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ORIGINAL RESEARCH

Association between Vital Signs Fluctuations and Pain Severity among Critically-ill Patients

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ABSTRACT

Background: pain is a critical issue in the Intensive Care Unit and need a proper management to improve patient's outcome and reduce the pain consequences in critically ill patients since patient in the intensive care unit being unable to reporting pain. Therefore, assessment vital signs frequently may be helpful.
Objectives: To describe vital signs and pain severity among critically ill patients. As well to find the relationship between pain severity and a patient's vital signs. Finally, to compare the vital signs at rest, during routine nursing and post-routine nursing procedures within 20 minutes.
Methodology: A descriptive-correlational design was conducted in the present study. A purposive sample of 135 subjects who had met the study's inclusion criteria were targeted. The data collection started from January 18thto April 7th, 2022.
Results: Patients were silently suffering pain during all three assessment phases pre-during and 20 minutes' post-routine nursing procedures. Of equal importance, there is a statistically significant association between the overall pain score and overall vital signs pre, during and post nursing procedures.
Conclusion: The pain severity had reached its highest level during nursing procedures, as it showed a severe unacceptable pain score, which is both clinically and ethically unacceptable. And there was a significant statistical difference, which was authenticated through vital signs readings during nursing procedures and within 20 minutes compared to pre-nursing procedures.
Recommendations: It is recommended to depend the changes in vital readings because it is considered important indicator of pain presence and its severity among patients who are unable to express their pain in the intensive care units. Also a highly recommended that Intensive Care Units use up-to-date clinical protocols to measure pain.

Keywords: Pain, Vital Signs, Critically-ill patients.

INTRODUCTION

The sensation and perception of pain are important for human life and have multidimensional and personal experiences in confronting various stimuli that may produce tissue damage (Alnajar et al., 2021). People who are able to verbalize their pain can be easier to assess accurately, because they are able to depict the pain that they feel (Oliveira et al, .2019). Therefore, the first step for effective pain management is diagnosing the presence and severity of pain among critically-ill patients using valid and reliable scales for the pain assessment. Therefore, health care providers (HCPs) should use an appropriate tool to assess pain (Deldar et al., 2018).

Pain is normally unpleasant and undesired; however, it also provides a defensive function, warning the body of potentially harmful circumstances (AL Attar, 2014; Terkawi, 2017). As a result, pain is considered the fifth vital sign, and it is recommended that pain to be assessed together with all other vital signs (Valério et al., 2019). Most patients in the ICU are not able to make any self-report pain due to their deteriorating health condition(s), such as, intubation and sedation. Alternately, patient's behaviors have proved to be a reliable way of communicating. Indicators of pain in intensive care are a key component of a nurse's assessment competence (Na'el & Mohammed, 2019; AL-Fayyadh, 2018; Kadhim, 2014). Routine pain assessment, as an attached step with vital signs in the critical care setting, is associated with a reduced duration of mechanical ventilation, a lower risk of infection, decreased use of sedative agents, and a reduced ICU stay (Yamashita et al., 2017; AL-Saad & Al-Jaafari, 2018). Patients hospitalized in ICUs may frequently experience both short-and long-term physiological and psychological issues, such as hemodynamic instability, high blood sugar, infections, delirium, anxiety, prolonged hospitalization, increased medical costs, and most importantly, potential neuropathic pain and chronic pain (Kia et al., 2021). Patients in the medical, surgical, and trauma departments of the ICUs are suffering from pain both at rest and while receiving standard ICU management (Liu, 2021).

Patient's physiological reactions would also be added to the pain assessment data. The sympathetic nervous system is triggered during acute pain, triggering a multitude of physiological reactions such as elevated blood pressure, pulse rate, pallor, respiratory rate, excessive sweating, and pupil size dilation (Shaikh et al., 2018). In medical, surgical, and trauma patients who were unable to describe their pain, the Behavioral Pain Scale (BPS) was approved to be the most reliable and valid pain evaluation instrument. The BPS can be used for sedated patients and depends on the three behavioral categories, including facial expression, upper-limb movements, and mechanical ventilation compliance (Salvadore, 2018; Berman & Snyder, 2018). The lack of evidence regarding pain assessment and lack of collaboration between physicians and nurses were identified as barriers to effective pain assessment and management. In addition, the physical and cognitive impairments of many critically ill patients and communication impediments, such as intubation, and diminished level of consciousness, are factors that shouldnot be overlooked when practicing pain management (Arrar & Mohammed, 2020; Gélinas & Arbour, 2009).

The main study question was: is there a relationship between pain severity and vital signs fluctuations?.

