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ORIGINAL ARTICLE

The Incidence, Risk Factors, and Effects of Constipation in Critical Patients: An Observational Cross-sectional Study

Yoğun Bakım Hastalarında Konstipasyon İnsidansı, Risk Faktörleri ve Etkileri: Gözlemsel Kesitsel Bir Çalışma

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Abstract

Objective: This study aimed to investigate the early, late, and total constipation frequency, related factors, and their effects on the hospitalization day, gastric residual volume, vomiting, distension, and diarrhea, the feeding type, white blood cells, and C-reactive protein levels, and body temperature.

Method: Data from this observational cross-sectional study were collected in an anesthesia and reanimation intensive care unit of a public hospital in Bolu, Turkey. The sample included 116 patients who met the criteria of the study. The sample size was determined using power analysis according to the results of a pilot study. The patient information form, daily observation form, and Bristol stool consistency scale were used for collecting the data.

Results: The constipation frequency was 63.8% in the unit. The early constipation frequency was 18.9%, and the late constipation frequency was 6.8%. The hospitalization day in these groups was longer than those without constipation. Also, the patients receiving mechanical ventilator support, enteral tube feeding, and diuretic medication had a higher risk for constipation. The enema/laxative was applied to half of the patients who developed constipation in the unit, after which more than half developed diarrhea. Distension and enteral feeding were more frequent in late-type constipation patients. The levels of white blood cells, C-reactive protein levels, and body temperature between all groups were not statistically different (p>0.05).

Conclusion: The frequency of constipation was higher in the intensive care unit, even when the defecation period was considered four days. Receiving mechanical ventilator support, enteral tube feeding, and diuretics increased the risk of constipation.

Keywords: Critical care, constipation, intensive care, nursing

Öz

Amaç: Bu çalışma erken, geç ve toplam konstipasyon sıklığı, ilişkili faktörler ve bunların hastaneye yatış günü, mide rezidüel hacmi, kusma, distansiyon, diyare, beslenme şekli, beyaz kan hücreleri, C- reaktif protein seviyeleri ve vücut sıcaklığı üzerine etkilerinin incelenmesini amaçladı.

Yöntem: Bu gözlemsel kesitsel çalışmanın verileri, Türkiye'de Bolu ilinde bulunan bir devlet hastanesinin anestezi ve reanimasyon yoğun bakım ünitesinde toplandı. Örneklem, çalışmanın kriterlerini karşılayan 116 hastayı içerdi. Örneklem büyüklüğü, pilot çalışmanın sonuçlarına göre güç analizi kullanılarak belirlendi. Verilerin toplanmasında hasta bilgi formu, günlük gözlem formu ve Bristol dışkı kıvam ölçeği kullanıldı.

Bulgular: Yoğun bakımda konstipasyon sıklığı %63,8 idi. Erken konstipasyon sıklığı %18,9, geç konstipasyon sıklığı ise %6,8 olarak belirlendi. Bu gruplarda hastanede kalış günü konstipasyonu olmayanlara göre daha uzundu. Ayrıca mekanik ventilatör desteği, enteral tüple beslenme ve diüretik ilaç kullanan hastalarda konstipasyon riski daha yüksekti. Yoğun bakımda konstipasyon gelişen hastaların yarısına lavman/laksatif uygulandı, sonrasında yarısından fazlasında diyare gelişti. Geç tip konstipasyon hastalarında distansiyon ve enteral beslenme daha sık görüldü. Beyaz kan hücreleri, C-reaktif protein seviyeleri ve vücut sıcaklığı tüm gruplar arasında istatistiksel olarak anlamlı değildi (p>0,05).

Sonuç: Yoğun bakım ünitesinde dışkılama süresi dört gün olarak kabul edildiğinde bile konstipasyon sıklığının daha yüksek olduğu görüldü. Mekanik ventilatör desteği almak, enteral tüple beslenmek ve diüretik kullanmak konstipasyon riskini artırmaktadır.

