Performance Compatibility of NICU Nurses in Blood Culture Procedure

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ABSTRACT

Blood culture is a procedure in NICU and gold standard procedure for diagnosis of newborn infections and it is necessary for appropriate management of patient. The present study was aimed to investigate the performance compatibility of Tabriz medical Sciences University nurses who worked in NICU. The present cross-sectional descriptive study was conducted using convenience sampling method on 180 nurses working at Alzahra, Taleghani and Tabriz Children Hospital. The study tools included a two-part questionnaire, the first part of which focused on demographic characteristics of the infants and nurses and the service area, and the second part was a checklist of the nurses' performance in pre & post of blood culture procedure. Data analysis was performed using SPSS (ver.18) statistical software as well as descriptive and Analytical statistics. While 72.6 present of nurses …trained about blood cultures sampling workshop. The average percentage of the total performance score before and after blood culture sampling was 1.65 ± 0.32 and 1.85 +0.21, from 2 score. It is necessary to provide adequate training about procedure in order to achieve sufficient skills. Therefore, organizations should regularly improve their systems in accordance with relevant standards and evaluate their activities. Such studies unfold the advantages of application of the standards as well as disadvantages of their neglect.

INTRODUCTION

At medical centers, nearly 70% of the medical decisions are made based on the laboratory tests; besides, most of the infants are exposed to numerous samplings including blood culture at their admission to the hospitals because infectious diseases account for 70% of deaths among children and infants in developing countries [1]. Statistics shows that in Iran, as in other countries, sepsis is one of the major causes of infants' hospitalization [2-4] .In recent years, hospital infections resistant to conventional drugs have been increasingly reported throughout the country [5-7].

Typically, blood culture is the basis for the diagnosis of bacterial infection and is also an essential component in detecting the threatening organisms. Accordingly, for starting the antibiotics and appropriate treatment, blood culture is considered as a definitive laboratory culture [8-10].

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The first criterion for the diagnosis of sepsis is the positive blood culture [9]. Furthermore, one of the major problems, with which the hospitals and laboratories are encountered, is the existence of extracorporeal bacteria. These bacteria enter the patient's blood through different ways and lead to false-positive blood culture results, which makes the isolation of sepsis from contamination (false-positive blood culture) challenging [10-12].

In the study conducted by Chitsaz on infants and children, the real-positive blood culture was reported equal to 15.95%, while 84.4% of the specimens had been reported as false-positive[13] In another work conducted by Ghorashi et al. in neonatal and hematology in Tabriz, 78.9% of the specimens were real-positive and 21.1% were reported as false infection[14] Moreover, in Asefzadeh's [15[study, the false-positive culture was equal to 66%, while in accordance with the standards established by the American Microbiology Society, the blood culture contamination rate should not exceed 3% [16]. Regarding the prevalence of blood culture sampling in neonatal units, the figures reported in the above-mentioned studies are not promising [14].

Although reducing the damage to safety is considered as one of the fundamental factors in high-quality care services [17, 18]. The nature of health care is complicated and exposed to the high probability of errors [19]. Medical errors have been announced as one of the five main causes of mortality in the world and, according to the WHO's estimation, dozens of millions of patients in the world are annually victimized by damage and harms of the mortality resulted from unsafe care and services [20] Nurses, as one of the key members of the care and treatment team, play a special role in preventing the treatment complications and achieving the desired therapeutic outcomes; therefore, it is inevitable and essential to train them based on the standards [21].

Since the blood culture procedure is performed by the nurses and the working conditions at neonatal units are unique, no studies have been conducted so far on the nurses' performance at neonatal units in terms of blood culture procedure and also the proper use of the available resources, maintenance of safety, cost savings, further survival of the patients and, consequently, application of the standard procedures are substantially important, the present study was conducted in order to assess the performance compliance rate of the nurses at NICUs of Tabriz University of Medical Sciences in blood culture procedure in the hospitals located in City of Tabriz.

MATERIALS AND METHODS

The present cross-sectional descriptive study was conducted using convenience sampling method on all the nurses working in Alzahra and Taleghani Educational and Medical Centers as well as Tabriz Children Hospital. Nurses who have BSc or MSc degree and direct work with newborn include to study .The sample size was estimated as approximately 168 samples based on Cinder Susan et al.'s study; and 180 procedure observed . Besides, it was attempted to observe each nurse at least twice. The data collection tool used in this study has a two-part, the first part of which included the information on demographic characteristics of the newborn (gender, fetal age, birth weight, postnatal age and medical history) as well as information on demographic characteristics of the nurses (gender, marital status, work experience, job position, education, working background and training courses). Furthermore, the second part of the questionnaire included a checklist to investigate the nurses' performance in blood culture procedure, which was adapted from Mosby Skills website [22]. The checklist measured performance of the nurses before the procedure by 8 three-item questions and after the procedure by 6 three-item questions.

