Original Article

Determination of Procedural Pain Intensity: Adult Intensive Care Unit Survey

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Abstract

Background: Pain is a major problem for patients expose to many invasive and noninvasive procedures the intensive care unit (ICU).
Aim: To determine the procedural pain intensity of adult patients in ICUs.
Methods: This is a prospective observational study. The study was conducted in the general intensive care in the 2nd and 3rd stage clinic of a state hospital in Turkey. 64 patients were evaluated, and data was collected by observation using a questionnaire form and the Critical Care Pain Observation Tool (CPOT). The pain intensity of the patients was determined according to CPOT in endotracheal suctioning (ES) and position change (PC) procedures (before, during and after 20 minutes).
Results: Most of the patients were male, 70 years and over, 71.9% of which were in the ICUs for 0-10 days. The mean CPOT score of the patients in ES procedures was measured as 0.52 before the procedure, 2.90 during the procedure and 0.55 after the procedure. Their mean CPOT scores in PC was measured before, during and after the procedure as 0.42, 1.30 and 0.42, respectively ($p<0.000$).
Conclusion: According to CPOT, the pain intensity scores of the patients were higher during ES than PC in the ICU.

Keywords: Intensive Care, Pain, Position Change, Endotracheal Suctioning.

Background

Pain is a common experience among mechanically ventilated patients and is aggravated by invasive procedures. Intensive care unit (ICUs) patients are exposed to many invasive and noninvasive procedures for diagnostic or therapeutic purposes every day and experience procedural pain during procedures, and nurses play a central role in its control.

The pain prevalence, intensity and risk factors associated with these procedures are not well known, whereas the proper assessment and management of pain is a cornerstone in the care and treatment of critical patients (Latorre-Marco et al., 2016). As reported in previous studies, ICU patients experience pain and uneasiness due to invasive and noninvasive procedures such as endotracheal suctioning (ES) and position change (PC) (Esen et al., 2010; Ayasrah, 2016). The determined pain rates in previous studies for patients in ICUs have been as follows: 40% (Puntillo et al., 2001) and 63% (Puntillo, 1990). The multicenter patient-based DOLOREA study showed that patients experienced pain during rest and ventilation procedure as 33% and 56%, respectively (Payen et al., 2007). In Gelinas's and Johnson's (2007), study, which was conducted with intubated patients, more than 50% experienced pain during common care procedures in the ICUs. Puntillo et al. (2014) showed that all around the world, ICU patients often experience twice that of the initial pain during procedures. In a study (Ayasrah, 2016), the overall mean procedural pain score (6.34) was reported to be significantly higher than the

mean preprocedural pain score (3.43). Procedural pain was defined as a pain associated with nonsurgical procedures (Puntillo et al., 2014) and as a type of acute pain (Czarnecki et al., 2011). Moreover, procedural pain increases stress response in ICU patients and is a stressor that increases the likelihood of complications by activating many pathophysiological mechanisms. Unfortunately, pain assessment and management rates in ICUs are still reported to be low (Georgiou et al., 2015; Kiavar et al., 2016). The main reasons for this has been reported in the literature as follows: sedation of patients, (Georgiou et al., 2015) bias of healthcare professionals, and the fact that pain may be seen as an inevitable consequence of the procedures performed in ICUs.; so they may be overlooked (Payen et al., 2007). The inability of information about pain transmission is a major barrier to adequate pain assessments and treatments. Therefore, pain perceived by the patients who are unable to report their pain in the ICUs is very important. However, pain assessment in intensive care is challenging, requiring a valid and reliable method to assess and optimize the outcomes of pain for mechanically ventilated or sedated patients (Lindenbaum and Milia, 2012).

It is believed that the pain experiences of patients must start with accurate pain assessment. It has been reported by McCaffery (1968). that the most reliable and valid indicator of pain is the individual's self-expression; so the presence and intensity of pain should be measured by the patients themselves if possible. However, mechanically ventilated or sedated patients cannot express pain by verbal or written methods (Rahu et al., 2015), and neither can they blink (yes or no expression) to answer questions (Herr et al., 2011).

