

# Pain assessment in sedated and ventilated critically ill patients

## Abstract

Pain is almost always present in critically ill people and its management represents a huge challenge for health professionals, who sometimes underestimate pain in critically ill patients, probably due to a lack of awareness or an adequate scale. However, it must be ensured that the critically ill patient has the right to pain management, thus fulfilling a professional duty and ensuring the effective humanization of care.

**Objective:** To identify the impact of nurses' intervention on pain assessment in critically ill patients sedated and on mechanical ventilation.

**Methods:** Integrative review, based on indexed material, having consulted the Ebsco search engine, with access to five electronic databases: Cinahl, Nursing & Allied Health Collection, Cochrane Plus Collection, MedicLatina and Medline, in the time horizon 2017 to 2022.

**Results:** The data contribute to the understanding that, when the user is ventilated, it is possible to perceive pain in order to act in the best possible way, developing scales. It is necessary to provide health professionals with scientific, technical and relational skills, encouraging the assessment and recording of a major vital sign, which is pain.

The results presented here are the result of a search for updated articles and studies on scales applied to critically ill patients, carried out at an international level.

**Keywords:** critical care, respiration, artificial, pain, nursing

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## Introduction

Pain in critically ill patients is not considered a priority when compared to other vital signs, however, since the recommendation of the Directorate General of Health issued in a normative circular no. 9/DGCG of 14/06/2003, which indicates that pain is the 5th vital sign, its management being a patient's right, a professional duty and a fundamental step towards the effective humanisation of healthcare.<sup>1</sup> In a study carried out by the Portuguese Society of Intensive Care (PNAD-SPCI), and in the first phase of the National Pain Assessment Plan, a diagnosis was made of the situation which sought to find out how pain was assessed in critically ill patients admitted to Portuguese Intensive Care Units (ICUs). It was found that 8% of ICUs did not assess the pain of critically ill patients or their response to analgesic therapy.<sup>2</sup> 67 per cent of the ICUs used the Visual Numeric Scale to assess the intensity of the pain reported by the patient, although this pain assessment tool is considered the 'gold standard' for pain assessment and is not used in all ICUs response to analgesia. This scale is recommended for assessing pain in patients who communicate, i.e. it is not suitable for critically ill patients who are mechanically ventilated and sedated. As a result, it was found that only 25 per-cent of ICUs used pain assessment tools suitable for this type of critically ill patient.

Ventilatory support for critically ill patients is a common therapeutic approach. Mechanical ventilation and sedation compromise the communication of painful experiences with healthcare professionals. These patients require nurses to take a comprehensive approach that incorporates, albeit subjectively, the interposition of factors that can intervene in the behavioural and physiological manifestations

associated with pain.<sup>3</sup> To overcome these barriers, scales have been developed to detect and monitor pain in critically ill patients whose communication is compromised by altered state of consciousness, sedation or curarisation. The Behavioural Pain Scale (BPS), which assesses 3 behavioural items (facial expression, upper limb movement and ventilatory adaptation); the Critical Care Pain Observation Tool (CPOT) which includes 4 behavioural items (facial expression, body movements, muscle tension and ventilatory adaptation or vocalisation); the Non-verbal Pain Scale (NVPS) which includes 5 assessment items (facial expression, activity, attention, vital signs and breathing) and the Scale of Pain Indicating Behaviours (ESCID) which establishes 5 behavioural items (facial muscles, tranquillity, muscle tone, ventilatory adaptation, comfort). With this in mind, and in an effort to contribute to the continuous improvement of nursing care for the critically ill, the aim of this study was to identify the impact of nurse intervention in the assessment of pain in critically ill patients who are sedated and under mechanical ventilation. We therefore asked which scales nurses use to assess pain in sedated and ventilated critically ill patients, and how do they assess pain in sedated and ventilated critically ill patients in the absence of suitable scales?<sup>4</sup>

## Methodology

The integrative review has been recognised as a unique tool in the field of health to ensure evidence-based practice, based on secondary studies contributing to discussions on methods and results, as well as reflections on a particular theme, enriching practice based on scientific knowledge. We carried out an extensive literature review in order to deepen our knowledge of pain assessment using the Table 1 PICO strategy, which is presented below.

