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THE AUDIT OF NURSING CARE ASSOCIATED WITH SUCTION IN INFANTS HOSPITALIZED IN NEONATAL INTENSIVE CARE UNIT IN SELECTED CENTERS OF TABRIZ UNIVERSITY OF MEDICAL SCIENCES & HEALTH SERVICES BY 2014

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ABSTRACT

Objective: conducting safe endotracheal suctioning in neonates under mechanical ventilation is necessary and inevitable, as well continuing the evaluation based on the standards of care is essential to improve neonates' health; so this study is conducted to audit the suction related

nursing cares of hospitalized neonates in intensive care units in selected hospitals of Tabriz University of Medical Sciences & Health Services by 2014.

Methods: at the descriptive study, 200 suction related nursing care cases of neonates were observed. After obtaining permission of the Ethics Committee of Tabriz University of Medical Sciences and coordination with Taleghani and children's hospitals centers in Tabriz, the checklist about suctioning cares was developed. Its validity confirmed by content validity index (75 percent) and its reliability was tested using inter-rater reliability (ICC=0.75). For purpose of data collection, nursing intensive cares units (NICU) of Taleghani and Tabriz Hospitals were observed and checklists were filled out. Then, data were analyzed using descriptive statistics and chi square test in significance level of $p<.05$.

Result: majority of staff have BA in nursing (91.37 percent), with work experience to 5-10 years (58.62 percent). All staff (100%) passed the in-service neonate intensive care unit (NICU) courses. The level of consistency between cares and standards in terms of general, before, during and after suction were 87.05, 74.5, 91.13 and 95.54 percent respectively.

Conclusion: nursing cares related to suctioning infants has been done to 85% based on standard, which indicates that the value is close to standards. However, because of removing some issues like washing hands and importance of this issue to prevent infections in infants in neonatal intensive care units, observance of intervals between suctions to prevent hypoxia and dangerous results of it, lack of using normal saline solution routinely and regardless of indication of consuming it like thick discharge, adjusting the negative pressure of suction and other cases evaluates in checklists, care unit has obtained average score.

Moreover, there is need to improve existing situation. Hence, holding in-service training courses and more supervision to improve quality of suctioning infants is suggested.

Keywords: Clinical audit, airway suctioning, neonatal intensive care, nursing standard care

INTRODUCTION

The most prevalent life-threatening diseases in infants are breathing problems. Many infants admitted in neonatal intensive care unit (NICU) with breathing problems can be an evident for this issue. A lot of these infants need oxygen and even mechanical ventilation. For this purpose, usually an artificial airway such as endotracheal tube is used (1). Existence of endotracheal tube can cause mucosal irritation and increase airway secretions. On the other hand, the endotracheal tube can disrupt function of mucosal cilia and as infant is unable to cough, the secretions would be accumulated and ability of infant

would be decreased to clean airways from secretions (2).

Hence, in order to clean airways from secretions, suctioning is required to save function of airways and to facilitate oxygenation and ventilation in infants (3). Although suction of airways is a vital issue, if it is not conducted based on practical principles and healthcare standards, it can result in potential dangers for infant. Lack of suctioning or inadequate suctioning can lead to dangerous outcomes including bronchoconstriction, increased intracranial pressure, intracranial hemorrhage, hypoxemia, tracheal mucosal damage, cardiac arrhythmias, bradycardia, and eventually cardiac arrest and death (4, 5).

However, despite to prove damaging disadvantages of suction, it seems that endotracheal tube suction in units is a routine action and not based on physiologic or existing evidence (6). Moreover, according to relevant studies, current healthcare centers don't use a standard method and based on evidence and use various methods for endotracheal suctioning (7, 8, 9). On the other hand, continuous scientific advancements, along with situation of patients, need skill of nurses to combine technical skills and professional knowledge and diagnose problems of patients based on scientific evidence and implement them in a continuous process and valuate a healthcare program to solve abundant problems of the patients (10). Therefore, identification of methods with least side effects and codification of standards for endotracheal tube suction and implementing them in practice and clinic is an important issue (2).

Professional function standards are declarations that are expected from performance of an expert nurse. In other words, standards can be applied in assessment and evaluation of performance of expert nurses and are an adequate framework to ensure of safe nurse care, desirable performance improvement and prediction of required actions to reform the processes (11). The amount of observance of the standards can be used as a tool to evaluate performance (12).

