Level of Practice Regarding Handling of Blood Culture Samples among Nurses in Public and Private Hospital of Lahore, Pakistan

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ABSTRACT

Background: Blood culture samples handling is considered the most common and important procedures that is performed by nurses in intensive care units. Blood cultures contamination can occur when the blood culture samples are not handled properly. Blood cultures frequently become contaminated during the phase of collection leading to downstream recovery. So, nurses play vital role in eliminating of the problems which may occur due to mishandling of blood culture samples. In this study the nurses of one public and one private hospital were observed drawing peripheral blood culture samples and central venous catheter blood culture samples.

Aim: This study aimed to assess level of practice regarding blood culture samples handling among nurses in public and private healthcare sector.

Methodology: A descriptive cross sectional research design was used to conduct this study. This study was conducted at intensive care units of one private and one public hospital in Lahore.

Results: The results of study revealed that the mean age of participants was 1.50, with a standard deviation of 0.508. Developing periodic training programs for nurses regarding care of patients undergoing blood culture sampling are recommended to update their knowledge and put into practice. Majority of participants had good practices regarding handling of blood cultures in public and private sector hospitals.

Conclusion: The results of the current study showed that most of the participants had moderate to good practices and few have poor practices. Lack of awareness was found a major barrier to blood culture samples handing among nurses.

Keywords: Peripheral blood culture samples handing, Central venous catheter devices blood culture samples, contamination, Blood cultures

Introduction:

Blood cultures aid in determining the precise type of microorganism that is causing the blood stream illness. When coupled with testing for antibiotic sensitivity, it offers details on therapeutic measures. The most frequent tasks carried out in an intensive care unit are removal of blood cultures. As a result, the nurse is crucial to solving potential issues and working with other medical specialists to manage the care plan. It has been a standard practice in the medical field for generations to blood cultures samples handling (BCSH). Additionally, BCSH is provided primarily for improving diagnosis and keeping track of patient's conditions. For the safety of the patients and the integrity of the blood samples, it demands strict adherence to the testing protocols and recommendations. (Lippi et al., 2019).

False blood culture results, longer hospital stays, delayed diagnoses, and the needless use of antibiotics are just a few of the negative outcomes of BCSH. Red blood cells can lyse or split open when test tubes are jostled and jarred while being transported, giving erroneous laboratory results. Another common side effect for patients is bruising at the puncture site, followed by nerve damage, hematomas, and pain. (Renton et al., 2019). The nursing staff also plays an important part in the diagnostic testing process; they frequently recognize the need for diagnostic and microbiological investigations, start the collecting of specimens, and take charge of timely and secure transportation to the laboratory. Nurses are in charge of gathering, moving, and keeping samples that could significantly affect test results (Speedie & Meddilton, 2021).

An intensive care unit nurse should be trained in blood sampling withdrawal to minimize patient harm and avoid needless exposure to blood. It is important to urge groups of healthcare professionals who have not previously received formal training in collecting blood samples to do so, since lax infection prevention and control procedures put patients and staff at risk and staff safety at risk. (Hjelmgren et al., 2021).

The most frequent side effects of central venous catheterization and venipuncture in patients are infections. Inadequate understanding of precise blood sampling withdrawal can have unfavorable effects. In order to complete the blood collection procedure and avoid errors in results, the nurse's role is crucial (Lippi & Salvango, 2019). Therefore, this study was carried out to evaluate the nurse's expertise and methods for handling blood culture samples for patients in intensive care units.

False-positive blood culture findings caused by contaminated samples have been found to raise patient health costs, such as the use of broad-spectrum antibiotics and hospital length of stay.

Objectives of the study

This study is aimed to assess "level of practices regarding blood culture samples handling among nurses in public and private hospital of Lahore, Pakistan."

Methodology

A descriptive cross sectional study design was utilized to conduct this study. This study was conducted at intensive care units of Lahore General Hospital (Public sector) and Doctors Hospital Lahore (Private sector). A Purposive sample of nurses and a convenient sample of patients who are undergoing blood culture sampling withdrawal was taken. Staff Nurses working in intensive Care units of the respective hospitals and having experience equal to or more than 01 year were included in the study. Nurses not involve in direct patient care and nurses not willing to participate were excluded from study. The duration of the study was 04 months. A sample size 80 is determined using Slovin's formula. An observational checklist to assess level of nurse's practices regarding Peripheral Blood Culture and Central Venous Access Device sampling for patients. The study included 84 nurses from the Intensive Care Unit after receiving ethical permission from the Research Committee. To obtain full consent, participants were given appropriate information and the goal of the study was described. SPSS version 21 was used to enter and analyze data. The quantitative variables were given as mean, standard deviation and histograms. Categorical variables were reported as frequencies and percentages. A pie chart and a bar chart are created. Descriptive statistics were used to examine the relationship between public and private hospitals.