**Table 1** PICO strategy

P	Participants	Who was studied?	Critically ill patients unable to communicate and/or sedated, under mechanical ventilation
I	Interventions	Can they exist or not?	Pain assessment
C	Comparisons	What was done?	Possible applicability; Pre-hospital ER; OR, ICU,
O	Outcomes	Results/effects	Consequences Promoting quality of care

To select the articles for this review,<sup>9</sup> the Ebsco search engine was consulted, with access to five electronic databases: Cinahl, Nursing & Allied Health Collection, Cochrane Plus Collection, MedicLatina and Medline, in the time horizon 2017 to 2022. The descriptors used in the searches were pain, nursing, critical care and artificial respiration, excluding paediatrics. The use of the descriptors critical care and artificial respiration was necessary so that no article involving sedation was overlooked. The search was carried out in the second week of March 2024, accessing articles in English, Spanish, French and one article in Norwegian. Systematic literature reviews, bibliographical

reviews and opinion articles were excluded. The data was analysed by reading the articles and/or their abstracts and then filling in the summary tables of the evidence found.<sup>10,11</sup>

## Data presentation

The summary of the scientific evidence subjected to critical analysis is described in Table 2, organised in chronological order.<sup>12</sup> Reference is made to the identification of the study; authors and year of publication, the type of study, the data collection instrument, the sample, the general objective and the main conclusions.

**Table 2** Synthesis of the evidence found on pain in ventilated people

### Pain assessment using the **critical-care pain** observation tool in Chinese critically ill ventilated adults.<sup>5</sup>

Autores: Li Q, Wan X, Gu C, et al.

Fonte: *Journal Of Pain And Symptom Management*. 48(5):975–982

Purpose of the study	The psychometric properties of the Critical Care Pain Observation Tool (CPOT) need to be tested in the general intensive care user population in China. To further evaluate the psychometric properties of the CPOT and provide a pain assessment method for critically ill ventilated Chinese adults, validating a translation of the CPOT.
Type of study	Descriptors: Not available
Sample and data collection	A total of 63 conscious, ventilated Chinese adults were repeatedly assessed by two independent examiners using the CPOT at rest, as well as before and during the two procedures: 1) nociceptive procedure (turning) and 2) non-nociceptive procedure (taking non-invasive blood pressure). A total of 12 assessments were included.
Main findings and conclusions	Factor analysis of the principal components revealed that the structure of the CPOT domain was acceptable. Cronbach's $\alpha$ coefficient as a measure of internal consistency ranged from 0.57 to 0.86; Intraclass correlation coefficients as a measure of inter-rater reliability ranged from 0.80 to 0.91. Spearman's non-parametric coefficients as a measure of test-retest reliability ranged from 0.81 to 0.93. The total CPOT score was significantly higher during the nociceptive procedure, indicating that its discriminant validity was good. Self-reported pain was obtained as the gold standard; receiver operating characteristic curve analysis determined the best CPOT cut-off value ( $> 2$ ) with specificity (73.3–81.8%) and sensitivity (80.8–89.4%), as well as the area under the curve (range 0.849–0.902). Conclusion: The CPOT has good psychometric properties and can be used as a reliable and valid instrument for assessing pain in critically ventilated Chinese adults.

### Pain among mechanically ventilated patients in **critical care** units.<sup>6</sup>

Autores: Sutari MA, Abdalrahim MS, Hamdan M, et al.

Fonte: *Journal Of Research In Medical Sciences*. 19(8):726–732

Purpose of the study	The aim of this study was to investigate pain levels and predictors among mechanically ventilated patients during rest and routine nursing interventions.
Type of study	A cross-sectional descriptive correlational design was used.
Sample and data collection	Total sample of 301 mechanically ventilated patients. Patients' pain levels were assessed using the Behavioural Pain Scale during rest and routine nursing interventions. The mean pain score levels during rest (mean = 3.69, standard deviation [SD] = 0.81) were lower than the mean pain score levels during routine nursing interventions (mean = 7.1, SD = 2.5). During rest, pain scores were significantly correlated with age ( $r = -0.12$ , $P = 0.046$ ) and heart rate ( $r = 0.24$ , $P < 0.001$ ). During nursing interventions, pain scores were significantly correlated with age ( $r = -0.25$ , $P < 0.001$ ), heart rate ( $r = 0.36$ , $P < 0.001$ ) and diastolic blood pressure ( $r = 0.21$ , $P < 0.001$ ). Age and past surgical history were found to be (age: $b = -0.009$ , $P = 0.002$ ; past surgical history: $b = -1.376$ , $P < 0.001$ ).
Main findings and conclusions	Conclusion: Mechanically ventilated patients experience pain during rest as well as during routine nursing interventions. Pain levels were associated with age, heart rate and diastolic blood pressure. Age and previous surgical history should be considered as important predictive factors.

