

## Original Article

## Cuff Management Practices In Adult Intensive Care Units In Turkey

**Ozlem Kardas Kin**

Nurse, Pazarcik State Hospital, Kahramanmaras, Turkey

**Oznur Usta Yesilbalkan**

Professor, Ege University, Nursing Faculty, Izmir, Turkey

**Asiye Akyol**

Pazarcik State Hospital, Ahmet Bozdog Neighborhood, Ahmet Aksu Street, 46700, Kahramanmaras, Turkey

**Correspondence:** Asiye Akyol, Pazarcik State Hospital, Ahmet Bozdog Neighborhood, Ahmet Aksu Street, 46700, Kahramanmaras, Turkey; E-mail: kardas.ozlem@hotmail.com

### Abstract

**Background:** There are some parameters that the nurse's attention to during endotracheal and tracheostomy tube monitoring. Cuff pressure monitoring has an important place among these parameters.

**Objectives:** This study is planned to increase quality nursing care and to examine how to cuff monitoring is performed in the adult intensive care units.

**Methods:** This is a descriptive study. The data were collected from neurology, anesthesia and chest intensive care units in the training and research hospital and one public hospital in Turkey. 40 nurses working in intensive care for at least 6 months constituted the sample of the study. This study was planned to learn about the cuff management processes of nurses working in a training and research hospital. The questionnaires were collected by the face-to-face method.

**Results:** The most frequent source of information about cuff pressure is colleagues with 18%. While 42.5% of the nurses considered themselves insufficient in measuring and managing cuff pressure, 62.5% stated the task of the cuff as fixing the tube, preventing it from coming off, and fixing it. The most frequently stated cuff-related complication was tracheal pain with 65%.

**Conclusion:** Considering the results of the study, the level of knowledge and skills of intensive care nurses regarding cuff pressure measurement and management is not at the desired level. The majority of the participants consider themselves insufficient in this regard and want to receive training on the subject.

**Keywords:** intensive care; cuff pressure; nursing care; nurse

### Introduction

Endotracheal intubation is an important procedure for critically ill patients (Talekar et al. 2014). The cuff, which is in the endotracheal and tracheostomy tubes and looks like a balloon; surrounded the lower outer part of the tube to ensure positive pressure ventilation without tidal volume loss (Rose & Redl 2008). In short, the cuff is a balloon located at the lower end of the tracheostomy cannula and acts as a set between the tracheal wall and the cannula when it is inflated. The main functions of the cuff are to prevent the cannula from coming

out again after the cannula is inserted, to prevent air leakage between the cannula and the tracheal wall, and to prevent foreign bodies from escaping into the trachea (Karaca 2015).

It is radiologically proven that secretions accumulating in the upper airway accumulate on the endotracheal tube cuff in intubated patients. Low cuff pressure causes the secretions accumulated in the subglottic area to progress to the lower respiratory tract and the development of ventilator-associated pneumonia (VIP) (Kapucu & Özdemir 2014). Keeping the endotracheal tube cuff

pressure between 20-30 cmH<sub>2</sub>O reduces the risk of VIP (Das & Kumar 2015; Grassie et al 2016; Yüce & Emine 2016). Adjusting the cuff pressure to 20-30 cm H<sub>2</sub>O; prevents volume loss during ventilation and complications such as sore throat, hoarseness and tracheomalacia (Das & Kumar 2015). Other complications associated with cuff; tracheoesophageal fistula, bleeding, tracheal stenosis, difficulty, necrosis in the trachea, laryngeal nerve palsy, sore throat after stridor and extubation (Karaca 2015; Jordan, Van Rooyen & Venter 2012). High cuff pressure can cause mucosal ischemia (Kapucu & Özdemir 2014, Nazari et al, 2020). In cases where it is less inflated, secretions descend into the bronchi, causing ventilator-associated pneumonia (Jordan, Van Rooyen & Venter 2012).

