



Comparison of Pain Score in Patients with Brain Disorders Using Care Pain Observation Tool (CPOT) and Nonverbal Pain Scale (NVPS)

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Abstract

Background: Traumatic brain injury (TBI) is one of the leading causes of death, which ranges from mild and irreversible to severe and life-threatening injuries.

Objectives: This study aimed to compare the pain score in patients with brain disorders using Care Pain Observation Tool (CPOT) and Nonverbal Pain Scale (NVPS).

Methods: A descriptive comparative study was performed in Ilam province, Iran, in a group of head trauma patients admitted to the intensive care unit who were intubated. One hundred twenty observations of nurses' practice were performed. A purposive sampling method was utilized. The CPOT and NVPS assessed the pain, and the Glasgow Coma Scale (GCS) assessed the state of consciousness. Data were analyzed by SPSS version 16 software.

Results: Patients' mean $\pm$ SD age was 38.45 ± 4.2 years. The mean $\pm$ SD pain score on the CPOT before the procedure was 0.39 ± 0.49 in the facial expression dimension, 0.56 ± 0.49 in activity, 0.54 ± 0.50 in muscle tension, and 0.55 ± 0.49 in compatibility with the ventilator. The mean $\pm$ SD pain score on the NVPS before the procedure was 0.97 ± 0.20 in facial expression dimension, 0.94 ± 0.49 in activity, 0.95 ± 0.31 in guarding, 0.64 ± 0.49 in vital signs, and 0.92 ± 0.53 in excitement.

Conclusions: Both CPOT and NVPS were effective in diagnosing patients' pain, but the CPOT was more appropriate for diagnosing pain in intubated patients.

Keywords: Brain Disorders, Care Pain Observation Tool, Nonverbal Pain Scales

1. Background

Traumatic brain injury (TBI) is one of the leading causes of death, which ranges from mild and irreversible to severe and life-threatening injuries. These traumas may be associated with traumatic cerebral hemorrhage, divided into primary and secondary types. In the primary type of hemorrhage, bleeding is observed in the first six hours after trauma, while in the secondary type, bleeding is observed in CT scans of patients after 6 hours of trauma (1-3). Traumatic brain injury can lead to long-term functional, cognitive, behavioral, and emotional disorders, affecting all aspects of a patient's daily life and causing many physical challenges. One of the challenges is the patient's hospitalization in the intensive care unit (ICU), where they may have endotracheal tube/tracheostomy while conscious (4, 5).

One of the challenges of nursing staff in the ICU is the accurate measurement of pain in patients, unconscious

or intubated. In order to properly assess the pain status of patients, nursing staff should use a valid and reliable scale. The lack of a proper pain assessment tool is an obstacle to pain management in inpatient wards, especially the ICU (6, 7). Compared to other members of the treatment team, nurses are in frequent contact with the patient and are closely involved in matters related to the patient; they are responsible for observing, interpreting, and informing other members of the treatment team and providing specialized and preventive care. For this reason, it is essential that this group of treatment staff, as one of the most vital members of the treatment team, have the necessary skills and ability to assess and evaluate patients' pain (8).

Proper pain management depends on a systematic and accurate pain assessment to guide the decision to titrate analgesics and prescribe medications if needed (9). Valid scales with authentic validity and reliability should be used to manage pain better. There are various scales for as-

sessing the pain of conscious patients, including the Visual Analogue Scale (VAS) and the Number Rating Scale (NRS). These tools are self-reported by the patient. Nevertheless, in unconscious patients, pain assessment depends on the skills of the medical staff, especially nurses, and the type and validity of the instrument. Behavioral Pain Scale, Critical Care Pain Observation Tool (CPOT), and Nonverbal Pain Scale (NVPS) are some of the tools used to assess pain in unconscious patients (10, 11).