Anahtar Kelimeler: Kritik bakım, konstipasyon, yoğun bakım, hemşirelik

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Introduction

The defecation need is one of the physiological requirements, which Maslow (1) defined as the most essential requirement. Constipation is a frequently encountered problem in bowel elimination and exists among nursing diagnoses of critical patients in general (2,3).

Although constipation is generally defined as defecating less than three times a week, it can also be expressed by various symptoms such as hard consistency of the stool, difficulty in defecation, and abdominal discomfort and swelling (4). However, decrement in the number of defecation is not used as a criterion for constipation in critical patients since incomplete defecation and difficulty in elimination are hard to determine due to patients' limited communication (5).

Different approaches are available in the literature for the detection of defecation numbers, where the frequency of constipation is determined in patients in the intensive care unit (ICU). In some studies, patients who did not defecate for three days were accepted as constipated (6-9), whereas in other studies, patients who did not defecate for four or more days were considered as constipated probably because enteral feeding was delayed during the first day of the ICU (10,11). Although the definitions of constipation are different in literature, the frequency of constipation remained high in intensive care patients, varying between 34 and 83% (6-10,12,13).

Also, the risk factors causing constipation in patients of ICUs differ from the general population, which is similar to the differences seen in the definition and frequency of constipation. Critically ill patients are more prone to constipation due to factors such as neurological, endocrine, and metabolic problems, usage of medical devices, sedation, opioid, and vasoactive drugs along with parenteral nutrition and immobility (6-9,11-14).

Constipation is an important issue, especially in intensive care patients, requiring careful discussion since it has negative effects as well as high incidence and excessive risk factors. Furthermore, untreated constipation in these patients delays enteral feeding prolonging the time of weaning from the mechanical ventilator, which consequently increases the duration of stay in the ICU (6). Additionally, it involves complications such as distention, nausea-vomiting, an increase in bacterial infection rate, high morbidity, and mortality (13).

Main Points

- Constipation duration can consider four days without defecation in critical patients because of some nutritional problems. Even in this consideration, the frequency of constipation is high in critical patients.
- Nurses should closely monitor the patients receiving mechanical ventilator support, enteral tube feeding, and diuretic medication since they have a higher risk for constipation.
- Nurses should be aware of enema/laxative-induced diarrhea because of high prescriptions. They should consider that distension and enteral feeding are more related to the late-type constipation.

Therefore, holistic nursing care is very important in intensive care patients to prevent constipation and complications that may develop from it. Nurses should evaluate the patient's risk factors for constipation, defecation activity daily, and intestinal motility to maintain a comfort level for patients. Moreover, since intestinal motility provides vital information about the functioning of the body, it was proposed as the sixth vital sign (15). However, only a limited number of studies explore the frequency and clinical characteristics of constipation in intensive care patients in terms of guiding evidence-based practices for nurses.

Material and Method

Objectives

The study aimed to determine the frequency of constipation, especially early and late constipation, and factors related to them, and also investigate some of their effects such as the duration of stay in the ICU, the amount of gastric residual volume (GRV), developing vomiting, distension, and diarrhea, change in the feeding type, levels of white blood cells (WBC), C-reactive protein (CRP) and body temperature.

Study Design

The study was an observational cross-sectional study. We had observed the patients in the ICU since starting their hospitalization prospectively for their constipation, early and late constipation duration, and some parameters. At the same time, we recorded the data on a daily observation form.

Setting and Participants

The data were collected from the anesthesia and reanimation ICU in a state hospital of Bolu in 2019. To determine the number of observations in our study, a pilot study was conducted with 20 patients. These patients were also included in the main study. The constipation rate in the ICU was determined as 67% in the pilot study. Considering this ratio, the sample size was calculated using the PASS 11 program. Accordingly, at least 86 patients had to be included in the study keeping a 95% probability and 10% deviation. The sample consisted of 116 patients who were reachable during the study, met the inclusion criteria, and volunteered to participate the study. However, the constipation type of the 21 patients who left the ICU without defecation could not be determined (Figure 1). These patients were not included in the comparison analyses according to the type of constipation and the characteristics of the patients.