AIMS OF THE STUDY

The Aim of study was to describe vital signs and pain severity among critically ill patients. As well to find the relationship between pain severity and a patient's vital signs. Finally to compare the vital signs

at rest, during routine nursing and post-routine nursing procedures within 20 minutes.

METHODOLOGY:

Study design: Descriptive-correlational design study. This research method supported the study's primary goal. While previous studies were conducted to assess the pain level and use different methods, the knowledge gained from these previous studies provides unclear answers. This descriptive correlational study can provide additional insight into this phenomenon. There are four types of schools in Erbil city according to the teaching language of that school (Kurdish, Arabic, Turkish or English). The 1st three types are either male or female schools, while the English schools are mixed. The teaching language of the majority of the schools (68 out of 78) is Kurdish.

Ethical Considerations and Official Agreements: With the submission of the study protocol, ethical approval was sought from the Scientific Committee of the Nursing Faculty, University of Baghdad. The reference number is 34, dated 5/12/2021. The researcher submitted a detailed description of the study, including problem statement, objectives, and questionnaire, to the Ministry of Planning (Central Statistical Organization) and to the Medical City Directorate, and Al-Muthanah Health Directorate, in order to obtain official permission to carry out the study. Informed consent was obtained from the patient's kin due to the selected patients' being unable to communicate. From the hospital administration, informed consent was also obtained to use the patient's medical file. To verify that the rights, welfare, and well-being of human participants are completely protected while they are participating in a study; the researcher has completed the Human Research Protection Fundamental Training offered by the Office for Human Research Protection.

Study Instrument: The Behavioral Pain Scale (BPS) was used in this study after obtaining official permission from the primary author Dr. Jean F Payen. The BPS is both reliable and valid for use in assessing pain for mechanically ventilated-sedated patients who are hospitalized in the ICUs and the patients who are unable to communicate and expressing their distress. Cronbach's alpha coefficients of the scale was highly reliable; the reliability coefficient for the BPS was 0.79 (Payen, 2001; Salvadore, 2018). The BPS contain three main domain Facial expression, compliance with mechanical ventilation and upper limb movement. Within each domain, behavioral responses are scored from (1) that indicate no pain to (4), which is the worst score that indicates the presence of pain. The health care professional uses BPS to assess the presence and severity of the pain and decide what the best behavioral response will be within each domain. Patients' responses are to be scored from 1 to 4 in each domain, with a total score of 12 that indicates maximum pain (Payen et al., 2001).

Data Collection Method: The data was collected through observational methods from January 18th , 2022, to April 7th , 2022. The severity of pain were measured objectively through observation of the patient's behavioral response using BPS and vital signs measured from patient's monitoring machine. The study sample include 135 patients selected purposively to find the relationship between vital signs readings and pain severity among critically ill patients with a diminished level of consciousness. The pain and vital signs were determined through three phases: the first was assessing patients' pain during rest (without any invasive or therapeutic procedures); the second was during routine nursing procedures. Finally, the third phase, which was done to determine patient's pain within 20 minutes post-nursing procedures. SpO2 levels were also assessed during all three assessment phases. According to Honan et al., (2019) the mean arterial pressure, was measured and categorized according to the following formula: (MAP= [2 × diastolic+ systolic]/3). And classification

of mean arterial pressure was calculated according to Kundu et al., (2017).

Settings: The study was conducted by using observational methods, targeting hospitalized adult patients in the ICUs in Baghdad teaching hospitals; Martyr Ghazy Al-Hariri Hospital for Surgical Specialties; and the Private Nursing Home Hospital of the Medical City Directorate; Al-Hussein Teaching Hospital of Al-Muthanna Health Department.

Participants and Study Design: The purposive non-probability sampling method was used for the current study method which is selected depending on population characteristics, eligibility criteria and the study's aims. The exclusion criteria of this study included patients who were < 18 years old. Patients who have had neuropathic conditions such as Myasthenia Gravis and Guillain-Barre Syndrome (GBS), patients with upper limb neuropathy were excluded because these conditions may interfere with behavioral responsivity when using the BPS. Patients who can report pain were excluded because the research tool was designed for patients who are unable to report the presence and intensity of pain, as well as patients with upper limb fractures. Those on a heavy anesthetic regimen were also excluded because they may be unable to show any behavioral response which may interfere with the research tool usability and measurement accuracy.

The Sample consisted of 135 patients the sample size was calculated according to A-priori sample sizes for student t-tests.

Table (1): Minimum Sample Size Determination

Parameter of calculating the minimum sample size	Selected Values
Anticipated effect size (Cohen's d):	0.5
Desired statistical power level:	0.8
Probability level:	0.05

- **Data Analysis Procedures:** Data were analyzed using IBM-Statistical Package for Social Sciences (SPSS) version 24, which included descriptive and inferential statistical measures. Descriptive statistics are used to describe the demographic data and health-related variables. Repeated measurement analysis of variance (ANOVA) used to measure the difference among vital signs over the three measures (pre-nursing procedures, during nursing procedures, and 20 minutes after nursing procedures). The nonparametric test of association (Spearman Correlation) was used to determine the relationship between pain levels and clients' demographic information and health-related variables.

