

ORIGINAL

An Investigation of the Attempts by Anesthesia Intensive Care Nurses to Increase Lung Capacity After Extubation of the Patient

Una investigación sobre los intentos de las enfermeras de cuidados intensivos de anestesia para aumentar la capacidad pulmonar tras la extubación del paciente

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Received: 16 - XII - 2023

Accepted: 8 - I - 2024

doi: 10.3306/AJHS.2024.39.03.33

Abstract

Objective: This study aimed to examine the efforts made by Anesthesiology Intensive Care nurses to increase patient lung capacity after extubation.

Materials and Methods: The research is descriptive and cross-sectional in design. The sample comprised 120 volunteer nurses working in the 3rd step Anesthesia Intensive Care Unit in İzmir. Data were collected online using a 41-item questionnaire created by the researchers. Research data were analyzed using SPSS (for Windows 25.0). Descriptive statistics (number, percentage, min-max values, mean, and standard deviation) were employed for data evaluation.

Results: 67.5% of nurses are women and 32.5% are men. It was determined that 30% of the nurses received training on Lung Capacity Increasing Interventions, but only 13.3% used evidence-based guidelines. It was determined that 87.5% of the nurses applied interventions to increase the patient's lung capacity after extubation. Usually (frequently) 37.9% postural drainage, 27.6% deep breathing-coughing exercise, 25% triflow exercise, 4.3% positioning (dik-fowler's), 2.6% Noninvasive Ventilation (NI), 2% It was determined that they applied 6 nebulate treatments. While implementing all these, nurses stated that their workload was high, the team's knowledge level was insufficient, some patients rejected the interventions, and the lack of materials (such as triflow) were obstacles.

Conclusion: Nurses were found to have knowledge and training in Interventions to Increase Lung Capacity. Nevertheless, their training in this area was insufficient, and the use of evidence-based guidelines in practice was limited.

Key words: Anesthesia Intensive Care, Nursing Interventions, Lung Capacity Increasing Interventions.

Resumen

Objetivo: Este estudio tuvo como objetivo examinar los esfuerzos realizados por las enfermeras de Cuidados Intensivos de Anestesiología para aumentar la capacidad pulmonar del paciente después de la extubación.

Materiales y métodos: La investigación tiene un diseño descriptivo y transversal. La muestra estuvo compuesta por 120 enfermeras voluntarias que trabajaban en la Unidad de Cuidados Intensivos de Anestesia de 3^{er} escalón en İzmir. Los datos se recogieron en línea mediante un cuestionario de 41 preguntas creado por los investigadores. Los datos de la investigación se analizaron con el programa SPSS (para Windows 25.0). Para la evaluación de los datos se emplearon estadísticas descriptivas (número, porcentaje, valores mínimo-máximo, media y desviación estándar).

Resultados: El 67,5% de los enfermeros son mujeres y el 32,5% son hombres. Se determinó que el 30% de las enfermeras recibió formación sobre Intervenciones para Aumentar la Capacidad Pulmonar, pero sólo el 13,3% utilizó directrices basadas en la evidencia. Se determinó que el 87,5% de las enfermeras aplicaron intervenciones para aumentar la capacidad pulmonar del paciente tras la extubación. Habitualmente (frecuentemente) 37,9% drenaje postural, 27,6% ejercicio de respiración profundatos, 25% ejercicio triflow, 4,3% posicionamiento (dik-fowler's), 2,6% Ventilación No Invasiva (VNI), 2% Se determinó que aplicaron 6 tratamientos con nebulizaciones. Durante la aplicación de todos ellos, las enfermeras manifestaron que su carga de trabajo era elevada, el nivel de conocimientos del equipo era insuficiente, algunos pacientes rechazaban las intervenciones y la falta de material (como el triflow) eran obstáculos.

Conclusiones: Se observó que el personal de enfermería tenía conocimientos y formación sobre las intervenciones para aumentar la capacidad pulmonar. Sin embargo, su formación en esta área fue insuficiente y el uso de guías basadas en la evidencia en la práctica fue limitado.

Palabras clave: Cuidados Intensivos de Anestesia, Intervenciones de Enfermería, Intervenciones para Aumentar la Capacidad Pulmonar.

