

# Evaluation of knowledge and behavior of nurses working in intensive care units for endotracheal aspiration application

Yoğun bakım ünitelerinde çalışan hemşirelerin endotrakeal aspirasyon uygulamasına yönelik bilgi ve davranışlarının değerlendirilmesi

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## Abstract

Aim: Endotracheal aspiration is one of the most common invasive procedures administered by intensive care nurses in patients receiving mechanical ventilation to provide and maintain adequate oxygenation, alveolar ventilation, and gas exchange, prevent pulmonary consolidation and atelectasis, and reduce the risk of ventilator-associated pneumonia. When the endotracheal aspiration procedure is not administered correctly, the patient may have serious complications such as arterial and venous desaturation, cardiac arrhythmia, cardiac arrest, atelectasis, bronchospasm, lower respiratory tract contamination, ventilator-induced pneumonia, anxiety, and dyspnea. The study aims to evaluate the knowledge and behaviors of nurses working in intensive care units for endotracheal aspiration applications.

Methods: This study used a cross-sectional and descriptive design including a questionnaire-based nurse survey. It was conducted between 17 March 2015-30 June 2015 with 54 nurses working in intensive care units in a public hospital. In the study, the data were collected with a questionnaire, endotracheal aspiration information form, and nurse observation form for endotracheal aspiration. The evaluation of the data was conducted using numbers and percentages. The ethics committee approval, institutional permission, and participant consent were obtained before starting the research.

Results: It was determined that the nurses participating in the study were incompetent before, during, and after the endotracheal aspiration procedure and that they did not have sufficient information about endotracheal aspiration.

Conclusion: In line with the results of the study, it was suggested that the nurses should be trained on endotracheal aspiration, the effect of education on practice should be evaluated, and that standardization studies should be carried out to minimize deficient and erroneous practices in endotracheal aspiration.

**Keywords:** Intensive care, Nurse, Endotracheal aspiration, Knowledge, Behavior

## Öz

Amaç: Mekanik ventilasyondaki hastalarda yeterli oksijenasyon, alveoler ventilasyon, gaz değişimini sağlamak ve sürdürmek, pulmoner konsolidasyon ve atelektaziyi önlemek, ventilatör ilişkili pnömoni riskini azaltmak amacıyla yoğun bakım hemşirelerinin en sık uyguladığı invaziv işlemlerden biri endotrakeal aspirasyon uygulamasıdır. Endotrakeal aspirasyon işlemi doğru yapılmadığında hastada arteriyel ve venöz desatürasyon, kardiyak aritmî, kardiyak arrest, atelektazi, bronkospazm, alt solunum yolları kontaminasyonu, ventilatöre bağlı pnömoni, anksiyete ve dispne gibi ciddi komplikasyonlara yol açabilir. Araştırma yoğun bakım ünitelerinde çalışan hemşirelerin endotrakeal aspirasyon uygulamasına yönelik bilgi ve davranışlarının değerlendirilmesini amaçlamaktadır.

Yöntemler: Tanımlayıcı türde olan kesitsel, anket tabanlı hemşirelik araştırması bir devlet hastanesindeki yoğun bakım ünitelerinde çalışan 54 hemşireyle, 17 Mart 2015 - 30 Haziran 2015 tarihleri arasında yapıldı. Araştırmada veriler kişisel bilgi formu, endotrakeal aspirasyon bilgi formu ve endotrakeal aspirasyona ilişkin hemşire gözlem formu ile toplandı. Verilerin değerlendirilmesi sayı ve yüzdelik ile yapıldı. Araştırmaya başlanmadan önce etik kurul, kurum izni ve katılımcı onamları alındı.

Bulgular: Araştırmaya katılan hemşirelerin endotrakeal aspirasyon işlemi öncesi, sırasında ve sonrası uygulamalarının yetersiz olduğu, endotrakeal aspirasyon konusunda yeterli bilgiye sahip olmadıkları belirlendi.

