Critical Care Nursing

Iran J Crit Care Nurs 2012; 5(2):109-116

Journal home page: www.inhc.ir

How to improve nurses' tendency toward employing closed suction method?

Salmani Fateme[1*], Irajpour Alireza[2], Abdoli Samereh[3], Sadeghi Nariman[4]

1. Master of nursing, Department of nursing, Najafabad Branch, Islamic Azad University, Isfahan, Iran.
2. Assistant Professor, Nursing& Midwifery Care Research Centre, Faculty of nursing and midwifery, Isfahan University of medical science, Isfahan, Iran
3. Assistant Professor, Faculty of nursing and midwifery, Isfahan University of medical science, Isfahan, Iran.
4. Master of nursing, Isfahan University of medical science, Isfahan, Iran

ARTICLE INFO

Article type:
Original article

Article history:
Received: 15Aug 2011
Revised: 9 Apr 2012
Accepted: 23 Apr 2012

Keywords:
Closed suction, ICU, Nurse

ABSTRACT

Goals: Tracheal suction is a method to clean the airway from discharge. This method is used for patients with reduced level of consciousness and respiratory muscle weakness who are not able to cough and discharge their secretions. There exist two suction systems: open suction system [OSS) and closed suction system [CSS). This study aims to improve application of closed suction in intensive care unit.

Methods: This study is an action research. 60 ICU nurses were selected through convenience sampling, 30 of whom were chosen by random sampling. The required data was gathered by the help of observation, interviews and the standard American Association of Critical Care Nurses [AACN) questionnaires. The following steps were exactly taken in the present study: precise statement of the problem, gathering information, planning and goal setting, implementation, and evaluation. In the present study, using the questionnaire and interview, problems associated with closed suction were prioritized and solutions were found out through silent brain storming and participation of nursing staff. Affordable solutions were eventually taken.

Results: The prevalence of preference for using closed suction before the study was 10.5% and 66.7% afterwards. The frequency of using the open suction method, according to the connectedness of closed suction to patients, was 60% before the intervention and 57.1% after that. No significant difference was observed between the mean score of suction before and after the intervention [p>0.05).

Conclusion: Action research is a suitable way to change and improve nurses' performance, since in this method, taking the advantage of the staff's comments and involving them in the study makes it plausible to bring about changes faster. Additionally, the made decisions would be more stable and reliable among the nursing staff.

Please cite this paper as:
Salmani Fateme, Irajpoor Alireza, Abdoli Samereh, Sadeghi Nariman. How to Improve Nurses Tendency toward Employing Closed Suction Method? Critical Care Nursing. Iran J Crit Care Nurs 2012;5(2):109-116.

* Correspondence Author: Fateme Salmani
Master of nursing, Faculty of nursing and midwifery, Islamic Azad University of Najaf Abad Branch, Isfahan, Iran.
Tel:+983312291111
Email: f-salmani@iaun.ac.ir

[Downloaded from jccnursing.com on 2026-11-03]

