

Behavioral Pain Scale versus Critical Care Pain Observational Tool on Mechanically Ventilated Patient

Noha Mohamed El Sayed, Prof- Sahar Yassien, Dr. Dalia Ali Amin

Medical Surgical Nursing Department, Faculty of Nursing, Ain Shams University

Abstract

Background: Critically ill patients frequently experience both procedural pain and pain at rest. Untreated acute pain in adult ICU patients can lead to short- and long-term physiological and psychological complications such as postoperative myocardial infarction, insufficient sleep and posttraumatic stress disorder. **Aim:** This study was conducted to assess pain intensity for mechanically ventilated patient through: Applying Critical care Pain Observational Tool for mechanically ventilated patient, Applying Behavioral Pain Scale for mechanically ventilated patient and Compare between critical care observational tool and behavioral pain scale. **Method:** This study was conducted at surgical Intensive care Units at Ain Shams University Hospital. **Research Design:** A comparative, descriptive study utilized for the conduction of this study. **Sample:** A purposive sample of (80) patients in surgical intensive care unit at Ain Shams University Hospital. **Tools:** 1) Patient assessment record 2) Critical care pain observational tool 3) Behavioral pain scale. **Results:** The results of this study shows that, (62.5%) of them were males with mean age of 54 ± 12.30 years old. 68.8% had mechanical ventilation for the first time While 73.8% of them were on SIMV mode. Regarding internal consistency the critical care observational tool were more than the behavioral pain scale. Regarding inter rater reliability the critical care observational tool was (0.904). While the behavioral pain scale was (0.851). Regarding the inter rater reliability the critical care observational tool was (0.632), while the behavioral pain scale was (0.515). A significant positive correlation of pain score during procedure and 10 minutes after using both scales. at $r=0.387$ and 0.248. **Conclusion:** The current study concluded that, the Critical pain observation tool is more accurate than Behavioral pain scale due to: Internal consistency "Cronbach alpha", Inter-rater reliability "ICCs" and test-retest reliability "correlation coefficient" at critical pain observation higher than observational pain scale **Recommendations:** Developing a simplified and comprehensive booklet including guidelines about how to use and implement the behavioral pain scale and critical care pain observational tool in intensive care units.

Key words: critical care pain observational tool, Behavioral pain scale.

Introduction:

Pain is an unpleasant subjective and multidimensional experience related to actual or potential tissue damage, Intensive care unit (ICU)-admitted patients experience pain because of the painful interventions and routine daily care procedures, there are barriers to effective verbal communication in these patients such as decreased level of consciousness, endotracheal intubation, and mechanical ventilation, which are limiting factors for patient's self-report of pain, the inability to

report pain does not exclude the possibility of its existence (Gomarverdi, Seifrabiei & Nikooseresht, 2019).

Critically ill patients frequently experience both procedural pain and pain at rest. Chest tube removal, tracheal suctioning, wound care, turning and arterial line insertion have been shown to be the most painful procedures. Untreated acute pain in adult ICU patients can lead to short- and long-term physiological and psychological complications such as postoperative myocardial infarction, insufficient

sleep and posttraumatic stress disorder (Rijkenberg, Peter.& Voort,2016).

Practice guidelines recommend an individualized and goal directed pain management. This includes a systematic assessment of pain with a validated pain scale appropriate to the patient's level of consciousness (Baron & Binder ,2015)

Pain assessment in critically ill patients is a challenge due to mechanical ventilation, severe illness, administration of sedatives and analgesics or a decreased level of consciousness. When a patient's self-report is unachievable, validated behavioral pain scores are advised for the assessment of pain in this particular group of patients. Two independent systematic reviews compared the psychometric proportions of pain assessment scores for intensive care patients who are unable to self-report pain, The critical-care pain observation tool (CPOT) and behavioral pain scale (BPS) received the best scores in their quality assessments and both scores are recommended in recent clinical practice guidelines for the assessment of pain in nonverbal critically ill adult (Rijkenberg, Peter.& Voort,2016)