- **Limitations:** The main limitations of the study were the relatively small sample size and the timeframe for the study and data collection. The more relevant method to classify the patient's consciousness and sedation level in the ICUs is the Richmond Agitation Sedation Scale (RASS), which is not used in the current study since it is not applicable in the health care settings and the health care providers and the informed consent to use the RASS was not obtained from the primary author. Therefore, the patients were classified according to the Glasgow coma scale.

RESULTS

Table (1): Descriptive statistics of sociodemographic data for patients.

Age groups	f	%
18 – < 32 Years Old	39	28.9
32.0 - < 45.0 Years Old	23	17.0
45.0 - < 58.0 Years Old	26	19.3
58.0 - < 71.0 Years Old	36	26.7
≥71 Years Old	11	8.1
Total	**135**	**100.0**
Gender	**f**	**%**
Male	79	58.5
Female	56	41.5
Total	**135**	**100.0**

The underlined numbers in table 1 represent the highest percentages of the selected variables. The dominant percentage of gender distribution for the targeted sample was males, representing more the half (58.5%) of the study sample and the age groups included (18– < 32 years old), more than one quarter with percentage (28.9 %).

Table (2): Frequencies and Percentages of health related variables

Diagnoses classification	f	%
Non-traumatic	83	**61.5**
Traumatic	52	38.5
Total	**135**	**100.0**
Assessment by Glasgow Coma Scale (GCS)	**f**	**%**
Severe condition (5-8)	79	**58.5**
Moderate condition (9-13)	56	41.5
Total	**135**	**100.0**
Pain Medication	**f**	**%**
No Medication	28	20.7
Non-Narcotics	10	7.4
Narcotics	57	**42.2**
Both (Narcotics & Non-narcotics)	40	29.6
Total	**135**	**100.0**

The underlined numbers in table (2) represent the highest percentages of the selected variables. In which the majority of the collected samples were as follow: patient's length of staying days, more than half (55.6%) of the subjects were hospitalized for 3 to 5 days. Additionally, more than half (61.5%) of the participants were medically classified as non-traumatic patients. Moreover, the consciousness level for the patients according to GCS was (5-8), representing more than half (58.5%) of the study subjects. Finally, narcotics was approximately used by about two-fifths (42.2%) of study subject.

Table (3): Descriptive statistics of overall vital signs and SpO2 level during all three phases of assessment (pre-routine nursing procedures, during- and within 20 minutes post-routine nursing procedures.

Pain Scores	Pre-routine nursing procedures					During-routine nursing procedures					Post-routine nursing procedures				
	Pain severity		Respiratory rate	f	%	Pain severity		Respiratory Rate	f	%	Pain severity		Respiratory Rate	f	%
No Pain (3)	f	%	Eupnoea 12-20 breath/min	84	**62.2**	f	%	Tachypnea >20 breath/min	135	**100.0**	f	%	Eupnoea 12-20 breath/min	71	**52.6**
			Pulse Rate	**f**	**%**			**Pulse Rate**	**f**	**%**	**129**	**95.6**	**Pulse Rate**	**f**	**%**
Mild Pain (4-5)	f	**%**	Normal 60-100 beat/min	80	**59.3**	f	%	Tachycardia >100 beat/min	104	**77.0**	f	%	Normal 60-100 beat/min	78	**57.8**
	83	**61.5**	**Mean Arterial Pressure**	**f**	**%**			**Mean arterial Pressure**	**f**	**%**			**Mean Arterial Pressure**	**f**	**%**
Severe unacceptable pain 6-11	f	%	Normal MAP (93-99mmhg)	93	**68.9**	f	%	Normal MAP (93-99mmhg)	51	**37.8**	F	%	Normal MAP (93-99mmhg)	88	**65.2**
			Body Temperature	**f**	**%**	**135**	**100 %**	**Body Temperature**	**f**	**%**			**Body Temperature**	**f**	**%**
Maximum pain 12	f	%	Euthermia 36.5-37.5 C°	120	**88.9**	f	%	Euthermia 36.5-37.5 C°	119	**88.1**	f	%	Euthermia 36.5-37.5 C°	126	**93.3**
			SPO2	**f**	**%**			**SPO2**	**f**	**%**			**SPO2**	**f**	**%**
			Normal (95 %-100%)	127	**94.1**			Below Normal (90 - 94%)	89	**65.9**			Normal (95 %- 100%)	107	**79.3**

The underlined numbers in table (3) represent the highest percentages of the selected variables. As noticed, the vital signs and pain severity increased during routine nursing care procedures and, conversely, the SpO2 decreased below normal during the procedural phase compared to pre and post-nursing procedures. Finally, the overall pain intensity was presented, which showed that more than two thirds of patients (71.1%) had an unacceptable pain level.