1. Introduction

Endotracheal suction is a common method to clean airway from discharge in patients undergoing mechanical ventilation [1]. Suction is done to extract discharge, improve oxygen supply and also to prevent tracheal obstruction. However, this procedure would bring about atelectasis, increase breathing as well as lung infections. In addition to extracting discharge and keeping the airway open, endotracheal suction can cause some side effects [2]. Respiratory infections are among the most common complications caused by suction [3]. Severe side effects such as hypoxia, decreased heart rate and its disorder, increased intracranial pressure, atelectasis, mild and severe hemorrhage, tracheobronchial rupture, emphysema, pneumothorax, infection [in both patients and their care givers), cardiac arrest and even death can occur due to suction [4,5]. The numbers of suctions vary in each patient but the average is eight to seventeen times per day [2]. There are two techniques for suction: the open suction system (OSS) and the closed suction system (CSS). In OSS, the patient is removed from the ventilator during the suction [6]. In this method, since oxygen, humidity and peep are not delivered to the patient during suction, small airways and alveoli would collapse [7]. In CSS, there is no need to disconnect the patient from the device. In contrast with OSS, in this method suction catheter is placed between trachea pipe and mechanical ventilation machine and according to the organization's regulations it would remain there for 24 hours. It can be used for suction for many times [6]. OSS is the most usual method for trachea suction. It requires removal of the patient from ventilation machine during the procedure, which results in decrease of pressure in airways and also reduction of lungs volume. Therefore, OSS may lead in decrease of air alveoli, reduction of lung volume and hypoxia [8]. CSS has been the center of attention in recent decades in a way that in the U.S. intensive care units about 58% of suctions are carried out through CSS and 4% of them are performed via OSS [6]. In CSS, without removing the patient from the ventilator, the suction is done by preserving the lung volume and providing oxygen continuously. This would prevent hemodynamic disturbances associated with the reduction of oxygen during suction of the endotracheal tube [9]. Moreover through blocking the connection between the patient and the ventilator during tracheal suction operation, the environment, nurses and also the patients would be preserved from pollution. This would additionally prevent lung volume reduction in patients with severe hypoxia. Although it is costly, this procedure is regarded economical since it is cheaper than OSS which requires two nurses and gloves and a disposable suction catheter [10]. Hospital nurses play a very important role as the main caregivers of patients. Therefore, improving the quality of their service is the most important factor which can accelerate healing patients [11]. Based on the statistics obtained from intensive care unit, in spite of the availability of CSS, about 80% of personnel do not use it properly because they believe that in CSS the suction intake is inadequate. Since in intensive care units, suction procedures are not among essential operations and respiratory support for patients is not among nurses' main responsibilities, this study aimed to "increase the willingness of nurses toward CSS".

2. Methods

This study was an action survey. Action research is a cooperative effort. This includes all the people in the study environment to design, collect, and analyze data, evaluate research, and publish it. In this method, the research is not suggested from outside the organization; rather it is planned and carried out by the participants themselves [12]. In this study, the research population included nurses of the critical care unit. The study sample consisted of 60 nurses of the critical care unit who were selected through convenience sampling. 30 of them were then randomly

[Downloaded from jccnursing.com on 2026-11-03]

chosen using their personnel codes. The required information was collected through observations, interviews and questionnaire. The study was conducted in accordance with the following steps:

2.1. Precise identification and Statement of the problem

In an intensive care unit, most patients are connected to a mechanical ventilator and airway suction is a common method applied in such units [13]. Non-sterile and improper suction in addition with dispersal of patients' airway discharge cause some problems for the patients as well as the nurses. CSS is a method which can reduce such problems. Despite the high cost spent for each patient's suction, according to researchers' observations, patients were frequently removed from the mechanical ventilator and their suction was done by open suction system. The staff was obviously dissatisfied with using this device. Since CSS is a young method which is applied for patients, the discussed problem is a novel one dealt with in the intensive care unit. The mentioned dissatisfaction with using the device is considered as an occupational one. If CSS was not utilized for patients, nurses would apply OSS for patients, which could cause several problems in critical care units [8] and eventually lengthened the duration of patients' stay in the hospital.

2.2. Data Collection

The required information was gathered by the help of observation, interviews and American Association of Critical-Care Nurses (AACN) questionnaire in 2010 [14]. This questionnaire included 18 questions in likert scale with three options of Always do, Sometimes do, and Never do. Some other questions were added to the questionnaire. These questions were about the preferences of the staff in using suction type, using OSS despite the connection of CSS catheter to the patient, nurses' opinions toward using OSS by their colleagues, also charge nurses' ideas about use of OSS by the personnel under their supervision, and information about work experience of personnel specifically there in intensive care unit. Conducting the study, some moral considerations were regarded: the educational supervisor and the charge nurse of the critical care unit were informed about the research before commencing the process of the study. Research goals were described for them and a mutual agreement was made. It was also agreed that they would be informed of any changes made. A session was held with the staff. They were assured that the collected information in addition to the name of the hospital and the unit would remain confidential. On the process of carrying out the research, the staff and the head of unit were informed of the procedure. The personnel were also assured that they can quit the study whenever they preferred [15].

The questionnaire was answered by 30 participants which were almost half of the staff of the intensive care unit. The gathered data was entered into SPSS V_{16} and then analyzed.

3. Results

30 questionnaires were given to the nurses of the intensive care unit and all the participants answered the questions.

3.1. Characteristics of participants

All the participants had a B.Sc. in nursery. 78.9 of them were women with an average of 55.6±35.7 months of experience of nursery and 32.8±30 months of working in the intensive care unit.

