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ORIGINAL RESEARCH / *ÖZGÜN ARAŞTIRMA*

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Pain Behaviors and Physiological Parameters During Painful Procedures in Surgical Intensive Care Patients

Cerrahi Yoğun Bakım Hastalarının Ağrılı İşlemler Sırasında Ağrı Davranışları ve Fizyolojik Parametreleri

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ABSTRACT *Objective:* This research was conducted to determine the pain behaviors and physiological parameters of patients connected to mechanical ventilators in the postoperative surgical intensive care unit.
Materials and Methods: This study was conducted descriptively and observationally with 176 patients. The introductory information form, physiological parameters follow-up form, behavioral pain scale (BPS), and Ramsey sedation scale were used to collect data. Descriptive statistics, Two-Way variance in repeated measures, Friedman analysis, post-hoc Bonferroni analysis, One-Way variance analysis, Kruskal-Wallis analysis, and Spearman correlation analysis were used.
Results: The mean arterial pressure (MAP), heart rate and mean BPS scores increased ($p<0.001$), and oxygen saturation decreased during aspiration, wound care, and position change ($p<0.001$). Additionally, while a moderate, positive correlation was found between BPS and MAP and heart rate during wound care ($r=0.447$; $p=0.001$, $r=0.306$; $p=0.033$). A moderate negative correlation was found between oxygen saturation and BPS during aspiration ($r=-0.389$; $p=0.000$).
Conclusion: It has been revealed that individuals connected to mechanical ventilators experience pain during wound care, position change and aspiration. Physiological parameters and behavioral symptoms resulting from pain should be analyzed together. Pain should be relieved with pharmacological and non-pharmacological nursing interventions in pain management.
Keywords: Intensive care, pain, painful procedure, pain assessment, physiological parameters

ÖZ *Amaç:* Bu araştırma ameliyat sonrası cerrahi yoğun bakımda mekanik ventilatöre bağlanmış hastaların ağrı davranışlarının ve fizyolojik parametrelerinin belirlenmesi amacıyla yürütülmüştür.
Gereç ve Yöntem: Yüz yetmiş altı hasta ile tamamlanan araştırma, tanımlayıcı ve gözlemsel tiptedir. Verilerin toplanmasında hasta tanıtım formu, fizyolojik parametreler takip formu, davranışsal ağrı ölçeği (DAÖ) ve Ramsey sedasyon skalasından yararlanılmıştır. Verilerin analizinde; tanımlayıcı istatistikler, tekrarlı ölçümlerde İki-Yönlü varyans, Friedman analizi, post-hoc Bonferroni analizi, Tek-Yönlü varyans analizi, Kruskal-Wallis analizi ve Spearman korelasyon analizi kullanılmıştır.
Bulgular: Pozisyon değişikliği, yara bakımı ve aspirasyon, yapılırken DAÖ ortalaması, nabız ve ortalama arter basıncı (OAB) yükselmiştir; oksijen satürasyonu ise düşmüştür ($p<0,001$). Yara bakımı yapılırken DAÖ ortalaması ile nabız ve OAB arasında pozitif yönlü orta düzeyde bir ilişki saptanmıştır (sırasıyla $r=0,306$; $p=0,033$; $r=0,447$; $p=0,001$). Aspirasyon yapılırken ise sadece DAÖ ortalaması ile oksijen satürasyonu arasında negatif yönlü orta düzeyde bir ilişki bulunmuştur ($r=-0,389$; $p=0,000$).
Sonuç: Mekanik ventilatöre bağlanmış bireylerin yara bakımı, pozisyon değişikliği ve aspirasyon yapılırken ağrı yaşadıkları ortaya konmuştur. Ağrı sonucu ortaya çıkan fizyolojik parametreler ve davranışsal belirtiler beraber analiz edilmelidir. Ağrı yönetiminde farmakolojik ve farmakolojik olmayan hemşirelik girişimleri ile ağrı dindirilmelidir.
Anahtar Kelimeler: Yoğun bakım, ağrı, ağrılı işlem, ağrı değerlendirmesi, fizyolojik parametreler

Introduction

The surgical intensive care patients can experience discomfort due to a range of procedures such as surgical intervention, diagnostic procedures that involve invasiveness, post-operative monitoring, use of mechanical ventilation, physical therapy, suctioning of airways, regular dressing changes, shifts in position, and transfer to other locations for medical purposes (1,2). Uncontrolled pain is an important

physiological and psychological stressor for intensive care unit (ICU) patients and can negatively affect the healing processes. It is stated that inadequate pain management causes physiological and psychological complications, such as pulmonary complications, severe vasoconstriction, increased oxygen consumption, tissue ischemia, depression, and anxiety. In addition, inadequate pain management negatively affects mortality and morbidity, increases the cost of care, and decreases the quality of life (1-3). Therefore, pain assessment and pain management in ICU patients are of great importance.