There are important points in cuff management. These points; checking the location of the endotracheal tube and the fixation point every 2 hours and cuff pressure is to be checked in 8-12 hours or every shift. Measurement of cuff pressure with a manometer is the safest method recommended. It is recommended to the patient should be given Semi-Fowler's position before measuring cuff pressure. Secretions on the cuff are routinely required to be aspirated (Harm et al 2013; Tekin & İyigün 2016; Özbayır et al. 2018).

Artificial airways, which are most frequently used in mechanical ventilation are endotracheal tubes and tracheostomy tubes. Nurses play an important role in the management of artificial airways (Asfour & Ayoub 2016). Endotracheal cuff pressure monitoring is one of the most important points that nurses working in intensive care units should pay attention, especially during intubated patient monitoring. Important care steps such as how nurses working in intensive care units monitor endotracheal cuff pressure, at what intervals, whether or not they pay attention to position affect the quality of care and affect the mortality/survival rate. Limited resources have been accessed on this subject. This

study was planned to increase the quality of nursing care and to examine how to cuff monitoring is performed in the intensive care environment. Therefore, this study aimed to examine cuff pressure practices of nurses working in adult intensive care units.

### **Material and Methods**

This study aimed to examine cuff pressure practices of nurses working in adult intensive care units. This study was designed as a cross-sectional descriptive study and conducted between April and November 2019 in a university hospital and one public hospital in Izmir, Turkey.

**Sample:** 40% of the data was collected from the state hospital and 60% from the university hospital. The data were collected from neurology, anesthesia and chest intensive care units at the university hospital. There was only one intensive care unit in the public hospital. A total of 70 nurses were working in the university hospital's 3 intensive care units and the state hospital's intensive care units. 40 nurses from 70 nurses participated in the study. Inclusion criteria consisted of staff nurses with a minimum of 6 months of experience in the current unit in which they were employed. Exclusion criteria consisted of part-time nurses and nurses who refused to participate in the research. Forms with missing answers were not included in the evaluation.

**Data collection tools:**The data were collected by face-to-face interview method by using the "Personal Characteristics Form" and "Cuff Management Process".

**Personal Characteristics:** This form was prepared by researchers based on the literature (Rose & Redl 2008; Das & Kumar 2015; Tekin & İyigün, 2016). The form contains 13 questions including the educational status of the person, the year of work in intensive care and nursing, having a certificate of intensive care nursing, and previous training in cuff management.

**Cuff Management Process:** This form was prepared by researchers based on the literature (Rose & Redl 2008; Das & Kumar 2015; Tekin & İyigün, 2016). There are a

total of 13 questions with yes / no options, open-ended and multiple-choice to evaluate the practices of nurses in measuring and monitoring cuff pressure. For the clarity of the question, opinions were received from the academicians who are experts in the field of Internal Medicine Nursing and who work in the field of intensive care (1 professor, 1 associate professor). The correct answers to the expressions used in the data collection form are given in Table I.

### Data analysis

Research data were evaluated in SPSS 21.0. A descriptive statistical method was used in the study, variables were calculated using numbers and percentages.

### Ethical and Research Approvals

Permission was obtained from each institution where the study was conducted, and approval was obtained from the Ethics Committee of the Faculty of Medicine, Ege University, with approval number 136513, the date is 25.04.2019. The nurses who agreed to participate were informed about the purpose and context of the study, and their consent was taken via an informed consent form.

### Results

Table II shows participating nurses' sociodemographic and occupational characteristics. The mean age of the nurses was 31.1 (SD=7.8) and most were female (72.5%). Of the respondents, 85.0% of nurses had bachelor's degrees. The average working year of the nurses was determined as 7.85 (min:1, max: 22,±6.2), and the working time in the intensive care unit was  $5.45 \pm 5.0$  (min:1, max:21). Furthermore, 35% of the nurses received the intensive care nursing certificate and 57.5% of the participants stated that they had previously received training on cuff pressure measurement and management (Table II).

