Original Article / Özgün Makale

# Evaluating the impact of positional changes on pain in stroke patients unable to communicate verbally in the intensive care unit

## Sözlü iletişim kuramayan yoğun bakım ünitesindeki inmeli hastalarda pozisyon değişiminin ağrıya etkisinin değerlendirilmesi

Esra Efe[1], Nurhan Doğan[2]

[1]Department of Anesthesia, Bandırma Training and Research Hospital, Balıkesir, Türkiye
[2]Department of Medical Nursing, Faculty of Health Sciences, Amasya University, Amasya, Türkiye

### ABSTRACT

**Background:** This study aims to determine the effect of position changes on pain in stroke patients who are unable to communicate verbally in the intensive care unit (ICU).

**Patients and Methods:** Between August 2021 and February 2022, a total of 129 stroke patients who were unable to communicate verbally in the ICU were included in this cross-sectional study. Data were collected using the Personal Information Form, Critical Care Observation Tool (CPOT), Behavioral Pain Scale (BPS), Motor Activity Assessment Scale (MAAS).

**Results:** Of a total of 129 patients included in the study, 56 were male and 73 were female with a mean age of 73.5±11.2 (range, 45 to 92) years. There was a significant difference in conditions such as heart rate, blood pressure, oxygen saturation value, changes in pupils, sweating, nausea-vomiting, and pallor-redness on the skin before, during, and after the position change ($p < 0.05$). In the multiple comparisons, the values before and after the intervention were lower than the values during the position change. There was a significant relationship between CPOT, BPS and MAAS in the study ($p < 0.05$).

**Conclusion:** Stroke patients in the ICU who are unable to communicate verbally experience pain associated with position changes, as evidenced by both behavioral responses and physiological alterations. In-service training programs should be organized for intensive care nurses to enhance their ability to recognize and evaluate pain-related behaviors.

**Keywords:** Critical Care Observation Tool, critical care pain assessment, Behavioral Pain Scale, intensive care unit, Motor Activity Assessment Scale, pain management, position change.

### ÖZ

**Amaç:** Bu çalışmada, yoğun bakım ünitesinde (YBÜ) sözlü olarak iletişim kuramayan inme hastalarında pozisyon değişikliklerinin ağrı üzerindeki etkisi belirlendi.

**Hastalar ve Yöntemler:** Ağustos 2021 - Şubat 2022 tarihleri arasında YBÜ'de takip edilen, sözlü iletişim kuramayan toplam 129 inme hastası bu kesitsel çalışmaya dahil edildi. Veriler Kişisel Bilgi Formu, Kritik Bakım Gözlem Aracı (CPOT), Davranışsal Ağrı Ölçeği (BPS) ve Motor Aktivite Değerlendirme Ölçeği (MAAS) kullanılarak toplandı.

**Bulgular:** Çalışmaya dahil edilen toplam 129 hastanın 56'sı erkek, 73'ü kadın olup, ortalama yaş 73.5±11.2 (dağılım, 45-92) yıl idi. Pozisyon değişimi öncesi, sırası ve sonrasında kalp atım hızı, kan basıncı, oksijen satürasyonu, pupilla değişiklikleri, terleme, bulantı-kusma ve ciltte solukluk/kızarıklık gibi durumlarda anlamlı farklılık saptandı ($p < 0.05$). Çoklu karşılaştırmalarda, müdahale öncesi ve sonrası değerlerin, pozisyon değişimi sırasındaki değerlere kıyasla daha düşük olduğu belirlendi. Çalışmada CPOT, BPS ve MAAS arasında anlamlı bir ilişki bulundu ($p < 0.05$).

**Sonuç:** Yoğun bakım ünitesinde sözlü iletişim kuramayan inme hastaları pozisyon değişikliklerine bağlı olarak hem davranışsal hem de fizyolojik değişikliklerle ortaya çıkan ağrı deneyimlemektedir. Yoğun bakım hemşirelerinin ağrıya ilişkin davranışları tanıma ve değerlendirme becerilerini artırmak amacıyla hizmet içi eğitim programlarının düzenlenmesi önerilmektedir.

**Anahtar sözcükler:** Kritik Bakım Gözlem Aracı, kritik bakım ağrı değerlendirmesi, Davranışsal Ağrı Ölçeği, yoğun bakım ünitesi, Motor Aktivite Değerlendirme Ölçeği, ağrı yönetimi, pozisyon değişimi.

Stroke is a condition which occurs as a result of the slowing or stopping of blood flow to the brain due to sudden occlusion or rupture of the vessels carrying blood to the brain.[1] Due to the motor, cognitive and sensory changes in stroke patients, physical, social and emotional functions are restricted and their

**Corresponding author:** Nurhan Doğan.
**E-mail:** nurhan_dogan38@hotmail.com
**Doi:** 10.5606/agri.2026.49

**Received:** June 01, 2025 | **Accepted:** December 14, 2025 | **Published online:** April 29, 2026

**Cite this article as:** Efe E, Doğan N. Evaluating the impact of positional changes on pain in stroke patients unable to communicate verbally in the intensive care unit. Agri 2026;38(2):96-110. doi: 10.5606/agri.2026.49.

satisfaction with life decreases.[2] Pain is another element that adversely impacts on the quality of life of stroked patients. According to the definition of the International Organization for the Study of Pain, pain is "an unpleasant sensory and emotional experience that accompanies existing or potential tissue damage".[3] Pain has been accepted as the fifth vital sign, and pain assessment is mandatory in patient care.[4]

Patients hospitalized in the intensive care unit (ICU) may not be able to verbally express their pain due to reasons such as being under the influence of sedative drugs, changes in their level of consciousness, and being connected to a respirator. It has been reported that individuals cannot explain the origin and intensity of their pain, and they experience moderate to severe uncontrollable pain.[5,6] The inability of patients treated in the ICU to express themselves verbally obligated nurses the responsibility of nurses to assess patients' pain.[5,7] When diagnosing pain in patients who are unable to communicate verbally, abnormal behavioral responses and physiological changes can be carefully evaluated and pain in the patient can be diagnosed. Even if patients are unable to communicate vocally, their bodies nonetheless show signs of pain through a variety of reactions.[5,7] If the motor functions of patients who cannot communicate verbally are full, it is recommended to use scales that can evaluate behavioral responses in pain measurement.[8]

Stroke individuals constitute some of the unable to communicate verbally patient groups treated in the ICU. In most stroke individuals, limitation of movement, brain fog or unconsciousness, and short or long-term bed dependence is observed.[9] Being dependent on the bed and being unable to move affects all body systems negatively and causes complications. To prevent the occurrence of complications or to reduce the complications, various care practices such as positioning or changing position, and mobilization are performed by the nurses.[10] Repositioning helps alleviate acute pain and prevents its onset by promoting blood flow and reducing muscle contractions and spasms.[11] In ICU patients, the goal is to mobilize secretions in the airways through position changes, increasing oxygenation, improving blood circulation, prevent pressure ulcers, and reduce the risk of ventilator-associated pneumonia.[12] According to studies performed on unable to communicate patients in the ICU, repositioning, which is among the non-invasive procedures, is one of the six most painful procedures (mechanical ventilation, tracheal aspiration, dressing, positioning, wound care, catheter removal).[6,13]

Position changes can lead to alterations in respiratory and hemodynamic parameters.[12] Untreated or undiagnosed pain can lead to serious complications and negatively affect the patient's overall condition. To illustrate, uncontrolled pain can cause physiological responses such as tachycardia, changes in the immune system, increased catecholamine release, and elevated oxygen consumption. Additionally, it can lead to prolonged mechanical ventilation, increased length of stay in the ICU, and consequently higher mortality rates. The most important step in preventing these adverse outcomes is to accurately measure pain using appropriate assessment tools. The most accurate approach to assessing pain is for patients to express the pain they themselves feel. However, many patients in ICU are unable to do so due to loss of consciousness, respiratory support, or sedative drugs.[6] Patients in the ICU who are unable to verbally express their pain may do so through behavioral responses such as writing, clenching their fists, altering their facial expressions, tightening their muscles, and performing aberrant body movements. Physiologically, changes such as heart rate, blood pressure, oxygen saturation, differences in pupils, and sweating can be seen. Since they cannot express their pain, pain measurement can be evaluated by measuring behavioral responses in these patients.[14] To ensure an accurate assessment of patients who are unable to express their pain, it is effective to use reliable and validated behavioral pain assessment tools.[15,16]

The Critical Care Observation Tool (CPOT) and Behavioral Pain Scale (BPS) demonstrate acceptable discriminant validity in distinguishing between non-nociceptive and nociceptive procedural pain.[6,17,18] Although CPOT and BPS have been used in various studies for pain assessment, there are no studies directly comparing the two scales in the same patient group.[6,16] The literature indicates that more studies are needed to evaluate behavioral responses according to the level of consciousness/unconsciousness and the type of stimulus in the same sample group.[19] Although there are studies on pain in the ICU in the literature, no study has been found in national and international literature on the effect of position change on pain in stroke patients who are unable to communicate verbally and on the relationship between CPOT, BPS, and Motor Activity Assessment Scale (MAAS).[5,7,13]

In the present study, we aimed to determine the changes in physiological and behavioral parameters before, during, and after position changes made to prevent complications in individuals with stroke diagnoses who were unable to communicate verbally and receiving treatment in the ICU, as well as the relationship between CPOT, BPS, and MAAS values.