Although reactions to pain are individual, musculoskeletal reactions are universal and are described as "pain behaviors" for patients who have difficulty in reporting their pain. Verbal or nonverbal movements of pain behaviors show that the patient's pain is often and can be observed. For this reason, the patients' behaviors and physiological parameters are used for the evaluation of the pain in ICU patients who cannot express their pain verbally.

It is emphasized by the International Association of Pain Studies (IASP) that "the possibility of experiencing pain in individuals who cannot communicate verbally and need of appropriate pain treatment cannot be denied". It was suggested that behavioral reactions should be observed to determine the intensity of pain in ICU patients who cannot communicate verbally along with the use of pain scales that can assess behavioral responses (Asadi-Noghabi et al., 2015; Gelinas, 2016).

In such situations, the use of valid behavioral pain scales is recommended. Regular assessment of pain intensity leads to improved outcomes for patients in ICUs.

Methods: This study was performed with an observational and prospective design with the purpose of determining procedural pain intensity in ventilated adult patients according to their pain behaviors before, during, and after 20 minutes of ES and PC procedures in ICUs.

The study was performed at the 2nd and 3rd level ICUs of a State Hospital in Turkey. As the instructions of the quality unit of the institution, PC was performed every two hours, and ES was performed according to patients' requirements.

The study group consisted of 64 sedated patients who were mechanically ventilated at least 24 hours before and were identified by Ramsey Sedation Scale (RSS) between the dates of November 1st, 2015 and April 30th, 2016. The following inclusion criteria were applied for patient selection: (1) 18 years and over, (2) connected to mechanical ventilation, (3) 2nd and 3rd step ICUs, (4) sedated with the same drug (midazolam), (5) stable hemodynamic status, (6) sedation levels 5 and 6 according to the RSS, (7) unable to report their pain intensity, (8) patients who had received written permission from their first-degree relatives. Peripheral neuropathy and quadriplegic patients or patients receiving neuromuscular and nerve blocking agents were excluded.

Two forms were used to collect the data of the study, which were a questionnaire and the Critical-Care Pain Observation Tool (CPOT). The questionnaire was prepared by the researchers. Patients' medical form consisted of 10 questions including age, gender, level of education, duration of intensive care, duration of intubation and sedation, invasive interventions in patients, decubitus and analgesic drug information.

The CPOT was originally developed in French by Gèlinas and Johnson (2007) and translated into English using a back-to-back translation

method. The CPOT was developed to assess pain for both mechanically ventilated and non-intubated ICU patients. It was based on four behavioral domains: 1) facial expression, 2) body movement, 3) muscle tension, and 4) compliance with the ventilator (for mechanically ventilated patients) or vocalization (for non-intubated patients). Each domain was scored from 0 to 2, and the total score variated from 0 to 8. Cronbach`s α coefficient of CPOT was found to be 0.89.

Data collection: In this study, the ES and PC procedures were performed by the first researcher. The first-degree relatives of the patients were informed about the study, and their written permissions were obtained after the patient's information form was filled in via patient files. Pain evaluation was performed three times as before, during, and 20 min after ES and PC procedures. A total of 1152 pain behavior measurements were performed in 64 patients; thus, each patient was assessed 18 times, 9 of which were performed after ES and 9 after PC. In the study, open ES procedure was performed on all patients. No standard application frequency was used for the ES operation. The aspiration need was determined with factors such as SaO_2 level and reduction in tidal volume on the patient monitor, mechanical ventilator alarming, wheezing, and secretion visualizing in the intubation tube. Patients were aspirated for a maximum of 4 hours and a minimum of 30 minutes. The protocol designed by the institution's quality unit for the PC was followed. According to this, position for turning right and left, right-side position to left and left to right positions were given every 2 hours to patients in supine position. PC was applied hourly to patients with decubitus and every 2 hours to patients with no decubitus.