When the sources of information acquired about cuff pressure are examined, 18% of colleagues, 12% of intensive care nursing training, 12% of undergraduate education, 3% of scientific resources (articles, journals, etc.), 2% of high school / associate education

and brochures/magazines. 37.5% of the participants don't know whether there is a cuff management protocol in the unit where they work. While 42.5% of the intensive care nurses consider themselves insufficient in cuff pressure measurement and management, 75% stated that they want to receive training on this subject. It was determined that 5% had problems in cuff pressure management, and these problems were material related problems and tube dislocation (Table III).

When the answers given to the question of what is the function of the cuff is examined; 27.5% did not answer this question. 62.5% stated the duty of the cuff as fixing the tube, preventing it from coming off, and fixing it, while 20% stated that it was preventing the risk of aspiration and pneumonia, 15% was providing the ventilation of the lungs and preventing air escape

When the information status about cuff-related complications is examined, the most frequently expressed complication is tracheal pain with 65%. This is followed by trachea necrosis and tracheal stenosis with 62.5%. Other transmitted complications by nurses aspiration pneumonia 40%, tracheal-esophageal fistula 32.5%, increased secretion 22.5%, respiratory failure 15%, laryngeal nerve palsy 5% and stridor is 2.5%.

55% of intensive care nurses stated that it was correct to inject 2-4 ml of air until the cuff pressure was 20-30 cm H<sub>2</sub>O, while 10% said they were not sure about this. 67.5% correctly marked the location of the endotracheal tube and the fixed point should be checked every 2 hours. The question of cuff pressure should be checked in 8-12 hours or every shift, 52.5% of the nurses stated right and 40% wrong. While 72.5% of the nurses knew that the cuff pressure should be controlled with a manometer, 87.5% stated that it was not enough to control the cuff pressure only when there was a leak. While the cuff pressure should be set to 30-40 cmH<sub>2</sub>O, 60% of them answered incorrectly, while 25% of them stated this statement as correct and marked this question correctly. While 70% of the nurses

said that secretions on the cuff should be routinely aspirated, 22.5% made the question wrong by marking the expression that the best cuff pressure is controlled by palpation as yes. 72.5% have doing cuff gymnastics

(Table IV). In the question of how many ml of air is required to inflate the cuff, the majority stated that 5 ml (17.5%) and 2-4 ml (15%) of air are required, and 15% answered as I do not know.

**Table 1: Questions and Answers in the Data Collection Form**

Question	Answer
<b>The basic function of the cuff?</b>	To prevent the cannula from coming out again after the cannula is inserted, to prevent air leakage between the cannula and the tracheal wall and to prevent foreign objects from entering the trachea.
<b>The most common complications associated with cuff?</b>	<ul style="list-style-type: none"> <li>• Tracheal stenosis</li> <li>• Aspiration pneumonia</li> <li>• Necrosis of the trachea</li> <li>• Strider</li> <li>• Increased secretion</li> <li>• Tracheal pain</li> <li>• Tracheal-esophageal fistula</li> <li>• Laryngeal nerve palsy</li> <li>• Respiratory Failure</li> </ul>
<b>2-4 ml of air should be injected until the cuff pressure is 20-30 cm H<sub>2</sub>O</b>	Correct
<b>The location of the endotracheal tube and the fixed point should be checked every 2 hours.</b>	Correct
<b>The cuff pressure should be checked in 8-12 hours or every shift.</b>	Correct
<b>The cuff pressure should be checked with a manometer.</b>	Correct
<b>It is sufficient to check the cuff pressure only when there is a leak.</b>	False
<b>The patient should be in a Semi-Fowler's position before cuff pressure measurement.</b>	Correct
<b>The best cuff pressure is controlled by palpation.</b>	False
<b>Secretions on the cuff should be aspirated routinely.</b>	Correct
<b>Setting the cuff pressure to 30-40 cmH<sub>2</sub>O; prevents volume loss during ventilation and complications such as sore throat, hoarseness and tracheomalacia.</b>	False
<b>How much ml of air is required to inflate the cuff?</b>	2-4 ml
<b>Cuff gymnastics should be done.</b>	Correct