Table (4): Relationship between overall pain and vital signs readings over three measurements

Overall Pain Scale	Pre Nursing Procedures	During Nursing Procedure	20 minutes post-Nursing Procedures
	Respiratory Rate		
Correlation Coefficient	.276**	.270**	.268**
Sig. (2-tailed)	**0.001**	**0.002**	**0.002**
N	135	135	135
Overall Pain Scale	**Pulse Rate**		
Correlation Coefficient	0.301	0.422	0.302
Sig. (2-tailed)	**0.001**	**0.001**	**0.001**
N	135	135	135
Overall Pain Scale	**Mean Arterial Pressure**		
Correlation Coefficient	0.266	0.281	0.259
Sig. (2-tailed)	**0.002**	**0.001**	**0.002**
N	135	135	135
Overall Pain Scale	**SPO2**		
Correlation Coefficient	-0.086-	-0.027-	-0.074-
Sig. (2-tailed)	0.323	0.752	0.392
N	135	135	135

Non-parametric Spearman Correlation in the Table 4 shows there is a statistically significant association between the overall pain score and overall vital signs pre-nursing procedures, during nursing procedures and post nursing procedures. When the pain intensity increases, the respiratory rate, heart rate, and mean arterial pressure also increase, so there is a positive relationship between these variables. Conversely, it shows there is no statistically significant association between overall pain score and SpO2% level during all three phases.

Table (5): Difference between three measurements of vital signs and SpO2% level with overall pain severity

Vital signs	ANOVA analysis		Times	Pre- nursing procedures (1)		During nursing procedures(2)		Post nursing procedures (3)	
	f	sig		2	3	1	3	1	2
RR	550.841	.000	Mean Difference (I-J)	-9.572-*	-1.109-*	9.572*	8.463*	1.109	-8.463-*
			Std. Error	0.332	0.275	0.332	0.336	0.275	0.336
			Sig.[b]	.000	.000	.000	.000	.000	.000
	f	sig	Times	2	3	1	3	1	2
PR	250.339	.000	Mean Difference (I-J)	-18.841-*	-2.398-*	18.841*	16.443*	2.398*	-16.443-*
			Std. Error	.967	.901	.967	.880	.901	.880
			Sig.[b]	.000	.026	.000	.000	.026	.000
	f	sig	Times	2	3	1	3	1	2
MAP	138.385	.000	Mean Difference (I-J)	-11.331-*	-2.017-*	11.331*	9.315*	2.017*	-9.315-*
			Std. Error	0.697	0.747	0.697	0.735	0.747	0.735
			Sig.[b]	.000	.024	.000	.000	.024	.000
	f	sig	Times	2	3	1	3	1	2

T	1.388	.245	Mean Difference (I-J)	0.022	0.097	-.022-	.075*	-.097-	-.075-*
			Std. Error	.072	.073	.072	.024	.073	.024
			Sig.[b]	1.000	0.566	1.000	.007	.566	.007
	f	sig	Times	2	3	1	3	1	2
SPO2	569.905	.000	Mean Difference (I-J)	6.472*	.970*	-6.472-*	-5.502-*	-.970-*	5.502*
			Std. Error	0.205	.124	.205	.266	.124	.266
			Sig.[b]	.000	.000	.000	.000	.000	.000

The mean difference is significant at the .05 level; Time 1= Pre-routine nursing procedures; Time 2= during-routine nursing procedures; Time 3= post-routine nursing procedures (RR –Respiratory rate, PR- pulse rate, MAP- mean arterial pressure, T- temperature.

Repeated measurement ANOVA test in Table 5 shows that there is a statistically significant difference between the overall vital signs during all three measurement phases. While the body temperature shows that there is no statistically significant difference between the body temperatures during three measurement phases. Ultimately, the SpO2% saturation level shows that there is a statistically significant difference between the SpO2% level during three measurement phases of pre- during and post nursing procedures within 20 minutes.