Cite as: Oyur Çelik G, Dalfidan Sayın B, Durmaz D. An Investigation of the Attempts by Anesthesia Intensive Care Nurses to Increase Lung Capacity After Extubation of the Patient. *Academic Journal of Health Sciences* 2024; 39 (3):33-39 doi: 10.3306/AJHS.2024.39.03.33

Introduction

Nowadays, mechanical ventilator (MV) devices are used in patients who cannot or are inadequate to maintain their breathing on their own¹. After the condition requiring mechanical ventilation disappears, the patient should be extubated as soon as possible². Extubation involves discontinuing respiratory support and gradually weaning from MV once the patient can breathe independently¹. If the appropriate timing for extubation (considering factors such as blood gas parameters, the patient's tolerance of P/S mode while on MV support, and consciousness) and method are not selected correctly, this process can be prolonged. Additionally, it can lead to potential complications, including pneumothorax, lung injury, alveolar damage, and VAP (Ventilator-Associated Pneumonia)^{1,3}. Patients who are on mechanical ventilator support for a long time have lung diseases that cause decreased mucociliary activities, prolongation of hospital stay, limited mobility of the patient or being immobile, presence of problems such as dehydration and shortness of breath; It causes secretions to accumulate in the lungs and not be excreted adequately⁴. However, laryngeal damage in patients who are mechanically ventilated reduces the excretion of secretion by preventing the patient from coughing⁵. Considering all these problems, many studies have highlighted that unnecessarily prolonged mechanical ventilation is a significant cause of mortality and morbidity^{6,7}.

The majority of these patients are followed up in anesthesia intensive care units defined as the third level of the Ministry of Health⁸. In this context, nurses working in these units play an active role in preventing prolonged MV-related mortality and morbidity by implementing a number of interventions to increase the patient's lung capacity after extubation. It is important to implement lung capacity-increasing interventions such as postural drainage, use of spirometer (triflow), deep breathing and coughing exercises in order to reduce the risk of complications that may occur in patients, correct impaired respiratory activity, ensure secretion in the bronchi, strengthen respiratory muscles and reduce the need for oxygen in the body^{9,10,11,12,13}. These practices, referred to as chest physiotherapy (CP) in many literatures, are performed by physiotherapists in intensive care units in today's conditions. However, due to the lack of sufficient number of physiotherapists (the number of patients per physiotherapist is high), all practices are carried out with the support of nurses²².

Intensive care units necessitate a multidisciplinary approach. While physiotherapists often claim responsibility for these tasks, their limited numbers prevent them from actively participating in rehabilitation efforts. As a result, nurses, who provide comprehensive holistic care in the intensive care unit, effectively perform chest physiotherapy rehabilitation procedures within the bounds of the legal framework^{8,16}. For this reason, it is

very important that intensive care nurses are trained on the subject and have sufficient knowledge¹⁴.

When the literature is examined, studies have been conducted to assess the knowledge levels and attitudes of intensive care nurses towards lung capacity-increasing interventions (LCI-I). However, there is a gap in the literature regarding specific examinations of interventions aimed at increasing lung capacity performed by anesthesia intensive care nurses. Therefore, this study was planned to examine the attempts of anesthesia intensive care nurses to increase the lung capacity of the patient after extubation.

Materials and methods

Study Design and Aim

This research is descriptive-cross-sectional in nature. This study was planned to examine the attempts of anesthesia intensive care nurses to increase the lung capacity of the patient after extubation.

Sample and Context (Sample size calculation)

The sample consisted of 120 volunteer nurses working in the 3rd step Anesthesia Intensive Care Unit in İzmir. Since it was sent to nurses online, no sample calculation was made. Nurses working in the Anesthesia Intensive Care Unit in İzmir (private, state and university hospitals) were reached via whatsapp groups. The Question Form has been sent as a link.

Data collection and instruments

Data was collected online with a questionnaire created by the researchers. The questionnaire includes information about the nurses' sociodemographic characteristics, clinical experience and post-extubation interventions (such as knowing the methods that increase lung capacity, their educational status, using these methods in intensive care, their obstacles in practice, etc.), and also includes open-ended questions to allow nurses to make additional comments. It consisted of 29 questions in total. Answers to open-ended questions; The answers reflecting the nurses' opinions were grouped in their own words, and the answers regarding the concepts were grouped based on literature knowledge.

Data analysis

The data obtained in the study were analyzed using the SPSS (Statistical Package for Social Sciences) for Windows 25.0 program. Descriptive statistics (number, percentage, min-max values, mean and standard deviation) were used when evaluating the data.

Ethical issues

Ethical permission for the study was obtained from the Non-Interventional Ethics Committee of İzmir Katip Çelebi

University (Ethics Committee Approval Date: 04.03.2021 Decision No: 0130). In addition, the participants were assured that they could leave the study whenever they wanted. In this context, online consent was obtained from each individual with an informed consent form.