## PATIENTS AND METHODS

This descriptive, cross-sectional study was conducted at Bandırma Training and Research Hospital's primary care Internal Medicine Intensive Care Unit, and its Secondary and Tertiary Care Intensive Care Units between August 16th, 2021 and February 16th, 2022. The study population consisted of those who were diagnosed with stroke and unable to communicate verbally in the primary internal medicine ICU, secondary and tertiary general ICUs. Initially, a total of 197 patients were screened. At ICU, where the study was conducted, pain assessment was performed every 4 hours using CPOT. Although the frequency of repositioning varied depending on the workload, repositioning was attempted every 2 hours. In our institution, there is no routine practice before or after repositioning. However, depending on the physician's order, analgesics are administered to some patients before repositioning. Inclusion criteria were as follows: age ≥ 18 years, hospitalized in the ICU with a diagnosis of stroke, unable to communicate verbally and not under sedation, individuals whose first-degree relatives have given consent for their participation in the study, those with a Glasgow Coma Scale (GCS) score below 8. Exclusion criteria were as follows: age below 18 years, individuals who were conscious or sedated, those with a GCS score of ≥ 9, those who were not diagnosed with stroke, and those whose relatives could not be contacted for consent. Accordingly, a total of 18 individuals for whom consent could not be obtained from their first-degree relatives, 26 conscious stroke patients, and 24 sedated patients were excluded. Finally, the study included a total of 129 individuals who met the inclusion criteria. A written informed consent was obtained from the first-degree relatives and/or legal representatives of the patients. The study protocol was approved by the Amasya University Ethics Committee for Non-Interventional Clinical Research Non-Interventional Clinical Research Ethics Committee (Date: 29.06.2021, No: 21452). The study was conducted in accordance with the principles of the Declaration of Helsinki.

**Data collection**

In the study, data were collected using the Personal Information Form, CPOT, BPS, MAAS, and Patient Follow-up Form, and Positioning Form.

*Personal information form*

The information form prepared by reviewing the literature involves demographic (age, sex, marital status, education level, number of children, occupation) and disease-related characteristics of individuals (diagnosis, chronic disease history, state of limitation, current catheters, length of stay in the ICU, place of arrival) and consists of 18 questions in total.[5,7,17] The information in the demographic form was filled in by obtaining information from patient files and patient relatives.

*Critical care observation tool*

It was first developed in Canada by Gèlinas et al.[17] to diagnose pain in ICU patients.[17] The form consists of four sub-dimensions, including facial expression, body movements, muscle tension, sounds made for extubated patients, or compliance with ventilation for intubated patients. Each of the sections is scored between 0-2. The total score ranges from 0 to 8 points. The individual's pain status is classified as pain-free (0), mild (0-3), moderate (3-6), or severe (6-8), and the individual's minimum and maximum pain is assessed based on the score obtained. The validity-reliability study of the form in our country was carried out by Gündogan et al.[20] in 2016 and the Cronbach's alpha coefficient was found to be 0.90-1.0. In this study, the Cronbach alpha coefficient of the scale was 0.88.

*Behavioral pain scale*

It was revised by Payen et al.[18] to determine the pain levels of ICU patients. The scale consists of three sub-dimensions: upper extremity movements, facial expression, and compliance with ventilation. Each sub-dimension contains four sub-items, and the scale consists of a total of 12 items. Each sub-dimension is scored between one (no response to pain) and four (complete response to pain). A minimum of three and a maximum of 12 points are obtained from the scale. The higher the score obtained, the higher the pain level. It is recommended that BPS be used in conjunction with the MAAS or the Ramsay Sedation Scale in patients who are sedated or unable to communicate verbally. In this study, it was used in conjunction with the MAAS. The Turkish adaptation of BPS was carried out by Vatansever and Eti Aslan.[21] The Cronbach's alpha coefficient was found to be 0.73-0.91. In this study, the Cronbach alpha coefficient of the scale was 0.81.

*Motor activity assessment scale*

It was developed by Devlin et al.[22] in 1999 to determine the level of agitation and sedation in patients treated in the ICU. It is a scale in which the agitation and sedation levels of the patients are diagnosed in seven sub-dimensions. It is used in ICU and mechanical ventilation to shorten the length of stay. The scale is evaluated between 0-6 points. "4-6 points indicate restless and agitated", "3 points calm and peaceful", "1-2 points indicate mild sedation and "0" points indicate that the patient is severely sedated". The higher the score the patients get on the scale, the higher the level of restlessness and agitation.[22] In this study, the Cronbach alpha coefficient of the scale was 0.81.

*Patient follow-up form and positioning form*

The form created by scanning literature is the form in which the physiological parameter changes caused by the positioning process are recorded.[5,7,17,18,20,22] The patient's pain levels are evaluated 1 min before the positioning procedure, during the position, and 10 min after the position. Physiological parameters and changes (blood pressure, pulse, respiratory rate, oxygen saturation, dilation of the pupils, sweating, nausea, vomiting, pale skin, redness) accompanied by pain are recorded.

**Statistical analysis**

As a result of the post-hoc power analysis, the power of the test was obtained as 99% with a 95% confidence interval (CI) (1-α) and d = 0.516 effect size. The study was completed with 129 patients.

Statistical analysis was performed using the IBM SPSS for Windows version 25.0 software (IBM Corp., Armonk, NY, USA). Normality was checked using normality tests and skewness and kurtosis values.[23] Descriptive data were presented in mean±standard deviation (SD), median (min-max) or number and

**Table 1.** Socio-demographic characteristics of individuals with strokes (n = 129)

| Characteristics | n | % |
|---|---|---|
| Sex | | |
| Female | 73 | 56.6 |
| Male | 56 | 43.4 |
| Age | | |
| 49 years and under | 5 | 3.9 |
| 50-59 | 9 | 7.0 |
| 60-69 | 23 | 17.8 |
| 70-79 | 52 | 40.3 |
| 80-89 | 36 | 27.9 |
| 90 years and older | 4 | 3.1 |
| Marital status | | |
| Married | 88 | 68.2 |
| Single | 41 | 31.8 |
| Education level | | |
| İlliterate | 22 | 17.1 |
| Literate | 23 | 17.8 |
| Primary school | 35 | 27.1 |
| Middle school | 8 | 6.2 |
| High school | 34 | 26.4 |
| University | 7 | 5.4 |
| ICU arrival location | | |
| Emergency service | 55 | 42.6 |
| Other services | 39 | 30.2 |
| From other ICU* | 25 | 19.4 |
| Outsourcing | 10 | 7.8 |
| Length of stay in ICU (days) | | |
| 1-10 | 67 | 51.9 |
| 11-20 | 48 | 37.2 |
| 21-30 | 14 | 10.9 |
| Analgesic use | | |
| There is | 70 | 54.3 |
| None | 59 | 45.7 |

| Characteristics | n | % |
|---|---|---|
| Frequency of analgesic use | | |
| Regular | 25 | 33.3 |
| In case of necessity | 50 | 66.7 |
| Pressure ulcer | | |
| There is | 82 | 63.6 |
| None | 47 | 36.4 |
| Intubation status | | |
| Intubation | 82 | 63.6 |
| Not intubated | 47 | 36.4 |
| Intubation form | | |
| Oral intubation | 76 | 92.7 |
| Tracheostomy | 6 | 7.3 |
| Existing catheters | | |
| CVP catheter | 23 | 17.8 |
| Arterial catheter | 7 | 5.5 |
| Urinary catheter | 99 | 76.7 |
| Chronic illness | | |
| Hypertension | 69 | 53.5 |
| Diabetes mellitus | 7 | 5.4 |
| Other** | 6 | 4.7 |
| No chronic illness | 1 | 0.8 |
| Operation status | | |
| There is | 25 | 19.4 |
| None | 104 | 80.6 |
| Physical restraint | | |
| There is | 56 | 43.4 |
| None | 73 | 56.6 |

ICU, intensive care unit; CVP, central venous pressure; *, cardiovascular surgery and coronary ICU etc. Medications used by the patients during hospitalization were taken from the patient file; **, allergic asthma, prostate, chronic obstructive pulmonary disease.

frequency, where applicable. Reliability analysis was performed to test whether the statements included in the scales were consistent with each other and whether all statements could measure the same item. The reliability of the scale was examined with the Cronbach's alpha. The Mann-Whitney U test was used for the comparison of two groups, while the Kruskal-Wallis H test was used for the comparison of more than two groups. A $p$ value of < 0.05 was considered statistically significant.