Sonuçlar: Araştırmmanın sonuçları doğrultusunda, hemşirelere endotrakeal aspirasyon konusunda eğitimin verilmesi ve eğitimin uygulamaya etkisinin değerlendirilmesi, endotrakeal aspirasyonda yapılan hataları, eksik uygulamaları en aza indirmek amacıyla uygulamaya yönelik standartizasyon çalışmalarının yapılması önerildi.

**Anahtar kelimeler:** Yoğun bakım, Hemşire, Endotrakeal aspirasyon, Bilgi, Davranış

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## Introduction

Although the need for mechanical ventilation support is the most common reason for hospitalization, it is one of the most frequently used and indispensable technologies in intensive care [1]. Endotracheal aspiration is one of the most common invasive procedures administered by intensive care nurses in patients receiving mechanical ventilation to provide and maintain adequate oxygenation, alveolar ventilation, and gas exchange, to prevent pulmonary consolidation and atelectasis, and to reduce the risk of ventilator-associated pneumonia [2]. When endotracheal aspiration procedure is not administered correctly, the patient may have serious complications such as arterial and venous desaturation, cardiac arrhythmia, cardiac arrest, atelectasis, bronchospasm, lower respiratory tract contamination, ventilator-induced pneumonia, anxiety, and dyspnea [3,4].

Studies have shown that intensive care nurses generally act following their personal experience, rather than in accordance with evidence-based practices in endotracheal aspiration [4-8]. This shows that there is an inconsistency between theory and practice in endotracheal aspiration practices. According to the results of the limited number of studies conducted on the topic in Turkey, the application of endotracheal aspiration procedure varies among intensive care unit nurses [8-10]. The lack of standardization in endotracheal aspiration may also affect the quality of nursing care negatively. Conducting studies in different sample groups on the subject is of significance in strengthening the existing data and revealing various aspects. As a result of the present study, knowledge, and practices of intensive care unit nurses for endotracheal aspiration will be evaluated. We think that this evaluation can increase the awareness of the intensive care unit nurses and help shape the programs planned to improve their endotracheal aspiration practices.

## Materials and methods

The study used a cross-sectional and descriptive design including a questionnaire-based nurse survey to determine the knowledge and behaviors of intensive care unit nurses regarding endotracheal aspiration.

### Universe and sample of the study

The study was conducted between 17 March 2015 and 30 June 2015 in the secondary and tertiary level intensive care units in a public hospital. Nurses in intensive care units worked between 08:00 and 16:00, and 16:00 and 08:00 on weekdays, and between 08:00 and 08:00 on weekends with shifts. In-service training programs were provided in the hospital; however, no training on endotracheal aspiration had been provided yet, and there was no endotracheal aspiration procedure.

The universe of the study consisted of 54 nurses working in the secondary and tertiary level intensive care units of the public hospital, for they were already performing endotracheal aspiration in the mentioned units. No sampling procedure was used in the study; instead, all the nurses were included as they had already agreed to participate in the study.

### Data collection tools

The study data were collected using a personal information form, an endotracheal aspiration knowledge form,

and endotracheal aspiration-related nurse observation form [11], which were designed in line with the literature.

### The questionnaire form

The questionnaire form consisted of 10 items aiming to collect information about nurses' age, gender, educational background, professional seniority, seniority in the intensive care clinic, and education status regarding endotracheal aspiration application.

### The endotracheal aspiration knowledge form

The endotracheal aspiration knowledge form consisted of a total of 35 propositions to determine the endotracheal aspiration-related knowledge [11,12].

### The endotracheal aspiration-related nurse observation form

The endotracheal aspiration-related nurse observation form consisted of a total of 57 steps regarding pre-(1-27), during-(28-49), and post-(50-57) application to determine whether the nurses follow endotracheal aspiration standards [11].