Results

Information about the sociodemographic and working status of the nurses participating in the study is given in **table I**.

The criteria for nurses to decide on extubation before extubation, attempts at the preparation stage, first attempts after extubation, and Lung Capacity Increasing Interventions (LCI-I) at all these stages were examined.

When the criteria used as a team to decide on extubation for the patient are examined; 32.5% of nurses stated that blood gas parameters should be sufficient for extubation, 5.7% stated that the patient's saturation should be over 95%, 24.2% stated that the patient should tolerate P/S (spontaneous) mode on the mechanical ventilator, 17.9% stated that the FIO₂ value (which is the amount of oxygen given to the patient on mechanical ventilator support) should be below 30%, 7.7% stated that extubation was a physician's decision, and 12% stated that the patient should be conscious and hemodynamically stable.

In order to accelerate the extubation of the patient in the intensive care unit, 28.3% of the nurses said that they applied interventions to increase lung capacity (postural drainage, active passive ROM exercises, etc.), 24.8% said that they turned off sedation support to encourage the patient to spontaneously breathe, and 9% said that 7 of them stated that they put the patient in P/S mode on the ventilator and monitor their tolerance and blood gas values, 3.5% stated that the patient should be protected from Ventilator Associated Pneumonia (VAP), 4.4% stated that they applied bronchodilator treatment and 0.9% stated that the orientation of the patient to the intensive care unit should be ensured.

When the first interventions they applied to the patient immediately after extubation were examined; 70.5% of nurses stated that oxygen mask should be worn and oxygen support should be started, 4.9% stated that intraoral secretions should be aspirated, 4.9% stated that postural drainage should be applied to the patient at frequent intervals to facilitate secretion excretion, 4.1% bronchodilator treatment should be started to prevent bronchospasm, 3.3% the patient should be followed in the upright-fowler's position, 6.6% stated that coughing exercises should be applied, 4.9% stated that saturation should be followed, 0.8% stated that the patient should be encouraged to breathe.

Table I: Sociodemographic characteristics.

Sociodemographics	n	%
Age mean±SD: 26,03±3,59 (min:21- max:47)		
Gender		
Female	81	67,5
Man	39	32,5
Education Level		
High School	15	12,5
University/Graduate	90	75
Master's Degree	13	10,8
PhD Graduate	2	1,7
Hospital		
Public Hospital	68	56,7
University Hospital	49	40,8
Private Hospital	3	2,5
Previous experience working in intensive care		
Yes	52	43,3
No	68	56,7
Do you have knowledge about lung capacity-increasing interventions (LCI-I)?		
Yes	61	50,8
No	59	49,2
Status of receiving training on LCI-I		
Yes	36	30,0
No	84	70,0
Status of implementing LCI-I		
Yes	105	87,5
No	15	12,5
Status of using evidence-based guidelines when applying LCI-I		
Yes	16	13,3
No	104	86,7
Total	120	100,0

Mean: Arithmetic Mean, SD: Standard deviation, Min: Smallest value, Max: Largest value

Nurses stated that some changes in the patient should be taken into account to decide on LCI-I. These changes were listed by the nurses as follows: The patient had respiratory distress and difficulty breathing (39% of the nurses), the patient started to breathe in the abdomen (6.8%), blood gas parameters deteriorated (3.4%), saturation It drops below 90 (29.7%) and the patient begins to become confused (6.8%).

After extubation, nurses usually perform 37.9% postural drainage, 27.6% deep breathing-coughing exercise, 25% trifold exercise, 4.3% positioning (dik-fowler's), 2.6% Noninvasive Ventilation (NIV). 2.6% stated that they applied nebule treatment.

When the nurses' knowledge regarding all these issues (LCI-I) was questioned, 50.8% stated that they knew these initiatives, while 30% were found to have received training on LCI-I. 87.5% of the nurses stated that they applied LCI-I to the patient after extubation. However, only 13.3% of them said that they used evidence-based guidelines when implementing these interventions (Table II).

Of the Anesthesia Intensive Care nurses participating in the study, 97.3% stated that they performed postural drainage every two hours, 39.8% performed deep breathing and coughing exercises every two hours, 77.9% performed suctioning every two hours and 41.2% performed the trifold exercise four times at two hour intervals. They stated that all these applications facilitated spontaneous breathing (60.8%) (Table II). 96.7% of the nurses stated that a chest x-ray was taken to measure the effect of their practices on the patient's lung capacity.

The problems experienced by nurses while performing LCI-I were examined. The problems experienced by nurses in this regard were grouped into 5 main themes (individual, team, patient, environment and equipment-related obstacles) and sub-themes (Table III).