## RESULTS

Of a total of 129 patients included in the study, 56 were male and 73 were female with a mean age of 73.5±11.2 (range, 45 to 92) years. Of the unable to communicate verbally individuals with stroke who could not express their pain verbally, 42.6% came to the ICU from the emergency room, 37.2% stayed in the ICU for 11 to 20 days, 54.3% used analgesic medication, 63.6% of them had pressure sores, and 63.6% of them were intubated. Almost all of the patients had chronic diseases and 53.5% had a diagnosis of hypertension (Table 1).

For CPOT facial expression sub-dimension, 52.7% of the patients had a loose result, and the mean value was 0.63±0.74. For CPOT body movements (activity) sub-dimension, 53.5% of the patients were found to have no body movement, and the mean value was determined as 0.88±0.97. For CPOT ventilator compliance, 52.3% of the patients had harmony in the ventilator or movements and normal tone or inability to speak. The mean value was 0.70±0.82. For CPOT muscle tension sub-dimension, 56.6% of the patients were found to be lax, and the mean value was 0.47±0.57. The minimum value for CPOT total score was 0, the maximum value is 7, and the mean score was 2.68±2.74 (Table 2).

For the facial expression sub-dimension, 51.9% of the patients were found to be comfortable and the mean value was 1.85±1.09. In the upper extremities sub-dimension, 52.7% of the patients had no movement and the mean value was 1.54±0.65. For the ventilator compliance sub-dimension, 59.3% of the patients were found to be tolerant of ventilation and the mean value was 1.64±0.84. The minimum

**Table 2.** CPOT sub-dimension and total score averages of stroke individuals (n = 129)

| Pain indicators | n | % | Mean±SD | Min-Max |
|---|---|---|---|---|
| Facial expression | | | | |
| Loose, neutral | 68 | 52.7 | | |
| Nervous | 41 | 31.8 | 0.63±0.74 | 0-7 |
| Grimace | 20 | 15.5 | | |
| Body movements (activity) | | | | |
| Absence of body movement or normal position | 69 | 53.5 | | |
| Preservation | 6 | 4.7 | 0.88±0.97 | 0-7 |
| Restlessness / agitation | 54 | 41.8 | | |
| Ventilator compliance (in intubated patients) And or sounds (in extubated patients) | | | | |
| Adaptation to the ventilator and or movements | 67 | 52.3 | | |
| Speaking in a normal tone or unable to speak | 32 | 25.0 | | |
| Coughs but tolerates | 30 | 22.7 | 0.70±0.82 | 0-7 |
| Sigh, moan | - | - | | |
| Fighting the ventilator | - | - | | |
| Crying, sobbing | - | - | | |
| Muscle tension | | | | |
| Loose | 73 | 56.6 | | |
| Tense, rigid state | 51 | 39.5 | 0.47±0.57 | 0-7 |
| Extreme tension and stiffness | 5 | 3.9 | | |
| Total | | | 2.68±2.74 | 0-7 |

CPOT, Critical Care Observation tool, SD, standard deviation.

**Table 3.** BPS sub-dimensions and total score averages of stroke individuals (n = 129)

| Pain indicators | n | % | Mean±SD | Min-Max |
|---|---|---|---|---|
| Facial expression | | | | |
| Relaxed | 67 | 51.9 | 1.85±1.09 | 1-4 |
| Partially tense | 36 | 27.9 | | |
| Completely tense | 5 | 3.9 | | |
| Grimaces | 21 | 16.3 | | |
| Upper extremities | | | | |
| No movement | 68 | 52.7 | 1.54±0.65 | 1-4 |
| Partially bent | 54 | 41.8 | | |
| Fully flexed, fingers flexed | 5 | 3.9 | | |
| Permanent retraction | 2 | 1.6 | | |
| Compliance with ventilation | | | | |
| Tolerates ventilation | 48 | 59.3 | 1.64±0.84 | 1-3 |
| Coughs, but tolerates it most of the time | 15 | 17.2 | | |
| Fighting with a ventilator | 19 | 23.5 | | |
| Unable to control ventilation | - | - | | |
| Total | | | 4.41±1.94 | 2-9 |

BPS, Behavioral Pain Scale, SD, standard deviation.

value for the BPS total score was 2, the maximum value was 9, and the mean score was 4.41±1.94 (Table 3).

A total of 27.9% of the patients only responded to excessive stimulation. The mean MAAS total score was 2.47±2.06 (Table 4).

**Table 4.** MAAS score averages of stroke individuals (n = 129)

| Score | State | Explain | n | % | Mean±SD | Min-Max |
|---|---|---|---|---|---|---|
| 6 | Dangerous agitation | Pulls endotracheal tube and catheters, tries to get out of bed and struggles, attacks staff. | 5 | 3.9 | | |
| 5 | Agitate | ETT bites, does not calm down despite frequent verbal warnings, require physical examination | 30 | 23.3 | | |
| 4 | Restless and coopere | No warning is needed, the patient plays with the sheet or tube, undresses, obeys orders. | 18 | 14.0 | | |
| 3 | Calm and cooperative | There is no need for stimulation, the patient can purposefully straighten his/her coverings and clothes and obey orders | 4 | 3.1 | | |
| 2 | Touching or responding on behalf of | When touched or called by name, opens eyes or raises eyebrows or turns head to the side of the stimulus or moves limbs. | 9 | 7.0 | | |
| 1 | Only responds to overstimulation | Only with excessive stimulation does he open his eyes or raise his eyebrows or turn his head in the direction of the stimulus or move his limbs. | 36 | 27.9 | | |
| 0 | Unanswered | There is no response despite excessive stimulation. | 27 | 20.8 | | |
| | Total score | | | | 2.47±2.06 | 0-6 |

MAAS, Motor Activity Assessment Scale; SD, standard deviation; ETT, endotracheal tube.

**Table 5.** Average heart rate, blood pressure and respiratory rate according to the position change of stroke individuals (n = 129)

| | Before-position | During position | After position | Test value | |
|---|---|---|---|---|---|
| Variables | Mean±SD | Mean±SD | Mean±SD | Mean±SD | *p* |
| Pulse rate | 86.44±28.55 | 97.5±28.87 | 85.9±28.54 | 1383.892 | **< 0.001*** |
| Blood pressure | 121.69±27.18 | 132.53±27.18 | 120.23±28.56 | 136.569 | **< 0.001*** |
| Respiration rate | 17.15±5.10 | 19.15±5.06 | 17.09±5.11 | 3140.062 | **< 0.001*** |

SD, standard deviation. Bold indicates statistically significant values. Repeated Measures ANOVA.

There was a significant difference in heart rate, blood pressure, and respiratory rate before, during, and after the change of position of the individuals ($p < 0.05$). As a result of the multiple comparison test, the heart rate, blood pressure, and respiratory rate before and after the position were lower than the values during the position. The eta square value showed the part of the change in the dependent variable explained by the measurement time, and the change in the relevant measurement time was explained in 91.5% of the change in heart rate, 51.6% of the blood pressure, and 96,1% of the change in the respiratory rate (Table 5, Figure 1).

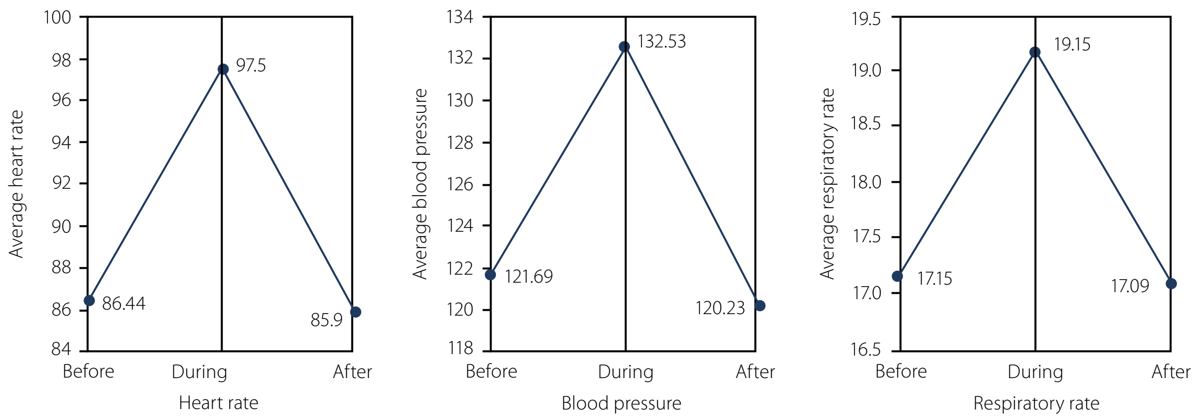


**Figure 1.** Vital signs observed before, during, and after position change.

**Table 6.** Some physiological variables according to the position change of stroke individuals (n = 129)

| | Before-position | | During position | | After position | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Physiological variables | n | % | n | % | n | % | Test value | *p* | Post-hoc |
| Pupil dilation | | | | | | | | | |
| There is | 21 | 16.3 | 98 | 76.0 | 17 | 13.2 | 137.429 | **< 0.001** | 2 > 1.3 |
| None | 108 | 83.7 | 31 | 24.0 | 112 | 86.8 | | | |
| Sweating | | | | | | | | | |
| There is | 22 | 17.1 | 114 | 88.4 | 14 | 10.9 | 174.792 | **< 0.001** | 2 > 1.3 |
| None | 107 | 82.9 | 15 | 11.6 | 115 | 89.1 | | | |
| Nausea, vomiting | | | | | | | | | |
| There is | 5 | 3.9 | 5 | 3.9 | 3 | 2.3 | 0.667 | 0.717 | |
| None | 124 | 96.1 | 124 | 96.1 | 126 | 97.7 | | | |
| Pallor/redness of the skin | | | | | | | | | |
| There is | 74 | 57.4 | 107 | 82.9 | 76 | 58.9 | 51.350 | **< 0.001** | 2 > 1.3 |
| None | 55 | 42.6 | 22 | 17.1 | 53 | 41.1 | | | |

Bold indicates statistically significant values. Repeated Measures ANOVA.