### Implementation of the study

To ensure the intelligibility of the data collection tools, the personal information form, the endotracheal aspiration-related nurse observation form, and the endotracheal aspiration knowledge form were piloted to 10 nurses working in the intensive care unit. After the pilot study, no corrections were made in the personal information form, endotracheal aspiration knowledge form, and endotracheal aspiration-related nurse observation form. For this reason, the pilot study data were included in the study.

To avoid pre-observation contamination in nurses, firstly, the endotracheal aspiration-related nurse observation form was filled out. After completing the observations, the personal information form and endotracheal aspiration knowledge form were administered. Each of the application steps in the endotracheal aspiration-related nurse observation form was evaluated according to whether they were done correctly. The researcher made three observations at different times to ensure the reliability of the observation. Nurses were told that their behaviors regarding aspiration application could be observed, but no information was given about when and by whom the observation would be performed. Observation forms were not filled out near nurses to avoid behavioral changes. The researcher who made the observation also took notes. The researcher took care not to let the nurses know that they were observed.

Each observation took about 15-20 minutes. Nurses were given the personal information and the endotracheal aspiration propositions forms, and they were asked to fill them out right away. While the nurses were filling out the forms, the researcher accompanied them to prevent interactions. It took nurses 15-20 minutes to complete the forms.

### Statistical analysis

The coding and statistical analyses of the data were conducted on the SPSS 20 statistical software package. Numbers, percentages, mean and standard deviation values were used in the analyses. "No" response to items 1, 3, 7, 9, 11, 12, 14, 16, 18, 19, 22, 24, 26, 29, 30, 31, and 34 and "yes" response to items 2, 4, 5, 6, 8, 10, 13, 15, 17, 20, 21, 23, 25, 27, 28, 32, 33, and 35 were accepted as correct [11,12]. Each correct answer was

assigned 1 point. The total knowledge score of each nurse was calculated by summing the points obtained from each correct response given to items in the endotracheal aspiration knowledge form. The highest knowledge score to be obtained was 35.

Nurses' behaviors were evaluated over three observations. Doing the procedure correctly in at least two of the three observations was accepted as "correct" while doing it incorrectly in two out of three observations was evaluated as "incorrect".

### Ethics of the study

At the outset, the ethics committee approval of Nevşehir Hacı Bektaş Veli University Ethics Committee (issue: 84902927-25-462) was obtained, in addition to the written permission of the General Secretariat of the Public Hospitals Association (issue: 45003370-2888) of the province where the study was conducted and the written consent of the nurses who participated in the study.

## Results

Of the nurses participating in the study, 90.7% were women, 37.1% belonged to the 24-28 age group, 37.0% were graduates of health vocational high schools, 61.1% had been working for 1 to 5 years, and 59.3% had been serving in the intensive care unit for 1 to 5 years. Also, 66.7% of the nurses stated that they had received aspiration training.

All of the nurses participating in the study were observed to apply the following procedures incorrectly: The patient is informed before the procedure (100.0%), while the patient is oxygenated, gloves are worn following the principles of surgical asepsis (100.0%), and the aspiration pressure is adjusted to 80-120 mmHg (100.0%) (Table 1).

On the other hand, the nurses participating in the study were determined to apply the following procedures incorrectly compared to the other steps: During endotracheal aspiration, the procedure is terminated when the heart rate of the patient decreases 20 beats/min or more or increases 40 beats/min or more, or cardiac arrhythmias are observed (98.1%); the patient's respiratory rate is evaluated from the monitor (96.3%); the patient's pulse rate is evaluated from the monitor (92.6%) (Table 2).

Of the nurses participating in the study, 83.3% were determined to record the endotracheal aspiration procedure. The nurses were observed to never apply the following steps: The pulse rate of the patient is evaluated from the monitor and compared to the pre-aspiration pulse value (100.0%); the blood pressure of the patient is evaluated from the monitor and compared to the pre-aspiration blood pressure value (100.0%); the respiratory rate of the patient is evaluated from the monitor and compared to the pre-aspiration respiratory rate (100.0%) (Table 3).