Data Collection

From the beginning of the study, the defecation frequency of each patient admitted to the ICU was monitored carefully. The informed consent was received from the patients who met the inclusion criteria or their relatives (for unconscious patients). The necessary information to fill up the collection forms was obtained from patient folders, patients' relatives, and observation. During the study, patients in the ICU with no bowel movements for four days were accepted

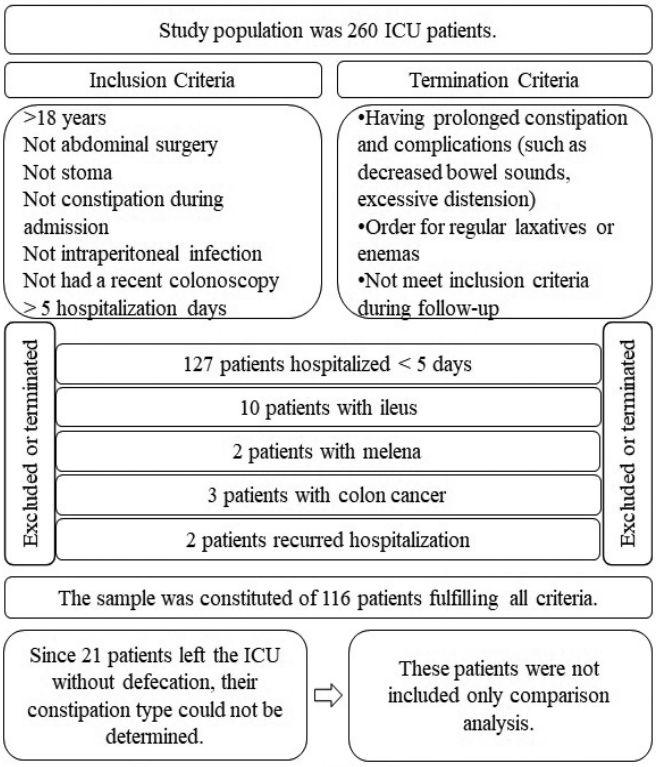

Figure 1.
Study population and sample

as constipated (10,11). The patients were divided into two groups based on the type of constipation, i.e., early and late constipation. The ones without defecation for five days were evaluated in the early constipation group, while the patients without defecation for six days or more were evaluated in the late constipation group. The enema and laxative treatment was not applied to the patients until seven days from the first day of without defecation. From the 7th day onwards, an enema or laxative treatment was applied to the patients who could not defecate. During the laxative/enema treatment process, the patient was followed up for diarrhea development. Laboratory data related to our research included CRP and WBC obtained from routine analysis results.

Data Collection Instruments

The data were collected using the patient information and daily observation form prepared by the researchers based on the literature (8-11) along with Bristol stool stiffness scale. Five experts (one intensive care doctor, two intensive care nurses, one ICU responsible nurse, and one academician nurse) were consulted on these forms.

Patient Information Form

This form consisted of two parts: The descriptive features, the history of the disease, and the history of constipation. In the first part of the form, descriptive data were obtained such as the patient's age, gender, the admission unit in intensive care, mobilization status, chronic diseases, the last defecation date, the defecation frequency, and constipation history. In the second part, the clinical features such as drug usage due to constipation and sedative status were evaluated.

Daily Observation Form

The form was filled out every day, starting from the patient's admission to the ICU and throughout the hospitalization period. Here, some crucial data were recorded, such as defecation type according to patient's Bristol stool stiffness scale, Glasgow Coma scale (GCS), acute physiology and chronic health assessment (APACHE2), WBC, and CRP levels, average fever values, mechanical ventilator status, nutrition type and route, presence of pneumonia associated with ventilator and other infections, the amount of GRV, presence of distension and vomiting, changes in the type and amount of nutrition, mobilization status, usage of laxative/enema as a result of constipation and then the existence of diarrhea because of the laxative treatment.

Bristol Stool Stiffness Scale

The duration and properties of the stool in the colon were evaluated using the scale developed by Lewis and Heaton (16), along with the changes that were followed after the treatment. The researchers classified the stool on a scale of 1-7, from slow intestinal transit (Type 1) to liquid stool (Type 7). However, no validity and reliability studies are available for the Bristol stool stiffness scale, which is frequently used in the evaluation of constipation in literature (17-19).