There was a significant difference between before position, during position, and after position values for pupil dilation, sweating, nausea vomiting and pallor/redness of the skin ($p < 0.05$). According to the multiple comparison test, the rate of dilation of the pupils during the position was 76.0%, while it was 16.3% before the position and 13.2% after the position. While sweating was 88.4% during the position, it was 17.1% before the position and 10.9% after the position. While pallor and redness of the skin were 82.9% during the position, it was 57.4% before the position and 58.9% after the position (Table 6, Figure 2).

In the CPOT body movements sub-dimension, married participants had higher scores than singles, and those without pressure sores had higher scores than those with pressure sores ($p < 0.05$). The CPOT facial expression, body movements, muscle tension sub-dimensions, and CPOT total scores showed a significant difference depending on the patient's length of stay in the ICU. Those staying for one to 10 days had higher scores than those staying longer in the ICU ($p < 0.05$). The CPOT facial expression, body movements, adaptation to the ventilator, muscle tension sub-dimensions and CPOT total scores showed a significant difference depending on whether the patient was intubated or not, and the scores of non-intubated patients were higher ($p < 0.05$). Patients who were subjected to physical restraint were higher than those who were not CPOT facial expression, body movements, adaptation to the ventilator, muscle tension sub-dimensions and CPOT total scores ($p < 0.05$, Table 7).

The BPS total score and that the scores of married individuals were higher than those of single individuals ($p < 0.05$). According to the multiple comparison test, the BPS upper extremity scores of those with a stay in the ICU of one to 10 days were higher than those with a stay in the ICU of 21 to 30 days ($p < 0.05$). The BPS upper extremity expression sub-dimension scores were higher in patients with pressure ulcers ($p < 0.05$). The BPS facial expression and BPS upper extremity expression sub-dimension scores showed a significant difference depending on whether the patient was intubated or not ($p < 0.05$). Patients who were subjected to physical restraint were higher than those who were not BPS facial expression, BPS upper extremity expression, BPS ventilator compliance sub-dimension and BPS total scores ($p < 0.05$). The MAAS score the individual the scores of non-intubated patients were higher

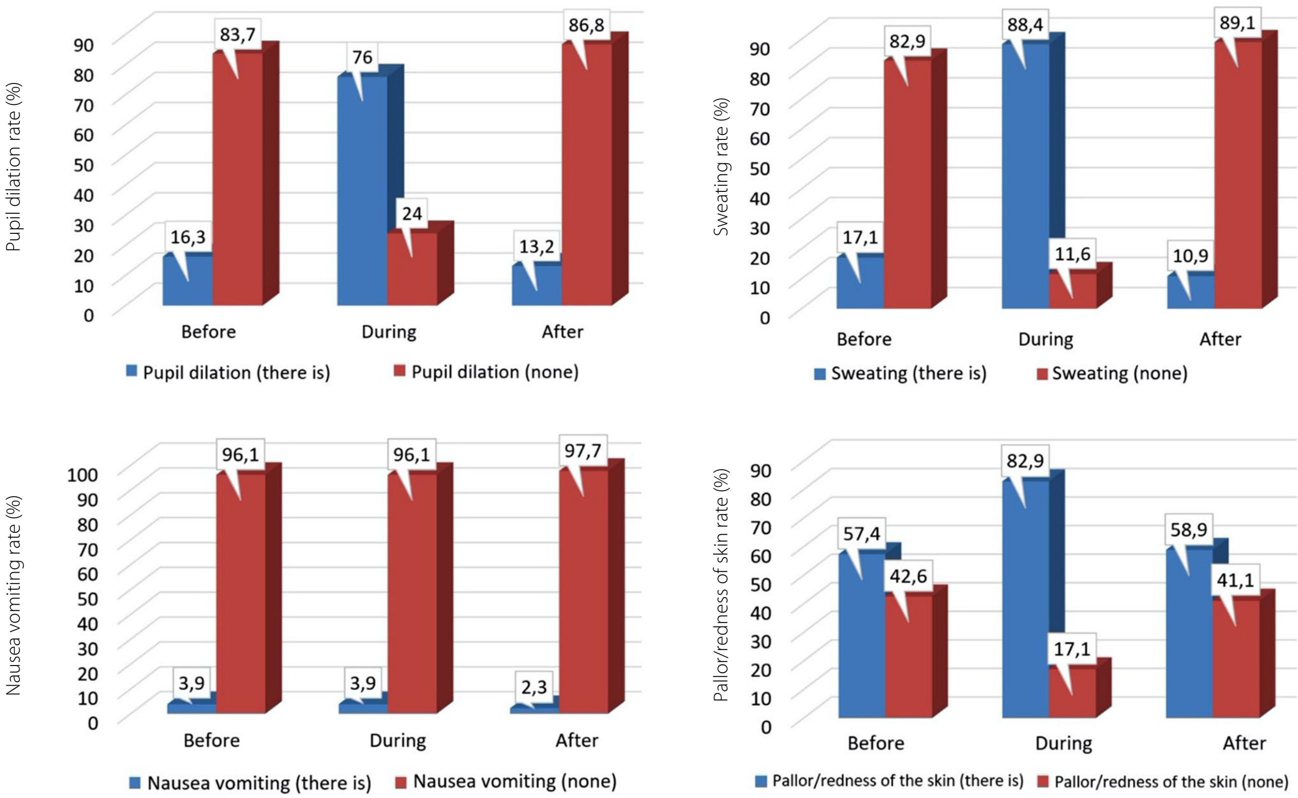


**Figure 2.** Physiological and autonomic symptoms observed before, during, and after position change.

**Table 7.** Comparison of CPOT and its sub-dimensions according to socio-demographic characteristics of stroke individuals (n = 129)

