: Nonsignificant, HS: Highly significant

DISCUSSION

This interventional study was conducted at Hemodialysis Unit in Benha University Hospital between February 2021 and September 2021. The study was conducted on 45 ESRD, males and females were almost equally represented (Males Vs females was 51.1 Vs 48.9% respectively), whose median ages was 62.0 years old. The highest percentage of them (35.6%) was suffering from multiple comorbidities. Almost half of study group (48.9%) were read and write, primary. As regarding occupation, about two thirds of the participants (64.4%) were not working, while 60.0% of them claimed that their income was enough for daily needs exactly.

There was no statistically significant difference in occurrence of infection as regard patients' gender, comorbidities, education, income, nor occupation. In agreement with **Nasiri *et al.*** [15] analysis of 122 individuals using temporary double-lumen acute hemodialysis catheters. Gender, age, or location of residence had no bearing on the presence of an infection. Furthermore, in accord with **Delistefani *et al.*** [16]**,** who conducted a retrospective analysis of 151 patients who had permanent hemodialysis catheters, gender, age, and comorbidities had no effect on the likelihood of infection.

Regarding patient role among the studied patients, the present study showed that the majority of patients (86.7 %) claimed that they keep the catheter dressing clean and dry and also that there was statistically significant difference in occurrence of infection as regard patient role in keeping catheter dry and clean. All patients who didn't develop infection claimed that they maintained the cleanliness of the catheter.

In the current study, more than half of the study population had applied the different infection control measures including hand hygiene betadine before insert of catheter (55.6%), cutaneous disinfection before CVC insertion (66.7%), usage of a mask (51.1%), usage of a sterile gloves (64.4%), usage of a sterile drape (71.1%), recorded difficult insertion (68.9%), spare it by appropriate sanitizer (66.7%).

The present study was supported by **Sahli *et al.*** [17] who reported that, the following hygiene measures were adhered to: hand hygiene, 80%; skin disinfection prior to CVC insertion, 70%; sterile gloves, 90%; sterile drapes, 70%; difficult insertion, 50%; and dressing repair after each dialysis, 60%. Maintaining adequate personal cleanliness is seen to be one of the most crucial steps in this prospective trial to protect hemodialysis patients from infection. Moreover, **Moemen** [18] claimed that all sanitary precautions were taken during insertion because all catheters were placed within the operating room under strict aseptic guidelines. Following were the percentages of maintenance compliance: hand hygiene (53.5%), mask use (57.9%), glove use (100%), and skin antiseptic application (100%).

In the current study, the incidence of infection was 40.0% in pre intervention phase. In line with our findings according to **Sedhain *et al.*** [19]**,** the incidence of infection was 39.2%. Moreover, **Sahli *et al.*** [17] said that 36% of cases of infection were recorded. However according to **Delistefani *et al.*** [16], the prevalence of infections was 17.9%. Whereas **Moemen** [18] found a 23.7% infection incidence rate.

In the current study, comparison between infection control practices (Pre-intervention versus post-intervention) showed that the intervention had significantly improved the infection control practices. We came to the conclusion that the use of suitable preventive measures, early identification, and efficient treatment of infectious complications are crucial for improving outcomes since all of these criteria were taken into account as infection risk factors.

This was in agreement with **Ahmed *et al.*** [20] according to a suitable sample of all nurses working in hemodialysis facilities, the investigation was carried out at Minia University and Minia General Hospital's Pediatric Hemodialysis Units. So, increasing hand cleanliness is necessary, but emphasis must also be placed on wearing protective clothing, such as a mask and sterile gown. It is well recognised that using aseptic methods when inserting, handling, and manipulating intravascular catheters can help prevent CVC-RI [21].

The present study showed that 40.0% of study group had suffered from fever, chills (28.9), discharge (35.6%) and tenderness (28.9). Right internal jugular was the common site of insertion among the patients (53.3%), while two thirds of patients claimed that the catheter was temporal. Although **Sedhain *et al.* [19]** noted that nausea and vomiting (25.8%), hypotension (63.4%), and catheter malfunction (41.4%) were the most frequent clinical features, fever with chills and rigidity (100%) topped the list. 12.1% and 7.3% of patients, respectively, had purulent discharge and erythema at the infection site. The majority of insertions (463) occurred in the right internal jugular vein (77.9%). In addition, **Alirezaei *et al.* [22]** observed that (92%) of patients exhibited fever and chills as part of their overall clinical symptoms. Moreover, **Jesus-Silva *et al.* [23]** observed that more than 80% of times, the right internal jugular vein was employed as an access site.