The mean knowledge score of the nurses regarding endotracheal aspiration was determined as 22.98 (3.21) [mean (SD)].

Table 1: Distribution of nurses by their practices in preparation steps before the endotracheal aspiration (n=54)

Preparation steps before endotracheal aspiration procedure	Correct n %	Incorrect n %
1. Hands are washed before the procedure.	5 9.3	49 90.7
2. Materials are prepared for open system endotracheal aspiration procedure.	53 98.1	1 1.9
3. Materials are brought near the patient.	54 100	0 0
4. Aspiration requirement of the patient is evaluated.	31 57.4	23 42.6
5. Patient's pulse rate is evaluated from the monitor.	5 9.3	49 90.7
6. Blood pressure of the patient is evaluated from the monitor.	7 13.0	47 87.0
7. Respiratory rate of the patient is evaluated from the monitor.	4 7.4	50 92.6
8. The patient is informed before the procedure.	0 0.0	54 100
9. The curtain hanging around the patient bed is pulled to ensure patient privacy.	3 5.6	51 94.4
10. Before the procedure, the patient's head is raised by 20-30 ° to set the correct position.	25 46.3	29 53.7
11. The lid of sterile saline solution is opened.	2 3.7	52 96.3
12. The aspirator is checked if it operates.	15 27.8	39 72.2
13. Sterile connector tube is attached to the tip of the aspirator.	1 1.9	53 98.1
14. The cap is attached to the connector tube of the aspirator.	1 1.9	53 98.1
15. The tip of the sterile aspiration catheter package is opened.	53 98.1	1 1.9
16. The catheter package is located in an accessible area.	48 88.9	6 11.1
17. Oxygen rate on the ventilator is set to 100%.	13 24.1	41 75.9
18. The patient is given 100% O <sub>2</sub> for 1 minute with a ventilator.	8 14.8	46 85.2
19. While the patient is oxygenated, gloves are worn under the principles of surgical asepsis.	0 0.0	54 100
20. The package of aspiration catheter is grasped with the non-dominant hand.	20 37.0	34 63.0
21. The catheter inside the sheath is wrapped around the dominant hand, without harming sterility.	23 42.6	31 54.7
22. The lid of the connector located at the tip of the aspirator is removed by the non-dominant hand.	3 5.6	51 94.4
23. The connection of the aspiration catheter is set with the aspirator tube in the non-dominant hand.	23 42.6	31 57.4
24. Aspirator is turned on with the non-dominant hand.	17 31.5	37 68.5
25. Aspiration pressure is adjusted to 80-120 mm Hg.	0 0	54 100
26. The catheter tip is dipped into sterile saline and then removed.	1 1.9	53 98.1
27. With the non-dominant hand, the ventilator is removed from the patient.	26 48.1	28 51.9

Table 2: Distribution of nurses by their practices in preparation steps during the endotracheal aspiration (n=54)

