ORIGINAL ARTICLE

Knowledge and Practices of Dialysis Unit Staff Regarding the Care and Management of Vascular Access Infections

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ABSTRACT
Background: Vascular access infections among dialysis patients are becoming the major concerns that contribute to a significant morbidity and mortality across the globe. Proper management and care must be planned according to the standard protocols for the prevention of these infections.
Objective: The objective of the study was to assess the knowledge and practices of dialysis staff regarding vascular access infection control in tertiary care hospitals of Peshawar, Pakistan.
Methodology: A cross-sectional study was conducted on dialysis staff including nurses and technicians (n=58). All hemodialysis staff (Nurses and Technician) was included in the study who were regularly working in dialysis unit and had at least 6 months of dialysis unit experience. Data was collected through a self-administered questionnaire and checklist with its proper validation. Data was analyzed through SPSS Version-20 for its proper presentation.
Results: The finding of the study showed that around 44.94% of the questions were corrected by the nurses and technician on the knowledge assessment questionnaire while looking into their practices 28.5% of the correct practices were followed by them. Additionally it was found that private sector hospital nurses and technician scored more than public sector hospitals in knowledge and practices.
Practical implication: It is one of the main responsibilities of the dialysis unit staff to have knowledge regarding vascular access infections. So based on their knowledge, they will maintain the aseptic protocol while practicing, which will ensure a low infection rate and prevent the patient from complications that will improve the patient's experience and reduce the length of stay.
Conclusion: It is concluded from the research findings that nurses and technician knowledge and practices are not sufficient to prevent the vascular access infections; therefore they must be trained for the provision of best possible care among the dialysis patients.
Keywords: Knowledge, Practice, Vascular Access, Infections, Dialysis, Nurse, Technicians

INTRODUCTION
Hemodialysis is a process of artificially removing waste products, excess electrolytes and water from blood by using a dialysis machine. Dialysis machine uses an artificial kidney containing semi-permeable membrane and dialysate to purify blood. Blood flows from the patients through dialyzer (artificial kidney) and dialysate over the semi permeable membrane to maintain concentration gradient that removes wastes from blood and return clean blood to the patient. [1] Dialysis machine requires a steady and uninterrupted flow of blood for effective hemodialysis. An essential part of management of dialysis is a well-functioning vascular access. The best access; which is considered for lowest rate of infection is arteriovenous fistula (AVF) followed by arteriovenous grafts and central venous catheters (CVCs). However, its utilization can go ahead to complications and infections that could results in significant morbidity, mortality and healthcare costs. [2]

Infections related to vascular access are the foremost cause of morbidity (62.7%) and mortality (20%) among hemodialysis dependent patients.[3] Systemic infections is serious complication of intravascular catheters; used for dialysis. Various studies show that bacteremia's, which are related to vascular access accounts from 48% to 73% of all bacteremia's among hemodialysis patients.[4]

Vascular access related infections mostly leads to systemic complications, that accounts most of inpatient admissions and found one of the major risk factors of increased morbidity (33%) and mortality (15-16%) among dialysis dependent patients. similarly, the ANDATA reported that 11% of death among dialysis dependent patient were only due to vascular access infections.[5]

Serious complications that arise from improper use of vascular access are systemic infections. The greatest number of devastating infections which transmitted through vascular access in patient on chronic dialysis are viral hepatitis (like hepatitis "B" and "C")[2] and gram-positive bacterial species, which are the main causative micro-organisms in 61-95% of cases of vascular access related bacteremia's.[6] Hoen conducted a prospective study, which explores that most of the vascular access related bacteremia were predominantly caused by S. aureus. The most common route of direct spread of these microorganisms was from the skin beside the outer surface of the catheter or arteriovenous fistula needles, involved most importantly in the contamination of the bloodstream.[6]

The prevalence of Chronic Kidney diseases in Pakistan is high as 12.5% 9 and in a recent study it is estimated 25.60% accounting a huge burden of disease.6 Among these 25.60% of population affected by CKD, many patients will require maintenance (80%-93%) dialysis which may prone towards the blood stream infections that still have a huge impact on patient health, survival and economic burden of the country.[7, 8] Medical resources, diagnosis, and treatment must improve in developing countries.