The most accurate and valid diagnosis of pain is the verbal expression of the pain. Therefore, verbal or visual comparison scales are used in the diagnosis of pain in communicative patients. However, it must be noted that individuals in the ICU who are dependent on mechanical ventilation are unable to verbally communicate their experience of pain. When verbal communication cannot be established with ICU patients, health professionals should observe behavioral responses while evaluating pain (4,5). Behavioral responses due to pain include symptoms such as contraction, pulling the damaged organ or area away from the stimulus, supporting the incision site, immobility, pulling the legs towards the abdomen, grimacing, chewing the intubation tube (5,6). In addition, physiological parameters such as blood pressure, heart rate, and oxygen saturation can be used in pain assessment (7). However, pain assessment may not be reliable because ICU patients often experience many hemodynamic problems that cause changes in their vital signs. For example, tachycardia may be due to pain, as well as fever or hypovolemia. For this reason, it is recommended to use validated pain assessment scales in patients who cannot express their pain and to use physiological parameters as supportive data (8).

In the literature, it has been documented that procedures such as endotracheal aspiration, oral care, vascular catheterization, and repositioning are commonly associated with causing discomfort or pain (9-11). It has been documented that only one study has been conducted to evaluate the experience of pain during wound care among patients who are unable to verbally communicate their experience of pain in the ICU. In that study, pain assessment during wound care in both conscious and unconscious patients after neurosurgery was performed on different scales, and this was reported as a limitation of the study (12). Our research was conducted to examine the pain behavior and the effect of pain on physiological parameters during aspiration, wound care, and position change in surgical ICU patients followed up on mechanical ventilation support and sedated.

Materials and Methods

Design and Sample

This study was conducted to descriptively and observationally. The data were collected between 2017-2018 in a university hospitals' general surgery intensive care, neurosurgery intensive care and anesthesia intensive care services in the Central Anatolia region of Turkey. There is no routine analgesic and sedation protocol in clinics. Analgesic and sedative drugs are administered according to the patient and clinical situation.

All patients who were hospitalized in neurosurgery intensive care, general surgery intensive care and anesthesia ICUs, underwent surgery and were on mechanical ventilation support constituted the population of the research. The study sample comprised of individuals who met the inclusion criteria: Followed on mechanical ventilation support, undergone surgery and 24 hours have passed, Ramsey sedation scale (RSS) 4 and 5 points, and patients with consent from their families. Patients with traumatic brain injury, quadriplegia, excessive postoperative bleeding, continuous analgesic infusion, and aneurysm patients whose blood pressure should be kept high against the risk of vasospasm after surgery were excluded from the study.

The study was completed with 176 patients. Sampling adequacy was decided according to post-hoc power analysis. Based on the mean behavioral pain scale (BPS) score in a study (12), the effect size was found to be 1.430, and when the type I error was 5% and the sample size was 176, the study's statistical power was determined as 99%.

Data Collection Tool

The data were collected using descriptive information form, physiological parameters follow-up form, BPS, and RSS.

The descriptive information form was created by scanning the literature (9,11,12). This form includes introductory data such as age, gender, occupation, diagnosis and the drugs used, the duration of stay in the ventilator.

BPS: It was developed in 2001 by Payen et al. (13). In this scale, there are three items: facial expression, upper extremities, and compliance with the ventilator, and four

variables for each item, including behavioral responses to pain. Each variable is rated on a scale of 1 (absent response) to 4 (full response). The scale ranges from 3 to 12, with a score of 6 or above indicating an unacceptable level of pain (9,10). In 2003, the scale was translated into Turkish and the Cronbach's alpha coefficient was found to be in the range of 0.71 to 0.93 (9). In our study, Cronbach's alpha was determined as 0.84.