Preparation steps during the endotracheal aspiration procedure	Correct n %	Incorrect n %
28. The catheter is advanced straight, quickly but gently, without aspiration (pressure closed) in the endotracheal tube.	38 70.4	16 29.6
29. The catheter is advanced to the trachea (until resistance is felt) and retracted 1 cm.	28 51.9	26 48.1
30. While the catheter is being removed from the endotracheal tube, it is removed by rotating it with intermittent aspiration.	38 70.4	16 29.6
31. Aspiration process takes no more than 10 seconds.	21 38.9	33 61.1
32. The connection of the endotracheal tube with the ventilator is done with the non-dominant hand.	48 88.9	6 11.1
33. The patient's pulse rate is evaluated from the monitor.	4 7.4	50 92.6
34. Blood pressure of the patient is evaluated from the monitor.	6 11.1	48 88.9
35. Respiratory rate of the patient is evaluated from the monitor.	2 3.7	52 96.3
36. During the aspiration, the procedure is terminated when the heart rate of the patient decreases 20 beats/min or more or increases 40 beats/min or more, or cardiac arrhythmias are observed.	1 1.9	53 98.1
37. After the aspiration procedure, the endotracheal tube and ventilator are connected with the dominant hand.	50 92.6	4 7.4
38. 100% O <sub>2</sub> is given with the ventilator for 1 minute.	10 18.5	44 81.5
39. Ventilator setting is brought to the pre-aspiration position.	11 20.4	43 79.6
40. After the endotracheal aspiration procedure, the catheter is washed in saline.	38 70.4	16 29.6
41. Intraoral and oropharyngeal areas are aspirated.	43 79.6	11 20.4
42. The catheter and the aspirator tube are washed with remaining saline.	44 81.5	10 18.5
43. The aspirator is switched off.	49 90.7	5 9.3
44. The catheter is detached from the aspirator pipe.	54 100	0 0
45. End of the aspirator pipe is closed.	5 9.3	49 90.7
46. The catheter is wrapped around the dominant hand.	5 9.3	49 90.7
47. The catheter is removed to remain in the glove.	6 11.1	48 88.9
48. Gloves and other materials are thrown into the medical waste bin.	53 98.1	1 1.9
49. Hands are washed.	48 88.9	6 11.1

Table 3: Distribution of nurses by their practices in preparation steps after the endotracheal aspiration (n=54)

Steps after the aspiration process	Correct n %	Incorrect n %
50. The pulse rate of the patient is evaluated from the monitor and compared with the pre-aspiration pulse rate value.	0 0	54 100
51. The blood pressure of the patient is evaluated from the monitor and compared with the pre-aspiration blood pressure value.	0 0	54 100
52. The respiratory rate of the patient is evaluated from the monitor and compared to the pre-aspiration respiratory rate.	0 0	54 100
The effectiveness of the aspiration process is evaluated.		
53. a) There will be no wheezing sounds when the patient's lung sounds are listened.	1 1.9	53 98.1
54. b) O <sub>2</sub> saturation should be 98 or above in pulse oximeter when the oxygen level is evaluated.	38 70.4	16 29.6
55. c) The ventilator should show no alarm regarding the presence of secretion.	24 44.4	30 55.6
56. The patient is given a comfortable and confident position.	35 64.8	19 35.2
57. Aspiration procedure is recorded.	45 83.3	9 16.7

## Discussion

The examination of the nurses' practices in the preparation steps before endotracheal aspiration indicated that almost all of the nurses prepared sterile aspiration catheters (98.1%), but they were observed to aspire without wearing surgical gloves following the principles of surgical asepsis (100.0%) and without attaching a sterile connector tube to the tip of the aspirator (98.1%) (Table 1). Özden [11] observed that more than half of the nurses (66.7%) prepared non-sterile disposable gloves, but that some of them (4.2%) prepared sterile gloves. On the other hand, some of the nurses (12.5%) who did not prepare gloves administered endotracheal aspiration with bare hands, while others (16.6%) administered the aspiration with the same gloves that they used for previous care. Elbokhary et al. [13] observed that all the nurses performed the aspiration procedure without wearing sterile gloves. In the study of Çelik and Elbaş [9], none of the nurses were found to use sterile connector tubes, and 97.6% were determined to not wear sterile gloves. Using a sterile connector tube before each aspiration procedure is important in maintaining the sterility of the aspiration catheter and gloves and preventing infection development in the patient. These findings were highly important in terms of showing that nurses knew that sterile aspiration catheters should be used but that their knowledge and practice regarding wearing gloves and attaching a sterile connector tube to the tip of the aspirator under the principles of surgical asepsis were inadequate. Also, these findings showed that the endotracheal aspiration procedure was not performed with the appropriate technique. Therefore, the findings also indicated that the risk of developing complications related to endotracheal aspiration might also be high. Determining why nurses do not wear sterile gloves during the administration of endotracheal aspiration and gaining the ability to wear sterile gloves is important. Wearing gloves is a basic requirement for protecting the person who administers the aspiration, the patient who is aspirated, and other patients from the risk of infection. It is also clear that nurses need information about the use of sterile connector tubes.