**Table 2. Sociodemographic and occupational characteristics of the nurses (n = 40)**

Variable	%	(n)
<b>Level of education</b>		

High school graduate	10.0	4
Associate degree	2.5	1
Bachelors degree	85.0	34
Master's or doctorate degree	2.5	1
<b>Age</b>		
24-29	45.0	18
30-35	32.5	13
36-42	22.5	9
<b>Working year</b>		
1-6	55.0	22
7-14	27.5	11
15-22	17.5	7
<b>To Get Critical Care Nursing Certificate</b>		
Yes	35.0	14
No	65.0	26
<b>To Get Previous Training on Cuff Pressure Measurement</b>		
Yes	57.5	23
No	42.5	17
<b>Total</b>	%100	40

**Table 3: Practices of Nurses on Cuff Pressure**

	n	%
<b>Knowledge Levels Regarding Whether There Is A Protocol About Cuff Pressure In The Unit Where He/She Works</b>		
Yes	21	52.5
No	4	10.0
Don't Know	15	37.5
<b>Seeing Herself/Himself Sufficiently About Measuring Cuff Pressure</b>		
Yes	23	57.5
No	17	42.5
<b>Request for Training on Cuff Pressure</b>		
Yes	30	75.0
No	10	25.0
<b>Problems in Cuff Pressure Management</b>		
Yes	2	5.0
No	38	95.0

**Table 4: Answers of ICU nurses to questions about cuff management processes**

Questions	Yes		No		Not sure	
	n	%	n	%	n	%
2-4 ml of air should be injected until the cuff pressure is 20-30 cm H <sub>2</sub> O.	22	55.0	8	20.0	4	10.0

<b>The location of the endotracheal tube and the fixed point should be checked every 2 hours.</b>	27	67.5	7	17.5	3	7.5
<b>The cuff pressure should be checked in 8-12 hours or every shift.</b>	21	52.5	16	40.0	2	5.0
<b>The cuff pressure should be checked with a manometer.</b>	29	72.5	5	12.5	5	12.5
<b>It is sufficient to check the cuff pressure only when there is a leak.</b>	1	2.5	35	87.5	3	7.5
<b>The patient should be in a Semi-Fowler's position before cuff pressure measurement</b>	22	55.0	8	20.0	8	20.0
<b>The best cuff pressure is controlled by palpation.</b>	9	22.5	23	57.5	6	15.0
<b>Secretions on the cuff should be aspirated routinely.</b>	28	70.0	6	15.0	6	15.0
<b>Setting the cuff pressure to 30-40 cmH<sub>2</sub>O; it prevents volume loss during ventilation and complications such as sore throat, hoarseness and tracheomalacia.</b>	24	60.0	10	25.0	4	10.0
<b>Do you do cuff gymnastics?</b>	29	72.5	11	23.5	-	-

## Discussion

In our study, 52.5% of the nurses stated that there is a cuff pressure management protocol in the unit where they work, whereas Tekin & Iyigun (2016) found this rate as 17.30%. Those who do not know whether there is a cuff management protocol in the unit they worked on is 37.5% in this study and 15% in Tekin & Iyigun (2016). Rose & Redl's study also found that only 37% of 92 intensive care units (n:34) had protocols for cuff pressure management. Preparing a protocol for applications and using it in the clinical field minimizes the possibility of making mistakes and makes it easy to follow the new information closely with constantly updated information. Therefore, each unit should have a protocol regarding cuff pressure management and should be known and read by the nurses working in the unit.

Functions of the endotracheal cuff in studies conducted; fixing the tube, closing the airway, ensuring the flow of air from the endotracheal tube, thereby preventing the pharyngeal content from leaking into the trachea and aspiration (Hamilton & Grap 2012; Khan et al 2016). In this study, 62.5% of the participants stated the task of the cuff as fixing the tube, preventing it from coming off, and fixing it, while 20% stated it to prevent the risk of aspiration and pneumonia and 15% to provide ventilation. In the study of Tekin & Iyigun (2016), almost all of the nurses; stated that the cuff helps to fix the tube, while 86.30% stated it as preventing extubation and 76.30% as preventing aspiration into the lungs.