Data Analysis

The data were analyzed using a statistical program. In descriptive statistics, some crucial parameters are given, such as mean for numerical variables, standard deviation, minimum and maximum values, and number and percentage values for categorical variables. Normality assumption was examined using the Shapiro-Wilks test. To analyze the differences between the groups, the significance test was used as the difference between the two means if normality assumptions were provided, whereas, in case of assumptions not being provided, the Mann-Whitney U test was used. The differences between the categorical variables were examined using the chi-square test. The meaningfulness between the groups was analyzed using the Tukey test for One-Way Variance Analysis and Dunn's Kruskal-Wallis test for multiple comparisons. The significance level was considered if $p<0.05$.

Ethical Approval

The study was approved by the Bolu Abant İzzet Baysal University Clinical Research Ethics Committee (30.11.2018/343). Verbal and written consent certificates were obtained from the patients and/or their relatives participating in the study. Also, the institution permission had been obtained.

Results

Descriptive Characteristics and Constipation History

The average age of patients who participated in this study was 75.5±1.4 years, which included 55.2% of women. Also, 61.2% were evaluated as immobile during their admission to the ICU. Previous constipation complaints were determined in 30.2% of patients while 26.6% defecated twice a week or less. Meanwhile, these patients had chronic diseases such as diabetes, stroke, or Parkinson's, with 42.9% of the patients using laxative drugs (Table 1).

Clinical Characteristics and Constipation in the ICU

In the ICU, some medications probably associated with constipation were used in the patients. It was determined that 82.8% of the patients used diuretics while 75.0% used anticholinergic drugs. Also, 46.6% and 75.9% used sedative drugs and mechanical ventilator (MV), respectively, while 6.9% of the patients in the ICU had mobility. Meanwhile, 16.4%, 1.7%, and 9.5% of patients developed an infection, ventilator-associated pneumonia (VAP), and vomiting, respectively. The average hospitalization days of patients in the ICU were calculated as 17.1±19.3. Other clinical features are given in Table 2.

During the study, the constipation frequency of patients in the ICU was determined to be 63.8%, where 18 patients developed early constipation and 35 patients developed late constipation.

The examination of the first stool types in patients with constipation revealed diarrhea in 56.6% of patients (Type 6-7), normal stool type in 28.3% (Type 3-4-5), and constipation in 15.1% of patients (Type 1-2). The mean value for constipation development in patients during their stay in the ICU was found to be 1.2±0.6, while the mean duration of constipation was 6.6±1.7 days, and the mean of the first constipation day was 6.0 3.0 (Table 3).

Distension related to constipation was observed in 8.1% of the patients, while changes in nutrition due to constipation were observed in 1.4% of the patients. The enema/laxative treatment was applied to 51.4% of patients

Table 1.
Descriptive Characteristics and Constipation History of the Patients

Descriptive characteristics	**Mean ± SD**	**Min-max**
Age	75.5±1.4	27-95
Gender	n	%
Female	64	55.2
Male	52	44.8
Mobility status		
Mobile	45	38.8
Immobile	71	61.2
Constipation history		
Presence of constipation before admission to ICU		
No	43	37.1
Yes	35	30.2
Unknown	38	32.7
Frequency of defecation before admission to ICU		
7 times per week	25	21.6
3 times per week	22	19.0
Twice per week	18	15.4
Once per week	9	7.8
More than a week	4	3.4
Unknown	38	32.8
Using drugs for constipation	15	42.9
Chronic disease associated with constipation		
Diabetes	30	85.7
Stroke	3	8.6
Parkinson disease	2	5.7