In the present study, comparison between participants' fever, chill, presence of discharge and presence of tenderness (Pre-intervention versus post-intervention) showed that the intervention had significantly decreased the incidence of participants' fever, chill, discharge and tenderness.

The current study showed that there was statistically significant difference in occurrence of infection as regard duration of catheter insertion. In agreement with current results **Sedhain *et al.* [19]** indicated that risk variables for the development of CRI included the length of duration of catheter in situ. This was corroborated by **Allon [24]** who noted a correlation between the risk of CRIs in hemodialysis patients and the length of indwelling and catheterization methods. Also, it was noted by **Sahli *et al.* [17] and Salem *et al.* [25]** that a catheter's lengthier duration increased the chance of catheter infection.

The present study revealed that the highest percentage of infected patients (33.3%) used vancomycin before results of culture and sensitivity appear. Staph aureus microorganism represented the most common microorganism identified (33.3%). While all patients were antibiotic susceptible. Current results were in line with **Sedhain *et al.* [19],** who stated that coagulase negative staphylococci (26.8%), Staph aureus (24.4%), and Klebsiella pneumoniae (21.9%) were the most frequently isolated bacteria in CRI. Staphylococcus aureus was the most prevalent causal organism, according to **Sahli *et al.* [17]** and **Al-Barshomy *et al.* [26]** who both found this to be the case.

Univraiate logistic regression shows that permanent catheter type and patient role were the significant predictors of presence of infection. **Shahar *et al.* [27]** findings that variations in catheter care habits and catheter type also impact the results, corroborated this. Also, **Sedhain *et al.* [19]** found that the time of catheter in situ was a risk factor for the development of CRI. Also, it was noted by **Sahli *et al.* [17] and Salem *et al.* [25]** that a catheter's lengthier duration increased the chance of catheter infection.

CONCLUSION

Prolonged duration of CVC usage, difficult insertion, patient role (Keep the catheter dressing clean and dry) and catheter type have been found as the risk factors for CRI. Catheter type and CVC duration was the significant predictor of presence of infection.

Supporting and sponsoring financially: Nil.
Competing interests: Nil.

REFERENCES

1. **Fraser Health (2018):** Central Venous Catheters In Adult Patients Self-Learning Module. Vascular Access Clinical Practice Committee Fraser Health Authority. Pp. 1-98. https://www.fraserhealth.ca/-/media/Project/FraserHealth/FraserHealth/Health-Professionals/Professionals-Resources/Acute-Care-Orientation/CVC-Self-Learning-Package-v9-June-2018-FINAL.pdf?la=en&hash=0F215DB815780CD96D9DED0AB63CA27A34D0D66B
2. **Marschall J, Mermel L, Fakih M *et al.* (2014):** Strategies to Prevent Central Line-Associated Bloodstream Infections in Acute Care Hospitals: 2014 Update. Infection Control & Hospital Epidemiology, 35: 89-107.
3. **Liyanage T, Ninomiya T, Jha V *et al.* (2015):** Worldwide access to treatment for end-stage kidney disease: a systematic review. The Lancet, 385(9981):1975-1982.
4. **El-Ballat M, El-Sayed M, Emam H (2019):** Epidemiology of end stage renal disease patients on regular hemodialysis in El-Beheira Governorate, Egypt. The Egyptian Journal of Hospital Medicine, 76(3): 3618-3625.
5. **Bearman G, Oppenheim M, Mendonca E *et al.* (2010):** A clinical predictive model for catheter related bloodstream infections from the electronic medical record. The Open Epidemiology Journal, 3(1): 24-28.
6. **Gahlot R, Nigam C, Kumar V *et al.* (2014):** Catheter-related bloodstream infections. International Journal of Critical Illness and Injury Science, 4(2):162-67.
7. **Amin T, Al Noaim K, Saad M *et al.* (2013):** Standard precautions and infection control, medical students' knowledge and behavior at a Saudi university: the need for change. Global Journal of Health Science, 5(4):114.
8. **Alexandrou E, Ray-Barruel G, Carr P *et al.* (2018)**: Use of short peripheral intravenous catheters: characteristics, management, and outcomes worldwide. J Hosp Med., 13(5): 1-7.
9. **Ferrara P, Albano L (2018):** The adherence to guidelines for preventing CVC-related infections: a survey among Italian health-care workers. BMC Infectious Diseases, 18(1):1-8.
10. **Clinical and Laboratory Standards Institute (2007):** Performance standards for antimicrobial susceptibility testing; Seventeenth informational supplement Antimicrobial Susceptibility Testing (AST) Recommendations 2007. M100-S17. Pp. 1-25. https://clsi.org/media/2663/m100ed29_sample.pdf