RESULTS

The result of this study is distributed into two sections, first section is related to demographic data of nurses taking blood cultures working in intensive care units and second is frequency and statistics of observational checklist items regarding level of practice regarding blood culture samples handing.

Section A: Table 1, shows that the frequency of demographics includes age, gender, education level, experience and 34 participants working in private sector.

Table 1: Demographic Characteristics of Private Hospital

Demographic Variable	Description	Frequency	Percentage
Age	21-25	17	50%
	26-30	17	50%
	30-35	00	0%
	Total	**34**	**100%**
Gender	Male	11	32.4%
	Female	23	67.6%
	Total	**34**	**100%**
Education Level	Dip. In General Nursing	27	79.4%
	BSN Generic	01	2.9%
	Post RN	06	17.6%
	MSN	00	0%
	Other	00	0%
	Total	**34**	**100%**
Experience	06 Months-01 Year	08	23.5%
	01-02 Years	03	8.8%
	02-03 Years	10	29.4%
	Above	13	38.2%
	Total	**34**	**100%**
Sector	Public (Government)	00	0%
	Private	**34**	**100%**

Table 1 shown statistics of demographic characteristics. The mean age is calculated to be 1.50, with a standard deviation of 0.508. The mean gender value is 1.68, indicating that there is a slight imbalance in the representation of genders within the sample. The variable "Education

level" also has a sample size of 34. The mean educational level is determined to be 1.38, with a standard deviation of 0.779. The mean experience value is 2.82, with a standard deviation of 1.193. The mean sector value is calculated as 2.00, with a standard deviation of 0.00.

Table 2: Demographic Characteristics of Public Hospital

Demographic Variable	Description	Frequency	Percentage
Age	21-25	13	26%
	26-30	31	62%
	30-35	06	12%
	Total	**50**	**100%**
Gender	Male	13	26%
	Female	37	74%
	Total	**50**	**100%**
Education Level	Dip. In General Nursing	20	40%
	BSN Generic	15	30%
	Post RN	13	26%
	MSN	02	04%
	Other	00	0%
	Total	**50**	**100%**
Experience	06 Months-01 Year	00	00%
	01-02 Years	08	16%
	02-03 Years	24	48%
	Above	18	36%
	Total	**50**	**100%**
Sector	Public (Government)	**50**	**100%**
	Private	00	00%

Table 3 presents the statistics for various demographic characteristics, including age, gender, education level, experience and job sector. For variable "Age," the sample size is 50. The mean age is calculated to be 1.86, with a standard deviation of 0.606. The mean gender value is 1.74, with a standard deviation of 0.443. The mean educational level is determined to be 1.94, with a standard deviation of 0.913. The mean experience value is 3.20, with a standard deviation of 0.700. The mean sector value is calculated as 1.00, with a standard deviation of 0.00.

Section B: It consists of two parts, **Peripheral blood culture samples (Part-1)** and **Central Venous Catheter blood cultures (Part-2).** Level of practice regarding blood culture samples handling among nurses.