SD=Standard deviation, ICU=intensive care unit

Table 2. *Clinical Characteristics of the Patients*		
Clinical characteristics	**n**	**%**
Using drugs associated with constipation in the ICU		
Diuretic	96	82.8
Anticholinergic	87	75.0
Vasoactive	69	59.5
Calcium channel blocker	56	48.3
Analgesic	24	20.7
Anticonvulsant	16	13.8
Opioid	11	9.5
Others*	9	7.7
Using sedative drugs	54	46.6
Using mechanical ventilator	88	75.9
The number of patients mobilized	8	6.9
The development of infections	19	16.4
The development of VAP	2	1.7
	Mean ± SD	**Min-max**
The duration of stay in the ICU	17.1±19.3	5-104
GCS	10.64±2.9	3-15
APACHE2	21.7±1.1	1-75
WBC (K/uL)	12.9±1.0	3.8-84.9
CRP (mg/L)	79.6±3.6	1-144
Body temperature	36.6±0.1	36.3-36.9
The duration of mechanical ventilator support (days)	11.6±9.0	1-30
The duration of enteral nutrition (days)	10.4±8.4	1-32
The duration of parenteral nutrition (days)	6.5±5.0	1-27
Amount of GRV	275±170.57	50-830

**=Antipsychotic, antispasmodic, antidepressant, **VAP=ventilator-associated pneumonia, ICU=intensive care unit, GCS=Glasgow Coma scale, APACHE 2=acute physiology and chronic health assessment 2, WBC=white blood cell, CRP=C-reactive protein, GRV=gastric residual volume*

who had developed constipation. Furthermore, 68.4% of patients developed diarrhea after receiving enema/laxative treatment (Table 3).

Comparison Between Descriptive and Clinical Characteristics of Patients According to the Constipation Status and Types

We initially compared the descriptive and clinical characteristics of patients with and without constipation (data not shown) and found no statistically significant difference between the descriptive and clinical characteristics of patients and constipation development ($p>0.05$).

The descriptive and clinical characteristics of patients who did not have constipation but developed early and late-type constipation were examined, which is shown in Table 4. Accordingly, no statistically meaningful difference was found between the patients' descriptive characteristics and groups ($p>0.05$). The mean value of the days of hospitalization in the ICU was found to be higher in the group with constipation compared to the group without constipation and was according to the clinical characteristics of the patients ($p<0.01$). Compared to the group without constipation, the diuretic drug usage was higher in the early constipation group, while the mean days of enteral feeding were higher in the late constipation group ($p<0.05$). Increased distension was developed in the late constipation group compared to the early type group ($p<0.05$). Furthermore, the number of constipation development in the late-type group was higher than those in the early-type constipation group ($p<0.05$).

Discussion

Patients in the ICU are more likely to encounter factors such as immobility, drug usage, mechanical ventilator, and

Table 3. ***Characteristics of the Constipated Patients in the Intensive Care Unit***		
Constipation characteristics	**n**	**%**
Developing constipation in ICU	74	63.8
Constipation type (n=74)		
Early constipation	18	34.0
Late constipation	35	66.0
Undetermined *	21	-
The first stool types in patients with constipation (n=53)		
Diarrhea (Type 6-7)	30	56.6
Normal (Type 3-4-5)	15	28.3
Constipation (Type 1-2)	8	15.1
Vomiting	11	9.5
Distension (n=74)*	6	8.1
Nutritional change due to constipation (n=74)**	1	1.4
Number of patients using enema/laxative (n=74)**	38	51.4
Enema/laxative-induced diarrhea (n=38)	26	68.4
	Mean ± SD	**Min-max**
The number of constipation developments during the stay in the ICU	1.2±0.6	1-4
The duration of constipation (days)	6.6±1.7	4-11
First constipation day from admission	6.0±3.0	4-25

**=Patients who left the ICU while constipation continues, **=it was evaluated on patients with constipation, **ICU=intensive care unit, SD=standard deviation, ICU=intensive care unit*

changes in nutrition which may affect their defecation processes owing to their critical condition. For these patients, it is recommended that four or more days of non-defecation is defined as constipation, contrary to its definition in the general population (10,11). In our study, this approach was used as a reference and in more than half of the patients, we observed the development of constipation. In the literature, constipation frequency varies between 34% and 83% (6-10,12,13). Similarly, the frequencies of early and late constipation obtained in different studies also vary (7-10,12,13). These differences may be due to the sample characteristics, measurement tools, and definitions of constipation in various studies.