3.2. Achieved Results

68.4% of nurses preferred OSS, 10.5% preferred CSS, and 21.1% selected the type of suction depending on patients' condition and their kind of discharge. About 60% of people were treated by OSS at intervals of utilizing CSS. These statistics which were collected via using a questionnaire were different from the statistics gathered orally by the personnel, which was about 80%. The statistics put forward by supervisors for their personnel using OSS were reported 50%, 80%, and 60%.

[Downloaded from jccnursing.com on 2026-11-03]

84.2% of nurses believed that their colleagues utilize OSS to connect patients to catheter of CSS. It is vital to mention that 15.8% of the staff did not answer this item (Table 1). On the process of scoring, the item "Always do" received score 3, "Sometimes do" got score 2, and "Never do" got score 1. The whole properly done procedure of CSS received the score of 57, of which the nursing staff received the average of 46.4±4. In general, suction procedure was done properly and above the average. Regarding the data collected by the help of questionnaire and asking oral questions [personnel, charge nurse, and colleagues talking about each other), it was indicated that there is a significant difference between the desired and the present condition. This is because although the nursing staff knew the principles of CSS, they did not use it properly according to the reasons they mentioned themselves. Considering the large number of nurses in the intensive care unit, some open questions were given to them. They were asked about not utilizing CSS and about guidelines to improve the present conditions. After collecting the questions, problems were encoded and rated based on the scores given to them if they were repeated. About 34 of the nursing staff respectively described the obstacles of utilizing the device as what follows:

1. Not having enough power to extract the thick and sticky secretions
2. Lack of adequate education about the benefits and use of closed suction.
3. Low quality of the device; it leaks after being used for several times

Table 1:
Characteristics of statistical population and comparing the obtained results before and after implementing suggesting solutions

	After interference	Before interference
Work experience in nursing	55/6±35/7 months	55/6±35/7 months
Work experience in ICU	32/8±30 months	32/8±30 months
Preference to use OSS	33.3%	68.4%
Preference to use CSS	66.7%	10.5%
Selecting suction type based on patient's condition	23.8%	21.1%
Using OSS at intervals of utilizing CSS	57.1%	60%
Observing other colleagues using OSS at intervals of utilizing CSS	23.8%	84.2%
Investigating the symptoms of needing suction in patients before doing it	71.4%	63.3%
Wearing clean gloves while doing the suction	75.9%	73.7%
Adjusting suction pressure before performing it	57.7%	52.6%
Checking vital signs before, while, and after suction	85%	84.2%
Utilizing CSS at the time of hemodynamic instability	61.1%	42.1%
Observing the right time of suction	95.2%	68.4%
Rinsing the catheter route through the connector next to closed suction	92.7%	90%
Pulling out the catheter thoroughly and blocking the tee to suction	100%	100%
Recording suction in the nursing report	90.5%	78.9%
Total score	49/5±3/3	46/4±4

[Downloaded from jccnursing.com on 2026-11-03]

4. High cost of the device in comparison with the open suction
5. Inadequacy of suction power makes the suction procedure longer and decreases saturation of arterial oxygen.
6. Inadequate intake of the device ends in more times of suction and consequently traumatized patient's airways.
7. Suction head remains more than 24 hours and results in infection.
8. Non-existence of a special suction head for tracheostomy

In most cases, providing appropriate solutions is easy but sometimes offering desired solutions is not trouble-free since it requires creativity, consideration, and discussion. Therefore, providing solutions can be regarded as an ongoing investigation which is helpful to identify and recognize problems. Seeking for a proper solution and getting ideas to overcome the mentioned problems, silent brain storming (writing) was utilized. In this technique, opinions are jotted down by each participant individually. Next, they are collected and recorded. The advantage of this technique is its confidentiality since participants can not impress on ideas of other group members [16]. To present strategies and ideas for better use of closed suction, the staff was asked to write the answers to some open questions. After writing the guidelines, answers were collected and all solutions and ideas were listed. Similar cases were combined and irrelevant ones were omitted. The solutions were then listed according to their priority. The offered solutions are presented as follows in order of preference:

1. Increasing the power of central suction,
2. Teaching the advantage of closed suction,
3. Increasing the quality of suction catheters,
4. Informing of the real statistics of infection decrease in closed and open suction,
5. Informing of its safety and immunity of the staff from it
6. Reducing costs of closed suction,
7. Limiting the number of ordinary suction heads merely for oral suction,
8. Cultivating lung secretions of both types of suction and notifying the staff to be encouraged to use closed suction,
9. Lengthening of closed suction set,
10. Using portable suction instead of central suction, and
11. Considering the type and size of suction catheter for the endotracheal tube or tracheostomy.