Nursing staff and other health care professionals including the technicians should be very skillful to prevent the vascular access infection because globally most of healthcare services providing and monitoring agencies like World Health Organization and CDC declared vascular access related blood stream infections a major patient safety issue. Simple precautionary methods can be used to prevent vascular access related infections. The most simple and most important preventive method of infection control is hand washing and use of personal protective equipment. The major constraint to follow these simple techniques were busyness of dialysis staff, nursing staff shortage and increased workload; these are also the contributing risk factors of blood stream infections.[9] The aim of this study was to assess the knowledge and practices regarding vascular access infection control among dialysis staff of five selected tertiary care hospitals of Peshawar

MATERIAL AND METHODS
The descriptive Cross sectional study design was used for this study which was completed from October 2021 to February 2022.

This study was conducted in the five major tertiary care hospitals' hemodialysis centers including Lady Reading Hospital Peshawar, Khyber Teaching Hospital Peshawar, Kidney Center Peshawar, North West General Hospital &Research Center Peshawar and Rehman Medical Institute Peshawar, and data was collected from all the dialysis staff working in these five tertiary care hospitals of Peshawar Pakistan. These are tertiary care hospital's hemodialysis units which provides both inpatient and outpatient services. Approximately 4500 dialysis procedures are performed monthly in these five hemodialysis units.

Universal sampling technique was used for data collection the sample size was calculated on the basis of staff working in the dialysis unit of these tertiary care hospitals. 95% of Confidence interval was incorporated in the study; Relative precision rate was taken as 20%, and the remaining 80% was calculated as the Power of study, as a result 58 was the sample size for the study.

In this study the following selection criteria were used for selection of participants. The inclusion criteria for the study was both male and female hemodialysis staff (Nurses and Technician) who were regularly working in dialysis unit and having 6 months of dialysis unit experience. While both male and female hemodialysis staff (Nurses and Technician) that were on managerial posts (not involved in vascular access handling and direct patient care) or absent during data collection was excluded from the study.

Scientific approval to carry out this study was taken from the Advanced Studies Review Board (ASRB), and Ethical review board (ERB) of Khyber Medical University Peshawar (KMU). Participants' autonomy, anonymity, and confidentiality were ensured. A well explicate informed consent was offered to the study participants prior data collection ensuring their autonomy, safety and confidentiality. After explaining questionnaire to them, they were asked to answer the questionnaire while their practice was observed on a checklist when they were performing procedure.

Data regarding Knowledge of dialysis staff about vascular access infection control was collected from participants through a questionnaire and a practice were observed though an audit tool. The Questionnaire composed of three sections, Section 1 comprises of participant's demographic data Section 2 comprises of resources available in dialysis unit and work load, Section 3 consist questions related to vascular access related infection. The audit tool (checklist) was used for assessing practices of staff; that was consisting of three procedures (Arteriovenous fistula or catheter connection with machine, disconnection from dialysis machine and Exit site dressing).

The checklist was validated from 3 experts while reliability of the study was conducted using pilot study on the 10% of the actual sample size and the Cronbach's alpha was 0.78 & 0.83.

The data were analyzed using SPSS software version 20. In descriptive statistics frequencies and percentages were used for categorical and nominal variables. Mean and standard deviation were calculated for the continuous variables.

Ethical Review Committee of the KMU Peshawar had formally given approval to conduct this study. Additionally; data collection permission were taken from research and ethical review boards of all five hospitals. Prior to data collection a brief informed consent was obtained from each participant. Participants' safety, Anonymity and confidentiality were ensured though out the project. Participants' data was kept in a locked drawer that was accessible only to the researcher. The findings of the study will be disseminated without giving any identifying information of the participants.

RESULTS

In this study the total population (n=58) of where the number of male participant were (63.8%) higher than female staff (36.2%). Most of the participants 36.2% were in age group 18-27 followed by27.6% in 28-37 age group and 24.1% in 38-47 age groups while 86% and 3.4% of participants were in 48-57 and above 57years age group. The staff distribution in hospitals; 20.7% staff from Lady Reading Hospital Peshawar, 25.9% Khyber Teaching Hospital Peshawar 25.9%, 19.0%, was Institute of Kidney Diseases Peshawar, 13.8% Rehman Medical Institute Peshawar and 20.7% North West General Hospital & RC Peshawar. Among these participants 15.5% were Nurses and 84.5% were Technicians. (See table 1).