Patients have the right to receive information about the procedures to be performed. On the other hand, one of the principal functions of the nurse is to educate and inform the individuals they serve. In this context, the nurse has to inform patients who will be aspirated. Due to the perception of aspiration "as an unpleasant and fearful experience" by patients and feelings such as fear and anxiety it causes in the patient, giving information to the patient both increases the effectiveness of the aspiration application and reduces the anxiety, as well as providing patients with collaboration. The procedure should be explained to the patient, even if the patient is unconscious [11]. In our study, all the nurses (100.0%) were observed to not explain the procedure to the patients (Table 1). The rate of nurses informing the patient about the procedure was found to be 26.7% in Elbokhary et al. [13], 2.8% in BülbülMaraş et al. [10], and 2.4% in Çelik and Elbaş [9]. The result of our study suggested that nurses neglected the patients in intensive care because they were generally unconscious.

Aspiration procedure affects the pulse and respiratory rate; therefore, it should be evaluated by nurses. Elbokhary et al.

[13] reported that all the nurses monitored the heart rate before the procedure, they recorded blood pressure and that 70% monitored oxygen saturation. BülbülMaraş et al. [10] found that only 6% of nurses monitored vital signs following the procedure. In our study, very few of the nurses were observed to evaluate pulse (7.4%) and respiratory rate (3.7%) (Table 2). This finding of our study suggested that nurses did not have adequate information about the complications of the aspiration procedure. The nurse should correctly evaluate the patient before, during, and after aspiration and prevent possible complications [14]. One of the most positive indicators of nursing care is to prevent the emergence of diseases and complications. By providing proper care, nurses can help reduce patients' hospitalization time and labor loss and cost due to hospitalization, and increase patient satisfaction [15, 16]. Therefore, the role of nurses is especially important in knowing and preventing the causes of complications. For this reason, nurses should do their practices according to current research recommendations and guidelines.

In our study, more than half of the nurses (83.3%) were observed to correctly perform the "aspiration procedure is recorded" step, which is one of the post-aspiration steps (Table 3). In the study of Sevinç [17], 70.83% of the nurses were determined to keep records at the end of the aspiration process. On the other hand, Elbokhary et al. [13] found that none of the nurses (100%) recorded the aspiration procedure. Recording the aspiration procedure is important in determining how often the patient needs aspiration. Besides, it creates a legal basis for nurses and provides communication between team members. According to this result of our study, intensive care nurses can be said to have behaviors of recording data of the procedure.

In our study, the mean score of the nurses regarding endotracheal aspiration was 22.98 (3.21) [mean (SD)] out of 35 points. In the study of Sevinç [17], the knowledge and practices of the nurses for tracheal aspiration were evaluated over 100 points, and the rate of the nurses who received a knowledge score of more than 50 points was 50%, while the rate of nurses who received an application score of 50 points or more was determined as 20.83%. The results of the study showed that the nurses participating in the study did not have sufficient knowledge about endotracheal aspiration.

### Limitations

The sample of the study consisted of 54 nurses working only in the secondary and tertiary level intensive care units of a public hospital. Therefore, the results of the study are valid only for the nurses participating in the study.

### Conclusion

The present study found that the nurses participating in the study did not have sufficient knowledge about endotracheal aspiration according to the evaluation with the endotracheal aspiration information form. In light of these findings, we recommend that nurses should be provided training on endotracheal aspiration and that the effect of the training on practice should be evaluated. Also, standardization studies should be carried out so that mistakes and deficient practices in endotracheal aspiration can be minimized.