Currently, one of the methods to improve and evaluate quality is auditing. Audit means systematic evaluation of health services using criteria that emphasize continuous improvement of healthcare, patient-orientation and paying attention to safety improvement of staff and patients. Auditing the process specifies that which performance standard is realized (13, 14). The evaluation helps nurses to use required knowledge, skill and attitude for performance to create a significant, productive and satisfactory workplace (15).

Through auditing nurse cares related to endotracheal suctioning in infants, existing situation of caring after infants can be specified and based on identification of problems and bottlenecks, required programs would be implemented to meet them. Through meeting the problems and enhancing nurse care level, amount of side effects resulted from undesirable performance could be minimized. As a result, hospitalization duration of infants in intensive care units and negative effects of non-standard nurse cares on different organs of infants could be also declined (16). Hence, this study has been adopted with the aim of determining and comparing nurse cares related to suction in infants hospitalized in NICU with standards in selected centers of Tabriz University of Medical Sciences & Health Services by 2014.

METHODOLOGY

The present study is a descriptive-comparative study with auditing approach that is adopted with the aim of assessing situation of observance of nursing standards in relation with safe suctioning in nurses employed in Taleghani Training and Medical Children Centers affiliated to Tabriz University of Medical Sciences & Health Services by 2014.

All nursing cares done before, while and after suctioning airway in infants hospitalized in NICU of mentioned centers have been selected using sampling of events in three shifts of morning, afternoon and evening. According to literature and as no study is found in this field, sample size has been estimated to 200 people in confidence level of 95% and maximum estimation error of 0.05. The size of sample is allocated based on birth and hospitalization rate of infants equally (100 observations for every hospital). For purpose of data collection, demographic information questionnaire and codified checklist based on available standards in regard with infant airway suctioning have been applied. Demographic information questionnaire has two sections and includes information related to nurses including work experience, education level, academic major, work shift and status of passing NICU courses and a section is related to infant and includes questions about infant's age, sex, type of delivery, birth weight, cause of admission, diagnosis, type of respiratory support received, the occurrence of pneumothorax after suctioning, cerebral ultrasound to check for brain hemorrhage at the day 7 after hospitalization. Checklist of nurse care evaluation includes 3 sections related to cares before (6 items), while (10 items) and after (9 items) endotracheal suctioning and mouth and nose suction. The items were ranked using three options

including "correctly done", "not correctly done" and "not done at all". Hence, point 2 was given to the first option; point 1 to second option and point 0 was given to the last option. Then, according to points of each item in relevant checklist and estimation of checklist score, point of each checklist was calculated and each checklist was divided to measures before, while and after suctioning due to gained point in three levels of weak (0-33), medium (36-47) and desirable (68-100). To determine validity of the checklist, Content Validity Index (CVI) and face validity index (FVI) have been applied. CVI has been estimated to 75% in minimum rate. Content validity for checklists before, while and after suctioning has been estimated to 97, 92 and 90% respectively and content validity has been estimated totally to 93% and no one of items was excluded. In order to test reliability of checklist, Method of Agreement between Observers has been applied. For this purpose, checklist was presented to two observers in same level in terms of accuracy of action, skill, knowledge and awareness. Two observers fulfilled checklists for 10 care items (events) at the same time. Then, internal correlation coefficient between their observations has been estimated (ICC=0.75).

After getting permission of Ethics Committee and Presentation of Tabriz University of Medical Sciences, manner of nurse cares related to suctioning was recorded by the observer in three working shifts. Afterwards, using descriptive statistics, central indices and scatter indices, one-dimensional frequency distribution table and statistical diagrams were derived for the data.

In order to investigate relationship of different factors associated with giving required nurse cares to infants, Chi square test has been applied and in regard with items that variable was normal, independent t-test and analysis of variance is applied. In case of abnormal variables, Mann Whitney or Kruskal-Wallis test is applied. Then, the data were entered to SPSS 16 respectively with codes 0, 1 and 2 as quantitative data. Firstly, points of checklists were estimated as follows:

$$point = \frac{(number\ of\ correctly\ done \times 2) + number\ of\ not\ correctly\ done}{(number\ of\ correctly\ done + number\ of\ not\ correctly\ done + number\ of\ No) \times 2}$$

Afterwards, obtained points have been changed into percent and then were analyzed.