Data Analysis: The available statistical software was used in the calculations (IBM SPSS Statistics 19, SPSS Inc., Somers, NY). Descriptive analysis were conducted to obtain information about the general characteristics of the study groups. Data for continuous variables was given as mean ± standard deviation, and the significance test of the difference between two means or the Mann Whitney-U test was used when comparing the averages of variables between groups with parametric assumptions. For repeated measurements, again parametric assumptions, variance analysis and Friedman's variance analysis were used. P-value was considered statistically significant when calculated to be less than 0.05.

Ethical Approval: Before the study, a written permission was obtained from the non-invasive clinical ethics committee of a University (2015-07/14) and Public Hospitals of Turkey (dated 28.10.2015, no: 12858426/604.02). Written permissions were obtained from the patients' families to observe the patients' reactions during ES and PC and to record these results for use. In addition, since the use of human beings in this research required the protection of individual rights, the study remained faithful to the Human Rights Helsinki Declaration during the whole research.

Results

The study group was divided into many subgroups as: 78.1% in the medical diagnosis group, 57.8% over 70 years old, 53.1% males, 71.9% in the ICUs for 0-10 days, 70.3% in sedation for 0-5 days, 53.1% intubated for 6 days or more, 6.2% (n=4) had tracheostomy, 14.1% (n=9) had decubitus and 4.7% (n=3) were taking an analgesic drug (Table 1). It was determined that during ES and PC procedures, the facial expression, muscle tension and body movements subscale scores and total scores of CPOT increased during the procedure compared to the pre-procedure period, and the difference between the scores was significant ($p<0.05$). In ventilator compliance subscale, the scores increased during the procedure, but the difference was not statistically significant ($p>0.05$) (Table 2). As shown in Table 3, according to the linear regression analysis, it was found that the age and sedated days of the patients were effective on facial expressions of the CPOT, and the effect was 14.2%. Length of stay in the ICU and duration of sedation were effective on the muscle tension subscale, and the effect was 17.3%. Duration of sedation was significantly effective on the subscale of body movements at 15.6%. In the diagnostic group, length of stay in the ICU and duration of sedation were effective on the ventilatory compliance subscale with a rate of 31.0%. As a result, duration of sedation was effective on the total score, and this rate was found to be 24.9%. Length of stay in the ICU and duration of sedation were found to be effective on the facial expressions subscale. In addition, age, length of stay in the ICU, duration of sedation, and existing procedures were found to be effective on the muscle tension subscale.

Table 1 Characteristics of patients (n=64)

Characteristics		**n**	**%**
Diagnosis group	Surgery	14	21.9
	Medical	50	78.1
Age	30-69	27	42.2
	70 and ↑	37	57.8
Gender	Male	34	53.1
	Female	30	46.9
Reason for admission to the ICU	Medical	50	78.1
	Surgery	14	21.9
Duration of stay in ICU	0-10 day	46	71.9
	11+ day	18	28.1
The duration of sedation	0-5	45	70.3
	6 day and ↑	19	29.7
The duration of intubated	0-5 day	30	46.9
	6 day and ↑	34	53.1
Tracheostomy	Yes	4	6.2
	No	60	93.8
Pressure sores/decubitus	Yes	9	14.1
	No	55	85.9
Analgesic administration	Yes	3	4.7
	No	61	95.2

Table 2 The CPOT scores in endotracheal suction and position change procedures of the patients

CPOT subdimension	**Procedures**	**Before**	**During**	**After**	**Min-Max**	***F***	***p***
		Mean±SD	**Mean±SD**	**Mean±SD**			
Face expression	ES	0.25±0.44	1.18±0.55	0.25±0.44	0- 2	276.161	.001
	PC	0.25±0.44	0.49±0.56	0.23±0.43	0- 2	19.824	.001
Muscle tension	ES	0.10±0.30	0.68±0.65	0.13±0.33	0- 2	61.561	.001
	PC	0.03±0.18	0.41±0.49	0.03±0.15	0-1	38.105	.001
Body movements	ES	0.10±0.30	0.68±0.65	0.13±0.33	0-2	61.561	.001
	PC	0.09±0.29	0.30±0.46	0.11±0.31	0-1	15.472	.001
Ventilator compliance	ES	0.06±0.23	0.35±0.56	0.05±0.21	0-2	24.462	.001
	PC	0.05±0.21	0.09±0.28	0.05±0.21	0-1	3.000	.088
Total	ES	0.52±1.07	2.90±2.14	0.55±1.11	0-8	144.530	.001
	PC	0.42±0.81	1.30±1.38	0.42±0.84	0-5	52.501	.001