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## References

- Cengiz H. Yoğun bakım hastalarında görülen ventilatör ilişkili pnömoninin azaltılmasında hemşirelere verilen eğitimin etkinliği. İstanbul Üniversitesi Sağlık Bilimleri Enstitüsü, Doktora Tezi, 2017.
- Er F. Yoğun bakım hemşirelerinin açık endotrakeal aspirasyon uygulamalarının izlenmesi ve hata odaklı kısa süreli bilgilendirmenin uygulamaya etkisinin incelenmesi. Adnan Menderes Üniversitesi Sağlık bilimleri Enstitüsü, Yüksek Lisans Tezi, 2017.
- Irajpour A, Abbasinia M, Hoseini A, Kashefi P. Effects of shallow and deep endotracheal tube suctioning on cardiovascular indices in patients in intensive care units. Iranian Journal of Nursing and Midwifery Research, 2014;19(4):366-70.
- Sole ML, Bennett M, Ashworth S. Clinical indicators for endotracheal suctioning in adult patients receiving mechanical ventilation. Am J Crit Care, 2015;24(4):318-24.
- Day T, Farnell S, Haynes S, Wainwright S, Wilson-Barnett J. Tracheal suctioning: an exploration of nurses' knowledge and competence in acute and high dependency ward areas. J Adv Nurs, 2002;9(1):5-45.
- Kelleher S, Andrews T. An observational study on the open-system endotracheal suctioning practices if critical care nurses. J Clin Nurs. 2008;17(3):360-9.
- Ansari A, Alavi NM, Hajbagheri MA, Afazel M. The gap between knowledge and practice in standard endo-tracheal suctioning of ICU nurses, Shahid Beheshti Hospital. Iran J Crit Care Nurs, 2012;5(2):71-6.
- Özden D, Görgülü S. Development of standard practice guidelines for open and closed system suctioning. J Clin Nurs. 2012;21(9-10):1327-38.
- Çelik SŞ, Elbas NÖ. The standard of suction for patients undergoing endotracheal intubation. Intensive and Critical Care Nursing, 2000;16(3):191-8.
- Maras GB, Güler EK, Eşer İ, Köse Ş. Knowledge and practice of intensive care nurses for endotracheal suctioning in a teaching hospital in western Turkey. Intensive and Critical Care Nursing, 2017;39:45-54.
- Özden D. Bir devlet hastanesinde açık ve kapalı sistem aspirasyon yöntemleri için standart geliştirilmesi ve bu yöntemlerin hastaların hemodinamik durumuna etkisinin belirlenmesi. Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü, Doktora Tezi, 2007.
- Potter PA, Perry AG, Stockert P, Hall A, Astle BJ, Duggleby W. Cardiopulmonary Functioning and Oxygenation. In: Canadian Fundamentals of Nursing. 6th Edition, Canada: Elsevier Health Sciences, 2018. pp. 3163-71.
- Elbokhary R, Osama A, Al-khade M. Knowledge and practice of ICU nurses regarding endotracheal suctioning for mechanically ventilated patients in Khartoum Teaching Hospital. American Journal of Clinical Neurology and Neurosurgery, 2015;1(2):92-8.
- Şenol S. Endotracheal aspirasyon uygulanan hastalarda aspirasyon standartı. Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü, Doktora Tezi, 1998.
- Akgül S. Endotracheal aspirasyonda serum fizyolojinin etkileri. Yüksek Lisans Tezi, Danışman: Doç. Dr. Neriman Akyolcu, İstanbul, 2000.
- Aslan FE, Karadağ Ş. Yoğun bakım ünitesinde hemşireye hastanın yerine düşünme ve hissetme zorunluluğu ve sorumluluğu yükleyen bir sorun. Yoğun Bakım Hemşireliği Dergisi, 2007;11(2):89-95.
- Seving S. Hemşirelerin trakeal aspirasyona karar verme durumları, uygulama biçimleri ve bunu etkileyen faktörler. Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü, Doktora Tezi, 1997.

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