RESULTS

All studies personnel had nursing degree and had the experience of passing NICU training courses. Majority of participants (44.8%) in circulating shifts has work experience of 5-10 years in NICU (58.62%)

and had education degree of BA (91.37%). In regard with assessing demographic variables, no significant correlation was observed between the variables and cares before, while and after suctioning (P>0.05). majority of observed infants were male (57%), were born in cesarean delivery process (70.5%) and had birth weight over 3kg (45.5%), birth age over or equal to 37weeks (71%) and with medical diagnosis of neonatal respiratory distress syndrome (20.5%).

Total consistency of nurse cares associated with suctioning in infants has been evaluated to 87.05%. Highest rate of consistency of cares with standards in checklist for measures after suctioning has been equal to 95.54%. Values of measures while suctioning in checklist has been estimated equal to 91.13% and before suctioning, the value is estimated to 74.5%. In other words, the care have been evaluated in desirable level in relation with measures before suctioning to 71.42%, while suctioning to 90.90% and after suctioning to 100%. Detailed information of these nurse cares have been presented in table 1.

Table 1: descriptive information of situation of implementation of nurse care standards related to required actions before, while and after suctioning in infants hospitalized in NICU of selected hospitals of Tabriz University of Medical Sciences by 2014

	table 1- required actions before suction	correctly done	not correctly done	not done at all	Total number (%)
		Number (%)	Number (%)	Number (%)	
	1- Control clinical symptoms requires suctioning	200 (100)	0 (0)	0 (0)	200 (100)
	2-infant hyperoxygenation	111 (55.5)	51 (25.5)	38 (19)	200 (100)
	3-washing hands	137 (68.5)	47 (23.5)	16 (8)	200 (100)
4-preparing equipment	4-1- suction catheter	200 (100)	0 (0)	0 (0)	200 (100)
	4-2- sterile gloves	200 (100)	0 (0)	0 (0)	200 (100)
	4-3- saline normal solution	142 (71)	0 (0)	58 (29)	200 (100)
	4-4- Stethoscope	200 (100)	0 (0)	0 (0)	200 (100)
	4-5- Bagging connected to Oxygen	195 (97.5)	0 (0)	5 (0.2)	200 100)
5-wear gloves		200 (100)	0 (0)	0 (0)	200 (100)
6-wear gun		3 (1.5)	1 (0.5)	196 (98)	200 (100)
7-using glasses		3 (1.5)	1 (0.5)	196 (98)	200 (100)

table 2- actions while suctioning	correctly done	not correctly done	not done at all	total
	Number (%)	Number (%)	Number (%)	Number (%)
1- Select the appropriate size of suction head	199 (99.5)	0 (0)	1 (0.5)	200 (100)
2- enter the suction endotracheal tube under sterile conditions	197 (98.5)	3 (1.5)	0 (0)	200 (100)
3-enter the suction head with good length	156 (78)	44 (22)	0 (0)	200 (100)
4- openness of connection hole while entering suction head to endotracheal tube	200 (100)	0 (0)	0 (0)	200 (100)
5-closeness of connection hole while suctioning and while pulling out suction head from endotracheal tube	200 (100)	0 (0)	0 (0)	200 (100)
6-number of times of entering suction head should be less than 3 times	194 (97)	6 (3)	0 (0)	200 (100)
7-suction duration should not be over 5-	193 (96.5)	7 (3.5)	0 (0)	200 (100)

10sec				
8-observance of intervals of suctioning (30-60sec)	**118 (59)**	**74 (37)**	**7 (3.5)**	**200 (100)**
9- Suitable negative pressure (80-60 mmHg	**75 (37.5)**	**119 (59.5)**	**6 (3)**	**200 (100)**
10-using normal saline if required and in case of thick secretions	**154 (77)**	**0 (0)**	**46 (23)**	**200 (100)**
11-considering hemodynamic changes (changes in heart rate, ..)	**194 (97)**	**1 (0.5)**	**5 (2.5)**	**200 (100)**