Table 3 Linear regression analysis of CPOT sub-dimension scores according to some characteristics of patients in endotracheal suction

CPOT sub-dimension	Independent variables	ß	t	p	F	Model (p)	R^2
Face expressions	Constant	5.374	7.373	.000	4.366	0.001	0.142
	Diagnosis group	.033	.337	.737			
	Age	**.212**	2.412	**.017**			
	Gender	.052	.647	.519			
	The duration to stay in ICU	-.138	-1.405	.162			
	The number of days intubated	-.022	-.219	.827			
	The number of days sedated	-.303	-2.751	**.007**			
	Current procedure	-.058	-.718	.474			
Muscle tension	Constant	-.701	-.940	.349	5.507	0.001	0.173
	Diagnosis group	-.006	-.060	.952			
	Age	.011	.119	.905			
	Gender	-.039	-.480	.631			
	The duration to stay in ICU	.208	2.066	**.040**			
	The number of days intubated	.054	.517	.606			
	The number of days sedated	.381	3.383	**.001**			
	Current procedure	.077	.921	.359			
Body movements	Constant	.154	.184	.854	4.873	0.001	0.156
	Diagnosis group	-.145	-1.279	.203			
	Age	-.123	-1.217	.225			
	Gender	-.074	-.809	.419			
	The duration to stay in ICU	.010	.091	.928			
	The number of days intubated	.068	.580	.563			
	The number of days sedated	.440	3.489	**.001**			
	Current procedure	.053	.567	.571			
Ventilator compliance	Sabit	-.723	-1.117	.266	11.807	0.001	0.310
	Diagnosis group	-.298	-3.398	**.001**			
	Age	.016	.203	.839			
	Gender	-.039	-.545	.587			
	The duration to stay in ICU	-.233	-2.658	**.009**			
	The number of days intubated	.226	2.477	.014			
	The number of days sedated	.452	4.620	**.000**			
	Current procedure	.133	1.840	.067			
Total	Constant	-1.320	-.556	.579	8.736	0.001	0.249
	Diagnosis group	-.618	-1.919	.057			
	Age	-.161	-.562	.575			
	Gender	-.246	-.942	.347			
	The duration to stay in ICU	.102	.319	.750			
	The number of days intubated	.341	1.018	.310			
	The number of days sedated	1.650	4.599	**.000**			
	Current procedure	.413	1.558	.121			