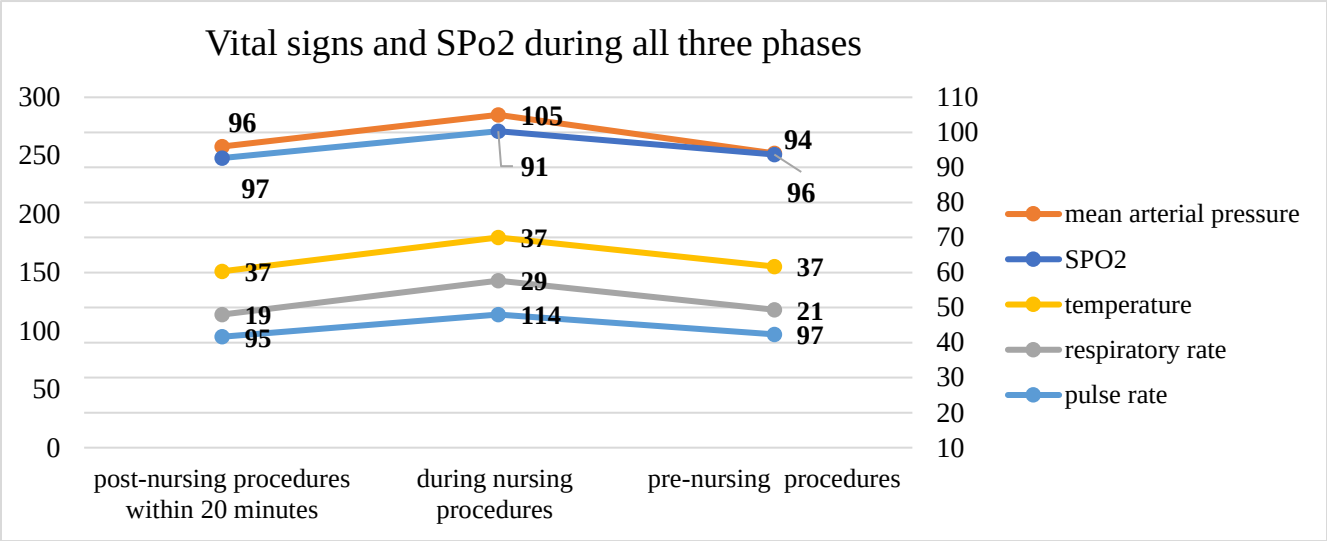

Figure (1): Vital signs and SPo2 during all three phases

The mean plot show Difference between all three phases pre- during and post routine nursing care procedures of vital signs and SpO2 levels. With a significant elevation during routine nursing procedures except the SpO2 level which is relatively below normal during routine nursing procedures phase.

DISCUSSION

The findings in table (4-2) showed that more than one quarter (28.9%) of the study participants' age group was (18– <32 years old). This result is similar to a cross-sectional study carried by (Alikiaie et al., 2019). Regarding the patients' gender, findings of the study indicated that more than half (58.5%) of the study sample were males. These results were not surprising to the researcher because male patients are more risky to develop cerebrovascular accidents and road traffic accidents due to these condition most common hodpitalized in the ICUs. This result was confirmed by an observational study Kemp et al., (2017), which indicated that the highest percentage

(54.9%) of study respondents were males. Another study supports this result with a percent (62.1%) of male patients (Ayasrah et al., 2014). This may be due to the fact that male individuals are more at risk of the occurrence of cerebrovascular accidents according to Hinksman et al., (2022), Analogaili & Khullof, (2021), which indicate that male individuals are more susceptible to road traffic accidents than females.

The findings in table 2 revealed more than half (61.5%) of the participants were medically classified as non-traumatic patients. This was confirmed by the researchers Oliveira et al., (2019). The majority (58.5%) of the patient's consciousness level was (5-8), according to the Glasgow coma scale. These results were not surprising to the researcher since the patients were hospitalized in intensive care units. This was validated in a descriptive-correlational retrospective study (Morris et al., 2021).

Moreover, the pain medication classification, the results appeared in this way: the majority of the patients' were under mild regimen of narcotics medications was approximately used by about two-fifths (42.2%) of the study subjects. This result was not surprising to the researchers since the patients are hospitalized in ICU, frequently treated with mild, moderate, and even heavy sedative regimens (Payen et al., 2001). The study results are supported by a prospective cohort study of (klein et al., 2018).

Non-parametric Spearman Correlation in the Table 4 shows there is a statistically significant association between the overall pain score and overall vital signs readings: pre-nursing procedures, during nursing procedures and post nursing procedures. Because the rate of breathing, the heart rate, and the mean arterial pressure, all go up in tandem with an increase in the intensity of the pain, it can be say that there is a positive relationship between these variables. This result did not surprise the researcher since alteration in the vital signs was expected as a reaction to increased patients' pain and discomfort and this was supported by the Sutari et al., (2014).