The scoring method was in such a way that the scores of 2, 1 and 0 were assigned to each of the "Satisfactory", "Unsatisfactory" and "No Operation" options, respectively. However, if each of the cases had no problem in this regard, the relevant variable would be eliminated from the total score and, finally, the average score was considered as the final score. In this questionnaire, the performance scores before and after the sampling ranged between 0-16 and 0-12, respectively.

Validity of the tools was evaluated through a survey among 10 nursing instructors and neonatal specialists. As for the reliability of scale was scored by two observers at the same time for 10 samples and, then, approved since the consistency coefficient exceeded 0.7.

After obtaining the invitation letter from the Vice Chancellor for Research, Faculty of Nursing and Midwifery, Tabriz university of Medical Sciences, and the permission from Committee of Ethics of the

same university with coordination of the hospital authorities, the researcher introduced himself to the research environment, which included the NICUs of Alzahra and Taleghani Educational and Medical Centers as well as Tabriz Children Hospital and spent several days in these units in order to normalize his presence in the environment. Subsequently, by studying the patients' records, the cases with blood culture order were selected and, then, included in the study through convenience sampling method. After completing the demographic data by studying the information in the patients' records, the sampling method was observed and the given checklists were completed. Furthermore, in order for ethical considerations, the participants were informed about observation on their performance. Sampling was performed at all the morning, evening and night working shifts. Once the questionnaires were completed, the cases in contrast with the standards were identified; if necessary, the essential items were presented to the staff as practical trainings at the end of the project. Finally, the collected data were analyzed using SPSS-21 software and descriptive indices (frequency, frequency percentage, mean and standard deviation).

RESULTS

Results of the present study showed that the majority of the infants were male and experienced the first-time hospital stay (Table-1). Furthermore, most of the nurses were female and married, had BSc degrees and were officially employed by the hospital. Besides, they were working at different rotational shifts; most of them had not passed any training course for sampling and blood culture (Table-1).

Investigating the performance status before blood culture sampling showed that the highest mean was related to the item "Doctor's order for blood culture is controlled and approved", while the lowest mean was related to the item "Expiration date of the culture media is controlled", indicating that nearly half of the nurses paid no attention to the expiration date of the culture media (Table-2).

Investigating the performance status after blood culture sampling showed that the highest mean was related to the item "Needle is slowly removed and bleeding is controlled" and the lowest mean was related to the item "Re-examination of the infant is done in terms of bleeding and relaxation ". Nearly one fourth of the nurses did not carry out labeling

beside the infant immediately after the sampling (Table-3).

Table 1: Socio-demographic and Job-related characteristics of NICU nurses participated in the study and infants (n=180)

Variables	NICU
Sociodemographic characteristics of nurses	N. (%)
Gender	
Male	2(1.1)
Female	173(98.9)
Marital status	
Single	49(27.5)
Married/other	129(72.5)
Level of Education	
Bachelor	173(97.8)
Master of Science	4(2.3)
Participation in moral training workshop during work time	
NO	127(72.6)
YES	48(27.4)
Job-related characteristics	
Workplace type	
Fixed	15(8.6)
Shift	160(91.4)
Employment status	
Official	76(42.9)
Non Official	101(57.1)
Sociodemographic characteristics of neonates	
Gender	
Female	64(35.8)
Male	115(64.2)
Has the Neonate or mother received antibiotic Prophylaxis?	
NO	65(41.9)
YES	90 (68.1)
Several Hospitalization	
First time	173(96.1)
Many time	7(3.9)
Gestational age (wk) Mean±SD	32.98±4.32
Newborn age (days)	18.89 ±13.99
Birth weight (g) Mean±SD	2159.91±1187.82

DISCUSSION

Improving the quality and safety of health services is of special importance and monitoring the key indicators is very important for achieving these goals as well as better performance among the nurses. Success of the reduced contamination in blood culture begins with the participation of the staff. Results of the present study showed that the mean percentage of the total score of performance before and after performing the blood culture sampling was equal to 1.65 ± 0.32 and 1.85 + 0.21, respectively. A study conducted on the nurses working at ICUs showed that the nurses required more specialized information in their working field [23]. These findings were consistent with those of the study conducted to evaluate performance of the

Table 2: Mean and standard deviation of check status check status before performing blood culture sampling