RSS: This scale was developed by Ramsay in the mid-1970's. This scale consists of a total of six items, three in each section including the level of wakefulness and sleep level. These are, respectively, "The patient is restless and/or agitated, patient-oriented, calm and cooperative, the patient only follows orders, obvious response, decreased response and no response". The first three responses are assessed in the awake patient, and the other three responses in the sleeping patient by hitting the glabella or by high verbal stimulation (9). The validity and reliability of the scale were made in 2015 and it was stated that it can be used safely (14). This scale is recommended to be used together with the BPS in sedated ICU patients (15).

Data Collection

It has been shown that physiological parameters such as mean arterial pressure immediately return to their baseline values 5 minutes after aspiration (16). Therefore, in our study, data collection forms were filled 3 times: 10 minutes before aspiration, wound care and position change (T1), during aspiration, wound care and position change (T2), and 10 minutes after the aspiration, wound care and position change (T3). The respiratory rate was not evaluated because the patients were followed up on a mechanical ventilator. Physiological parameters were recorded on the monitor, and BPS was filled in by observation.

Data were collected by researchers and observers who responsible for patient care. For the observers to follow-up with the same protocol, joint meetings were held and data were collected by exchanging information.

Ethical Considerations

Before starting the study, Erciyes University Clinical Research Ethics Committee approval (decision no: 2017/355, date: 16.06.2017) and approval from the institutional authority of the institution in which the study was conducted was obtained. Because of intubation and sedation, which is one of the sampling criteria, the aim of the study and the method was explained to the first-degree relatives of the patients, and permission was obtained. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

The data was analyzed using SPSS 24.0 (IBM Corp., Armonk, NY, USA). The Shapiro-Wilk test and Q-Q plots were utilized to assess the normality of the numerical data. Descriptive statistics were given as number, percentage, and mean ± standard deviation. Two-Way variance in repeated measures, Friedman analysis, One-Way analysis of variance, Kruskal-Wallis analysis, and the Spearman correlation analysis was employed, and results were considered statistically significant if $p<0.05$ in all cases.

Results

In the study, it was determined that 64.2% of the patients were male, 57.4% were 51 years and older, and 60.8% had cranial surgery. The mean duration of the patients on followed up on mechanical ventilation support was 9.81±15.11 days. As a painful procedure, aspiration was performed for 46% of the patients, wound care for 27.8%, and position change for 26.1%. In addition, 83.0 % of the patients use analgesics, 48.3% of the patients use sedative drugs (Table 1).

Table 2 shows the vital signs and mean BPS of the patients before, during, and after the painful procedure. It was determined that during aspiration, wound care, and position change, MAP, heart rate and mean BPS scores increased ($p<0.001$), and oxygen saturation decreased ($p<0.001$).

The comparison of the procedures of wound care, aspiration and position change revealed that there was no significant difference between the groups in terms of mean BPS scores and heart rate ($p>0.05$). However; it was found that MAP increased during wound care and oxygen saturation decreased during aspiration ($p<0.05$) (Table 3).

A significant negative correlation was found between the oxygen saturation during aspiration and BPS ($r=-0.389$; $p=0.000$). As the BPS mean score increases, the oxygen saturation decreases. In addition, a significant positive correlation was found between BPS and MAP and pulse rates during wound care ($r=0.447$; $p=0.001$, $r=0.306$; $p=0.033$, respectively). As the mean BPS mean score increases, the MAP and heart rate increase (Table 4).

Table 1. Descriptive characteristics of the patients		
Descriptive characteristics	**n**	**%**
Gender		
Female	63	35.8
Male	113	64.2
Age (years)		
≤30	28	15.9
31-40	25	14.2
41-50	22	12.5
≥51	101	57.4
Mean age ± SD (min-max)	53.67±19.78 (18-95)	
Operation type		
Cranial surgery	107	60.8
GIS surgery	28	15.9
Cancer surgery	13	7.4
Trauma and orthopedic surgery	28	15.9
Painful procedures		
Aspiration	81	46.0
Wound care	49	27.8
Position change	46	26.1
Occupation		
House wife	48	27.3
Retired	57	32.4
Worker	46	26.1
Self-employed	25	14.2
Duration on mechanical ventilation (days)		
1-5	90	51.1
6-10	43	24.4
11-15	15	8.5
≥16	28	15.9
Mean duration on mechanical ventilation ± SD	9.81±15.11	
Use of analgesic medication*		
Yes	146	83.0
No	30	17.0
Use of sedative medication**		
Yes	85	48.3
No	91	51.7