Previous constipation history and some clinical features of intensive care patients may cause the development of constipation. In contrast to other studies, we examined the constipation history of patients before admitting them to the ICU. Although the defecation duration was evaluated as four days, the frequency of constipation was observed to be approximately two times higher in intensive care compared to that found in the evaluation of patients before admission to the ICU. Additionally, no significant difference was observed in terms of constipation history between patients who developed constipation and those who did not develop constipation. Furthermore, no significant difference was found between the groups in terms of patients' descriptive characteristics, including age, gender, mobilization status at admission, and clinical characteristics such as drugs used and the average number of days spent on mechanical ventilation. These findings may indicate the homogeneous distribution of the groups.

Some medications used in the ICU, such as diuretics, sedatives, vasoactive, etc., can also affect the development of constipation (5,20). We determined that although the usage of diuretics triggered constipation, the use of sedatives (midazolam) and opioids (transdermal fentanyl) did not show a significant difference in the development of constipation.

The effect of diuretic usage on constipation has not been investigated in related studies. Prat et al. (8) determined that the sedation usage (midazolam and sufentanil) was higher in patients who developed constipation. However, Nassar et al. (7) found no relationship between opioid usage and constipation development, while Fukuda et al. (12) reported an association between an opioid, i.e., fentanyl group drugs, and constipation. Transdermal fentanyl is less effective in developing constipation compared to morphine (21). The use of fentanyl as an opioid in our study may have affected the result. As a result, we also considered the use of drugs that do not cause or cause less constipation in intensive care patients.

Table 4.
Descriptive and Clinical Characteristics of Not Constipated, and Early and Late-type Constipated Patients

Constipation status				
Descriptive and clinical characteristics	**No constipation (n=42)**	**Early constipation (n=18)**	**Late constipation (n=35)**	**p**
Age ($\bar{x}$) ± SD	77.83±12.67	77.94±10.92	74.17±16.38	0.46
Gender (female/male)	25 (59.5)/ 17 (40.5)	11 (61.1)/ 7 (38.9)	18 (51.4)/ 17 (48.6)	0.71
Mobility status				
Immobile	23 (54.8)	14 (77.8)	21 (60.0)	0.24
Mobile	19 (45.2)	4 (22.2)	14 (40.0)	
Presence of constipation before admission to ICU				
No	16 (38.1)	7 (38.9)	16 (45.7)	0.33
Yes	14 (33.3)	4 (22.2)	14 (40.0)	
Unknown	12 (28.6)	7 (38.9)	5 (14.3)	
Frequency of defecation before admission to ICU				
7 times per week	11 (26.2)	3 (16.7)	7 (20.0)	0.21
3 times per week	9 (21.4)	5 (27.8)	5 (14.3)	
Twice per week	5 (11.9)	1 (5.6)	11 (31.4)	
Once per week	4 (9.5)	1 (5.6)	4 (11.4)	
More than a week	1 (2.4)	0 (0.0)	2 (5.7)	
Using drugs for constipation	7 (50.0)	0 (0.0)	8 (57.1)	0.06
Presence of chronic disease associated with constipation				
Absent	25 (59.5)	16 (88.9)	26 (74.3)	0.06
Available	17 (40.5)	2 (11.1)	9 (25.7)	
Chronic disease associated with constipation				
Diabetes	15 (88.2)	2 (100)	7 (77.8)	0.08
Stroke	1 (5.9)	0 (0.0)	1 (11.1)	0.65
Parkinson disease	1 (5.9)	0 (0.0)	1 (11.1)	0.65
Using drugs associated with constipation in the ICU				
Diuretic	32 (76.2)	18 (100.0)	30 (85.7)	0.02
Anticholinergic	32 (76.2)	12 (66.7)	27 (77.1)	0.69
Vasoactive	25 (59.5)	12 (66.7)	18 (51.4)	0.55
Calcium channel blocker	19 (45.2)	9 (50.0)	18 (51.4)	0.85
Analgesic	11 (26.2)	6 (33.3)	6 (17.1)	0.40
Anticonvulsant	6 (14.3)	2 (11.1)	5 (14.3)	0.94
Opioid	5 (11.9)	1 (5.6)	3 (8.6)	0.71
Sedative drug use				
No	25 (59.5)	9 (50.0)	14 (40.0)	0.23
Yes	17 (40.5)	9 (50.0)	21 (60.0)	
The number of patients mobilized	2 (4.8)	2 (11.1)	3 (8.6)	0.65
The development of infections	6 (14.3)	6 (33.3)	5 (14.3)	0.20
The development of VAP	0 (0.0)	1 (5.6)	1 (2.9)	0.27
Vomiting	5 (11.9)	3 (16.7)	2 (5.7)	0.42