| | Facial expression | | Body movements | | Adaptation to ventilator | | Muscle tension | | CPOT | |
|---|---|---|---|---|---|---|---|---|---|---|
| Characteristics | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median |
| Sex | | | | | | | | | | |
| Female | 0.63±0.75 | 0.0 | 0.84±0.97 | 0.0 | 0.65±0.82 | 0.0 | 0.44±0.55 | 0.0 | 2.55±2.74 | 1.0 |
| Male | 0.63±0.73 | 0.0 | 0.95±0.98 | 0.5 | 0.77±0.81 | 1.0 | 0.52±0.6 | 0.0 | 2.86±2.72 | 2.5 |
| Test value† | 0.039 | | 0.648 | | –0.915 | | –0.699 | | –0.602 | |
| *p* value | 0.969 | | 0.517 | | 0.360 | | 0.484 | | 0.547 | |
| Marital status | | | | | | | | | | |
| Married | 0.68±0.75 | 1.0 | 1.02±0.97 | 1.0 | 0.75±0.81 | 1.0 | 0.52±0.59 | 0.0 | 2.97±2.74 | 3.0 |
| Single | 0.51±0.71 | 0.0 | 0.59±0.92 | 0.0 | 0.61±0.83 | 0.0 | 0.37±0.54 | 0.0 | 2.07±2.62 | 1.0 |
| Test value† | –1.264 | | –2.415 | | –1.032 | | –1.465 | | –1.505 | |
| *p* value | 0.206 | | **0.016*** | | 0.302 | | 0.143 | | 0.132 | |
| ICU arrival location | | | | | | | | | | |
| Emergency service | 0.56±0.71 | 0.0 | 0.8±0.95 | 0.0 | 0.58±0.79 | 0.0 | 0.38±0.56 | 0.0 | 2.33±2.61 | 1.0 |
| Other services | 0.59±0.68 | 0.0 | 0.9±0.99 | 0.0 | 0.74±0.79 | 1.0 | 0.56±0.6 | 1.0 | 2.79±2.64 | 3.0 |
| From other ICU* | 0.84±0.9 | 1.0 | 1.0±1.0 | 1.0 | 0.92±0.91 | 1.0 | 0.52±0.59 | 0.0 | 3.28±3.06 | 4.0 |
| Outsourcing | 0.6±0.7 | 5.0 | 1.0±1.05 | 1.0 | 0.67±0.87 | 0.0 | 0.5±0.53 | 0.50 | 2.7±2.91 | 2.0 |
| Test value‡ | 1.674 | | 0.866 | | 2.975 | | 2.899 | | 2.004 | |
| *p* value | 0.643 | | 0.834 | | 0.395 | | 0.407 | | 0.572 | |
| Length of stay in ICU (days) | | | | | | | | | | |
| 1-10 | 0.69±0.74 | 1.0 | 0.99±0.98 | 1.0 | 0.75±0.82 | 1.0 | 0.52±0.59 | 0.0 | 2.94±2.7 | 3.0 |
| 11-20 | 0.69±0.78 | 0.5 | 0.96±0.99 | 0.5 | 0.77±0.84 | 1.0 | 0.52±0.58 | 0.0 | 2.92±2.8 | 2.5 |
| 21-30 | 0.14±0.36 | 0.00 | 0.14±0.53 | 0.0 | 0.29±0.61 | 0.0 | 0.07±0.27 | 0.0 | 0.64±1.65 | 0.0 |
| Test value‡ | 7.096 | | 9.234 | | 4.333 | | 8.248 | | 8.961 | |
| *p* value | **0.029*** 1.2 > 3 | | **0.010*** 1.2 > 3 | | 0.115 | | **0.016*** 1.2 > 3 | | **0.011*** 1.2 > 3 | |
| Analgesic use | | | | | | | | | | |
| There is | 0.61±0.71 | 0.0 | 0.89±0.97 | 0.0 | 0.62±0.81 | 0.0 | 0.49±0.58 | 0.00 | 2.60±2.72 | 1.50 |
| None | 0.64±0.78 | 0.0 | 0.88±0.98 | 0.0 | 0.80±0.83 | 1.0 | 0.46±0.57 | 0.0 | 2.78±2.75 | 2.00 |
| Test value† | –0.039 | | –0.040 | | –1.270 | | –0.250 | | –0.744 | |
| *p* value | 0.969 | | 0.968 | | 0.204 | | 0.803 | | 0.457 | |
| Frequency of analgesic use | | | | | | | | | | |
| Regular | 0.61±0.71 | 1.0 | 0.89±0.97 | 1.0 | 0.62±0.81 | 1.0 | 0.49±0.58 | 0.0 | 2.6±2.72 | 4.5 |
| In case of necessity | 0.64±0.78 | 0.0 | 0.88±0.98 | 0.0 | 0.8±0.83 | 1.0 | 0.46±0.57 | 0.0 | 2.78±2.75 | 1.5 |
| Test value† | –0.904 | | –0.266 | | –1.805 | | –0.147 | | –0.819 | |
| *p* value | 0.366 | | 0.790 | | 0.071 | | 0.863 | | 0.413 | |
| Pressure ulcer | | | | | | | | | | |
| There's | 0.77±0.73 | 1.0 | 1.17±0.96 | 2.0 | 0.85±0.86 | 1.0 | 0.55±0.5 | 1.0 | 3.34±2.72 | 5.0 |
| None | 0.55±0.74 | 0.0 | 0.72±0.95 | 0.0 | 0.62±0.78 | 0.0 | 0.43±0.61 | 0.0 | 2.3±2.67 | 1.0 |
| Test value† | –1.821 | | –2.546 | | –1.523 | | –1.665 | | –1.796 | |
| *p* value | 0.069 | | **0.011*** | | 0.128 | | 0.096 | | 0.073 | |
| Intubation status | | | | | | | | | | |
| There is | 0.55±0.77 | 0.0 | 0.66±0.92 | 0.0 | 0.59±0.82 | 0.0 | 0.33±0.47 | 0.0 | 2.12±2.71 | 0.0 |
| None | 0.77±0.67 | 1.0 | 1.28±0.95 | 2.0 | 0.91±0.78 | 1.0 | 0.72±0.65 | 1.0 | 3.66±2.5 | 5.0 |
| Test value† | –2.081 | | –3.464 | | –2.443 | | –3.499 | | –3.132 | |
| *p* value | **0.037*** | | **0.001** | | **0.015*** | | **< 0.001*** | | **0.002*** | |
| Operation status | | | | | | | | | | |
| There is | 0.68±0.9 | 0.0 | 0.68±0.95 | 0.0 | 0.56±0.77 | 0.0 | 0.44±0.65 | 0.0 | 2.36±2.86 | 0.0 |
| None | 0.62±0.7 | 0.0 | 0.93±0.98 | 0.0 | 0.74±0.83 | 0.0 | 0.48±0.56 | 0.0 | 2.76±2.7 | 2.0 |
| Test value† | –0.026 | | –1.169 | | –0.960 | | –0.89 | | –0.758 | |
| *p* value | 0.979 | | 0.243 | | 0.337 | | 0.556 | | 0.449 | |
| Physical restraint | | | | | | | | | | |
| There is | 1.05±0.62 | 1.0 | 1.64±0.75 | 2.0 | 1.2±0.8 | 1.0 | 0.89±0.49 | 1.0 | 4.77±2.16 | 6.0 |
| None | 0.3±0.66 | 0.0 | 0.3±0.68 | 0.0 | 0.33±0.6 | 0.0 | 0.15±0.4 | 0.0 | 1.08±1.91 | 0.0 |
| Test value† | –6.408 | | –7.739 | | –5.991 | | –7.624 | | –7.430 | |
| *p* value | **< 0.001*** | | < 0.001* | | < 0.001* | | < 0.001* | | < 0.001* | |

CPOT, Critical Care Observation Tool; SD, standard deviation; ICU: Intensive Care Unit; †, Mann-Whitney U test; ‡, Kruskal-Wallis test; * Cardiovascular Surgery and Coronary Intensive Care Unit *vb.*
* $p < 0.05$.

**Table 8.** Comparison of MAAS, BPS and sub-dimensions according to sociodemographic characteristics of stroke individuals (n = 129)