The CPOT is a tool for determining the presence and severity of pain. It has been used in various studies in patients admitted to the ICU. It evaluates four parameters: Facial expression, body movements, mechanical ventilation tolerance rate, and muscle tone (12). The NVPS includes behavioral and physiological symptoms such as blood pressure, heart rate, and respiration rate, which are more comprehensive and pervasive in assessing pain than other pain monitoring instruments that include only behavioral symptoms (13).

2. Objectives

Due to the trauma and resulting injuries, paying special attention to these patients is necessary. Therefore, this study aimed to compare the pain score in patients with head trauma using CPOT and NVPS.

3. Methods

3.1. Study Design

A descriptive comparative study was performed in Ilam province, Iran, on a group of head trauma patients admitted to the ICU.

3.2. Study Population

We selected intubated patients with trauma admitted to the ICU of Imam Khomeini hospital in Ilam province, Iran, as the only referral center for trauma patients. One hundred twenty observations of nurses' practice were performed. A purposive sampling method was utilized.

3.3. Inclusion and Exclusion Criteria

3.3.1. Inclusion Criteria

Inclusion criteria for nurses included informed consent to participate in the study (written informed consent), bachelor's degree or higher education, and working in the morning, evening, and night shifts. Also, about the patient, inclusion criteria included patients with a decreased level of consciousness and hospitalization in the ICU, head trauma, inability to report pain for at least 24 hours, ability to respond to pain stimuli, age of 18 to 65 years, having an

intratracheal tube or tracheostomy tube, not using muscle relaxants, inability to self-report pain, GCS score between 5 and 8, and patient's legal consent to participate in the study.

3.3.2. Exclusion Criteria

Exclusion criteria for nurses included unwillingness to continue the study at any time during the research or receiving specialized training about research instruments during the research process. Exclusion criteria for patients included drug addiction, analgesic or narcotic drug use during the study, musculoskeletal dysfunction or quadriplegia, severe facial injuries, and failure to continue working with the patient (death, transfer, or dissatisfaction of legal guardians).

3.4. Data Gathering

A demographic form was used to assess the demographic status. The CPOT and NVPS assessed the patient's pain, and the Glasgow Coma Scale (GCS) assessed the patient's state of consciousness.

3.4.1. Demographic Characteristic

Nurses' demographics included age, gender, work experience, and education.

3.4.2. Critical Care Pain Observational Tool

This tool assesses patients' pain in the ICU at rest or when performing routine procedures. It has four dimensions to assess pain in patients unable to express it. Each dimension includes a group of different behaviors, such as facial expression, body movements, muscle tension, and adaptation to the ventilator. In this tool, the score of each dimension is 0 - 2 and the maximum score obtained is 8 on the scale; a higher score indicates more pain. The reliability of this tool was 0.77 in the study of Asadi Noghabi et al. in ICU patients, and its validity was confirmed by the content validity method (14).

3.4.3. Nonverbal Pain Scale

It is a tool for monitoring pain in intubated patients and sedative receivers by examining physiological aspects and behavioral symptoms. This scale includes behavioral and physiological indicators. In this study, a version of this instrument was used, which was revised by Tahmasbikouhpaie et al. and included the dimensions of facial expression, activity, guarding, vital signs, and excitement (15). The score of each dimension of this instrument is from 0 - 2, and the minimum and maximum acquired scores from all dimensions are between zero (minimum pain) and 10 (maximum pain) (16, 17). In the study of Tahmasbikouhpaie et al. on ICU patients, the content validity of the whole scale

was approved at 0.82 (15). The associations of all items with patients' pain were also confirmed (15).

3.4.4. Glasgow Coma Scale

This scale scores the patient's ability in three areas of visual responses (score 1 - 4), motor responses (score 1 - 6), and verbal responses (score 1 - 5). The overall score on the scale ranges from 3 to 15 (18).