SD: Standard deviation, min-max: minimum-maximum. *Paracetamol, diclofenac sodium, dexketoprofen trometamol, **dormicum, fentanly + propofol, rocuronium bromide

Table 2. Distribution of physiological parameters and mean BPS score before, during and after the procedure according to painful procedures

Painful procedures	Variables	Time			Test
		T1	T2	T3	
Aspiration (n=81)	Vital signs	Mean ± SD Median (min-max)	Mean ± SD Median (min-max)	Mean ± SD Median (min-max)	
	MAP	84.49±17.11[a]	103.06±20.53[b]	90.65±16.37[c]	p=0.000*
	Heart rate	94.61±18.48[a]	110.96±20.73[b]	97.88±16.70[c]	p=0.000*
	Oxygen saturation	94.92±6.69[a]	87.18±10.46[b]	96.17±4.00[a]	p=0.000*
	BPS mean score	3.97±1.27[a] 3 (4-5)	6.40±2.03[b] 5 (6-8)	4.19±1.20[c] 3 (4-5)	p=0.000**
Wound care (n=49)	Vital signs				
	MAP	87.38±10.85[a]	105.72±17.43[b]	94.17±15.28[c]	p=0.000*
	Heart rate	94.73±19.14[a]	111.32±26.14[b]	97.26±18.70[c]	p=0.000*
	Oxygen saturation	96.93±3.53[a]	93.08±5.88[b]	97.20±2.97[a]	
	BPS mean score	3.85±1.00[a] 3 (4-4)	6.32±1.95[b] 5 (6-8)	4.16±1.14[c] 3 (4-5)	p=0.000**
Position change (n=46)	Vital signs				
	MAP	83.56±16.99[a]	94.10±19.19[b]	87.49±18.44[c]	p=0.000*
	Heart rate	89.54±17.68[a]	105.69±22.54[b]	93.26±17.92[c]	p=0.000*
	Oxygen saturation	95.63±3.73[a]	91.10±5.70[b]	96.32±3.75[a]	p=0.000*
	BPS mean score	4.15±0.98[a] 3 (4-5)	6.56±1.79[b] 5 (7-8)	4.34±1.03[a] 4 (4-5)	p=0.000**

SD: Standard deviation, min-max: minimum-maximum, MAP: mean arterial pressure, BPS: behavioral pain scale. *Two-Way variance in repeated measures was used. **Friedman analysis has been done. [a, b, c]: Different letters show statistically difference between the groups. Post-hoc Bonferroni analysis was performed

Table 3. Distribution of physiological parameters and mean BPS score during the procedure (T2) according to the painful procedures

Physiological parameters	Painful procedures			
	Aspiration (T2) Mean ± SD Median (min-max)	Wound care (T2) Mean ± SD Median (min-max)	Position change (T2) Mean ± SD Median (min-max)	p-value
MAP	103.06 ±20.53[a]	105.72±17.43[a]	94.10±19.19[b]	**0.009***
Heart rate	110.96±20.73	111.32±26.14	105.69±22.54	0.386*
Oxygen saturation	87.18±10.46[a]	93.08±5.88[b]	91.10±5.70[b]	**0.000***
BPS mean score	6.40±2.03 6 (5-8)	6.32±1.95 7 (5-8)	6.56±1.79 6 (5-8)	0.716**

SD: Standard deviation, min-max: minimum-maximum, MAP: mean arterial pressure, BPS: behavioral pain scale. *One-Way analysis of variance was used. Post-hoc Tukey analysis was performed. **Kruskal-Wallis analysis was used. [a, b, c]: Different letters show statistically difference between the groups

Table 4. Relationship between vital signs and BPS mean scores of patients during painful procedures

Vital signs	BPS scores in painful procedures (T2)					
	Aspiration		Wound care		Position change	
	r*	p	r*	p	r*	p
MAP	0.113	0.314	0.447	0.001	0.078	0.604
Heart rate	0.193	0.084	0.306	0.033	0.096	0.526
Oxygen saturation	-0.389	0.000	-0.247	0.086	-0.191	0.205

MAP: Mean arterial pressure, BPS: behavioral pain scale. *Spearman correlation analysis were used