Table 3: Peripheral Line Blood Culture

Sr#	Peripheral Blood Culture	Private Hospital Yes %	Private Hospital No %	Level of Practice	Public hospital Yes %	Public Hospital No %	Level of Practice
1	Prepared the sampling basket and collect required items.	77.8	22.2	Level 1 (Good practice)	70	30	Level 1 (Good practice)
2	Verified patient identification by using two unique identifiers and explained the procedure.	55.6	44.4	Level 2 Moderate practice)	50	50	Level 3 (Poor practice)
3	Performed hand hygiene and wear non-sterile gloves.	77.8	22.2	Level 1 (Good practice)	65	35	Level 2 Moderate practice)
4	Removed the plastic flip cap and disinfect the bottle septum with alcohol swabs.	33.3	66.7	Level 3 (Poor practice)	60	40	Level 2 Moderate practice)
5	Applied a tourniquet to find a vein and released the tourniquet.	88.9	11.1	Level 1 (Good practice)	75	25	Level 1 (Good practice)
6	Cleanse the skin site with alcohol swabs 3 times in a circle (inner to outer) and allowed the site to air dry.	77.8	22.2	Level 1 (Good practice)	55	45	Level 2 Moderate practice)
7	Re-applied the tourniquet, cleanse the site with Chlorhexidine 2% in 70% alcohol spray, and allowed the site to air dry.	33.3	66.7	Level 3 (Poor practice)	20	80	Level 3 (Poor practice)
8	To avoid contamination, did not re-palpate the venepuncture site.	66.7	33.3	Level 2 Moderate practice)	55	45	Level 2 Moderate practice)
9	Drawn required amount of blood sample (20ml in adults and according to weight in children).	66.7	33.3	Level 2 Moderate practice)	75	25	Level 1 (Good practice)
10	Filled the anaerobic	77.8	22.2	Level 1	70	30	Level 2

	culture bottle first.			(Good practice)			Moderate practice)
11	Labelled the bottle: Patient name and MR number, date, time and site of draw. Blood sample collector name initials and E. code.	66.7	33.3	Level 2 Moderate practice)	55	45	Level 2 Moderate practice)
12	Transported the specimens to the laboratory immediately.	77.8	22.2	Level 1 (Good practice)	60	40	Level 2 Moderate practice)

Table 4: Central Venous Catheter Device Blood Culture

Sr#	CVAD Blood Culture	Private Hospital Yes %	Private Hospital No %	Level of Practice	Public hospital Yes %	Public Hospital No %	Level of Practice
1	Prepared the sampling basket and collect required sterile items e.g.: sterile glove and sterile prep tray.	80	20	Level 1 (Good practice)	66.7	33.3	Level 2 (Moderate practice)
2	Verified patient identification by using two unique identifiers and explained the procedure.	92	08	Level 1 (Good practice)	53.3	46.7	Level 2 (Moderate practice)
3	Performed hand hygiene and wear non-sterile gloves.	92	08	Level 1 (Good practice)	80	20	Level 1 (Good practice)
4	Removed the plastic flip cap and disinfect the bottle septum with alcohol swabs.	72	28	Level 2 (Moderate practice)	66.7	33.3	Level 2 (Moderate practice)
5	Performed hand hygiene, and wear sterile gloves.	36	64	Level 3 (Poor practice)	33.3	66.7	Level 3 (Poor practice)
6	Maintained the sterile field under the patient's arm or	32	68	Level 3 (Poor practice)	26.7	73.3	Level 3 (Poor practice)

	no the chest.						
7	Cleanse all the CVC lumens and removes needless injection cap (bionector) and clean the hub with chlorhexidine 2% in 70% and allowed the site to air dry.	16	84	Level 3 (Poor practice)	16.7	83.3	Level 3 (Poor practice)
8	To avoid contamination, did not touch the hub after disinfect.	76	24	Level 1 (Good practice)	73.3	26.7	Level 2 (Moderate practice)
9	Discarded initial blood (3 ml for adults and 0.2 ml for pediatric patients), and drawn required amount of blood sample (20 ml in adults and according to age in children).	84	16	Level 1 (Good practice)	73.3	26.7	Level 2 (Moderate practice)
10	Filled the anaerobic culture bottle first.	84	16	Level 1 (Good practice)	80	20	Level 1 (Good practice)
11	Label the bottle: Patient name and MR number, date, time and site of draw. Blood sample collector name initials and E. code.	84	16	Level 1 (Good practice)	66.7	33.3	Level 2 (Moderate practice)
12	Transported the specimens to the laboratory immediately.	80	20	Level 1 (Good practice)	73.3	26.7	Level 2 (Moderate practice)

DISCUSSION

This study was conducted among 84 participants with 100% response rate in private and public hospitals, respectively.

First, observations regarding peripheral blood cultures in both private and public sector. The practice variable explains the existing practices the participants have with preparing the sample basket and collecting required items for peripheral blood cultures, 77.8% collected the required items to draw blood cultures and 22.2% did not collected the items appropriately in private hospital. Whereas, in public hospital 70% collected the items and 30% failed to perform this step appropriately.