3.5. Method of Research

After obtaining the code of ethics and presenting an introduction letter to the mentioned units, qualified nurses were included in the study by a purposive sampling method to evaluate patients' pain and teach them how to work with tools. The training method was face-to-face. Also, for better training, posters were used in inpatient wards to use observational tools for assessing pain. After teaching, the nurses were asked to apply and perform the instructions practically. The research process continued if the researchers approved the ability to work with the tool. The pain was measured by CPOT and NVPS in the presence of an independent evaluator (to prevent any errors in the research).

Before the study, the nursing staff was assured that the data would be reported as a whole and that the name of the nurses, wards, and other related items would not be disclosed. The CPOT and NVPS were completed by nurses in three stages before, during, and after each procedure. The patient's vital signs (blood pressure and pulse) were assessed by a company-made cardiorespiratory monitoring device, whose quality control had been done. In this study, the performance of nurses in assessing patients' pain was evaluated by performing 120 observations in the morning, evening, and night shifts on all weekdays and holidays.

3.6. Data Analysis

Data were analyzed by descriptive and analytical statistical tests, including mean, standard deviation, frequency distribution, independent *t*-test, paired *t*-test, and repeated measures analysis of variance using SPSS version 16 software.

4. Results

The patients' mean $\pm$ SD age was 38.45 ± 4.2 years. Also, the mean $\pm$ SD pain score on the CPOT was 0.39 ± 0.49 in facial expression, 0.56 ± 0.49 in activity, 0.54 ± 0.50 in muscle tensions, and 0.55 ± 0.49 in compatibility with ventilator (Table 1).

Table 2 shows that the mean $\pm$ SD pain score on the NVPS was 0.97 ± 0.20 in facial expression, 0.94 ± 0.49 in

activity, 0.95 ± 0.31 in guarding, 0.64 ± 0.49 in vital signs, and 0.92 ± 0.53 in excitement.

Table 3 shows that the correlation matrix among the items after the procedure was 115/120 for the CPOT and 104/120 for the NVPS.

Table 4 shows that the percentage of disagreement between raters for activity/body movements was 54/120 on the CPOT and 65/120 on the NVPS.

5. Discussion

This study aimed to compare the pain severity of head trauma patients using the CPOT and NVPS in patients with head trauma. Patients with brain disorders suffer much pain from injuries, and reducing pain in these patients requires the necessary diagnostic methods to determine the pain level in this group of patients. Pain may also exacerbate trauma-related cognitive processes and cause jactitation and disruption of the patient's sleep cycle by causing secondary damage (19, 20).

According to the findings, the mean $\pm$ SD pain score in patients before the procedure was 2.04 according to the CPOT and 4.42 according to the NVPS. In a study by Vazquez et al., who studied pain using CPOT in intubated patients admitted to the general ICU, the mean $\pm$ SD pain score in 330 observations made before the procedure was 0.27 ± 0.64 , during the procedure was 1.93 ± 1.41 , and after the procedure was 0.10 ± 0.37 (21). Also, in the study by Dale et al. in intubated patients admitted to the general ICU due to trauma, the mean $\pm$ SD pain score on the CPOT was 0.36 ± 0.65 at rest, 0.42 ± 0.62 in a gentle touch, 2.36 ± 1.47 in Toothette swabbing, 1.96 ± 1.37 in tooth brushing, and 2.44 ± 1.43 in oral suction (22).

According to the findings, the mean $\pm$ SD pain scores in the facial expression dimension were 0.97 ± 0.20 before the intervention, 1.89 ± 0.54 during the intervention, and 0.87 ± 0.57 after the intervention, while in the excitement dimension, the scores were 0.92 ± 0.53 before the intervention, 2.30 ± 0.64 during the intervention, and 1.26 ± 0.77 after the intervention. In the study by Heidarzadeh et al. in intubated patients admitted to trauma, internal, neurological, and surgical ICU, the mean $\pm$ SD pain scores in the facial expression were 0.08 ± 0.27 before the procedure and 1.20 ± 0.54 during the painful operation, confirming the increase in the pain score and the capability of the NVPS to detect it during the painful procedure (17). However, in Tahmasbikouhpaie et al.'s study, the facial expression score of ICU patients was 0.6 ± 0.61 before the intervention, 0.45 ± 1.72 during the intervention, and 0.49 ± 1.29 after the intervention; in the excitement dimension, the scores were 0.44 ± 0.26 before the intervention, 0.53 ± 1.2 during the intervention and 0.6 ± 0.74 after the intervention (15). One