table 3- actions after suctioning	**correctly done**	**not correctly done**	**not done at all**	**total**
	Number (%)	**Number (%)**	**Number (%)**	**Number (%)**
1- Quick Connection of infant to ventilator for open suctioning	**200 (100)**	**0 (0)**	**0 (0)**	**200 (100)**
2- reducing Increased oxygen levels	**142 (71)**	**43 (21.5)**	**15 (7.5)**	**200 (100)**
3- Listen to the sounds of the baby's lungs	**138 (69)**	**7 (3.5)**	**55 (27.5)**	**200 (100)**
4- Check the baby's heart rate and rhythm, blood pressure newborn, respiratory rate and …	**193 (96.5)**	**0 (0)**	**7 (3.5)**	**200 (100)**
5- Check secretions characteristics in terms of color and record it	**199 (99.5)**	**0 (0)**	**1 (0.5)**	**20 (100)**
6- Check secretions characteristics in terms of amount and record it	**200 (100)**	**0 (0)**	**0 (0)**	**200 (100)**
7- Check secretions characteristics in terms of consolidation and record it	**200 (100)**	**0 (0)**	**0 (0)**	**200 (100)**
8-check infant's tolerance	**196 (98)**	**0 (0)**	**4 (2)**	**200 (100)**
9-gathering devices	**200 (100)**	**0 (0)**	**0 (0)**	**200 (100)**
10-washing hands	**200 (100)**	**0 (0)**	**0 (0)**	**200 (100)**
11-recoding the process in file of infant	**200 (100)**	**0 (0)**	**0 (0)**	**200 (100)**
12- Report to doctor if experience any problems during suctioning	**200 (100)**	**0 (0)**	**0 (0)**	**200 (100)**

DISCUSSION AND CONCLUSION

The most consistency of cares with standard has been in checklist of actions after suctioning and checklist of actions while suctioning and before suctioning are in next positions. Obtained results indicate that in regard with level of implementing required nurse care standards before suctioning, 74.6% of these cares are done correctly, 4.2% are done incorrectly and 21.2% have not done. In this regard, the highest scores have been related to correctly implementation of symptom control items of need to suction and preparation of equipment, which was expected to do suction due to necessity of existence of the equipment. In study of Mazaheri et al (2011), about 28% of personnel have done suction always and 29.6% of them most of the time to 2hrs and if necessary (17). One of the most important issues in this section was that despite to importance of hyperventilate before suctioning to prevent drop of oxygen saturation, the suctioning action was done correctly only in half of cases before suctioning infant.

As it was mentioned, lack of hyperventilate of infant before suction can lead to a considerable decline in arterial oxygen and expose infant to hypoxia danger. According to theoretical and practical lessons in regard with respiratory system while educating and in-service training courses of nurses, it

seems that all of them are informed of necessity of hyperventilation before suctioning; although they are inattentive to this issue in practice. Therefore, due to importance of this issue in protecting infant, reasons for this problem should be investigated to consider good solutions in consistence with it. Moreover, although nurses used gloves in all observed situations; only in 68.5% of cases, personnel washed their hands and a few number of them used Personal protective equipment like gun and glasses. Therefore, it could be mentioned that although using personal protective equipment and observance of sterilization of suction invasive technique are important issues to prevent transmission of infection in this unit, they have not been observed in this study desirably. Polin et al (2012) believe that washing hands properly is the most important way to prevent hospital infections. Moreover, relevant activities of suction and position of infant in bed are effective factors in airway infection (18).

Chehrzad et al (2007) have found in their study that although washing hands is the most important factor to prevent infection in NICU, majority of medical team have undesirable performance in regard with washing hands and personal protective techniques like using guns and glasses and gloves have been declined (19). Study of Amirzadeh et al (2011) in Uremia has also indicated that 80.6% of nurses didn't wash their hands before suctioning (20). Although in all stages of education and in relevant books of nurse care, especially nurse aggressive units, necessity of proper hand washing and using personal protective equipment is emphasized, the issue has been neglected in practice. Experiences indicate that most of the nurses neglect this sensitive stage easily in cases that have not enough time for this action and conduct only the main procedure; although lack of observance of relevant points can enhance the damage resulted from doing the procedure more than its advantages.

In regard with level of implementing nurse care standards while suctioning, 84.4% of these cares are done correctly, 11.5% are done incorrectly and 3.1% have not done. Actions in this step was desirable in some items; although it gained respectively weakest points in 4 items including maintaining appropriate negative pressure, suctioning intervals, use of normal saline if needed and thick secretions of suction and insert the appropriate length of suction head. Kohan et al (2008) have found in their study that doing suction properly through observance of hyperoxygenation of patient before suctioning and lack of using normal saline can lead to significant

increase in arterial blood oxygen and decrease in carbon dioxide in patients (21).