When the state of knowledge about the complications related to cuff is examined, the most frequently expressed complication is tracheal pain with 65%. In this study,



while tracheal necrosis and tracheal stenosis knowledge was 62.5%, in the study of Tekin & Iyigun (2016), tracheal necrosis was reported as 78.80% and tracheal stenosis was 28.80%. In this study, aspiration pneumonia was stated as 40%, and it was found to be 73.80% in the study of Tekin & Iyigun (2016). In the study of Soyer, Ozyurek & Giersbergen (2020); in the pre-training information of nurses, VAP development at low cuff pressure is 59%, microaspiration development at low cuff pressure is 71.9%, tracheal damage at high cuff pressure is 87.5%. In this study, tracheal pain, tracheal-esophageal fistula, stridor, laryngeal nerve palsy complication information was also examined, but the study examining these complications in the literature has not been reached.

Studies suggest that cuff pressure should be a minimum of 20 cm H<sub>2</sub>O to prevent VAP and aspiration (Asfour & Ayoub 2016) and 2 to 4 ml of air should be injected to create 20-30 cm H<sub>2</sub>O cuff pressure (Jordan, Van Rooyen & Venter 2012; Sultan et al 2012). In our study, 55% of the participants knew correctly. While most of them stated that 5 ml (17.5%) of air is required, 15% of them answered as I don't know and 2.5% of them stated that they inflated with 24-28 ml of air. In the study of Tekin & Iyigun (2016), 36.3% stated that with 10 ml of air, 35% of them were inflated until the audible leakage ceased and 2.5% of them were inflated with 20 ml of air. In the study of Soyer, Ozyurek & Giersbergen (2020) showed that while 21.9% of the nurses could answer the question related to a safe ETT cuff pressure range before the training, this percentage rose to 100% following the training. The results of this study show that nurses use different air rates in cuff inflation. High cuff pressure may cause mucosal ischemia (Kapucu & Özdemir 2014). In cases where it is less inflated, secretions descend into the bronchi, causing ventilator-associated pneumonia (VAP). (Jordan, Van Rooyen & Venter 2012). Cuff pressure should be checked between 8 and 12 hours (Asfour & Ayoub 2016). In the study of Turkan et al

(2018), this information was answered correctly by 85%, while it was determined as 52.5% in this study. While Rose & Redl (2008) stated that 71% of the nurses checked every seizure (every 8-12 hours), while Tekin and Iyigun (2016) measured more than half of the nurses when the mechanical ventilator gave an alarm. Jordan, Van Rooyen, & Venter (2012) in the work of intensive care unit (ICU) nurses, 52% check cuff pressure every 6-12 hours, 32% check the cuff pressure at 2-4 hour intervals, 15% evaluate the cuff only when there is a leak, it was found that 1% did not follow cuff pressure at all. In the study of Saritaş, Kaya & Dolanbay (2019) 85% of the nurses controlled the cuff pressure routinely. According to the literature, cuff pressure; is recommended to measure after intubation, in every shift, when transferred to another hospital or unit, in the early postoperative period, when there is an audible leak from the trachea and when the ventilator gives a low volume alarm in expiration (Rose & Redl, 2008; Tekin & Iyigun, 2016).