### Nurse and patient interaction behaviors' effects on nursing care quality for mechanically ventilated older adults in the ICU<sup>2</sup>

Autores: Nilsen ML, Sereika SM, Hoffman LA, et al.

Fonte: *Research In Gerontological Nursing*. 7(3):113–125

Purpose of the study	The aims of the study were: (a) to describe interaction behaviours and factors that can affect communication and (b) to explore associations between interaction behaviours and indicators of quality of nursing care.
Type of study	Behaviours were measured by rating videotaped observations from the Study of Patient Nurse Effectiveness with Communication Strategies (SPEACS). Characteristics and quality indicators were obtained from the SPEACS database and medical record abstraction

Table 2 Continued..

Sample and data collection	38 mechanically ventilated patients (aged $\geq 60$ years) and intensive care unit nurses [n = 24]. All positive behaviours occurred at least once. Significant associations ( $p < 0.05$ ) were observed between (a) positive nurse and positive patient behaviours, (b) augmentative and alternative communication (AAC) strategies without patient assistance and positive nurse behaviours, (d) positive nurse behaviours and pain management, and (e) positive patient behaviours and level of sedation.
Main findings and conclusions	The results provide evidence that the behaviours of nurses and patients affect communication and may be associated with the quality of nursing care
Purpose of the study	Inadequate diagnosis and treatment of pain, agitation and delirium (PAD) in intensive care settings results in unfavourable patient outcomes.
Type of study	Protocol for the systematic assessment and management of PAD by nurses to improve clinical outcomes in the intensive care unit (ICU).
Sample and data collection	A total of 201 patients, admitted to 2 mixed medical-surgical ICUs, were randomly allocated to the protocol and control groups. A multidisciplinary team approved the protocol. Pain was assessed using the Numerical Rating Scale and the Behavioural Pain Scale, agitation using the Richmond Agitation Sedation Scale and delirium using the Confusion Assessment Method in ICU. The Persian version of the scales was prepared and tested for validity, reliability and feasibility in a preliminary study. Patients in the protocol group were treated pharmacologically according to the protocol, while those in the control group were managed according to ICU routine.
Main findings and conclusions	The median (interquartile range) for the duration of mechanical ventilation in the protocol and control groups was 19 (9.3-67.8) and 40 (0-217) hours, respectively ( $P = 0.038$ ). The median (interquartile range) ICU stay was 97 (54.5-189) hours in the protocol group vs 170 (80-408) hours in the control group ( $P < 0.001$ ). The mortality rate in the protocol group was significantly reduced from 23.8% to 12.5% ( $P = 0.046$ ). Conclusion: The current randomised study provided evidence of a substantial reduction in the duration of ventilatory support requirement, length of ICU stay and mortality rates in patients admitted to the ICU through protocol-guided treatment of POAD.
Facial expression as an indicator of pain in critically ill intubated adults during endotracheal suctioning. <sup>7</sup> Autores: Rahu MA, Grap MJ, Cohn F, et al. Fonte: <i>American Journal Of Critical Care</i> . 22(5):412–422.	
Purpose of the study	To describe facial behaviour during endotracheal suctioning, to determine the facial behaviours that characterise the pain response and to describe the effect of patient factors on facial behaviour during the pain response.
Type of study	Descriptive.
Sample and data collection	Fifty non-communicating patients receiving mechanical ventilation were videotaped during two phases (rest and endotracheal suction). Pain ratings were collected using the Behavioural Pain Scale. Facial behaviours were coded using the Facial Action Coding System for 30 seconds for each phase.
Main findings and conclusions	14 facial actions were associated more with endotracheal suction than with rest ( $z = 5.78$ ; $P < 0.001$ ). The sum of the intensities of the 14 actions correlated with total scores on the Behavioural Pain Scale ( $\rho = 0.71$ ; $P < 0.001$ ) and with the facial expression component of the scale ( $\rho = 0.67$ ; $P < 0.001$ ) during suctioning. In the step-by-step multivariate analysis, 5 pain-relevant facial behaviours (eyebrows, brow furrowing, nose wrinkling, head turned to the right and head turned up) accounted for 71% of the variance (adjusted $R^2 = 0.682$ ; $P < 0.001$ ) in pain response. The sum of the intensity of the 5 actions correlated with total scores on the behavioural scale ( $\rho = 0.72$ ; $P < 0.001$ ) and with the facial expression component of this scale ( $\rho = 0.61$ ; $P < 0.001$ ) during aspiration. Patient factors were not associated with pain intensity scores. Conclusions: Upper facial expressions are more frequently activated during the pain response in non-communicated critically ill patients and may be a valid alternative to self-report ratings.
The effects of music therapy in endotracheal suctioning of mechanically ventilated patients. <sup>8</sup> Autores: Yaman AY, Karabulut N. Fonte: <i>Nursing In Critical Care</i> . 2016(1):44–52.	
Purpose of the study	To determine the effect of music therapy on pain intensity, sedation level and physiological parameters during endotracheal suctioning of mechanically ventilated patients in a cardiovascular surgery intensive care unit (ICU).
Type of study	Experimental research.
Sample and data collection	The study was carried out between May 2010 and June 2013 in the Cardiovascular Surgery Intensive Care Unit at Ordu Medical Park Hospital. The study sample consisted of 66 patients (33 experimental and 33 controls) who met the inclusion criteria for the study. Data was collected using the 'Patient Information Form', 'Critical Care Tool', 'Ramsay Sedation Scale' and 'Physiological Parameters Form'.
Main findings and conclusions	Results: The mean Ramsay Sedation Scale scores during endotracheal suction were 1 - 88 and 1 - 55 respectively in the experimental and control group and the difference between the groups was statistically significant ( $p = 0.003$ ). The mean Critical Care Pain Observation Tool score during endotracheal suctioning in the experimental group was statistically lower than in the control group ( $p < 0.001$ ). There were no significant differences before, during and 20 minutes after suctioning between the two groups with regard to systolic blood pressure, diastolic blood pressure, heart rate and oxygen saturation ( $p > 0.05$ ). The results of this study imply that music therapy can be an effective practice for nurses trying to reduce patient pain and control the level of sedation in patients on mechanical ventilators during endotracheal suctioning. Reflection on clinical practice: It is recommended that music therapy be added to routine nursing care for mechanically ventilated patients. Background: Endotracheal suction has been identified as a painful procedure for critically ill patients.