Nurses commonly identified staff shortages and excessive workloads as obstacles they encountered in implementing LCI-I. The majority of nurses (n: 82) mentioned that their individual performance declined due to heavy workloads and insufficient staffing, viewing this as an individual challenge. Furthermore, some nurses cited occupational health issues and a lack of education as individual barriers. Similarly, an excess workload and a shortage of personnel were prominent themes in the perceived obstacles for the team. Nurses mentioned that this situation hindered coordinated teamwork. In response to this issue, one nurse reported that the crowded team environment led to breakdowns in communication. Additionally, insufficient knowledge among the team was identified as one of the reported obstacles.

The majority of obstacles experienced by patients were due to their refusal of intervention due to pain (n:99). Additionally, nurses reported that caring for obese patients posed obstacles for both the patient, the team, and the individual.

More than half of the nurses (n:70) stated that they perceived the noise caused by the devices in the intensive care unit as an environmental obstacle. Regarding equipment-related obstacles, almost all nurses (n:103) reported that a lack of equipment (such as trifold) made it difficult to apply LCI-I.

Table II: Questions asked to nurses regarding LCI-I.

Questions-Nurse Answers	n	%
Nurses' opinions about the benefits of AKA-Gs to patients*		
It increases lung capacity.	22	18,3
It helps reduce the length of stay in intensive care.	4	3,3
It facilitates the patient's spontaneous breathing.	73	60,8
The development of atelectasis is prevented.	9	7,5
It facilitates the patient's secretion excretion.	4	3,3
Reintubation of the patient is prevented.	8	6,7
Lung X-ray Status		
Yes	116	96,7
No	4	3,3
How often do you perform postural drainage on patients?*		
1 time per hour	2	1,8
1 time in 2 hours	108	97,3
1 time per day	1	0,9
How often do you have patients do deep breathing and coughing exercises?*		
1-2 times per hour	44	37,3
3-4 times per hour	27	22,9
Once every 2 hours	47	39,8
How often do you have patients do spirometry?*		
3 times at 1 hour intervals	42	36,8
4 times at 2 hour intervals	47	41,2
1 time per hour	25	21,9
How often do you aspirate patients?*		
1-2 times per hour	23	20,4
3-4 times per hour	2	1,8
Once every 2 hours	88	77,9

Table III: Themes and subthemes regarding nurses' perceived barriers to LCI-I implementation.

Main Themes	Subthemes
Individual Barriers	Time Pressure Providing Care to Obese Patients Excess Workload Due to Personnel Lack Lack of Equipment Occupational Diseases Lack of Education
Team-Related Barriers	Staff Shortage Workload Excess Lack of Information of People in the Team Providing Care to Obese Patients Lack of Equipment Crowded Team (Lack of Communication)
Patient-Related Barriers	Staff Shortage Providing Care to Obese Patients Refusal of Treatment/Intervention Due to Pain Lack of Equipment
Environmental Barriers	Staff Shortage Lack of Equipment High Patient Change Noisy Time Pressure Intensity
Equipment Related Barriers	Lack of Equipment (Especially Like Triflow) Staff Shortage

Discussion

In healthy individuals, airway cleaning is typically accomplished through mucociliary activity and coughing. However, in intensive care patients receiving mechanical ventilation support, factors like impaired oxygenation, dehydration, limited mobility, reduced use of intercostal muscles in breathing, and ineffective coughing can lead to the accumulation of thick and dark secretions¹⁵. Intensive care nurses are responsible for planning, implementing, and evaluating interventions to address respiratory issues in patients unable to effectively clear their airways¹⁶.

It was determined that almost half of the nurses participating in the study did not know LCI-I (49.2%) and only 30% had received training on the subject. Additionally, it was determined that only 13.3% of nurses used evidence-based guidelines when implementing these initiatives. Although 87.5% of the nurses stated that they used LCI-I in intensive care, when other results are evaluated, it can be thought that these nurses lack evidence-based and up-to-date knowledge. It suggested that these deficiencies were a limiting factor in the effective and regular implementation of these patient-specific interventions. It is very important for nurses to know these methods in order to be aware of the needs of the patients and to plan the appropriate intervention for the patient in cooperation with the team.