11. **Hadian B, Zafarmohtashami A, Razani M (2020):** Catheter-related blood stream infections in hemodialysis patients. Journal of Renal Injury Prevention, 9(4): 34-40.
12. **Maki D, Weise C, Sarafin H (1977):** A semiquantitative culture method for identifying intravenous-caheter-related infection. N Engl J Med., 296(23):1305-9.
13. **World Health Organization (2010):** Hand Hygiene Self-Assessment Framework 2010. http://www.who.int/gpsc/country_work/hhsa_frame work.
14. **O'Grady N, Alexander M, Burns L *et al.* (2011):** Summary of recommendations: Guidelines for the Prevention of Intravascular Catheter-related Infections. Clin Infect Dis. 52(9):1087-99.
15. **Nasiri E, Rafiei M, Mortazavi Y *et al.* (2022):** Causes and risk factors of hemodialysis catheter infection in dialysis patients: A prospective study. Nephro-Urology Monthly, 14(1): 1-7.
16. **Delistefani F, Wallbach M, Müller G *et al.* (2019):** Risk factors for catheter-related infections in patients receiving permanent dialysis catheter. BMC Nephrology, 20(1): 1-7.
17. **Sahli F, Feidjel R, Laalaoui R (2017):** Hemodialysis catheter-related infection: rates, risk factors and pathogens. Journal of Infection and Public Health, 10(4): 403-408.
18. **Moemen D (2022):** Hemodialysis Catheter-related infections among pediatric patients in Mansoura University Children Hospital. Egyptian Journal of Medical Microbiology, 31(1): 7-14.
19. **Sedhain A, Sapkota A, Mahotra N (2019):** Hemodialysis catheter-related infection in a teaching hospital of Central Nepal. Journal of Institute of Medicine Nepal, 41(2): 11-16.
20. **Ahmed S, Mohamed A, Ahmed S (2019):** Effect of educational program about infection control precautions for nurses in pediatric hemodialysis units. Minia Scientific Nursing Journal, 5(1): 77-88.
21. **Pronovost P, Needham D, Berenholtz S *et al.* (2006):** An intervention to decrease catheter-related bloodstream infections in the ICU. New England Journal of Medicine, 355(26): 2725-2732.
22. **Alirezaei A, Massoudi N, Zare E *et al.* (2019):** Catheter related blood stream infections; the incidence and risk factors in Iranian hemodialysis patients. Journal of Nephropharmacology, 8(2): 17. doi: 10.15171/npj.2019.17
23. **Jesus-Silva S, Oliveira J, Ramos K *et al.* (2020):** Analysis of infection rates and duration of short and long-term hemodialysis catheters in a teaching hospital. Jornal Vascular Brasileiro, 19: e20190142. doi: 10.1590/1677-5449.190142.
24. **Allon M (2009):** Treatment guidelines for dialysis catheter–related bacteremia: an update. American Journal of Kidney Diseases, 54(1): 13-17.
25. **Salem H, Ahmed M, Gulzar K *et al.* (2021):** Hemodialysis catheter-related infections: incidence, microbiology and outcome 5 years of Dubai hospital experience. European Journal of Clinical Medicine, 2(3): 111-115.
26. **Al-Barshomy S, El-Antony N, Sakr M *et al.* (2021):** Epidemiology of central venous catheters infection in hemodialysis patients. The Egyptian Journal of Hospital Medicine, 82(2): 225-230.
27. **Shahar S, Mustafar R, Kamaruzaman L *et al.* (2021):** Catheter-related bloodstream infections and catheter colonization among haemodialysis patients: Prevalence, Risk Factors, and Outcomes. International Journal of Nephrology, 21: 5562690. https://doi.org/10.1155/2021/5562690.