Table 4. ***Continued***				
Constipation status				
Descriptive and clinical characteristics	**No constipation (n=42)**	**Early constipation (n=18)**	**Late constipation (n=35)**	**p**
Distension *	-	1 (5.6)	5 (14.3)	0.016
Enema/laxative-induced diarrhea *	-	3 (60.0)	23 (74.2)	0.603
The duration of stay in the ICU (day) ($\bar{x}$) ± SD	15.64±19.61	24.47±24.23	20.52±19.35	0.00
GCS	10.88±2.88	10.28±2.62	10.20±2.57	0.52
APACHE2	22.64±13.26	22.81±13.16	19.83±8.38	0.71
WBC (K/uL)	13.22±12.57	11.54±6.55	10.58±3.73	0.79
CRP (mg/L)	81.61±32.15	85.11±30.37	70.62±33.27	0.21
Body Temperature	36.58±0.13	36.57±0.13	36.58±0.12	0.95
The duration of mechanical ventilator support (days) ($\bar{x}$) ± SD	13.88±10.55	14.5±9.37	11.5±8.67	0.38
The duration of enteral nutrition (days) ($\bar{x}$) ± SD	8.38±7.38	11.82±8.59	13.21±9.05	0.04
The duration of parenteral nutrition (days) ($\bar{x}$) ± SD	7.59±6.17	6.54±4.16	5.71±4.89	0.29
Amount of GRV	330.91±166.76	188.75±71	251.67±211.44	0.15
The number of constipation developments during the stay in the ICU*	-	1.06±0.24	1.46±0.74	0.02
First constipation day from admission *	-	6.44±4.80	6±2.01	0.46
The first stool types in patients with constipation*				
Diarrhea (Type 6-7)	-	11 (61.1)	20 (57.1)	0.84
Normal (Type 3-4-5)	-	5 (27.8)	9 (25.7)	
Constipation (Type 1-2)	-	2 (11.1)	6 (17.2)	

**=it was evaluated on patients with constipation, ****VAP=ventilator-associated pneumonia, ICU=intensive care unit, GCS=Glasgow Coma scale, APACHE 2=acute physiology and chronic health assessment 2, WBC=white blood cell, CRP=C-reactive protein, GRV=gastric residual volume, SD=standard deviation*

Similar to other studies, our study also determined longer days of enteral feeding in patients with constipation (8,9). Bittencourt et al. (22) determined that constipation is more frequent than diarrhea in patients who are fed with the enteral route. Also, the use of fiber-free enteral nutrition products and mechanical ventilators was associated with constipation. We could not achieve homogeneity in our study in terms of nutritional products due to the differences in diagnoses of the disease, length of the study, and inability to supply the same products. Feed starting time is also essential to evaluate the effect of enteral feeding on constipation. The risk of developing constipation is stated to be low in patients who start enteral feeding early (10). However, due to the lack of enteral feeding protocol in the ICU of our study, there was no availability of a standard feeding day or starting dose. Therefore, we could not evaluate the effect of time on constipation related to the start of enteral feeding.

Among the other clinical features related to the development of constipation in the ICU, a similarity was observed in the average number of days on mechanical ventilation between patients with early and late constipation and patients without constipation. Although the effect of the mechanical ventilator on the gastrointestinal system is not clear (23), literature has reported different results in explaining the relationship between constipation and the usage of a mechanical ventilator.