Discussion

The evaluation of pain in non-verbal patients undergoing mechanical ventilation is crucial for ensuring consistent care and patient comfort (17). In this study, the correlation between physiological parameters and behavioral indicators of pain was assessed in non-verbal patients who underwent surgery. In the study, it was found that the heart rate, MAP and BPS mean score increased and oxygen saturation decreased during aspiration, wound care, and position change in patients who were unconscious and followed up on a mechanical ventilator. Our study results are in line with some studies investigating the vital signs and pain levels of intensive care patients during the painful procedure (11,12,18). In the studies, Erden et al. (12), reported that both conscious and unconscious patients had an increase in heart rate during the painful procedure, Al Sutari et al. (11), reported that the mean BPS score increased, Arbor and Gélinas (18), reported that MAP and heart rate showed an increase, while oxygen saturation demonstrated a decrease. These results can be considered as a reason for tachycardia and an increase in blood pressure as a result of the release of catecholamines by the pain experienced during painful procedures stimulating the sympathetic nervous system.

In ICU patients, pain may develop at rest, depending on surgical procedures, or during procedures such as endotracheal aspiration, wound care, change of position, and withdrawal of drain tubes and catheters (19,20). In our study, when the pain behavior and physiological parameters of the patients were compared during aspiration, position change, and wound care procedures; it was determined that there was no significant difference in terms of mean BPS scores and heart rate according to the procedures, but the MAP increased significantly during wound care. The reason for this situation may be the tissue damage caused by the recent surgical procedure and the skin integrity has not yet reached its former strength and the pain experienced is more. Furthermore, it was discovered that oxygen saturation significantly decreased during the process of aspiration. Complications such as injury to the tracheal tissue, hypoxia, and reduced oxygen saturation may arise during endotracheal aspiration (21). In this study, it was hypothesized that the decrease in oxygen saturation during aspiration could have resulted from both the procedure itself and the accompanying pain.

In the study, while there was a moderately negative correlation between BPS score and oxygen saturation during aspiration, a moderate positive correlation was observed between BPS and heart rate and MAP during wound care. There are conflicting results on this subject in the literature. Erden et al. (12), found a moderate association with pain score and heart rate during wound care. Similarly, in another study, it was reported that there was a relationship between pain score and heart rate and MAP during painful procedures (11). On the contrary, in the Chen and Chen (22) study, no relationship was found between heart rate and blood pressure and pain level. As intensive care patients may experience many hemodynamic problems that cause changes in their vital signs, pain assessment using physiological parameters alone may not be reliable (12). Therefore, physiological parameters such as heart rate, MAP, respiratory rate, and oxygen saturation should be used in combination with BPSs.

The dose of sedative drugs administered to the patients during the study and the related change in the patient's consciousness were applied according to their clinical routines and the decision was made beyond our control. In addition, the presence of more than one researcher and observer in the study is one of the limitations of the study.

When considered ethically, every individual has the right to have his/her pain evaluated and relieved (3). Defining pain is a pre-requisite for effective pain management. Consequently, it is crucial to assess the level of pain experienced by patients dependent on mechanical ventilation, who are unable to verbally communicate their pain (23).

Conclusion

The results of this study demonstrated an increase in the BPS scores, MAP, and heart rate, along with a decrease in oxygen saturation levels in surgical intensive care patients during procedures such as suctioning of airways, dressing changes, and shifts in position.

In this patient group, it may be suggested that intensive care nurses should understand the importance of identifying pain with BPSs as well as vital signs to maintain the critical role they play in the assessment and management of pain. In addition, case discussions and training sessions on the physiological effects of pain may be recommended to intensive care nurses.

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Ethics

Ethics Committee Approval: Before starting the study, Erciyes University Clinical Research Ethics Committee approval (decision no: 2017/355, date: 16.06.2017) and institutional permission from the institution where the study was conducted was obtained.

Informed Consent: Consent was obtained from their families.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: Y.S., Ö.C., Design: Y.S., Ö.C., Data Collection and Process: Y.S., Analysis or Interpretation: Y.S., H.Y.K., Literature Search: Y.S., H.Y.K., Writing: Y.S., H.Y.K., Ö.C., İ.Y.