Table 1: Demographic data of the participants

Variables		Frequency (n) 58	Percentage (%)
Gender	Male	37	63.8%
	Female	21	36.2%
Age	18-27	21	36.2%
	28-37	16	27.6%
	38-47	14	24.1%
	48-57	5	8.6%
	>57 years	2	3.4%
Job title	Technician	49	84.5%
	General nursing	3	5.2%
Hospitals	Lady Reading Hospital Peshawar	12	20.7%
	Khyber Teaching Hospital Peshawar	15	25.9%
	Institute of Kidney Diseases Peshawar	11	19.0%
	Rehman Medical Institute Peshawar	8	13.8%
	North West General Hospital Peshawar	12	20.7%
Professional Education	Diploma in nursing +Specialization	2	3.4%
	BSc Nursing	7	12.1%
	Dialysis Technician Training Certificate	24	41.4%
	Dialysis Technician Diploma	18	31.0%
	BSc Dialysis Technology	4	6.9%
Experience	From 6 Months to 3Years	20	34.5%
	Above 3 years to 5 Years	12	20.7%
	Above 5 years to 7 Years	4	6.9%
	Above 7Years to 10 Years	10	17.2%
	Above 10Years to 12 Years	1	1.7%
	Above 12Years to 15 Years	11	19.0%

The demographic characteristics of hemodialysis unit: The results show that vascular access related infection control orientation and education are given to53.4% of the staff while they are employed in hemodialysis unit while 46.7% of staff didn't received any education. 77.6% of participant responded that they are not using any evidence-based guidelines while 22.4% responded in positive. Similarly, 65.5% of hemodialysis units had no protocols about strategies to prevent Nosocomial infection while 34.5% have specific protocols available in hemodialysis units. (See table 2).

Table 2: The demographic characteristics of Hemodialysis Unit

Variable (n=58)	Categories	Frequency (n-58)	Percentage
Vascular Access Infection Control Education	Education Received	31	53.4%
	Education Not Received	27	46.7%
Uses of Evidence Based Guidelines	Yes	13	22.4%
	No	45	77.6%
Patients Per Staff	1-2	5	8.6%
	3-4	20	34.5%
	5-6	23	39.7%
	7-8	3	5.2%
	9-10	1	1.7%
	More than 10	6	10.3%
Personal Protective Equipment Provided	Disposable Gloves Only	28	48.3%
	Disposable Gloves & Mask	1	1.7%
	Cap	00	00
	No PPE provided	8	13.8%
	All PPE Provided	5	8.6%
	Disposable gloves, Mask, Gown & biohazard containers	16	27.6%
Protocols about Strategies to Prevent Nosocomial Infection	Available	20	34.5%
	Not available	38	65.5%
Patient's Privacy Properly Maintained	Yes	23	39.7%
	No	35	60.3%

Knowledge of nurses regarding vascular access infection: In the current study 10 questions were asked from the study participants to identify the level of knowledge regarding vascular access infections. Table 3 illustrates that majority of the nurses knowledge was good regarding, (78%) knows about infection, (55%) answer right about wash of hands, (56.9%) about change of gloves, and (62%) about the hub cup should be changed (see table 3).

Table 3: Knowledge regarding vascular access infections

	Items	Correct	Incorrect
1	What is infection	45 (78%)	13 (22%)
2	What is meaning of universal precaution	24 (41.3%)	34 (58.7%)
3	What is sign of infection on catheter site	24 (41.3%)	34 (58.7%)
4	When should wash hand when dealing dialysis patient	32 (55%)	26 (45%)
5	When should change the gloves	33 (56.9%)	25 (43.1%)
6	After cleaning the catheter hub/port how much time it can be left unattended/open?	20 (34.48%)	38 (65.5%)
7	Who is responsible to manipulate the catheter?	22 (38%)	36 (62%)
8	About the use of Antiseptic solution	25 (43.1%)	33 (56.9%)
9	The hub cup should be changed?	36 (62%)	20 (38%)
10	When face mask should be worn while caring dialysis patients?	21 (37.9%)	37 (62.1%)

Comparing the level of knowledge among different hospital settings: Comparing the level of knowledge among the 5 tertiary care hospitals, figure 1 demonstrates that the nurses of north-west general hospital give the right answers (55.5%), followed by rehman medical institute (55%), then institute of kidney diseases (46.06%), then Khyber teaching hospital (39.1%), and last was lady reading hospital (33.89%) (See figure 1).