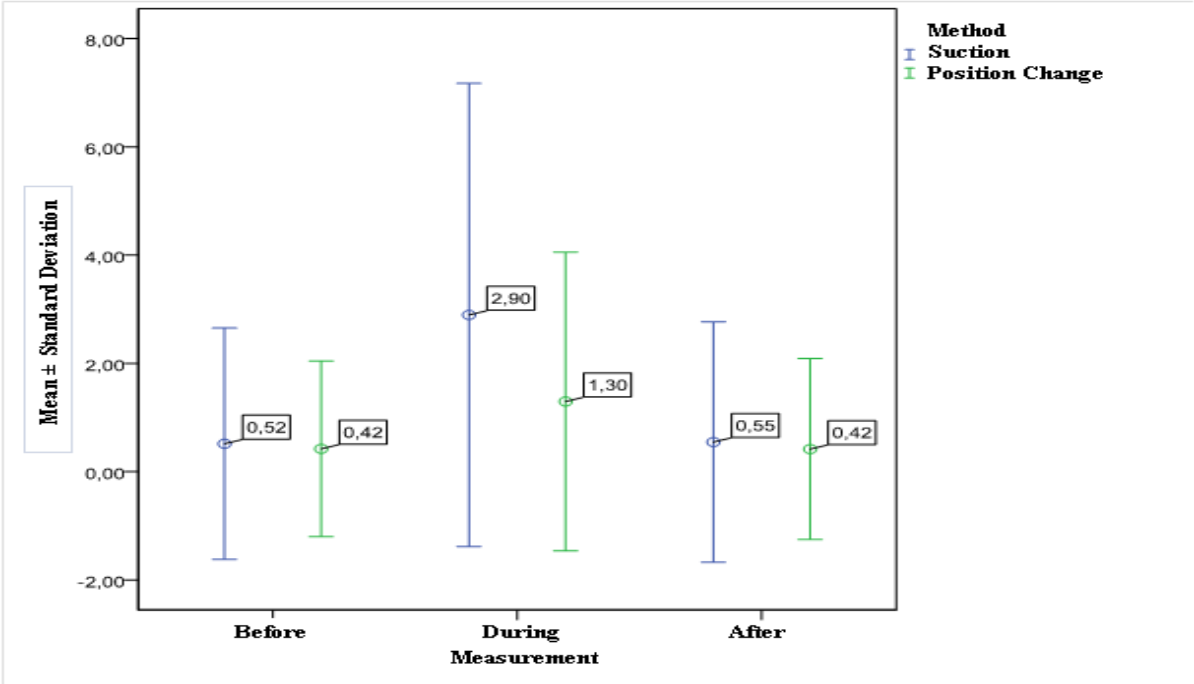
Table 4 Linear regression analysis of CPOT scores according to some characteristics of patients in the position change procedure

CPOT sub-dimensions	Independent value	ß	t	p	F	Model (p)	R^2
Face expressions	Constant	.883	1.232	.220	5.903	0.001	0.183
	Diagnosis group	-.091	-.934	.351			
	Age	-.078	-.901	.369			
	Gender	.058	.731	.466			
	The duration to stay in ICU	.192	1.980	**.049**			
	The number of days intubated	-.254	-2.514	.013			
	The number of days sedated	**.546**	5.043	**.000**			
	Current procedure	-.099	-1.243	.216			
Muscle tension	Constant	1.836	2.929	.004	5.273	0.001	0.167
	Diagnosis group	-.109	-1.285	.200			
	Age	**-.173**	-2.293	**.023**			
	Gender	.035	.512	.609			
	The duration to stay in ICU	**.187**	2.203	**.029**			
	The number of days intubated	-.151	-1.712	.089			
	The number of days sedated	**.340**	3.591	**.000**			
	Current procedure	-.192	-2.750	**.007**			
Body movements	Constant	.174	.305	.761	6.960	0.001	0.209
	Diagnosis group	-.078	-1.009	.314			
	Age	.041	.595	.553			
	Gender	-.017	-.265	.791			
	The duration to stay in ICU	**-.196**	-2.544	**.012**			
	The number of days intubated	.050	.627	.532			
	The number of days sedated	**.456**	5.304	**.000**			
	Current procedure	-.025	-.395	.693			
Ventilator compliance	Constant	-.079	-.225	.822	7.559	0.001	0.223
	Diagnosis group	**-.115**	-2.436	**.016**			
	Age	.008	.191	.849			
	Gender	.042	1.095	.275			
	The duration to stay in ICU	**-.155**	-3.279	**.001**			
	The number of days intubated	.092	1.865	.064			
	The number of days sedated	**.221**	4.189	**.000**			
	Current procedure	.009	.235	.814			
Total	Constant	2.813	1.690	.093	8.35	0.001	0.249
	Diagnosis group	-.393	-1.743	.083			
	Age	-.202	-1.007	.315			
	Gender	.118	.646	.519			
	The duration to stay in ICU	.028	.123	.903			
	The number of days intubated	-.263	-1.121	.264			
	The number of days sedated	1.563	6.217	**.000**			
	Current procedure	-.308	-1.656	.099			

Table 5 Pearson correlation between the CPOT scores of endotracheal suction and position change procedures according to some characteristics of the patients