Repeated measurement ANOVA test in Table 5 shows that there is a statistically significant difference between the overall vital signs during all three measurement phases. This result was confirmed by Arbour et al.,)2014); by Erden et al., (2018), a repeated measure study design. They discovered a significant difference in vital signs during routine care procedures versus pre- and post-procedures. These results were not surprising to the researchers as last mentioned the change or alteration in vital signs was an expected outcome as a response to patients' discomfort and suffering. This was confirmed by (Considine et al., 2020; Ayasrah, 2019). It is crucial to comprehend how unbalanced key physiological signals affect patients' hemodynamics since pain is a significant indicator of pain and instability. Therefore, when utilizing traditional vital signs to provide support to patients in pain, physiological and biochemical processes stand out as the most essential to monitor and document in order to simultaneously explore pain symptoms (Araujo & Romero, 2015). While the body temperature shows that there is no statistically significant difference between the body temperatures during three measurement phases. This result was confirmed by Khojeh et al., (2018). Ultimately, the SpO2% saturation level shows that there is a statistically significant difference between the SpO2% level during three measurement phases of pre- during and post nursing procedures within 20 minutes. That was an expected outcome of increased pain episodes and was confirmed by a descriptive observational study of Menekli et al., (2021).

CONCLUSION

The pain severity had reached its highest level during nursing procedures, as it showed a severe unacceptable pain score, which is both clinically and ethically unacceptable. And there was a significant

statistical difference was authenticated in vital signs during nursing procedures and within 20 minutes compared to pre-nursing procedures. Therefore, the nurses should be alert to any change in patients' health status and vital signs and attempt to reduce patients' discomfort that leads to disturbance of their health conditions. Aiming for minimizing patients' pain and discomfort that may lead to disturbance of patient's condition. There was a significant statistical difference, which was authenticated, between Spo2% levels, pre-nursing procedures, during nursing procedures, and within 20 minutes post-nursing procedures. Therefore, the nurses should be alert to any change in patients' health status and vital signs and attempt to reduce patients' discomfort that leads to disturbance of their health conditions.

NURSING IMPLICATIONS

It is important to use the EBP when providing intensive care unit patients' care and during routine nursing care provision. It can improve patient's outcomes. Also frequently assessing and monitoring patients' discomfort and pain intensity through the use of recommended tools for assessing pain, particularly for non-communicative critically ill patients, through the use of the behavioral pain scale and other tools that are designed for patients unable to report pain can be reduce the needs for mechanical ventilation and reduce patients length of stay in the ICU.

RECOMMENDATIONS

It is recommended to depend the changes in vital readings because it is considered important indicator of pain presence and its severity among patients who are unable to express their pain in the intensive care units. It is highly recommended that Intensive Care Units use up-to-date clinical protocols to measure pain. Of equal importance, mandatory practice policies of using of the well-established behavioral pain assessment tools, particularly in Iraqi ICUs, are crucial. It is becoming mandatory to maximize the level of care quality to improve patients' recovery. Using behavioral pain assessment tools such as the Behavioral Pain Scale that depend on behavioral response for non-communicative patients are extremely required especially when supported with vital signs fluctuations assessment.

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Conflicts of Interest

No conflict of interest

REFERENCES:

AL Attar, M. (2014). Assessment Of Patients Stressors At Intensive Care Units. *Kufa Journal for Nursing Sciences, 3*(2).

Alnajar, M. K., Shudifat, R., Mosleh, S. M., Ismaile, S., N'erat, M., & Amro, K. (2021). Pain Assessment and Management in Intensive Care Unit: Nurses' Practices, Perceived Influencing Factors, and Educational Needs. *The Open Nursing Journal*, 15(1). DOI: 10.2174/1874434602115010170.

Al Sutari, M. M., Abdalrahim, M. S., Hamdan-Mansour, A. M., & Ayasrah, S. M. (2014). Pain among Mechanically Ventilated Patients in Critical Care Units. Journal of research in medical sciences: *the official journal of Isfahan University of Medical Sciences*, 19(8), 726. DOI: 10.13140/RG.2.2.12728.34568

AL-Fayyadh, S. (2018). Critical Care Nurse's Capacities to Express a Caring Relationship with Patients in Teaching Hospitals. *Indian Journal of Public Health Research & Development*, 9(8). DOI: 10.5958/0976-5506.2018.00733.7

Alikiaie, B., Mousavi, S., Ebrahimi, A., & Foroughi, Z. (2019). Evaluation of pain assessment and management in critically Ill intubated patients in a referral university hospital in Iran. *Journal of Research in Pharmacy Practice*, 8(3), 137. DOI: 10.4103/jrpp.JRPP_18_81

Alogaili, A. A. H., & Khullof, W. A. (2021). Epidemiological, characteristics and outcomes of Road Traffic accident among patients in emergency units. *Journal of MAR case reports*, 3(3), 1-13.