| | Facial expression | | Upper limb expression | | BPS compliance | | BPS | | MAAS | |
|---|---|---|---|---|---|---|---|---|---|---|
| Characteristics | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median |
| Sex | | | | | | | | | | |
| Female | 1.73±0.99 | 1.0 | 1.52±0.58 | 1.0 | 1.58±0.85 | 1.0 | 4.18±1.86 | 4.0 | 2.27±1.96 | 1.0 |
| Male | 2.0±1.21 | 1.5 | 1.57±0.74 | 1.0 | 1.71±0.84 | 1.0 | 4.73±2.03 | 4.0 | 2.71±2.17 | 2.5 |
| Test value† | −0.989 | | −0.016 | | −0.855 | | −1.577 | | −1.122 | |
| *p* value | 0.323 | | 0.987 | | 0.392 | | 0.115 | | 0.262 | |
| Marital Status | | | | | | | | | | |
| Married | 1.94±1.15 | 2.0 | 1.6±0.69 | 2.0 | 1.71±0.86 | 1.0 | 4.67±2.03 | 4.0 | 2.69±2.09 | 2.5 |
| Single | 1.63±0.94 | 1.0 | 1.41±0.55 | 2.1 | 1.48±0.79 | 1.0 | 3.88±1.66 | 3.0 | 1.98±1.93 | |
| Test value† | −1.355 | | −1.403 | | −1.149 | | −2.206 | | −1.655 | |
| *p* value | 0.182 | | 0.161 | | 0.251 | | **0.027*** | | 0.098 | |
| ICU arrival location | | | | | | | | | | |
| Emergency service | 1.65±0.99 | 1.0 | 1.56±0.74 | 2.0 | 1.63±0.84 | 2.0 | 4.4±1.88 | 1.5 | 2.4±2.07 | 1.0 |
| Other services | 1.82±1.0 | 1.0 | 1.49±0.56 | 1.0 | 1.75±0.85 | 2.0 | 4.21±1.79 | 1.5 | 2.51±1.96 | 2.0 |
| From other ICU* | 2.2±1.29 | 1.0 | 1.56±0.58 | 1.50 | 1.67±0.9 | 1.0 | 4.76±2.3 | 1.0 | 2.56±2.08 | 2.0 |
| Outsourcing | 2.1±1.37 | 4.0 | 1.6±0.7 | 4.0 | 1.33±0.82 | 4.0 | 4.5±2.12 | 3.50 | 2.4±2.59 | 2.0 |
| Test value‡ | 3.662 | | 0.315 | | 1.505 | | 0.616 | | 0.452 | |
| *p* value | 0.300 | | 0.957 | | 0.681 | | 0.893 | | 0.929 | |
| Length of stay in ICU (days) | | | | | | | | | | |
| 1-10 | 1.96±1.13 | 2.0 | 1.6±0.60 | 2.0 | 1.66±0.88 | 1.0 | 4.49±1.98 | 4.0 | 2.54±2.06 | 2.0 |
| 11-20 | 1.79±1.03 | 1.0 | 1.58±0.74 | 1.0 | 1.74±0.86 | 1.0 | 4.5±1.92 | 4.0 | 2.63±2.01 | 2.0 |
| 21-30 | 1.5±1.09 | 1.0 | 1.14±0.36 | 1.0 | 1.33±0.65 | 1.0 | 3.79±1.89 | 3.0 | 1.57±2.14 | 1.0 |
| Test value‡ | 3.621 | | 7.119 | | 2.075 | | 2.661 | | 3.351 | |
| *p* value | 0.164 | | **0.028*** 1 > 3 | | 0.354 | | 0.264 | | 0.187 | |
| Analgesic use | | | | | | | | | | |
| There is | 1.97±1.18 | 2.0 | 1.53±0.6 | 1.0 | 1.57±0.83 | 1.0 | 4.53±1.3 | 4.0 | 2.37±2.08 | 1.0 |
| None | 1.69±0.97 | 1.0 | 1.56±0.70 | 1.0 | 1.74±0.85 | 1.0 | 4.29±1.97 | 4.0 | 2.58±2.04 | 2.0 |
| Test value† | −1.178 | | −0.021 | | −1.062 | | −0.708 | | −0.443 | |
| *p* value | 0.239 | | 0.983 | | 0.288 | | 0.479 | | 0.658 | |
| Frequency of analgesic use | | | | | | | | | | |
| Regular | 1.97±1.18 | 2.0 | 1.53±0.61 | 2.0 | 1.57±0.83 | 2.0 | 4.53±1.93 | 4.0 | 2.37±2.08 | 2.0 |
| In case of necessity | 1.69±0.97 | 1.5 | 1.56±0.7 | 1.0 | 1.74±0.85 | 1.0 | 4.29±1.97 | 4.0 | 2.58±2.04 | 1.0 |
| Test value† | −0.314 | | −0.656 | | −2.007 | | −0.997 | | −0.846 | |
| *p* value | 0.753 | | 0.512 | | 0.045* | | 0.319 | | 0.398 | |
| Pressure ulcer | | | | | | | | | | |
| There is | 1.94±1.03 | 2 | 1.72±0.62 | 2.0 | 1.79±0.94 | 2.0 | 4.77±2.0 | 4.0 | 2.83±2.11 | 4.0 |
| None | 1.79±1.13 | 1.0 | 1.44±0.65 | 1.0 | 1.56±0.78 | 1.0 | 4.22±1.9 | 3.0 | 2.26±2.01 | 1.0 |
| Test value† | −1.396 | | −2.851 | | −1.002 | | −1.698 | | −1.381 | |
| *p* value | 0.163 | | **0.004*** | | 0.316 | | 0.090 | | 0.167 | |
| Intubation status | | | | | | | | | | |
| Intubation | 1.6±0.98 | 1.0 | 1.39±0.56 | 1.0 | 1.64±0.84 | 1.0 | 4.61±2.08 | 3.0 | 2.10±2.13 | 1.0 |
| Not intubated | 2.28±1.16 | 2.0 | 1.81±0.71 | 2.0 | | | 4.09±1.65 | 4.0 | 3.11±1.77 | 4.0 |
| Test value† | −3.784 | | −3.565 | | - | | −0.824 | | −2.007 | |
| *p* value | **< 0.001*** | | **< 0.001*** | | - | | 0.410 | | **0.003*** | |

**Table 8.** Continued

| | Facial expression | | Upper limb expression | | BPS compliance | | BPS | | MAAS | |
|---|---|---|---|---|---|---|---|---|---|---|
| Characteristics | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median | Mean±SD | Median |
| Operation status | | | | | | | | | | |
| There is | 1.72±1.02 | 1.0 | 1.48±0.59 | 1.0 | 1.6±0.82 | 1.0 | 4.48±1.73 | 4.0 | 2.12±2.15 | 1.02 |
| None | 1.88±1.11 | 1.0 | 1.56±0.67 | 1.0 | 1.66±0.85 | 1.0 | 4.4±2.0 | 4.0 | 2.55±2.04 | 2.0 |
| Test value† | −0.571 | | −0.418 | | −0.199 | | −0.606 | | −0.879 | |
| *p* value | 0.568 | | 0.676 | | 0.842 | | 0.545 | | 0.380 | |
| Physical restraint | | | | | | | | | | |
| There is | 2.52±1.1 | 2.0 | 2.0±0.57 | 2.0 | 2.26±0.9 | 3.0 | 3.51±1.37 | 1.0 | 3.75±1.75 | 4.0 |
| None | 1.33±0.76 | 1.0 | 1.19±0.46 | 1.0 | 1.33±0.61 | 1.0 | | | 1.48±1.71 | 1.0 |
| Test value† | - | | - | | - | | −6.567 | | −5.847 | |
| *p* value | - | | - | | - | | **< 0.001*** | | < 0.001* | |

MAAS, Motor Activity Assessment Scale; BPS, Behavioral Pain Scale; SD, standard deviation, ICU, intensive care unit; † Mann-Whitney U test; ‡ Kruskal-Wallis test; * Cardiovascular Surgery and Coronary Intensive Care Unit *vb.* * $p < 0.05$.

**Table 9.** Relationship between CPOT, BPS and MAAS scales (n = 129)

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | CPOT face expression | 1.000 | | | | | | | | | |
| 2. | CPOT body movements | 0.823* | 1.000 | | | | | | | | |
| 3. | CPOT ventilator adaptation | 0.603* | 0.708* | 1.000 | | | | | | | |
| 4. | CPOT muscle tension | 0.822* | 0.857* | 0.633* | 1.000 | | | | | | |
| 5. | CPOT | 0.886* | 0.907* | 0.855* | 0.868* | 1.000 | | | | | |
| 6. | BPS face expression | 0.826* | 0.780* | 0.654* | 0.826* | 0.830* | 1.000 | | | | |
| 7. | BPS upper limb | 0.732* | 0.861* | 0.591* | 0.762* | 0.788* | 0.726* | 1.000 | | | |
| 8. | BPS ventilator adaptation | 0.731* | 0.724* | 0.869* | 0.726* | 0.877* | 0.793* | 0.656* | 1.000 | | |
| 9. | BPS | 0.799* | 0.768* | 0.669* | 0.764* | 0.825* | 0.843* | 0.759* | 0.908* | 1.000 | |
| 10. | MAAS | 0.675* | 0.752* | 0.667* | 0.691* | 0.774* | 0.708* | 0.703* | 0.744* | 0.688* | 1.000 |

CPOT, critical care observation tool; BPS, behavioral pain scale; MAAS, motor activity assessment scale, Pearson correlation; * $p < 0.01$. Correlation coefficients were expressed as (0.00-0.20 very poor, 0.21-jw0.40 poor, 0.41-0.60 moderate, 0.61-0.80 good and 0.81 and above excellent).

($p < 0.05$). The MAAS score of patients who were subjected to physical restraint was higher than those who were not ($p < 0.05$, Table 8).

There was a significant relationship between CPOT, BPS and MAAS ($p < 0.05$, Table 9).

## DISCUSSION

In the present study, we determined the changes in physiological and behavioral parameters before, during, and after position changes made to prevent complications in individuals with stroke diagnoses who were unable to communicate verbally and receiving treatment in the ICU. Since stroke patients are unable to communicate verbally during the ICU stay and express their pain, physiological symptoms and pain behaviors gain importance in pain assessment.[6,8,13,14,17,19,20,24] Facial expression assessment used in the clinical care observation tool was found to be highly correlated with behavioral pain and motor activity in the study. In line with the study results obtained, nociceptive stimuli caused changes in facial expressions.[24] In previous studies, facial grimacing has been reported as the most common pain behavior.[25] In our study, we also found that 31.8% of individuals frowned as a sign of tension and 15.5% as a sign of pain. Based on these findings, we can speculate that the facial expression of the patient is an important indicator of pain, and that the patient's face should be carefully observed while performing the procedure.

Patients treated in the ICU may exhibit pain behaviors such as facial tension, fist clenching, frowning, startle, groaning, coughing, endotracheal tube pulling, kicking, twisting, bending the feet towards the abdomen, or staying still.[13,14,19,20] In the study, the pain observation scores of non-intubated patients in the ICU were significantly higher. Intubated patients attempt to indicate that they are in pain by clenching their fists, pulling their legs toward their stomachs, and trying to pull out the tube.[6,11] The individuals in the study were unable to exhibit physical responses such as arm-leg pulling or tube pulling due to their history of stroke. It was found that 53.5% of the patients had no body movement. The study differs from literature due to the physical limitations caused by strokes in these individuals.