## Discussion

After analysing the summary table of the evidence found, six studies predominated in the eleven articles analysed. For the purposes of analysis, the findings were grouped into two generic categories that compile the evidence in order to facilitate discussion, and which include: pain assessment scales and practical evidence of pain management. For each topic, the barriers and facilitating instruments identified in the review were addressed. Pain assessment tools suitable for critically ill patients unable to communicate pain of the studies analysed, the BPS appears to be the most valid, reliable and sensitive tool to be used appropriately in the ICU, followed by the CPOT. NVPS has less consensus among researchers. The CPTO appears to be a valid and accepted tool in the ICU.<sup>13</sup> The CPOT has good psychometric properties and can be used as a reliable and valid instrument for assessing pain in critically ventilated Chinese adults. The BPS and CPOT pain monitoring scales are the most valid assessment tools for use in critically ill patients (medical, surgical or trauma) who are incapable of self-assessment and whose motor functions are intact. This result is in line with the study by the Portuguese Society of Intensive Care, in which when nurses were asked about pain assessment tools for adult, sedated critically ill patients who do not communicate verbally or with motor skills, the majority chose the BPS. Although the evidence is limited, the studies analysed suggest that the BPS is a useful, reliable, simple, objective

and discriminating tool for assessing pain, followed by the CPTO, while the NVPS is described with some limitations.<sup>14</sup>

### Practical evidence of pain perception management

Mechanically ventilated patients experience pain during rest, as well as during routine nursing interventions. Pain levels were associated with age, heart rate and diastolic blood pressure. Age and previous surgical history should be considered important predictive factors. However, the scales, rather than indicating the alterations present, should guide actions, always aiming to improve the patient's condition. The needs of the critically ill person are multiple, of different kinds and are not the same for everyone. Needs are concrete and unique, and the extent to which these needs are met varies from person to person. We may be providing the 'best' care, but not for certain real, singular and concrete needs of the person in those singular and concrete circumstances. The following is a meta-synthesis of the studies, because it is essential to synthesise their meanings and implications for nursing practice in an understandable way.

The purpose of meta-synthesis is 'to develop syntheses of qualitative studies that, through rigorous methodologies, allow the knowledge developed by qualitative research to be integrated into clinical nursing practice. Based on these premises, we turned to Jean Watson for the following procedures: after analysing each study, we removed the most significant phrases and assigned themes in which they could potentially fit (Table 3).