Table 1. Comparison of Mean Pain Score Before, During, and After Suction Using Care Pain Observation Tool ^a

Item	Before	During	After	P
Facial expression	0.39 ± 0.49	1.34 ± 0.47	0.91 ± 0.27	0.000
Activity	0.56 ± 0.49	1.21 ± 0.41	0.86 ± 0.44	0.000
Muscle tensions	0.54 ± 0.50	1.06 ± 0.25	1.07 ± 0.56	0.000
Compatibility with ventilator	0.55 ± 0.49	1.20 ± 0.40	1.15 ± 0.57	0.000
Mean total	2.04	4.81	3.99	0.000

^a Values are expressed as mean ± SD.**Table 2.** Comparison of Mean Pain Score Before, During, and After Suction Using Nonverbal Pain Scale ^a

Item	Before	During	After	P
Facial expression	0.97 ± 0.20	1.89 ± 0.54	0.87 ± 0.57	0.000
Activity	0.94 ± 0.49	1.97 ± 0.57	0.49 ± 0.63	0.000
Guarding	0.95 ± 0.31	2.18 ± 0.51	0.50 ± 0.53	0.000
Vital signs	0.64 ± 0.49	0.84 ± 0.42	0.69 ± 0.49	0.000
Excitement	0.92 ± 0.53	2.30 ± 0.64	1.26 ± 0.77	0.000
Mean total	4.42	9.18	3.81	0.000

^a Values are expressed as mean ± SD.**Table 3.** Correlation Matrix Among Items of Care Pain Observation Tool and Nonverbal Pain Scale

Sequence	Care Pain Observation Tool	Nonverbal Pain Scale
Before	118/120	117/120
During	108/120	105/120
After	115/120	104/120

Table 4. Percentage of Disagreement Between Raters of 120 Subjects Jointly Observed

Sequence	Care Pain Observation Tool	Nonverbal Pain Scale
Face	26/120	25/120
Respiratory/compliance with ventilator	46/120	54/120
Guarding/muscle tension	30/120	39/120
Activity/body movements	54/120	65/120

of the reasons for the high mean pain scores in this study is the difference in the patient population. In the study of Tahmasbikouhpaie et al., patients admitted to the ICU were observed, while in this study, patients with brain disorders were studied (15). A high prevalence of pain has been reported in patients with a diagnosis of brain disorders, and most of these patients are admitted with a diagnosis of head trauma (23).

Pain management is essential, and it is necessary to

take measures to reduce it (24, 25). Patients suffering from trauma or hospitalized in the ICU need specialized services, so the necessary attention should be paid to them (26, 27).

5.1. Conclusions

Both the CPOT and NVPS were effective in diagnosing patients' pain, but the CPOT was more appropriate in diagnosing pain in intubated patients.

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Footnotes

Authors' Contribution: M. H. and K. H. conceived the study, performed data analysis, and wrote the manuscript. M. H. and K. H. collected data and wrote the manuscript. M. H. and K. H. interpreted the results and wrote the manuscript. M. H., B. S., and K. H. designed the study, wrote, and edited the manuscript.

Conflict of Interests: One of the authors (Khalil Komlakh) is a journal editorial board member.

Data Reproducibility: The dataset presented in the study is available on request from the corresponding author during submission or after publication.

Ethical Approval: The Ethics Committee of the Kermanshah University of Medical Sciences approved the study (IR.KUMS.REC.1401.214, link: ethics.research.ac.ir/EthicsProposalView.php?id=271465).

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