There are various LCI-I that positively affect physiological and metabolic processes in patients in intensive care^{17,18}. According to study data, nurses frequently apply postural drainage (37.9%), deep breathing and coughing exercises (27.6%) and triflow exercises (25%)

for this purpose. In a similar study, nurses applied Chest Physiotherapy (CP) techniques at the following rates: 93% for deep breathing exercises, 62% for percussion, 62% for postural drainage, and 55% for vibration¹⁴. As nurses' CP technique, Karaali et al. stated that they used positioning, postural drainage, percussion and vibration¹⁹. In another study, it was stated that aspiration and percussion were the most frequently used CP techniques⁶. When studies on the subject are examined, it is seen that nurses implement similar initiatives.

A healthy person produces about 100 ml of secretion daily. In intensive care, patients with compromised respiratory function, mechanical ventilation, and weakened or lost cough and swallowing reflexes require aspiration to remove secretions due to inadequate ciliary movement and alveolar ventilation¹⁸. In this study, nurses mentioned that patient saturation decreased due to secretions, leading 77.9% of them to perform secretion aspiration as part of their LCI-I every two hours.

In this study, 60.8% of the nurses said that LCI-I facilitated spontaneous breathing, while 6.7% mentioned that it reduced the re-intubation rate. A similar result was found in a study by Flenady and Gray²⁰, which showed that LCI-I, especially when applied after extubation, reduced the re-intubation rate.

Nurses encounter various obstacles, including individual, patient-related, team-related, and environmental factors, while performing their nursing practices. In this study, nurses stated that their workload was high (56.9%), the team's knowledge level was insufficient (42.9%), and

some patients refused interventions (67.5%) and lack of materials (such as trifold) (59.3%) as obstacles. Similarly, in their study by Kira et al., during GF practices, nurses paid attention to the patient being overweight (29.33%), lack of personnel (27.8%), excessive workload (24%) and having a musculoskeletal disorder (%18.8) was found to be an obstacle²¹. Intensive care nurses complain about excess workload not only in LCI-I practices, but also in all stages of patient care. This can be attributed to the fact that intensive care nurses unfortunately care for more patients than the calculated workload (number of bed-patients-nurses). The low number of nurses and staff working in these units causes short-term injuries to this group of caregivers during care and permanent musculoskeletal disorders in the long term. In this context, these problems are not sufficient to provide the desired level of quality of care in patient care.

In addition, in anesthesia intensive care units, which are multidisciplinary working areas, CP is undertaken by physiotherapists. In this study, it is seen that nurses apply CP in the intensive care unit, either in line with their wishes or obligations. Moreover, they expressed the excessive workload as an obstacle as a reason for not being able to implement it. Although it is the primary duty of another professional group, nurses apply LCI-I diligently in line with their duty awareness due to staff shortage (increasing the quality and comfort of the patient's care is also included in their job responsibilities).

In this study, trifold, which is the simplest applicable method in LCI-I, was reported by nurses as a missing material in intensive care units (59.3%). It seems that the lack of this material, which has a wide range of applications, limits LCI-I applications.

Evidence-based guidelines are important at every step of care. Utilizing evidence-based guidelines and up-to-date information in LCI-I practices increases the quality of care. In the LCI-I applied in this study, it was determined that only 13.3% of the nurses benefited from evidence-based guidelines. It is a pity that the nurses who take care to apply LCI-I (87.5%) while caring for so many patients in practice have not consulted evidence-based guidelines. Similarly, in Karagözoğlu's study, only 2.1% of the nurses stated that there was a standard guide regarding LCI-I in the department where they worked¹⁵. This is an indication that although nurses know the practices they perform, they cannot spare enough time to follow current information due to the excessive workload in the clinic and difficulties in patient care processes. It is important for nurses to have up-to-date and accurate information about LCI-I in order to plan and implement these practices accurately and effectively in intensive care.

Strengths and limitations

Due to the limited number of participants in the study, there were difficulties in collecting sufficient data through survey responses, necessitating a time extension.

Conclusions and recommendations

In conclusion, nurses in the study exhibited knowledge and training in Interventions to Increase Lung Capacity. Nevertheless, the training they received was found to be insufficient, and the utilization of evidence-based guidelines in practice was limited. It is crucial to offer in-service training for nurses to ensure the regular updating of their knowledge in this area. Additionally, it is advisable to develop a standardized guide for intensive care units to enhance the effectiveness and accuracy of these interventions. It is necessary to ensure that healthcare professionals (nurses, physicians and physiotherapists) receive training that supports each other. Thanks to the guides to be created, teamwork can be strengthened by ensuring unity of language and application in common applications. In light of the study's findings and the researchers' current roles in education, it is recommended that undergraduate nursing programs consider extending the duration of intensive care clinical rotations and further integrating this topic into the curriculum.

Funding

No external funding.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We would like to thank the participants who agreed to participate in the study for their dedication.

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