Figure 1: Knowledge of nurses regarding Vascular access infection
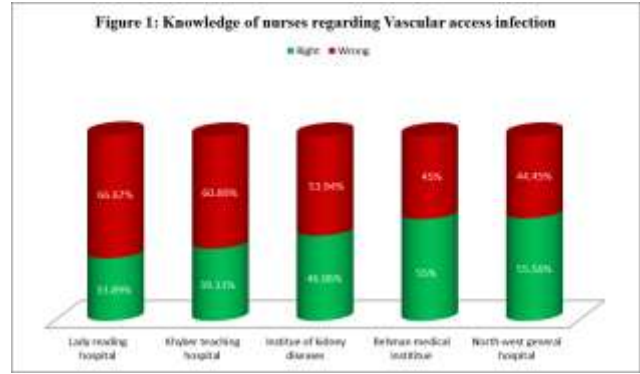
Practices of study participants regarding vascular access infection: The results of connection or initiating hemodialysis procedure audit show that 6.67% of participants from KTH, 15.8% of participants from IKD, 55.36% from RMI and 89.28% of participants from NWGH initiated hemodialysis procedure aseptically,

Results of bloodline disconnection (putting off the patient from dialysis machine) procedure reveal that 77.5% of participants from NWGH, 41.7% from RMI, 14.18% from KTH and 5.05% from IKD preformed procedure aseptically.
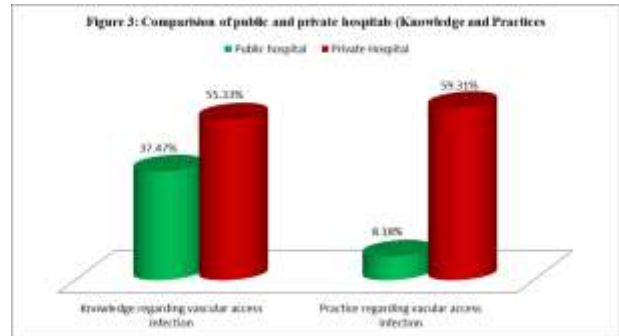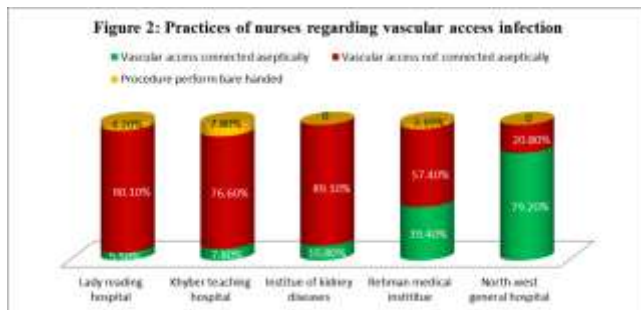
The results illustrated that 70.83% of NWGH participants, 21.25% of RMI participants, 11.82% of IKD participants, 8.33% of LRH and 2.67% of KTH participants performed exit cite dressing aseptically (see table 4).

Table 4: Practices of staff while handling dialysis patients

Items	Category	LRH	KTH	IKD	RMI	NW-GH
1: Blood line connection practices	Vascular access connected aseptically	0	6.6%	15.5%	55.3%	89.2%
	Vascular access not connected aseptically	88%	79%	84.4%	42.8%	10.7%
	Procedure perform bare handed	12%	14.7%	0	1.7%	0
2: Blood line disconnection (putting patient off from dialysis)	Vascular access connected aseptically	9.2%	14.1%	5.0%	41.6%	77.5%
	Vascular access not connected aseptically	90.7%	76.8%	94.9%	58.3%	22.5%
	Procedure perform bare handed	0%	8.9%	0	0%	0
3: Exit cite (intravascular catheter) dressing	Vascular access connected aseptically	8.3%	2.6%	11.8%	21.25%	70.8%
	Vascular access not connected aseptically	90.8%	74%	88.1%	71.25%	29.1%
	Procedure perform bare handed	0.8%	23.3%	0	7.5%	0

Comparing the level of practices among different hospitals: Comparing the level of practice among the five tertiary care hospitals, the maximum number of staff who practice aseptically was belong to North-west general hospital (79.2%), followed by Rehman medical institute (39.4%), then Institute of kidney diseases (10.8%), while Khyber teaching hospital (7.8%), and Lady reading hospital (5.5%) (See figure 2).