Najafyarandi et al (2001) have also found that using normal saline during suctioning can decline oxygen saturation significantly; although it has no effect on oxygen level and carbon dioxide of arterial blood (22). In study of Mazaheri et al (2011) 25.9% of personnel use normal saline always and 44.4% use it most of the time before suctioning. It means that most of them use normal saline while suctioning. 40.8% of nurses use it always and 44.4% enter suction catheter most of the time to the place of carina in the endotracheal tube. It means that, in most cases, personnel used to do suction deeply (17). In study of Amirzadeh et al (2011), only one nurse gained about 50% of point related to suction stages and all remained people gained below 50% of points (20).

Success or failure of endotracheal suctioning is depended on observance of details during the process and each step can affect result of suction positively or negatively. An important issue here is that suction should be done deeply for sure and saline should not be applied as much as possible and in case of using saline, all of the solution should be suctioned to prevent decline of oxygen saturation of patient.

In regard with level of implementing nurse care standards after suctioning, 94.5% of these cares are done correctly, 2.1% are done incorrectly and 3.4% have not done. Actions in this step was desirable in most items and in all cases, ventilator was connected in immediately after suctioning to prevent drop in arterial blood gases; although in two items of listen to sounds of baby's lung and reduction of increased FIO2 have been done incorrectly or not done at all in 1 third of cases. In study of Mazaheri et al (2011), in most cases (66.7%) after suctioning, patients used to be hyperventilated and nurses used to listen to sounds of lungs only in 3.8% of cases always and to 29.9% most of the times. 44.4% of them used to take this action rarely or never (17). Rezaei Hussein et al (2004) indicated that hyperventilating patients before and after suctioning can result in effect on indices including arterial and physiologic blood gases. The most important effect is increasing effect on arterial blood oxygen pressure and oxygen saturation percent. The study has suggested taking this action before suctioning according to obtained results (23).

Obtained results from the present study in this section are better than other studies. It seems that studied nurses are aware that pulling the catheter out is not the end of suctioning process and are also properly informed of necessity of oxygenation after suctioning and act based on standards.

Unfortunately, in this study and other similar studies, nurses are inattentive to lung sounds after suctioning to ensure of secretions and to check position of endotracheal tube after suctioning. The reason for this problem can be probable weakness of nurses in field of physical checking, since practical unit of physical check out is eliminated from BA course of nursing and nurses have no opportunity and time to practice in actual conditions. This can also result in decrease in self-confidence while physical checking.

Obtained results from analytical investigations indicate that there is no significant correlation between work experiences of personnel and actions before, while and after suctioning. In study of Gudarzi et al (2004) and study of Mazaheri et al (2011), no significant correlation was found between age, gender, passing training course and work experience and performance of nurses to supply standard care (17, 24). Therefore, it seemed that factors other than demographic factors can affect performance of nurses based on standards and further studies are required to identify its reasons.

In general, obtained results from the study indicate that consistency of cares before, while and after suctioning in NICU with standards have been desirable generally and the consistency was in better level in after suctioning Care unit compared to other stages. Obtained results also indicate relatively desirable level of suctioning procedure in NICU, which has been in better position than other Iranian studies in this field. Suction is one of the aggressive procedures in NICU, which is applied many times in this unit. In addition to advantages like airway cleaning and improvement of arterial blood gases, it can result in serious problems (Hospital infections, hypoxia, tracheal injury and so on) in case of implementing it inadequately. Particularly, infants are under more dangers than adults because of lack of completion of immune system. Hence, special training courses using modern methods like problem-based training and task-based training about suctioning standards should be considered regularly in retraining programs. Relevant guidelines of suctioning should be installed in units and periodic evaluations should be done using modern method of personnel performance evaluation. Moreover, according to obtained results, simple problems in appearance like washing hands before suctioning should be considered to prevent transmission of infection. Infant hyperoxygenation should be considered before and after suctioning to prevent hypoxia and deep suctioning should be also

considered to clean lungs completely in relevant programs of suctioning procedure.

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