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References

1. Hasegawa R. Consideration of pain felt by patients in the ICU. J Intensive Care 2017;5:73.
2. Park JM, Kim JH. Assessment and treatment of pain in adult intensive care unit patients. Acute Crit Care 2014;29:147-59.
3. McGuire DB, Kaiser KS, Haisfield-Wolfe ME, Iyamu F. Pain assessment in noncommunicative adult palliative care patients. Nurs Clin North Am 2016;51:397-431.
4. Yaman Aktaş Y, Karabulut N. Pain assessment in mechanically ventilated patient. Gümüşhane University Journal of Health Sciences 2014;3:1132-46.
5. Pinheiro ARPQ, Marques RMD. Behavioral pain scale and critical care pain observation tool for pain evaluation in orotracheally tubed critical patients. A systematic review of the literature. Rev Bras Ter Intensiva 2019;31:571-81.
6. Gélinas C. Pain assessment in the critically ill adult: Recent evidence and new trends. Intensive Crit Care Nurs 2016;34:1-11.
7. Jafari H, Courtois I, Van den Bergh O, Vlaeyen JWS, Van Diest I. Pain and respiration: a systematic review. Pain 2017;158:995-1006.
8. Gélinas C, Tousignant-Laflamme Y, Tanquay A, Bourgault P. Exploring the validity of the bispectral index, the Critical-Care Pain Observation Tool and vital signs for the detection of pain in sedated and mechanically ventilated critically ill adults: A pilot study. Intensive Crit Care Nurs 2011;27:46-52.
9. Esen H, Kan Öntürk Z, Badır A, Eti Aslan F. Entübe ve sedatize yoğun bakım hastalarının pozisyon verme ve aspirasyon sırasındaki ağrı davranışları. ACU Sağlık Bil Derg 2010;1:89-93.
10. Ahlers SJ, van der Veen AM, van Dijk M, Tibboel D, Knibbe CA. The use of the Behavioral Pain Scale to assess pain in conscious sedated patients. Anesth Analg 2010;110:127-33.
11. Al Sutari MM, Abdalrahim MS, Hamdan-Mansour AM, Ayasrah SM. Pain among mechanically ventilated patients in critical care units. J Res Med Sci 2014;19:726-32.
12. Erden S, Demir N, Ugras GA, Arslan U. Arslan S. Vital signs: Valid indicators to assess pain in intensive care unit patients? An observational, descriptive study. Nurs Health Sci 2018;20:502-8.
13. Payen JF, Bru O, Bosson JL, Lagrasta A, Novel E, Deschaux I, et al. Assessing pain in critically ill sedated patients by using a behavioral pain scale. Crit Care Med 2001;29:2258-63.
14. Hepkarşı A, Bor C, Demirağ K, Çankayalı İ, Uyar M. The comparison of Ramsay and Richmond scales for intensive care unit sedation, the consistency between doctors and nurses. J Turk Soc Intens Care 2015;13:112-6.
15. Çelik S. Pain management in intensive care patients. Yoğun Bakım Hemşireliği Dergisi 2016;20:1-8.
16. Uğraş GA, Aksoy G. The Effects of open and closed endotracheal suctioning on intracranial pressure and cerebral perfusion pressure: a crossover, single-blind clinical trial. J Neurosci Nurs 2012;44:E1-8. doi:10.1097/jnn.0b013e3182682f69
17. Arbour C, Gélinas C. Behavioral and physiologic indicators of pain in nonverbal patients with a traumatic brain injury: an integrative review. Pain Manag Nurs 2014;15:506-18.
18. Arbour C, Gélinas C. Are vital signs valid indicators for the assessment of pain in postoperative cardiac surgery ICU adults? Intensive Crit Care Nurs 2010;26:83-90.
19. Kotfis K, Zegan-Barańska M, Szydłowski Ł, Żukowski M, Ely EW. Methods of pain assessment in adult intensive care unit patients - Polish version of the CPOT (Critical Care Pain Observation Tool) and BPS (Behavioral Pain Scale). Anaesthesiol Intensive Ther 2017;49:66-72.
20. Puntillo KA, Max A, Timsit JF, Vignoud L, Chanques G, Robleda G, et al. Determinants of procedural pain intensity in the intensive care unit. The Europain® study. Am J Respir Crit Care Med 2014;189:39-47.
21. Abbasinia M, Irajpour A, Babaii A, Shamali M, Vahdatnezhad J. Comparison the effects of shallow and deep endotracheal tube suctioning on respiratory rate, arterial blood oxygen saturation and number of suctioning in patients hospitalized in the intensive care unit: a randomized controlled trial. J Caring Sci 2014;3:157-64.
22. Chen HJ, Chen YM. Pain assessment: Validation of the physiologic indicators in the ventilated adult patient. Pain Manag Nurs 2015;16:105-11.
23. de Hora TCNS, Alves IGN. Scales for the assessment of pain in the intensive care unit. Systematic review. BrJP 2020;3:263-74.