Accurate assessment is the basis for effective pain management. A patient's self-report is the gold standard for pain assessment, but the majority of critically ill patients cannot report the experience of pain because of unconsciousness, endotracheal intubation, and/or other factors. Patients' manifestations of pain include vocalizations, movement and mobility, facial expressions, and mood and behaviors, which are also commonly used as behavioral indicators to assess pain in nonverbal patients. Behavioral pain assessment tools, recommended by the American Society for Pain Management Nursing (ASPMN), may help recognize pain in patients unable to self-report (Liu, Li & Herr 2015)

Significance of the study:

The estimates of the World Health Organization (WHO) demonstrate that almost 83% of the world population lives in countries with poor or no access to pain management.

During ICU treatment, up to 40–70% of patients experience pain (moderate to severe). According to some authors, almost 30% of patients experience pain at rest and 50% during various nursing interventions. The majority of patients discharged from an ICU identify the pain experienced as a huge source of stress. Most of them are not able to self-assess their pain (verbally) due to consciousness-related changes and connection to mechanical ventilation (Seya, Gelders, Achara, et al., 2011).

In Egypt, the most recent incidence of patient on mechanical ventilator at 2017 according to El-demerdash Hospital statistical Department ,at surgical intensive care units were 506 patients who on mechanical ventilator admitted to general surgical ICU, neurosurgery ICU and emergency neurosurgery ICU, This study will assess pain intensity for mechanically ventilated patient and predict the most effective scale for assessing pain for mechanically ventilated patient.

Aim of the study:

The study aims to:

Assess pain intensity for mechanically ventilated patient through:

- Applying Critical care Pain Observational Tool for mechanically ventilated patient.
- Applying Behavioral Pain Scale for mechanically ventilated patient.
- Compare between critical care observational tool and behavioral pain scale.

Research question:

Which pain assessment scale is more effective in assessing pain for mechanically ventilated patient?

Subjects and Methods

A-Research design:

Comparative, Descriptive study was conducted to achieve the aim of this study.

B- Research Setting:

This study was conducted in surgical Intensive Care Unit at El demerdash Hospital affiliated to Ain Shams University.

C- Subjects:

A purposive sample of (80) patients in surgical intensive care units at EL demerdash Hospital.

Inclusion criteria:

- Adult patients from both genders.
- Intubated on mechanically ventilated patient
- Patients conscious level is not less than 8 according to GCS
- Willing to participate in the study by patient or his guard

D-Tools for data collection:

The study data was collected through the following tools:

I. Patient assessment record

It was developed by the researcher to assess the patient condition it includes:

A) The first part:

It was concerned with assessment of demographic data of the patient as (age, sex, and marital status).

B) The second part:

It concerned with present surgical history that involve surgical diagnosis: (such as brain, spinal cord, chest, abdominal and other surgeries), length of stay, first time on mechanical ventilation, recurrent place on mechanical ventilation, duration of mechanical ventilation, ventilator modes.

c) The third part: It was concerned with Physiological Parameters record that includes base line vital signs and conscious level by (glasco-coma scale).

Regarding scoring system:

The maximum GCS score is 10T and the minimum score is 2T. The total scores were categorized into two levels as follow: Eye open range from (4-1) (spontaneous opening = 4, opening to speech = 3, opening to pain =2 and

No response = 1). Motor response range from (6-1) (Obey command = 6, Localized to pain = 5, Withdraw to pain = 4, Decorticate = 3, Decerebrate = 2 and No response = 1).

D) Ventilator setting and parameters: it designed by the researcher to monitor and follow up the patient ventilator parameters on mechanical ventilation at one minute before, during and 10 minutes after painful.