Next step was to perform hand hygiene. As it is very important and 100% compliance is necessary (as per WHO guidelines) to prevent hospital acquired infections (HAIs). Blood cultures sampling is sterile procedure and should be done appropriately to prevent patient from HAIs. In private sector, 77.8% participants performed hand hygiene and 22.2% didn't show compliance. However, in public sector, 65% strict to the compliance and 35% failed to follow the step. For collecting blood cultures, it is necessary that all the equipment used during the procedure must be sterile, specially the culture bottle.

Applying a tourniquet is necessary to find a vein during peripheral blood samples. The majority of participants 88.9% used the tourniquet efficiently and 11.1% were not able to use it efficiently in private sector. Same level of majority was seen in public hospital, where 75% used tourniquet efficiently and 25% failed to do so. Cleaning the skin with alcohol swabs 3 times is a circle and allowing it to dry is very important to kill the microorganisms on the skin surface. During this step, 77.8% clean the sin site and allowed it to dry and 22.2% didn't do it well in private sector. In public sector the adherence to skin site cleaning remained low 55% (due to the non-availability of alcohol swabs) and 45% didn't performed the step. Chlorhexidine 2% in 70% alcohol spray (Hexi prep solution) was not available in either of the sectors from which data were gathered. So, the adherence to this step remained low in both sectors. 33.3% cleaned the site with pyodine solution or alcohol swabs and 66.7% did not perform this step in private hospital. Same in public hospital, 20% done and 80% not done this step.

Now we will be discussing observations regarding Central venous catheter device blood cultures. Hand hygiene and wearing of non-sterile gloves was done by 92% and 08% skipped tis step in private sector. Whereas in public sector, 80% had compliance of hand hygiene and 20% skipped the step. Good number of participants removed the plastic flip cap and disinfect the bottle septum with alcohol swabs. In public sector, 66.7 clean the bottle septum and 33.3% didn't clean it. Once again hand hygiene was performed and sterile gloves were wear by 36% and 64% did not wear sterile gloves in private sector.

Peripheral Blood Sampling Withdrawal (PBSW) has been used for millennia and is one of the most prevalent invasive procedures in medicine. Furthermore, PBSW is provided primarily for improving diagnostic and patient monitoring. It demands for strict adherence to test methods and recommendations to maintain patient safety and blood sample integrity (Lippi et al., 2019). Blood cultures (BCs) provide timely identification and definitive diagnosis of systemic blood infections for prompt clinical treatment and management (Samiolo et al., 2017). They are one of the most critical laboratory (lab) tests for safe infection control and medical care (Liu et al., 2016). The contamination of BCs is an ongoing medical community (AlHamad et al., 2015). Pathogens present on the skin surface at the venipuncture site are the most common source of BC contaminants (Chang et al., 2015).

Blood cultures (BCs) are collected to assess and discover systemic infection in clients (Liu et al., 2016). When the consistency of the aseptic technique is compromised, contamination accounts for 50% of all positive results (Sanders, Agger, Gray, Fischer, & Kamprud, 2019). The contamination can result in diagnostic uncertainty, false-positive BC results, unnecessary antibiotic therapy, extended hospitalization, and increased healthcare workload and cost (Bell, Bogar, Plante, Rasmussen, & Winters, 2018). False blood culture results, prolonged hospitalization, delayed diagnosis, and inappropriate antibiotic administration are all possible side effects of PBSW. Moving test tubes can lyse or split open red blood cells, resulting in misleading laboratory results. Other typical side effects for neonates include bruising at the puncture site, nerve damage, hematomas, and discomfort (Renton et al., 2019).

The findings of the current study suggest that there is existing gap between the practice and delivery of care. The education provided to the nurse is not enough or there is a problem

between the delivery of knowledge to the practices that will have an overall beneficial effect to both the client, sector and the health care provider.

Conclusion

The results of the current study showed that most of the participants had moderate to good practices and few have poor practices. Lack of awareness was found a major barrier to blood culture samples handing among nurses. The reason for poor practices in some steps were the non-availability of scarce resources to perform this procedure, especially in public sector. The other main reason of blood cultures contamination is staff over burden. It was observed that in intensive care units (public hospital) staff ratio is 1:3 (vented patients). Therefore, it is difficult for the staff to perform such aseptic procedures efficiently.

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