**Table 3** Extraction and transformation of data relating to the experiences of nurses, other careers, grouped by theme with the respective description and understanding of the data that characterize them

Themes	Description of the data characterising the experience	Understanding the data that characterises the experience
Needs of the critically ill person (factors that interfere with the nurse/critically ill person relationship)	The studies focus on the assessment of pain during the nurse-person interaction in critical condition. Mechanically ventilated patients experience pain during rest as well as during nursing care. Pain levels were associated with age, heart rate and diastolic blood pressure. Age and previous surgical history should be considered important predictive factors. Nurses' behaviours improve communication and may be associated with the quality of nursing care. Carers need to be aware of patients' physical, social and emotional needs in order to provide appropriate care for each person.	The needs of people in a critical state are multiple, of different kinds and are not the same for everyone. The needs are concrete and singular; and the extent to which these needs are met varies from person to person. Caring for the person in a critical situation inevitably means matching what we know to be universal and generic needs with singular and concrete needs.
The contribution of nursing care in the assessment and management of pain in critically ill patients.	Nursing care is essentially based on observing facial expressions and music therapy, which should be added to the care practice. The environment influences the provision of nursing care	Nursing care plays a fundamental role in the assessment and management of pain in critically ill patients, especially given the clinical complexity of these patients, who are often sedated, intubated or unable to communicate verbally. The main contributions of nursing care in this context are: 1) Continuous monitoring - Nurses are with the critically ill patient 24 hours a day, allowing for constant vigilance. This proximity facilitates the early identification of signs of pain, even when the patient cannot express it verbally. On the other hand, the presence of nurses with these patients allows them to identify and observe physiological indicators such as increased heart rate, high blood pressure and sweating, which may suggest pain 2) Use of pain assessment scales for critically ill patients - CPOT (Critical Care Pain Observation Tool) and BPS (Behavioural Pain Scale). These scales allow for a systematic approach, even in non-communicative patients. Nurses implement actions and evaluate their effectiveness. Nurses offer educational and emotional support to patients and families, reducing patient anxiety that can exacerbate pain.

Table 3 Continued...

Environment and relevance to quality of care	<p>In the context of these studies, there are multiple interactions that translate into challenges for nurses. The interactions that take place with the person in a critical condition lead nurses to a process of training/transformation which, in the first place, is a questioning of themselves and what underpins their care, challenging them to rethink their interpretative framework.</p> <p>Studies based on hospital contexts show the complexity of the interactions that take place in these environments, resulting from the relationships between all the professionals who work there (Kamimura e Banaszak, 2004; Green, et al., 2005).</p>	<p>The environment in which the critically ill patient is placed and its relationship with the quality of care are crucial to pain management and control. In the context of intensive care, various factors in the environment and the organisation of care directly influence the patient's well-being:</p>
		<ol style="list-style-type: none"> <li>1) Physical environment - the ICU (Intensive Care Unit) environment often has high levels of noise (equipment, alarms) and continuous lighting, which can increase stress and worsen the experience of pain. A quieter environment that is adjusted to the patient's need for rest helps to reduce stimuli that can aggravate the pain experience.</li> <li>2) Human Factors - An attentive team, which shows empathy and sensitivity, may not only be better at assessing pain, but also to provide psychological comfort, which is essential for pain control in critically ill patients.</li> <li>3) Relationship with the family - The presence of the family can reduce the patient's anxiety, promoting a more welcoming emotional environment, which indirectly helps with pain relief.</li> <li>4) Relevance to the Quality of Care – Pain control in critically ill patients has direct implications for the quality of care. Effective pain control in critically ill patients contributes to hemodynamic stability, improves recovery, reduces the risk of complications and promotes a more humanized experience even in situations of extreme vulnerability. Furthermore, pain control reduces the risk of complications such as delirium, prolonged immobility and infections associated with excessive stay in bed. Providing comfort and pain relief reflects the ethical and humanitarian commitment to the dignity of the patient.</li> </ol>

## Conclusion

Undeniably, pain in critically ill patients is an extremely important issue, as these patients are often unable to communicate their needs clearly, due to factors such as sedation and mechanical ventilation. As nurses, we must also understand that in the context of intensive care, various factors in the environment and the organization of care directly influence the patient's well-being. Uncontrolled pain can lead to complications such as increased physiological stress, an exacerbated inflammatory response and a worsened prognosis, directly impacting patients' recovery and quality of life. The limitations of this study are that it is a subject that needs more in-depth study in order to act in the most concrete and timely manner possible. The data obtained serves as a reference to help caregivers understand that although ventilated patients can perceive pain, they are often unable to express it, so nurses need to ensure that the pain of critically ill patients is assessed and treated in a continuous and humanized way. In this way, the quality of care is significantly improved, promoting the patient's recovery in a safe and dignified manner.

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## Conflicts of interest

The authors declare that there are no conflicts of interest.

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