The likelihood of patients experiencing pain during position changes increased with the length of their ICU stay.[15,16] Those who stayed in ICU for one to 10 days had higher BPS upper extremity scores than those who stayed for 21 to 30 days. Patients who stayed in the ICU for one to 10 days had higher CPOT facial expression, body movements, muscle tension sub-dimensions, and CPOT total scores compared to patients who stayed in the ICU for a longer period. The incidence of early-stage pressure ulcers and associated pain was higher in ICU patients who were bedridden for long periods of time compared to other patients. The formation of pressure ulcers and immobility lead to sensitization of the skin which, in turn, increases the likelihood of pain when moving.[26] In the study, BPS upper extremity was high in patients with pressure ulcers, and BPS and MAAS were high in physically restricted patients. Physical restraint was used on patients who were mobile, agitated, and harmful to themselves and their surroundings. Individuals with excessive pain behaviors may struggle with the ventilator, move their extremities, pull out the endotracheal tube, or remove intravenous catheters, among other unconscious actions.[27] These observations may help shape care and therapeutic approaches that decrease the reliance on physical restraints in ICU.

In the current study, the body movements assessment used in the clinical care observation tool was highly correlated with behavioral and motor activity. The significant relationship between the scales used in the study is similar to the literature.[28,29] The CPOT ventilator compliance sub-dimension complies with all dimensions of BPS and MAAS. We can interpret this situation as individuals expressing their pain behaviorally and using CPOT, MAAS, and BPS together in measuring pain behaviors of individuals are effective in achieving more precise results. In the present study, there was a significant relationship between the CPOT muscle tension sub-dimension and all sub-dimensions of BPS and MAAS. In most of the studies, it has been reported that patients who are unable to communicate verbally express their pain through facial expressions and movements of the eyes, hands, arms, and legs.[19,29,30]

In the pain algorithm recommended in clinical guidelines, nurses are advised to assess pain regularly and systematically using valid pain assessment tools and to manage pain based on these assessments.[16] Based on this information, the MAAS, CPOT, and BPS were used together in the study. In the study, a significant relationship was determined between CPOT and BPS sub-dimensions and MAAS, while a strong relationship was observed between CPOT and BPS. In a study conducted by Rijkenberg et al.[31] with 68 patients who could not communicate with and connected to mechanical ventilators, the scales used together with the BPS and CPOT were valid and reliable and were compatible with each other. Individuals in the scales show compliance with muscle tension, facial expressions, and extremity movements.

In the study, a significant, positive, and high-level relationship was determined between MAAS and BPS and all its sub-dimensions. In the study of Payen et al.[18] in which they used BPS to determine the pain of inpatients in the ICU, there was a negative correlation with the Ramsey pain scale score. This study indicates that as the sedation rate increases, the BPS score decreases. Since the individuals included in our study did not receive sedation, it can be speculated that MAAS and BPS have a positive and high-level relationship in all sub-dimensions.

In assessing pain, pain assessment tools should be used in conjunction with physiological parameters.[19] During ICU procedures, behaviors such as jaw clenching, teeth grinding, frowning, closing the eyes, facial grimacing, blushing, and muscle stiffness were observed more frequently than before and after the procedure. Among physiological responses, significant increases in systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, and respiratory rate were reported.[19] It has been specifically reported that changes in physiological indicators such as heart rate, blood pressure, respiration, sweating, pupillary reflexes, and redness on the skin during the painful procedure are significant markers in the detection of pain in patients hospitalized in the ICU who cannot express their pain verbally.[11,32] In the present study, the heart rate of the individuals during the change of position was significantly higher than before and after the position. Rijkenberg et al.[31] in a study with 68 patients showed a two-point increase in both BPS and CPOT during painful procedures compared to before and after the position. Pain is a trigger for stress response, stimulating the sympathetic nervous system and inflammatory cells. This activation can adversely affect both the cardiovascular and respiratory systems.[19] In this study, the significant difference in heart rate during positioning may be associated with the individual's feeling of pain. Even if they are unable to communicate verbally, individuals do not lose their sense of pain and can exhibit their pain with physiological symptoms. Heart rate is one of the physiological responses of the body to the sensation of pain. Effective pain management requires accurate identification of pain. Proper assessment is essential to improve the quality of pain control.

When individuals are excited, stress and in pain, their breathing accelerates, and their blood pressure rises.[19,33] In the current study, there was a significant increase in respiratory rate and blood pressure during the position change of the individuals. In the study of Zaybak and Güneş,[34] the respiratory rate reached the highest-level during position change. As a result of the literature review, the frequency of breathing increased in parallel with the severity of pain and decreased again after the procedure was completed.[35]

In the study, the dilation of the pupils during the position was higher than before and after the position. A relationship between pupil dilation and pain has been observed in the literature; this is one of the symptoms of sympathetic activity as a result of pain.[36] Pain stimulates the sympathetic nervous system and causes sweating, nausea, and vomiting.[36,37] The increase in sweating to 88.4% during positioning is thought to be caused by pain. In the study, skin pallor and redness were 82.9% during the position, while it was 57.4% before the position and 58.9% after the position. Paraplegic and quadriplegic patients may not always perceive discomfort or pressure-related pain due to sensory impairment; however, this does not eliminate the need for regular repositioning. Since these patients are unable to change position independently, they are at increased risk of impaired circulation and pressure-related complications.[31] Therefore, routine position changes remain essential for maintaining adequate tissue perfusion and preventing secondary complications. During the positioning process, an increase in heart rate, blood pressure, respiratory rate, decrease in oxygen saturation, dilation of pupils, pallor, and redness of the skin is important in the evaluation of pain. It is thought that vital signs are affected as a result of increased sympathetic activity, moving the patient during positioning, and stress.[19,33,37] Study findings also support the literature.

The unique aspect of this study is the detailed analysis of physiological and behavioral parameters before, during, and after position change using a combined and comparative application of the CPOT, BPS, and MAAS scales. This study provides an important and original contribution to the literature on pain assessment and management in stroke patients who are unable to communicate verbally while receiving treatment in the ICU.

No studies were found in the national or international literature that specifically examine the effect of position changes on pain in stroke patients who are unable to communicate verbally in the ICU. The investigation of the relationships between BPS, CPOT, and MAAS, as well as the evaluation of pain-related physiological parameters, represents a novel contribution of this study. This study is critical in demonstrating changes in pain perception associated with position changes in ICU-treated stroke patients. It is also expected to inform the planning and delivery of nursing care aimed at reducing pain severity. By contributing to the existing body of literature, the study may serve as a reference for future research in this field.

Nonetheless, there are several limitations to this study that should be acknowledged. The study was conducted in a single center and a district hospital, which constitutes a limitation. In addition, inclusion and exclusion criteria were not based on sensory-motor deficits in patients with stroke, which may have introduced variability in the assessments. Another limitation is the inclusion of patients with a GCS score below 8 who were not intubated. Since intubation status may influence patients' ability to express pain and exhibit behavioral responses, the inclusion of non-intubated patients with low GCS scores may have reduced the homogeneity of the sample and affected the sensitivity of pain assessment tools, as well as the generalizability of the findings. Furthermore, patients receiving analgesic treatment were not analyzed as a separate subgroup. This may have limited the ability to identify treatment-related differences affecting pain responses. Future studies are recommended to perform subgroup analyses considering the type, dose, and timing of analgesic administration, and to ensure more homogeneous patient grouping, particularly with regard to intubation status.

In conclusion, our study results demonstrated that stroke patients in the ICU who were unable to communicate verbally experienced pain associated with position changes, as evidenced by both behavioral responses and physiological alterations. A significant relationship was observed among the CPOT, BPS, and MAAS scores. In addition, changes were detected in heart rate, blood pressure, respiratory rate, pupil dilation, sweating, and skin color (pallor/redness) before, during, and after repositioning. In line with these findings, we recommend that treatment and care protocols should be developed to minimize pain during positioning procedures. Frequent and systematic pain assessment is essential in ICU patients who are unable to verbalize their pain. The use of validated assessment scales, along with appropriate pharmacological and non-pharmacological interventions based on assessment outcomes, is strongly recommended. Furthermore, in-service training programs should be organized for intensive care nurses to enhance their ability to recognize and evaluate pain-related behaviors.

**Author Contributions**

E.E., N.D.: Conception, design, analysis and/or interpretation, literature review, writer; N.D.: Supervision, critical review; E.E.: Resource, data collection and/or processing.

**Conflict of Interest**

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

**Funding**

The authors received no financial support for the research and/or authorship of this article.

**Data Sharing Statement**

The data that support the findings of this study are available from the corresponding author upon reasonable request.

**AI Disclosure**

The authors declare that artificial intelligence (AI) tools were not used, or were used solely for language editing, and had no role in data analysis, interpretation, or the formulation of conclusions. All scientific content, data interpretation, and conclusions are the sole responsibility of the authors. The authors further confirm that AI tools were not used to generate, fabricate, or 'hallucinate' references, and that all references have been carefully verified for accuracy.