Araujo, L. C. D., & Romero, B. (2015). Pain: evaluation of the fifth vital sign. A theoretical reflection. Revista Dor, 16, 291-296. https://doi.org/10.5935/1806-0013.20150060.

Arbour, C., Choinière, M., Topolovec-Vranic, J., Loiselle, C. G., & Gélinas, C. (2014). Can Fluctuations in Vital Signs be used for Pain Assessment in Critically ill Patients with a Traumatic Brain Injury? Pain research and treatment. 2014, 175794. http://dx.doi.org/10.1155/2014/175794.

Arrar, A., & Mohammed, S. (2020). Evaluation of Nurses' Knowledge and Practices Concerning Nursing Care Guide in the Intensive Care Unit in Misan Governorate Hospitals. *Kufa Journal for Nursing Sciences*, 10(1), 12-22. DOI: 10.36321/kjns/2020/100102

AL-Saad, S. N., & Al-Jaafari, H. A. S. (2018). Comparison between dexmedetomidine and propofol as sedatives for critically ill patients in intensive care units. *Journal of the Faculty of Medicine Baghdad*, 60(1), 28-31. https://iqjmc.uobaghdad.edu.iq/index.php/19JFacMedBaghdad36/article/view/36.

Ayasrah, S. M. (2019). Pain among non-verbal critically Ill mechanically ventilated patients: Prevalence, correlates and predictors. *Journal of critical care*, 49, 14-20. https://doi.org/10.1016/j.jcrc.2018.10.002.

Ayasrah, S. M., O'Neill, T. M., Abdalrahim, M. S., Sutary, M. M., & Kharabsheh, M. S. (2014). Pain Assessment and Management in Critically-ill Intubated Patients in Jordan: A Prospective Study. *International Journal of Health Sciences*, 8(3), 287. Doi: 10.12816/0023981

Berman, A., Snyder, S. J., Levett-Jones, T., Dwyer, T., Hales, M., Harvey, N. & Stanley, D. (2018). *Kozier and Erb's Fundamentals of Nursing* [4th Australian edition]. http://www.pearson.com.au/9781488687341.

Considine, J., Street, M., Hutchinson, A. M., Mohebbi, M., Rawson, H., Dunning, T., & Bucknall, T. (2020). Vital Sign Abnormalities as Predictors of Clinical Deterioration in Subacute Care Patients: A Prospective Case-Time-Control Study. *International Journal of Nursing Studies*, 108, 103612. https://doi.org/10.1016/j.ijnurstu.2020.103612.

Deldar, K., Froutan, R., & Ebadi, A. (2018). Challenges Faced by Nurses in using Pain Assessment Scale in Patients Unable to Communicate: a Qualitative Study. *BMC nursing*, 17(1), 1-8. https://doi.org/10.1186/s12912-018-0281-3.

Erden, S., Demir, N., Ugras, G. A., Arslan, U., & Arslan, S. (2018). Vital signs: Valid Indicators to Assess Pain in Intensive Care Unit Patients? An Observational, Descriptive Study. *Nursing & health sciences*, 20(4), 502-508. DOI: 10.1111/nhs.12543.

Gélinas, C., & Arbour, C. (2009). Behavioral and Physiologic Indicators during a Nociceptive Procedure in Conscious and Unconscious Mechanically Ventilated Adults: Similar or Different? *Journal of critical care*, 24(4), 628-e7. doi:10.1016/j.jcrc.2009.01.013

Hinksman, C. A., Haylock, R. G., & Gillies, M. (2022). Cerebrovascular disease mortality after occupational radiation exposure among the UK National Registry for Radiation Workers Cohort.

Radiation Research, 197(5), 459-470. https://doi.org/10.1667/RADE-20-00204.1.

Honan, L., Bautista, C., & Esposito, C. (2018). Focus on Adult Health Medical-Surgical Nursing 2nd Ed. Wolters Kluwer Health | Lippincott Williams & Wilkins.

Kadhim, H. (2014). Evaluation of Nurses' Practices toward the Control of Patients' Complications at the Respiratory Care Unit in Baghdad Teaching Hospitals. *Iraqi National Journal of Nursing Specialties*, 1(27), 47-58. https://injns.uobaghdad.edu.iq/index.php/INJNS/article/download/193/182.

Kemp, H. I., Bantel, C., Gordon, F., Brett, S. J., Plan, Search, ... & Mahgoub, S. (2017). Pain Assessment in Intensive care (PAINT): an Observational Study of Physician-Documented Pain Assessment in 45 Intensive Care Units in the United Kingdom. *Anaesthesia*, 72(6), 737-748. https://doi.org/10.1111/anae.13786.