Variable	SD	Mean	Percentage of performance score
Verified the prescribing practitioner's order.	1.98	0.13	99%
The appropriate venous site is evaluated before sampling	1.96	0.18	98%
The necessary equipment is completely prepared before the newborn is sampled (Culture medium, Suitable needle, blood culture kit, appropriate disinfectant solution and sterile gloves)	1.95	0.19	97.5%
Performed hand hygiene before newborn contact.	1.88	0.64	94%
Verified the correct newborn using two identifiers.	1.80	1.54	90%
Reviewed the newborn 's medication history and Tests (such as coagulant disorders and platelet)	1.73	1.01	86.5%
With the assistance of a staff or family member, positioned and support the newborn)	1.61	1.04	80.5%
The expiration date of the cultivation environments is controlled	1.10	0.83	55%
Average total score	1.65	0.32	82.5%

Table 3: Mean and standard deviation of the checklist for evaluating functional status after blood culture sampling

Variable	Mean	SD	Percentage of performance score
carefully withdrew the needle from the vein and bleeding is controlled	1.98	0.13	99
Immediately applied pressure over the venipuncture site with gauze or antiseptic pad until the bleeding stopped	1.95	0.21	97.50
Gently mixed the medium and blood after inoculation.	1.95	0.21	97.50
Immediately transported the specimen to the laboratory.	1.75	0.58	87.50
Reassess the child for bleeding and relaxation done	1.73	0.55	86.50
In the presence of the newborn, labeled the specimen per the organization's practice	1.68	0.46	84
Average total score	1/84	0/21	92/33

NICU nurses in reducing blood contamination in the culture procedure, which had been reported as poor results due to the knowledge gap on the standardized method as well as lack of awareness about the consequences of failing to follow the standard method. However, they were not consistent with results of the present study. Indeed, such a difference in the results might be due to the difference between the research units, study environments, applied tools, sampling methods and observations in these works [24].

Results of one study demonstrated that in the blood culture procedure in NICU, by using a simple educational tool and providing precise reports on clinical performance accordingly, the nurses evaluated themselves in the determined tool, which led to a significant reduction in blood contamination among the infants. Hence, performance of the nurses was reported at a good level, which was consistent with the results of our study [23]. Moreover, findings of another work showed that blood contamination was reduced due to the nurses' use of sterile method and checklist in blood culture and also performance of the nurses was reported at a good level [25].

Results of Bloom *et al.*'s study indicated that concentration on time limits, use of gloves and hand-washing before interacting with the patients led to a significant reduction in the incidence of sepsis among infants. Furthermore, the performance results were reported at a good level, which was consistent with results of the present study [26]. However, these results were not consistent with those of a study conducted in Ghana on the nurses' performance in terms of hand-washing and infection control at NICU since their performance was reported as poor [27].

In another study, due to the nurses' wrong beliefs on the sterility of the Blood culture bottles and lack of need for cleaning their upper surfaces resulted in the penetration of the contaminants into the bottle, performance of the nurses was reported as poor, which was not consistent with results of the present study.

Determining the contamination in blood culture media is essential for appropriate management of the patients and the rational use of the patient resources. A nursing team committed to optimize the quality of patient care affects the clinical results (patient safety and efficacy, reduced consumption of unnecessary antibiotics, reduced risk of

microbial and unnecessary diseases as well as their side-effects and hazards) by improving the blood culture procedure.

If the blood culture procedure is not performed, it will lead to incorrect decisions, long and unnecessary hospitalization up to 4.5 days, administration of inappropriate and unnecessary antibiotics, increased medical costs, infant's blood loss, increased workload of treatment staff as well as increased pain and stress in the infants, which in turn entails reduced immune system and increased infection. Furthermore, it will result in the increased financial losses and more stress on the infant's family [10-12, 28-30].

According to the studies, the nurses are responsible for adopting the correct technique for performing the procedure from sample collection to sample submission. Thus, it is essentially necessary to provide the staff with adequate training to achieve sufficient skills for collecting the specimens, selecting the appropriate place, preparing the appropriate blood collection site, appropriate tools and appropriate blood volume, as well as carrying and maintaining the specimens [11, 15, 28].

The organizations should regularly improve their systems in accordance with the relevant standards and evaluate their activities [31]. Since such investigations reveal the advantages of applying the standards as well as disadvantages of their neglect. Furthermore, they may lead to considerable savings in the costs related to the nursing time and the pharmacy costs associated with processing, delivery, administration, monitoring, interventions and antibiotics costs.

One of the constraints of the present study was that it was conducted only on the nurses working in hospitals located in City of Tabriz, which could limit generalization of the obtained results. Therefore, results of this study cannot be generalized to other nurses.

Acknowledgments

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