To ease planning and implementation process, solutions were divided into three groups: training solutions, technical-specific solutions, and human resource-equipment solutions. Then, based on Thomas table each of solutions was scored. Training solutions and increasing suction intake received the highest scores.

3.3. Planning

To plan means programming to reach a goal, to achieve demands. Planning includes suggesting solutions to take the highest advantage of existing facilities in order to achieve the desired goals [17]. According to the obtained results, the major obstacle to use closed suction device is the insufficiency of its suction power. Therefore, at this stage, the focus is on replacing the present central suction device with a device which can provide the proper needed suction power pressure for a closed suction (120-150 mmHg). This included: requesting hospital management to agree with replacement of the existing central suction device in the ICU, pursuing the request sent to the hospital management, at the interval between asking for changing the suction and approval of this request, the staff was trained face to face by some nurses about the advantages of utilizing CSS. The trained staff would train some other personnel and in this way the intensive care unit would receive the training. Training can make the learner learn and learning is a process to get knowledge and skills; additionally, it increases individuals' ability in decision making and consequently leads in changing behavior [18]. The other plan was providing the staff with pamphlets about the advantages of CSS. Considering educational

[Downloaded from jccnursing.com on 2026-11-03]

level and other characteristics of the target group, it seems applying proper educational methods (such as poster, pamphlet, and face to face training) can influence their promotion of knowledge level and function [19]. Sensitizing to utilize CSS in addition to taking the advantage of feedback was also included in the caring design.

3.4. Implementing the plan

At this stage, according to the rating, a combination of solutions which included improving the suction intake via replacing the central suction [20], training [19], sensitizing [21], and feedback [22] were implemented. By the agreement of the hospital management on replacing the central suctions, new devices were installed. Patients in the intensive care unit were treated by CSS. The staff was reevaluated. At this stage the personnel were sensitized about using CSS. Sensitization was done according to the study of Zambudio, who expressed that sensitization can be applied to change the attitude of nursing [21]. Through sensitizing, educational messages about CSS were hung in the unit every three days (the staff's shifts were repeated every two or three days). Educational messages started with "Do you know...?" and statistics about infection caused by using open or closed suction (extracted from foreign and Iranian articles) in addition to the requirements for carrying out closed suction were presented. Based on the achieved results from the standard suction questionnaire (2010), the nursing staff of the unit was provided with some pieces of information in the form of educational pamphlets by some nursing personnel about their deficiencies and the advantages of proper use of CSS for both patients and nurses. Stages of suction were practically taught. After that the trained staff observed other personnel carry out suction process. By the help of the study conducted by Day, which investigated the impact of feedback of endotracheal suction function on nurses' knowledge and skills, the process of giving feedback to personnel was utilized as a criterion to assess accuracy or inaccuracy of suction process. This study indicated that training by itself does not improve performance, especially in clinical skills, and it is not stable over time. However, when teaching suction skills is associated with individual feedback during the procedure, training would last longer [22].

3.5. Evaluation

After eight weeks of program implementation, the nursing staff was assessed by the same standard suction questionnaire of American Association of Critical-Care Nurses (2010). The obtained data was analyzed by SPSS V_{16} software. 66.7% of nurses preferred closed suction and 33.3% preferred open suction. About 23.8% of individuals utilized open suction at intervals of using closed suction system, 28.6% sometimes used open suction, and 47.6% only utilized closed suction. However, 57.1% of the nursing staff asserted that other colleagues used open suction when connecting patients closed suction system catheter. The general procedure of suction by closed system after interference was 49.5±3.3 which was not significantly different from the pre-interference stage (Table 1). Through replacing the suction device, providing the suitable pressure, training and sensitization of staff about the advantages of using closed suction, employees' tendency toward using this device is increased.