Khojeh, A., Sajjadi, M., & Ajam, H. (2018). The Effect of the Organized Auditory Stimulation with a Familiar Voice on Pain Intensity and Physiological Indices of Comatose Patients Admitted to the Intensive Care Unit. *Journal of Research in Medical and Dental Science*, 6(3), 69-77. DOI: 10.5455/jrmds.20186311

Kia, Z., Allahbakhshian, M., Ilkhani, M., Nasiri, M., & Allahbakhshian, A. (2021). Nurses' use of non-Pharmacological Pain Management Methods in Intensive Care Units: A Descriptive Cross-Sectional Study. *Complementary Therapies in Medicine*, 58, 102705. https://doi.org/10.1016/j.ctim.2021.102705.

Klein, C., Caumo, W., Gélinas, C., Patines, V., Pilger, T., Lopes, A., ... & Vieira, S. R. R. (2018). Validation of two pain assessment tools using a standardized nociceptive stimulation in critically ill adults. *Journal of Pain and Symptom Management*, 56(4), 594-601. https://doi.org/10.1016/j.jpainsymman.2018.06.014.

Kundu, R. N., Biswas, S., & Das, M. (2017). Mean arterial pressure classification: a better tool for statistical interpretation of blood pressure related risk covariates. *Cardiology and Angiology: An International Journal*, 6(1), 1-7. DOI: 10.9734/CA/2017/30255.

Liu, K. (2022). The Impact of Psychological Interventions Given to ICU Patients to Help with Pain Management. [Bachelor of Science in Nursing, Dominican University]. Dominican Scholar. https://doi.org/10.33015/dominican.edu/2022.NURS.ST.01.

Menekli, T., Dogan, R., & Yaprak, B. (2021). Pain Behaviors and Hemodynamic Parameters of Intubated and Sedatized Intensive Care Patients during Aspiration. Medicine, 10(3), 798-803. Doi: 10.5455/medscience.2021.02.063.

Morris, J. L., Bernard, F., Bérubé, M., Dubé, J. N., Houle, J., Laporta, D., ... & Gélinas, C. (2021). Determinants of Pain Assessment Documentation in Intensive Care Units. *Canadian Journal of Anesthesia/Journal canadien d'anesthésie*, 68(8), 1176-1184. https://doi.org/10.1007/s12630-021-02022-1.

Na'el K, A., & Mohammed, W. K. (2019). Nurses' Knowledge toward Care of Unconscious Adult Patients at Teaching Hospitals in Al-Hilla City. *Iraqi National Journal of Nursing Specialties*, 32(1). https://www.iasj.net/iasj/article/166928.

Oliveira, L. S., Macedo, M. P., Silva, S. A. M. D., Oliveira, A. P. D. F., & Santos, V. S. (2019). Pain Assessment in Critical Patients Using the Behavioral Pain Scale. *Brazilian Journal of Pain*. 2, 112-116. https://doi.org/10.5935/2595-0118.20190021.

Payen, J. F., Bru, O., Bosson, J. L., Lagrasta, A., Novel, E., Deschaux, I., ... & Jacquot, C. (2001). Assessing pain in critically ill sedated patients by

using a behavioral pain scale. Critical care medicine, 29(12), 2258-2263. DOI: 10.1097/00003246-200112000-00004

Salvadore, C. A. (2018). Implementation of the Critical Care Pain Observation Tool. [Master's Theses, Rhode Island College].. DOI: https://doi.org/10.28971/532018SC71.

Shaikh, N., Tahseen, S., Haq, Q. Z. U., Al-Ameri, G., Ganaw, A., Chanda, A., ... & Kazi, T. (2018). Acute pain management in intensive care patients: facts and figures. In Shallik, N. (Eds.) Pain management in special circumstances. (pp 60-76). London, England: BoD–Books on Demand. DOI: 10.5772/intechopen.78708.

Terkawi, A. S., Sullivan, M., Abolkhair, A., Al-Zhahrani, T., Terkawi, R. S., Alasfar, E. M. & Tsang, S. (2017). Development and Validation of Arabic Version of the Pain Catastrophizing Scale. *Saudi journal of anaesthesia*, 11(Suppl 1), S63. Doi: 10.4103/sja.SJA_130_17

Valério, A. F., Fernandes, K. D. S., Miranda, G., & Terra, F. D. S. (2019). Difficulties Faced by Nurses to Use Pain as the Fifth Vital Sign and the Mechanisms/Actions Adopted: An Integrative Review. Boston Residents Jobs Policy office, 2, 67-71.https://doi.org/10.5935/2595-0118.20190013.

Yamashita, A., Yamasaki, M., Matsuyama, H., & Amaya, F. (2017). Risk factors and prognosis of pain events during mechanical ventilation: a retrospective study. *Journal of Intensive Care*, 5(1), 1-7. DOI 10.1186/s40560-017-0212-5.