II. Critical Care Pain Observation

Tool: it was a standardized tool used to assess the level of patient's comfort, and intensity of pain among critically ill mechanically ventilated patients. It has 4 sections, each with different behavioral categories first section is facial expression (relaxed or nature, tense, grimacing), second section is body movements, (absence of movement, protection, restlessness) third section is muscle tension (relaxed, rigid, very tense), and fourth section is compliance with the ventilator (tolerating ventilator, coughing but tolerating, fighting ventilator) Items in each section are scored from 0 to 2, with a possible total score ranging from 0 to 8 and pain was describe according to the score include no pain=0 mild pain ranging from 1-3, moderate pain ranging from 4-6 and severe pain ≥ 6 degree. it will be measured 1 minute before, during and after 10 minute of painful procedure.

Regarding scoring system:

Items in each subsection are scored from 0 to 2. The total score for critical care pain observational tool ranged from 0 (no pain) to 8 (the most pain) the total scores were categorized into three levels as follow:

- No pain = 0
- Mild pain = 1-3
- Moderate pain = 4 – 6 and
- Severe pain = > 6 score

III. Behavioral pain scale

It was a standard tool used to assess the level of patient's comfort, and intensity of pain among critically ill mechanically ventilated patients. It composed of 3 observational items (facial expressions, upper limbs, and compliance with ventilation) that are scored from 1 to 4, with higher numbers indicating higher levels of discomfort.

Scoring system:

Each subsection scored from 1 to 4, with higher numbers indicating higher levels of discomfort and pain was describe according to the score. The total score for Behavioral pain scale can range from 3 (no pain) to 12 (the most severe pain). The total scores were categorized into three levels:

- No pain =3
- Mild pain = 4- 6 ,
- Moderate pain = 7 – 9 and
- Severe pain = > 9 score

II. Operational design:

The operational design included preparatory phase, ethical considerations, validity and reliability, pilot study, field work and limitation of the study.

- Preparatory phase:

It included reviewing of relevant literature, and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and journals to develop data collection tools.

- Pilot study

A pilot study was conducted to test feasibility and applicability of the study tools used in this study. It was carried out on 10% of total study subjects (8 patients). Modifications on tools were done based after pilot study.

- Validity and reliability:

Testing validity by a plan and will expect in critical care nursing **Testing reliability** of proposed tools was done statistically by alpha Cronbach test for the following:

The critical pain observational tool = 0.89

The behavioral pain scale = 0.58

- Field work:

The sample of the study was recruited according to the inclusion criteria; the purpose

of the study was simply explained to the patient's guards who agreed to participate in the study prior to any data collection. The tools for data collection were filled in by the researcher. The patients' files were screened for eligibility. The patient name, age, sex, marital status, diagnosis, length of stay, duration of mechanical ventilation and first or second time on ventilation were all obtained from the file.

The baseline vital signs were obtained before measuring the two scales. The patient assessed for pain level, ventilator setting and parameters during turning procedure before, during and 10 minutes after procedure, assessed for pain level with wound dressing procedure before, during and 10 minutes after the procedure and assessed for pain level with blood pressure measuring procedure before, during and 10 minutes after the procedure with two scales the critical care pain observational tool and behavioral pain scale.

The researcher visited the study setting three days/week (Saturday, Tuesday and Thursday), the researcher filled the tools in the morning and afternoon shift. The actual fieldwork started and completed within six months from November 2018 to April 2019.

III. Administrative Design: An official letter was issued from the faculty of nursing Ain Shams University to the director of El-Demerdash hospital and the director of surgical intensive care units at El-Demerdash hospital at which the study was conducted, explaining the purpose of the study and requesting the permission for data collection from the study group.