4. Discussion

The amount of utilizing CSS is increased by the help of action research, and nurses' attitude toward utilizing it is improved and they tend more to use this device and replace OSS with it. In the present study, after identifying the problem, interviews with the staff and questionnaires were used to collect information. Although the questionnaire provided little information about the current problem, interviews with the personnel indicated the problem more clearly. Likewise, to collect information, Pratt in his study realized nurses

[Downloaded from jccnursing.com on 2026-11-03]

and medical staffs' attitude through interviews [23]. Open questions were also used since they embrace a wide range of problems caused by not utilizing closed suction in addition to the solutions for them. At this point, there was a significant difference between the verbal responses of personnel about using suction and answers gathered through the questionnaire. Determining the priority of problems and solutions after listing them, the charge nurse and supervisor's comments were used. One of the problems with prioritizing solutions was that some of them, considering their top rating, were not applicable due to their high cost and unavailability of facilities. In planning stage, after choosing the best solution, a meeting was arranged with the hospital manager, its charge nurse, supervisor of intensive care unit, and educational supervisor about the applicability of solutions. One of the offered solutions was increasing the suction power which was discussed in the study of Losaki [20] and John Smith [24]. This solution required replacing central suctions, about which the headmaster was consulted with. Because of the availability of the device in the storage room of the hospital, three central suction devices were installed to be piloted. When the devices proved to be efficient, the results were reported to the hospital management and other machines were also installed in the unit.

To apply the suggested solutions, different techniques, such as sensitization, were primarily utilized [21]. Regarding educational messages hung on ICU walls about suction, the staff was sensitized and motivated about using CSS. The staff was also continuously and clinically trained about the issue. One of the problems was that some of the personnel could not share their knowledge with others. To solve this problem, different nurses working in various shifts were utilized. Additionally, to make the training more effective, the technique of feedback [22] was used in different stages of suction. The questionnaire was again used for evaluation stage and it was asserted that using action research increases the nursing staffs' tendency. The results obtained from the present study accord with those of Chao et al. (2007) which was conducted to reduce the side effects of suction in patients of ICU. In their study, implementing the solutions was found practical and reduced the side effects. They noted that it is important for nurses to be able to perform a safe procedure and act according to the research-wise suggestion. This article presented the process of improvement, expansion, and implementation of the best suction instruction and investigated the procedure and results of taking care of patients while and after suction in ICU. It proved that utilizing action research reduces suction side effects [25].

Prat et al. (2001) applied action research method and doctors and nurses' participation to change their attitude and improve their functioning while taking care of AIDS patients. The results showed that applying this method changed the staff's opinion toward AIDS patients [23].

5. Conclusion

Conducting an action research is an apt method to change and improve nurses' functioning since in this method asking the staff's ideas and making them participate in the study makes changes happen faster and decisions more stable and acceptable among nurses. In the present study, presenting solutions by the staff's participation augmented their tendency in using CSS in ICUs.

6. Acknowledgments

We warmly appreciate the efforts of the hospital manager, charge nurses of ICU, and the nursing staff who assisted us in this study with collecting the data and running the program.

References

1. Ebrahimi fakhar HR, Rezaei K, Kohestani HR. The effect of Closed suction on ventilator associated pneumonia. KORDESTAN Med J. 2009;15(2):79-87. [Persian]
2. Caramez MP, Schettino G, Suchodolski K, Nishida T, Harris RS, Malhorta A, et al. The impact of endotracheal suctioning on gas exchange

[Downloaded from jccnursing.com on 2026-11-03]