CPOT scores in ES procedure		Age	Gender	The duration to stay in ICU	The number of days intubated	The number of days sedated	Current procedure
Face expressions	r	-.128	-.094	**.157***	**.227****	**.351****	**.160***
	p	.077	.196	.030	.002	.000	.027
Muscle tension	r	.008	-.044	**.270****	**.275****	**.382****	.043
	p	.917	.546	.000	.000	.000	.550
Body movements	r	**-.157***	-.087	.092	**.263****	**.352****	.069
	p	.029	.233	.206	.000	.000	.342
Ventilator compliance	r	**-.176***	-.110	-.023	**.371****	**.425****	**.145***
	p	.015	.130	.748	.000	.000	.045
CPOT scores in PC procedure							
Face expressions	r	-.036	.082	**.230****	.102	**.357****	-.054
	p	.623	.258	.001	.161	.000	.455
Muscle tension	r	-.122	.063	**.207****	.128	**.291****	**-.143***
	p	.093	.386	.004	.077	.000	.048
Body movements	r	-.058	-.072	-.008	**.277****	**.417****	-.012
	p	.423	.318	.914	.000	.000	.867
Ventilator compliance	r	**-.142***	.001	-.073	**.293****	**.359****	.044
	p	.049	.987	.317	.000	.000	.549

Grafic 1 The total CPOT averages in patients' endotracheal suction and position change



Length of stay in the ICU and duration of sedation were found to be effective on the body movements subscale. Length of stay in the ICU and duration of sedation were found to be effective on the ventilatory compliance subscale. Duration of sedation was effective on the total score. The percentages of effects on CPOT scores are observed in Table 4. It was found that there was a significantly positive correlation between length of stay in the ICU, duration of intubation and sedation and existing procedures and the facial expressions subscale in the ES procedure. We also found a significantly positive correlation between length of stay in the ICU, duration of intubation and sedation and the muscle tension subscale. In addition, there was also a significantly positive correlation between age, duration of intubation and sedation and the body movements subscale. For the PC procedure, there was a positive correlation between length of stay in the ICU and number of sedated days and the face expressions and muscle tension subscales. There was a positive correlation between duration of intubation and sedation and the body movements and compliance ventilatory subscales. However, a negative correlation was found between age and compliance ventilatory subscales and between existing procedures and the muscle tension subscale (Table 5). As shown in Graphic 1, the mean total CPOT score was measured as 0.52 before, 2.90 during and 0.55 after the ES procedure. For PC, the score was measured before, during and after the procedure as 0.42, 1.30 and 0.42, respectively. There was a statistically significant difference among total and all subscale scores except for ventilator compatibility (p=.001).

Discussion

Pain is an enduring concern and a common symptom in critically ill adults. In the present study, we evaluated the pain intensity of sedated and intubated adult patients. We found that patients had more pain during ES (2.90) than PC (1.30). In the study conducted by Puntillo et al. (2001), patients experienced pain at a score of 3.00 in the ES procedure and 2.80 in the PC procedure. Furthermore, in previous studies, (Esen et al., 2010; Gelinas et al., 2011) patients experienced more intense pain during ES than PC. In a study that compared the face expressions and CPOTs of patients to determine pain intensity in intubated patients after cardiac surgery, (Kiavar et al., 2016) it was found that the level of pain increased in painful procedures such as ES and PC, while measurements revealed the intensity of pain as 58.2% according to CPOT and 67% according to face expression. Evidence from other studies on the subject similarly found that patients in ICUs had the highest pain intensity in the ES procedure (Arroyo-Novoa et al., 2008; Esen et al., 2010; Al Sutari et al.,2014; Rahu et al., 2015; Kiavar et al., 2016).

Since tracheal intubation and mechanical ventilation in the ICUs cause deterioration of ability to clean airway spontaneously, patients' secretions must be cleaned with ES intermittently (Pedersen et al., 2009). Although ES is a required procedure for the majority of ICU patients, it has been described as painful and uncomfortable and causes choking and severe coughing in patients (Al Sutari et al., 2014; Rahu et al., 2015). Additionally, catheter insertion for aspiration (Patak et al., 2004) was described as an unpleasant sensation by patients.