IV. Statistical Design:

The collected data were organized, tabulated and analyzed using appropriate statistical significant tests. The data were collected and coded. Then, the data were analyzed with the program (the statistical package for social science) (SPSS) under windows version 25. Number and percentage for qualitative variable were done. Alpha Cronbach test was used to test reliability of tools. The interclass correlation used to test Inter-rater reliability of critical pain observation

and behavioral pain scale. Test of significance was used and regarding significance of the result, the observed differences and associations were considered as follows: **Probability (p-value)**

- Chi-square test (χ^2) was used in order to compare proportions between two qualitative parameters

- Correlation coefficient (r) test was used to test the relation between two quantitative variables

- The Friedman test is a non-parametric test for testing the difference between several related samples

- Non-significant (NS) $p > 0.05$

- Significant (S) $p < 0.05$

- Highly significant (HS) $p < 0.001$

Results

Table(1) Frequency and percentages distribution of the studied patients according to

Table (1): Frequency and percentages distribution of the studied patients according to their demographic characteristics (N=80)

Demographic Characteristics	N	%
Age		
20-<40	12	15
40-<60	38	47.5
60-65	30	37.5
Mean±SD	54±12.30	
Sex		
Male	50	62.5
Female	30	37.5
Marital Status		
Single	7	8.7
Married	38	47.5
Divorced	14	17.5
Widow	21	26.3

their demographic characteristics. The results revealed the mean age of the study sample was 54 ± 12.30 , 62.5 were males, and 47.5% were married

Table (2) shows that, 41.2% of the studied patients had abdominal surgery, 68.8% had mechanical ventilation for the first time. While about 72.5% of the studied patients were on mechanical for 1-3 days. Besides, 73.8% of them were on SIMV mode.

Table (3): Regarding internal consistency the critical care observational tool was (0.904) .while the behavioral pain scale was (0.851).

Table (4) Regarding inter rater reliability the critical care observational tool was (0.632) .while the behavioral pain scale was (0.515).

Table (5) Regarding the correlation of pain scores during painful procedure and 10m after procedure the Critical pain observation was (0.387).while the behavioral pain scale was (0.248).

Table (2): Frequency and percentage distribution of the studied patients according to their Present history (N=80)

Present history	N	%
Diagnosis		
Brain surgery	22	27.5
Spinal cord surgery	15	18.8
Chest surgery	4	5
Abdominal surgery	33	41.2
Others	6	7.5
Length of stay		
1-5 days	63	78.8
6-10 days	17	21.2
Mean±SD 3.9±2.66		
Mechanical ventilation		
First time on mechanical ventilation	55	68.8
Recurrent place on mechanical ventilation	25	31.2
Duration of mechanical ventilation		
1-3 days	58	72.5
4-6 days	22	27.5
Mean ±SD 2.5±1.62		
Ventilator modes		
CMV	3	3.8
A/C	5	6.2
SIMV	59	73.8
CPAP	13	16.2

Table (3): Internal consistency of critical pain observation and behavioral pain scale

Items	Critical pain observation	Behavioral pain scale
Cronbach's Alpha	.904	.851

Table (4): Inter-rater reliability of critical pain observation and behavioral pain scale.

Items	Critical pain observation	Behavioral pain scale
Intraclass Correlation (ICCs)		
At confidence interval 95%	.632	.515
P value	.000	.000

Table (5): Correlation of pain scores during painful procedure and 10m after procedure at Critical pain observation

Item	Pain score during painful procedure	
	Calculated R	P value
Pain score after procedure	0.387	.000**

Correlation of pain scores during painful procedure and 10m after procedure at Behavioral pain scale

Item	Pain score during painful procedure	
	Calculated R	P value
Pain score after procedure	0.248	.011*

Discussion

Concerning demographic characteristics of the studied patients, the result revealed that; about half of studied patients' age was range from (40-60) years and the mean age of them was 54 ± 12.30 . This finding was in agreement with a study done by **Gomarverdi, Seifrabiei & Nikooseresht (2019)** "Who study" Comparison of two pain scales: Behavioral pain scale and critical-care pain observation tool during invasive and noninvasive procedures in intensive care unit-admitted patients" and found that the sample age was ranged from 40-60 years with mean 50 ± 13.2 .