heamodynamics during lung-protective ventilation in acute respiratory distress syndrome. Respir Care. 2006;51(5):497-502.
3. Perry A, Potter P. Clinical nursing skills techniques. 6th ed. Elsevier Mosby. 2006.
4. Morrow BM, Futter MJ, Argent AC. Endotracheal suctioning: from principles to practice. Intensive Care Med. 2004;30(6):1167-74.
5. Tayler C, Lillis C, LeMone P. Fundamental of nursing. Philadelphia: Lippincott Williams&Willkins. 2005.
6. Jongerden IP, Rovers MM, Grypdonck MH, Bonten MJ. Open and closed endotracheal suction systems in mechanically ventilated intensive care patients: a meta analysis. Crit Care Med. 2007;35(1):260-70.
7. Jae Woo J, Eun Hee C, Jin Hee K, Hyo Kyung S, Ji Yeon C, Jae Cheol C. Comparison of a Closed with an Open Endotracheal Suction: Costs and the Incidence of Ventilator-associated Pneumonia . Tuberc Respir Dis. 2008;65(3):198-206.
8. El Masary A, Williams PF. Chipman DW, Krahtovil JP, Kacmerak RM. The impact of closed endotracheal suctioning system on mechanical ventilator performance. Respir Care. 2005;50(3):345-53.
9. Stenqvist O, Lindgren S, Karason S, Lundin S. Warning! Suctioning. Alung model evaluation of closed suctioning system. Acta Anaesthesiol scand. 2001;45(2):167-72.
10. Topeli A, Harmanci A, Cetinkaya Y, Akdeniz S, Unal S. Comparison of the effect of closed versus open endotracheal suction systems on the development of ventilator associated pneumonia. J Hosp Infect. 2004;58(1):14-9.
11. Zigheimat F, Mokhtari Nori J, Ebadi A, Hamedanizadeh F. The assessment of intravenous nursing care in one of the Tehran educational hospital wards in 2002. Iran J Nurs. 2004;17(37):27-31. [Persian]
12. Abedi H, Ravani pour M, Karimolahi M, Yosofi H. Qualitative research methods in nursing. Tehran. Boshra. 2006. [Persian]
13. Jae Woo J, Eun Hee C, Jin Hee K, Hyo K yung S, Ji yeon C, Jae Cheol C, et al. Comparison of a closed with an open endotracheal suction: costs and the incidence of ventilator-associated pneumonia. Tuberculosis and Respiratory Diseases. 2008; 65(3): 198-205.
14. Weigand DL. AACN procedure manual for critical care. 6th ed. Philadelphia. Saunders . 2010.
15. Ahanchian M. Action research [design, implementation, evaluation).1st ed. TEHRAN. Roshd. 2002. [Persian]
16. Moeini J. How to solve their problems . 1st ed. TEHRAN. Danesh. 1998. [Persian]
17. Mirzabegi A. Curriculum and lesson plans. 3th ed. TEHRAN. Yastaroon. 2008. [Persian]
18. Karimi S, Kazemi M, Shabani Share Babaki Z, Vaziri Nejhad R. Comparison of two methods of teaching speech and pamphlet on knowledge and attitudes of senior high school students about AIDS in the city of Sirjan. HORMOZGAN Med J. 2006;10(3):285-90. [Persian]
19. Aghamolaei T, Eftekhar H, Kazem M, Sobhani AR, Shojaeizadeh D, Nakhjavani M, et al. Influence of educational intervention using interaction approach on behavior change, hemoglobin Alc and health – related quality of life in diabetic patients. J Sch Public Health Inst Public Health Res. 2005;3(4):13-20. [Persian]
20. Lasocki S, Lu Q, Sartorius A, Fouillat D, Remerand F, Rouby JJ. Open and closed-circuit endotracheal suctioning in acute lung injury: Efficiency and effects on gas exchange. Anesthesiology. 2006;104(1):39-47.
21. Zambudio A, Alaracon L, Parrilla P, Ramirez P. Attiude of nursing staff towardorgan donation in a Spanish hospital with a solid- organ transplantprogram. Prog Transplant. 2009;19(4):371-7.
22. Day T, Iles N, Griffiths P. Effect of performance feedback on tracheal suctioning knowledge and skills: randomized controlled trial. J Adv Nurs. 2009;65(7):1423-31.
23. Pratt RJ, Pellowe CM, Juvekar SK, Potdar NS, Weston AJ, Joykutty A, et al. Kaleidoscope: a 5-year action research project to develop nursing confidence in caring for patients with human immunodeficiency virus in west India. Int Nurs Rev. 2001;48(3):164-73.
24. St John RE, Seckel MA. Airway management. In S.M Burns (Ed), AACN protocol for practice: Care of the mechanically ventilated patient. 2th ed. Sudbury. Jones and Bartlett. 2006.
25. Chau J, Thompson DR, Chan D, Chung L, Au WL, Tam S, et al. An evaluation of the implementation of a best practice guideline on tracheal suctioning in intensive care units. Int J Evid Based Healthc. 2007;5(3):354-9.

[Downloaded from jccnursing.com on 2026-11-03]