Although Prat et al. (8,9) and Gacouin et al. (13) reported constipation in patients who stayed more on mechanical ventilation, Fukuda et al. (12) and Guerra et al. (10) found no

relationship between the usage of a mechanical ventilator and the development of constipation. This difference may be due to the characteristics of patients and the drugs being used.

We determined that the patients in early and late constipation groups stayed longer in ICU than patients without constipation. Although our study results were similar to Prat et al. (8,9) and Fukuda et al. (12), the results differed from those of Nassar et al. (7) and Guerra et al. (10). The length of stay in the ICU may increase exposure to other constipation risk factors such as risky medications, inactivity, and enteral nutrition.

We found no difference between the development of constipation and the amount of GRV, which was similar to the literature (7,13). The enema/laxative treatment was applied to half of the patients with constipation, and after the treatment, more than half developed diarrhea. Additionally, for the first time, we examined vomiting and distension as a result of constipation in our study. No relationship was observed between vomiting and constipation development in patients, while increased distension was developed in the late constipation group. Our data confirm the relationship between constipation and distension, which was also reported in the previous literature (24,25).

We found no relationship between the development of VAP and constipation. Prat et al. (8) reported a higher rate of VAP in patients with constipation. Also, Gacouin et al. (13) reported higher VAP development in the late defecation group. The results of our study showed some differences when compared to the literature data. We observed that two patients (1.7%) developed both VAP and constipation. While one of these patients was in the early constipation group, the other one was in the late constipation group. The low VAP frequency in the unit, the application of a care package to prevent VAP, and the low sample number may have affected our data.

Our study was different from the literature since, for the first time, we determined the first type of defecation in patients after constipation using the Bristol stool consistency scale. As a result, the first form of defecation after constipation was determined as diarrhea (type 6-7) in more than half of the patients. While some of these patients developed diarrhea as a result of laxative usage, diarrhea in patients without the use of laxatives suggested a slow rate of routine intestinal transit. Hence, our data confirmed the constipation period in ICU patients to be six days.

Furthermore, no statistically significant difference was detected between the development of constipation and the values of GCS, APACHE2, WBC, CRP, and body temperature. However, in one study, CRP, WBC, and body temperature values increased more in the late defecation patients compared to the early defecation patients, which may be associated with inflammatory activity and organ failure (12). Some factors were believed to affect the mobilization status of the intensive care patients, such as prognosis (APACHE2) and consciousness state (GCS), which might be associated with constipation. However, in our study, no difference was found between the groups. Finally, we observed that the numbers of constipation was higher in late constipation patients, which may indicate the relationship between recurrent constipation and the development of chronic constipation in intensive care patients.

Study Limitations

The data are limited to the patients who were followed up on certain dates in the hospital. Also, a standard nutritional product, weaning from the ventilator, and mobilization program for the patients could not be maintained.

Conclusions

Although the duration of defecation was evaluated as four days, the frequency of constipation in the ICU was found to be approximately two times higher than that found in the evaluation of patients/their relatives before admission to the ICU. The enema/laxative was applied to half of the patients with constipation after which, more than half of the patients developed diarrhea. Additionally, the hospitalization time of patients in both constipation groups was longer than the group without constipation. We observed that patients who developed constipation were given more diuretics. Increased constipation and distension were developed in late-type constipation than in early-type constipation patients. Furthermore, we concluded that patients with constipation were more frequently fed via enteral feeding with a higher number of enteral feeding days in late-type constipation than those without constipation. Holistic nursing care is very important in preventing constipation and its complications in ICU patients. Therefore, nurses should evaluate the patient's risk factors for constipation, defecation activity, and daily bowel movements to maintain the patient's comfort. The nurse should evaluate the patients who are started on diuretics, have a longer stay in the ICU, and switch to enteral nutrition more frequently in terms of constipation. Nurses should attempt to prevent or eliminate constipation via non-pharmalogical interventions in line with the patients' evaluation of the defecation pattern. Nurses should attempt to prevent or eliminate constipation via non-pharmacological interventions in line with the patients' evaluation of the defecation pattern. The study recommends investigating related factors with constipation in intensive care such as using MV, and the development of VAP in larger sample groups. Also, the same study can be conducted in different patient groups.

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