## REFERENCES

1. Topcuoglu MA, Ozdemir AO. Acute stroke management in Turkey: Current situation and future projection. Eur Stroke J 20238:16-20. doi: 10.1177/23969873221103943.
2. VanGilder JL, Hooyman A, Peterson DS, Schaefer SY. Post-stroke cognitive impairments and responsiveness to motor rehabilitation: A review. Curr Phys Med Rehabil Rep 2020;8:461-8. doi: 10.1007/s40141-020-00283-3.
3. Gandolfi M, Donisi V, Battista S, Picelli A, Valè N, Del Piccolo L, et al. Health-related quality of life and psychological features in post-stroke patients with chronic pain: A cross-sectional study in the neuro-rehabilitation context of care. Int J Environ Res Public Health 2021;18:3089. doi: 10.3390/ijerph18063089.
4. Tompkins DA, Hobelmann JG, Compton P. Providing chronic pain management in the "Fifth Vital Sign" Era: Historical and treatment perspectives on a modern-day medical dilemma. Drug Alcohol Depend 2017;173:S11-21. doi: 10.1016/j.drugalcdep.2016.12.002.
5. Nordness MF, Hayhurst CJ, Pandharipande P. Current perspectives on the assessment and management of pain in the ıntensive care unit. J Pain Res 2021;14:1733-44. doi: 10.2147/JPR.S256406.
6. Nazari R, Froelicher ES, Nia HS, Hajihosseini F, Mousazadeh N. Diagnostic values of the critical care pain observation tool and the behavioral pain scale for pain assessment among unconscious patients: A comparative study. Indian J Crit Care Med 2022;26:472-6. doi: 10.5005/jp-journals-10071-24154.
7. Ashkenazy S, Weissman C, DeKeyser Ganz F. Perception of discomfort by mechanical ventilation patients in the Intensive Care Unit: A qualitative study. Intensive Crit Care Nurs 2021;64:103016. doi: 10.1016/j.iccn.2021.103016.
8. Shimoji K, Aida S. Pain measurements. In: Shimoji K, Nader A, Hamann W, editors. Chronic pain management in general and hospital practice. Singapore: Springer; 2021. p. 173-200. doi: 10.1007/978-981-15-2933-7_10.
9. Poomalai G, Prabhakar S, Sirala Jagadesh N. Functional ability and health problems of stroke survivors: An explorative study. Cureus 2023;15:e33375. doi: 10.7759/cureus.33375.
10. Alaparthi GK, Gatty A, Samuel SR, Amaravadi SK. Effectiveness, safety, and barriers to early mobilization in the intensive care unit. Crit Care Res Pract 2020;2020:7840743. doi: 10.1155/2020/7840743.
11. Alakan YŞ, Ünal E. Yoğun bakım hemşireliğinde ağrı değerlendirmesi ve ağrı yönetimi. HÜ Sağlık Bilimleri Fakültesi Dergisi 2017;4:2:12-29.
12. Kılıç İ, Ceylan İ, Karasu D, Gürsoy S. The effects of the position changes of critical care patients on respiratory and cardiac parameters. Turk J Intensive Care 2021;19:4:167-173. doi:10.4274/tybd.galenos.2020.02996
13. Kurt E, Zaybak A. Pain behavior experienced during nursing interventions by patients on mechanical ventilation: A cross-sectional study. Florence Nightingale J Nurs 2022;30:126-32. doi: 10.54614/FNJN.2022.21178.
14. Afenigus AD. Evaluating pain in non-verbal critical care patients: A narrative review of the critical care pain observation tool and Its clinical applications. Front Pain Res (Lausanne) 2024;5:1481085. doi: 10.3389/fpain.2024.1481085.
15. Devlin JW, Skrobik Y, Gélinas C, Needham DM, Slooter AJC, Pandharipande PP, et al. Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. Crit Care Med 2018;46:e825-73. doi: 10.1097/CCM.0000000000003299.

16. Olsen BF, Rustøen T, Valeberg BT. Nurse's evaluation of a pain management algorithm in intensive care units. Pain Manag Nurs 2020;21:543-8. doi: 10.1016/j.pmn.2020.05.006.
17. Gélinas C, Fortier M, Viens C, Fillion L, Puntillo K. Pain assessment and management in critically ill intubated patients: a retrospective study. Am J Crit Care 2004;13:126-36. doi: 10.4037/ajcc2004.13.2.126.
18. Payen JF, Chanques G, Mantz J, Hercule C, Auriant I, Leguillou JL, et al. Current practices in sedation and analgesia for mechanically ventilated critically ill patients: A prospective multicenter patient-based study. Anesthesiology 2007;106:687-95. doi: 10.1097/01.anes.0000264747.09017.da.
19. Cho Y, Hong GS. Behavioral and physiological pain responses in brain-injured patients who are unable to communicate in the intensive care unit. Pain Manag Nurs 2021;22:80-5. doi: 10.1016/j.pmn.2020.08.006.
20. Gundogan O, Bor C, Korhan EA, Demirag K, Uyar M. Pain Assessment in Adult Intensive Care Patients: Validity and Reliability Study of the Turkish Version of the Critical-Care Pain Observation Tool Scale. Turk J Intense Care 2016;14:93-99. doi: 10.4274/tybdd.95967.
21. Vatansever E, Eti Aslan F. The effect of pain on sedation level in intensive care patients. [Master's Thesis], İzmir: Dokuz Eylül University; 2005.
22. Devlin JW, Boleski G, Mlynarek M, Nerenz DR, Peterson E, Jankowski M, et al. Motor Activity Assessment Scale: A valid and reliable sedation scale for use with mechanically ventilated patients in an adult surgical intensive care unit. Crit Care Med 1999;27:1271-5. doi: 10.1097/00003246-199907000-00008.
23. Ozdamar K. Paket programlar ile istatistiksel veri analizi. Eskişehir: Kaan Publication; 1999.
24. Mieronkoski R, Syrjälä E, Jiang M, Rahmani A, Pahikkala T, Liljeberg P, et al. Developing a pain intensity prediction model using facial expression: A feasibility study with electromyography. PLoS One 2020;15:e0235545. doi: 10.1371/journal.pone.0235545.
25. Kappesser J. The facial expression of pain in humans considered from a social perspective. Philos Trans R Soc Lond B Biol Sci 2019;374:20190284. doi: 10.1098/rstb.2019.0284.
26. Aslan FE, Olgun N. Yoğun bakımda seçilmiş semptom ve bulguların yönetimi. Ankara: Akademisyen Kitabevi; 2023.
27. Cohen S, Meyer A, Ifrach N, Dichtwald S. Physical restraint and associated agitation. Nurs Crit Care 2024;29:1132-41. doi: 10.1111/nicc.13130.
28. Seo Y, Lee HJ, Ha EJ, Ha TS. 2021 KSCCM clinical practice guidelines for pain, agitation, delirium, immobility, and sleep disturbance in the intensive care unit. Acute Crit Care 2022;37:1-25. doi: 10.4266/acc.2022.00094.
29. Jurth C, Zimmermann V, Schaaf L, Lezius F, Bublitz VK, Lichtner G, et al. Investigation of Behavioural Pain Scale, Critical Care Pain Observation Tool, nociceptive flexion reflex and pupillary dilatation reflex as predictors of behavioural reactions to nociceptive procedures in critically ill patients unable to self-report pain. Eur J Pain 2022;26:2074-82. doi: 10.1002/ejp.2019.
30. Yaman Gülper R, Reisli R, Arıcan Ş, Yosunkaya A, Tuncer Uzun S. Comparison of pupillometer, critical care pain observation scale, and vital findings in the evaluation of pain in intensive care patients without oral communication. Agri 2023;35:53-62. doi: 10.14744/agri.2021.72246.
31. Rijkenberg S, Stilma W, Endeman H, Bosman RJ, Oudemans-van Straaten HM. Pain measurement in mechanically ventilated critically ill patients: Behavioral Pain Scale versus Critical-Care Pain Observation Tool. J Crit Care 2015;30:167-72. doi: 10.1016/j.jcrc.2014.09.007.
32. Shahiri T S, Gélinas C. The validity of vital signs for pain assessment in critically ill adults: A narrative review. Pain Manag Nurs 2023;24:318-28. doi: 10.1016/j.pmn.2023.01.004.
33. Sujaritha J, Deepa N, Nandhini J, Vandhana V, Mahalakshmi D. Stress and stress management: A review. Indian J Nat Sci 2022;13:45558-71.
34. Zaybak A, Güneş ÜY. Effect of Bathing on Vital Signs in Bedridden Paiıents. Atatürk Univ Hemsirelik Fak Derg 2009;12:4:91-5.
35. Mehpare Kaya Akı, Yurdanur Demir. Hemodiyaliz hastalarına primer bakım veren aile üyelerinin bakım yükleri ve yaşam kaliteleri üzerine bir gözden geçirme. J DU Health Sci Inst [Internet] 2013;2:24-8.
36. Arslan D, Ünal Çevik I. Interactions between the painful disorders and the autonomic nervous system. Agri 2022;34:155-65. doi: 10.14744/agri.2021.43078.
37. Dalamagka MI. Mechanism of Pain. World J Biol Pharm Res 2023;4:1:1-5.