Regarding gender, the study result revealed that more than half of the studied patients' were males. This result supported by **Gomarverdi et al. (2019)** who found that more than half of the studied patients were males.

Regarding diagnosis the present study revealed that two fifths of studied patients were admitted for abdominal surgery. This finding was in agreement with a study done by **(Rafei, Ghadami, Irajpour & Feizi (2017)** entitled about " Validation of critical care pain observation tool in patients hospitalized in surgical wards" who found that, more than two third of studied patients' were admitted for abdominal surgery.

The present study revealed that more than two-thirds of the studied patients were at first time on mechanical ventilator. This finding was in agreement with a study done by **Williams (2018)** about" Duration of Mechanical Ventilation in an Adult Intensive Care Unit after Introduction of Sedation and Pain Scales" Who found that about two third of the studied patients were at first time on mechanical ventilator.

Regarding the duration of mechanical ventilation the present study revealed about three fourths of the studied patients stayed from 1-3 days on the mechanical ventilation this short duration may be due to the majority of patient in Surgical ICU was admitted in an acute condition after surgery, and weaned sooner after their stabilization. Besides, all effort has been

done to decrease stay on mechanical ventilation for the purpose of increase patient turn over in the university hospitals due to high patient flow rate.

This finding was in agreement with a study done by **Williams (2018)** who found that about two third of the studied patients left on mechanical ventilation from 1-3 days with a mean 2 ± 1.2 .

Regarding the Internal consistency of critical pain observation and behavioral pain scale, the study result revealed that, that the internal consistency of critical pain observation was.904, while the internal consistency of behavioral pain scale was.851. This high internal consistency provide evidence on the high efficiency of those scales in detecting pain and determine the pain level efficiently in mechanically ventilated ICU patient., with a superiority of Critical Pain Observation Tool over the Behavioral Pain Scale. This result was in agreement with a study done by **Liu et al. (2015)** who found that the internal consistency of critical pain observation was 0.795, while the internal consistency of behavioral pain scale was 0.791.

Regarding the Inter-rater reliability of critical pain observation and behavioral pain scale, the study result revealed that the inter-rater reliability of critical pain observation was 0.632, while inter-rater reliability of behavioral pain scale was 0.515.

This was the case in a study done by **Liu et al. (2015)** who found that that the inter-rater reliability of critical pain observation was 0.950, while inter-rater reliability of behavioral pain scale was 0.941.

Regarding the Correlation of pain scores during painful procedure and 10m after procedure at Critical pain observation, the study result revealed a middle correlation between pain score during painful procedure and 10m after procedure with highly significant at level 0.01, it might be due to the pain intensity was significantly change after 10 minutes when measured with critical care observational tool.

This result was in agreement with a study done by **Rafiei et al. (2017)** who found that the middle correlation between pain score during painful procedure and 10m after procedure was 0.369 with a highly significant at level 0.01.

Regarding the Correlation of pain scores during painful procedure and 10m after procedure at behavioral pain scale, the study result revealed that the middle correlation between pain score during painful procedure and 10m after procedure was 0.248 with highly significant at level 0.01, it might be due to the pain intensity was significantly changed when pain measured with behavioral pain scale.

This result was in agreement with a study done by **(Kotfis et al., 2018)** who found that the middle correlation between pain score during painful procedure and 10m after procedure was 0.167 with a highly significant at level 0.01.

Conclusion

Based on this study finding, it can be concluded that: The study revealed that, the Critical pain observation tool is more accurate than Behavioral pain scale due to: Inter consistency "Cronbach alpha", Inter-rater reliability "ICCs" and test-retest reliability "correlation coefficient" at critical pain observation higher than observational pain scale.

Recommendations

- Further studies are recommended to assess pain intensity of mechanically ventilated patient.

- Developing a simplified and comprehensive booklet including guidelines about how to use and implement the behavioral pain scale and critical care pain observational tool in intensive care units.

- Replication of the current study on large sample and different hospitals settings to be able to generalize the results.

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