As known, the patients' verbal expressions of pain in the ICUs may be prevented due to sedative agents, mechanical ventilation, and changes of consciousness. Therefore, there might be an inadequacy in the evaluation and management of pain (Rose et al., 2013). For this reason, nurses' nonverbal pain behavior evaluation is very important in ICUs (Kiavar et al., 2016).

Nociceptive stimuli cause certain pain behaviors that can be observed by facial expressions and muscle movements. In current study, the subscale score of CPOT facial expression was the highest before, during, and after 20 minutes in ES and PC. In a study (Aïssaoui et al., 2005) conducted to determine the pain intensity of sedated and mechanically ventilated patients using the Behavioral Pain Scale (BPS), the average score of facial expressions was similar to the results of the current study. In another study, (Va´zquez et al., 2011) the average score of face expressions according to CPOT was found to be high during PC. A study by Arroyo-Novoa et al. (2008) reported that "grimace" was observed in 11% of patients before the procedure, whereas this value increased to 52% during the ES procedure. The study also reported the frequency of pain-associated behavioral expressions as follows: grimace (42.8%), closing eyes (33.7%), stiffening (26.8%), recoil (23.7%) and murmuring (23.7%).

In the current study, body movements and muscle tension scores according to CPOT were found to be significantly higher in the ES and PC procedures, circumstantially. Moreover, visual observations were performed to evaluate some patients' pain, and the results obtained were as follows: fist clenching, moving their hands and arms to the left and right and hitting the bed more frequently, unlike the behavioral items of the scale, patients were pulling their feet towards themselves, chewing the intubation tube, tearing from their eyes, holding the healthcare worker's arm and pushing the healthcare worker by hand, lifting their feet, and moving and trying to lift their legs. These results obtained from the study can be interpreted as ICU patients trying to express their pain through body movements.

It has been reported that PC provides increased gas exchange in ICU patients, shortens duration of stay in the ICU, and improves outcomes (Marklew, 2006). However, in previous studies (Young et al., 2006; Gèlinas and Johnson, 2007; Esen et al., 2010; Va´zquez et al., 2011; Topolovec-Vranic et al., 2013), it was determined that patients in ICUs experienced considerable pain during PC. Again, PC and ES are procedures described as the most painful by ICU patients (Puntillo et al., 2014). In the current study, experienced pain intensity according to CPOT was 1.30 during PC. In this respect, Young et al. reported pre-PC and post-PC pain intensity as 3.36 and 5.02, respectively (Young et al., 2006). Additionally, patients' pain intensity also increased during PC in other studies (Gelinas et al., 2011; Va´zquez et al., 2011; Al Sutari et al., 2014; Topolovec-Vranic et al., 2013). PC is known to be a painful procedure in the literature; thus, our results and the results of the other studies confirmed PC as a painful procedure for sedated ICU patients.

In the present study, the duration of intubation and sedation and length of stay in the ICU were found to be predominantly effective in both the ES and PC procedures and were correlated with pain behaviors of patients according to the subscales of CPOT. Pain is one of the most common experiences in patients admitted to ICUs. These patients are exposed to several interventions that can lead to pain, like endotracheal intubation, mechanical ventilation, and central venous and arterial catheterization. Long stays in ICUs causes more exposure to painful procedures, but patients will not be able to report pain verbally due to self-sedative drugs and intubation. It has been reported by scientists that pain assessment is the basis of adequate pain management. Thus, pain should be monitored routinely in all adult ICUs patients. In this context, pain assessment in ICU patients who are unable to verbally communicate is recommended to be done by a valid pain assessment tool such as CPOT.

Conclusion: Pain management in the ICU is a complex process. However, nurses have an ethical responsibility to relieve pain and suffering. As a result of this study, the patients' behaviors determined by CPOT showed pain during the ES and PC procedures. In conclusion, the results obtained from the current study can be interpreted as follows: patients' facial expressions changed, they tried to express their pain by body language, pain caused tension in their muscles and this affected their mechanical ventilation compatibility during the ES procedure. The PC procedure caused less pain than ES according to the scores of facial expressions, body movements and muscle tension and did not affect the ventilatory compliance.

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