When the cuff pressure values measured in the intensive care unit are examined; cuff pressure values were in the range of 26-38 cm at most (Vyas et al; 2002). In the study of Nseir et al (2009), it was determined that the cuff pressure measured in the majority of the patients who were followed up was 30 cm H<sub>2</sub>O, while Özbayır et al. (2018) study, mean cuff measurement values were found above 30 cmH<sub>2</sub>O. In this study, 60% of the answer was wrong when the cuff pressure should be adjusted as 30-40 cmH<sub>2</sub>O, while 25% marked this question correctly by saying that this statement was wrong. Studies suggest that cuff pressure should be a minimum of 20 cmH<sub>2</sub>O to prevent VAP (Asfour & Ayoub 2016). Adjusting the cuff pressure to 20-30 cmH<sub>2</sub>O; prevents volume loss and complications such as sore throat, hoarseness and tracheomalacia during ventilation (Das & Kumar 2015). It is recommended to use a semirecumbent (lifting bed head 30°- 45°) position in cuff pressure measurement. In this study, 55% of nurses reported that it was correct to bring the patient to a Semi-

Fowler's position. In Rose & Redl's (2008) study, the rate of nurses using semirecumbent position was stated as 58%, and in Tekin & Iyigun's (2016) study, it was stated as 58.80%. A semi-sitting position is recommended because it reduces the risk of aspiration and the gag reflex (Rose & Redl 2008).

The application recommended as a cuff pressure measurement method in the guides is to inflate it with minimal leakage technique at first and then to control it with a manometer. Measuring with a manometer is the safest way (Jordan, Van Rooyen & Venter 2012). The most frequently used method in the study of Tekin & Iyigun (2016) palpation of the test balloon. In this study, 22.5% of the participants marked the best cuff pressure controlled by palpation as yes and made the question wrong. In the study of Saritaş, Kaya & Dolanbay (2019) 63% made this control by touching with hands. Just as, in the study of Jordan, Van Rooyen & Venter (2012), 37% stated that they used cuff pressure measurement method and 24% used palpation or air leak listening method. No participant stated that she/he used the minimal leak technique.

In our study, while 70% of the participants stated that they routinely aspirate secretions on the cuff, in the study of Tekin & Iyigun (2016), similarly the majority of nurses routinely aspirated secretions on the cuff. Aspirating continuous subglottic secretions is recommended because it reduces the risk of ventilator-associated pneumonia (Rose & Redl 2008).

**Limitations:** This study had some limitations. The data collection tool used in the study is used by researchers, it is not a measurement tool whose validity and reliability have been tested. Chosen by the researchers can not be generalized to Turkey was made at certain hospitals.

**Conclusion:** Considering the results of the study, the knowledge and skill level of cuff pressure measurement and management of intensive care nurses is not at the desired

level. Just as, in the study of Saritaş, Kaya & Dolanbay (2019) was determined that the nurses, following up the mechanically ventilated patients in the intensive care units, did not have enough knowledge about mechanical ventilation practices. In this study, only 35% of the participants have an intensive care nursing certificate, and also their sources of information on the subject are their colleagues by 18% rather than in-service training or a scientific resource. While 57.5% of the nurses stated that they considered themselves insufficient in this regard, 75% stated that they wanted to receive training on cuff pressure measurement and management. Especially in intensive care nursing certificate training, it can be emphasized how important the cuff pressure measurement subject is. Continuity of information should also be ensured through in-service training.

It is difficult to keep the cuff pressure within the range you choose. Many variables, such as the patient's position, affect this condition. Intensive care nurses have a very important position in monitoring cuff pressure, preventing complications and providing ventilation. Cuff pressure monitoring is required in all intubated patients and nurses should be trained to keep the cuff pressure safe and within the normal range (Asfour & Ayoub, 2016).

**Acknowledgments:** We would like to thank Ege University and Tire State Hospital intensive care nurses for their support. This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

## References

- Asfour, H.I., & Ayoub, N.S. (2016). Effectiveness of pressure adjustment on attaining a safe cuff pressure inflation in elderly critically ill patients. *Journal of Nursing and Health Science*, 5 (1), 17-25.
- Chan, S., Wong, C., Cheng, C. (2009). Determining an optimal tracheal tube cuff pressure by the feel of the pilot balloon: a training course for trainees providing airway care. *Acta Anaesthesiol Taiwan*;47(2):79-83.