Figure 2: Practices of nurses regarding vascular access infection

Comparison of public and private tertiary care hospital for knowledge and practices regarding vascular access infections: The comparative analysis of public and private hospitals reveals that private sector hospital has more knowledge (55.33%) as compared to the knowledge of public sector hospitals (39.47%). Similarly, the practices of private sector hospital staff (59.31%) are far better than public sector hospitals (8.18%). (See figure 3).

Figure 3: Comparison of public and private hospitals (Knowledge and Practices)

DISCUSSION

This study explores that 53.4 % of dialysis staff received vascular access related infection control education when they were employed in dialysis unit but at the same time 46.7% of dialysis staff did not received any education. It's a huge proportion of participant who did not received education which may put them, and patients cared by them to life threatening risk. An educational interventional study conducted by EL Nemr (2013) including nurses working in surgical units and emergency intensive care units, the results illustrate increase in knowledge level which

eventually improved their practices leading to decrease catheter related blood stream infections by 50%.[10]

The protocols about strategies to prevent nosocomial infection were not enough in dialysis units. From the results of this study it is evident that only 34.5 % of respondents indicated that they have specific polices to prevent nosocomial infection in dialysis units. Similar findings were presented in a research study conducted by Chitimwango PC (2017) where 52% of participants identified that polices regarding vascular access infection are not enough in their hospitals.[11] This study revealed that 39.7% of dialysis staff must care 5-6 patients per staff and 34.5% of staff has to care 3-4 patients per staff per shift (table 4.2) which indicated a huge workload on dialysis staff. A similar study conducted by Chitimwango PC (2017) indicating that 66.2% of staff were not able to follow infection control guideline due to workload. They lack time to practice according to infection control guidelines. [11]

The analysis of demographic characteristic of dialysis unit (table 4.2) shows that 13.8% of participants had no personal protective equipment(PPE) available at dialysis unit, 48.3% of participants replied that they have only disposable gloves available at dialysis unit. Only 8.6% participants had all PPE. This indicates severe shortage of personal protective equipment which affects the practices of dialysis staff. The effect of this shortage of supplies leads to malpractices evident from the current study practice finding presented in bar chart (4.4.4), which illustrate 4.58% of participants from different institutes performed dialysis procedure bare handed. According to Timilshina (2011) the decreased use of personal protective equipment is associated with the knowledge and importance of its use whole caring haemodialysis patients.[12]

The knowledge of vascular access related infection control enables dialysis nurses and technicians to prevent nosocomial infection among dialysis dependent patients. The researcher found that the mean knowledge level of participants regarding vascular access was 44.94% indicating very poor knowledge. According WHO (2016); the effect of poor knowledge and practices become more devastating with scarcity of resources available to the staff for infection control practices. [13] Low level of knowledge is associated with poor compliance [14] improve knowledge of dialysis staff regarding vascular infection control, formal and periodic in-service education is mandatory.[15] According to Bianco (2013) the knowledge level of staff was found significantly high 72.9% in hospitals' units where written policies regarding infection control are available.[16]

In the current study; it is evident from data analysis that the mean practice level of staff regarding vascular access infection control is 28.63%, indicating very poor adherence to infection control guidelines. A study conducted by Arthi et al.(2016) illustrating similar results about the infection control practices of nursing (5%).[17] Furthermore, it is explored in the study while comparing public sector hospital knowledge and practice regarding vascular access infection control that private sector hospitals have more mean knowledge (55.33%) and practice level (59.31%) than public sector hospital 39.47% and 8.18% respectively. According to Mohammad Jawad (2015) increasing the number of nurses who holds higher educational degrees showed decrease in the risk of mortality, according to him on every 10% increase of nurses with higher educational degree will decrease the risk of mortality by 5%, patient received high quality safe care. The second reason is availability of personal protective equipment. This depict that there is scarcity of personal protective equipment in public sector hospital and increased workload that hinders their performance to perform according to standard protocols. [18]

CONCLUSION
The knowledge of vascular access related infection control enables dialysis nurses and technicians to prevent nosocomial infection among dialysis dependent patients. The study concluded that the mean knowledge level of participants regarding vascular access was 44.94% indicating very poor knowledge, while the mean

practice level of staff regarding vascular access infection control is 28.63%, indicating very poor adherence to infection control guidelines. The hospital should arrange regular educational programs on infection control, standard and transmission-based precautions, and ward-based teaching programs on various care practices. This type of training entails the implementation of educational and induction programs intended to address any gaps in infection control knowledge, attitude, and practice among healthcare workers.

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