- Das, S., & Kumar, P. (2015). Comparison of minimal leak test and manual cuff pressure measurement technique method for inflating the endotracheal tube cuff. *Indian Journal of Clinical Anaesthesia*, 2(2), 78-81.
- Grassie, S.S., Kayaaslan, B., Gevrek, S.C., Kumral, D., & Emre, C. (2016). Experience in using checklists to prevent the development of ventilator-associated pneumonia in our intensive care unit. *Journal of The Turkish Society of Intensive Care/Türk Yogun Bakim Dernegi Dergisi*, 14:13-7.
- Harm, F., Zuercher, M., Bassi, M., & Ummenhofer, W. (2013). Prospective observational study on tracheal tube cuff pressures in emergency patients—is neglecting the problem?. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 21(1), 83.
- Hamilton, V.A., & Grap, M.J. (2012). The role of the endotracheal tube cuff in microaspiration. *Heart & Lung*, 41(2), 167-172.
- Jordan, P., Van Rooyen, D., & Venter, D. (2012). Endotracheal tube cuff pressure management in adult critical care units. *Southern African Journal of Critical Care*, 28(1), 13-16.
- Karaca, T. (2015). Nursing care of the patients with tracheostomy. *Journal of Human Sciences*, 12(2), 1078-1091.
- Kapucu, S., & Özdemir, G. (2014). Ventilator-associated pneumonia and nursing care. *Hacettepe University Faculty of Nursing Journal*, 1(1).
- Khan, M.U. et al. (2016). Measurement of endotracheal tube cuff pressure: Instrumental versus conventional method. *Saudi Journal of Anaesthesia*, 10(4), 428.
- Nazari, R., Boyle, C., Panjoo, M., Salehpour-Omran, M., Nia, H. S., & Yaghoobzadeh, A. (2020). The changes of endotracheal tube cuff pressure during manual and intermittent controlling in intensive care units. *Iranian Journal of Nursing and Midwifery Research*, 25(1), 71.
- Nseir, S. et al. (2009). Variations in endotracheal cuff pressure in intubated critically ill patients: prevalence and risk factors. *European Journal of Anaesthesiology*; 26;229-234.
- Ozbayir, T. et al. (2018). Endotracheal tube cuff pressure monitoring: clinical pilot study. *Journal of Ege University Nursing Faculty*, 34 (2), 44-54.
- Rose, L., & Redl, L. (2008). Survey of cuff management practices in intensive care units in Australia and New Zealand. *American Journal of Critical Care*, 17(5), 428-435.
- Saritas, S., Kaya, A., & Dolanbay, N. (2019). Knowledge and Practices of Intensive Care Nurses on Mechanical Ventilation. *International Journal of Caring Sciences*, 12(1).
- Soyer, O., Ozyurek, P., & van Giersbergen, M. Y. (2020). The Effect of Endotracheal Tube Cuff Pressure Control Training on Nurses' Knowledge Level. *Turkish Journal of Intensive Care*, 18(3).
- Sultan, P., Carvalho, B., Rose, B. O., & Cregg, R. (2011). Endotracheal tube cuff pressure monitoring: a review of the evidence. *The Journal of Perioperative Practice*, 21(11): 379.
- Talekar, C.R., Udy, A.A., Boots, R.J., Lipman, J., & Cook, D. (2014). Tracheal cuff pressure monitoring in the ICU: a literature review and survey of current practice in Queensland. *Anesthesia and Intensive Care*, 42(6): 761.
- Tekin, Y.E., & Iyigun, E. (2016). Examination of tracheostomy / endotracheal tube cuff pressure practices of nurses in intensive care units. *Turkey Clinical Journal of Nursing Sciences*, 8(1), 26-33.
- Vyas, D., Inweregbu, K., Pittard, A. (2002). Measurement of tracheal tube cuff pressure in critical care. *Anaesthesia*; 57: 275-277.
- Yuce, Z.T., & Alp, E. (2016). Infection control bundles in the prevention of nosocomial infections. *Mediterranean Journal of Infection Microbes and Antimicrobials*, 5.