

# **PAIN MANAGEMENT IN THE CRITICAL ILL PATIENTS WITH MECHANICAL VENTILATOR: A Literature review**

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## **Abstract**

*Pain is the most common experiences and stressors in the critically ill patients, because many sources of pain are present in critical care settings, such as acute illness, surgery, trauma, invasive equipment, nursing and medical interventions. Poor treatment of acute pain may lead to the development of serious complications which may seriously impact the patient's functioning, quality of life, and well being. The critical nurse must understand the mechanisms, assessment, and appropriate intervention in managing pain. This study aim to describe pain experienced by critical ill patients, identify contributing factors of pain experience, the appropriate pain assessment tools among critically ill patients and critically analyze existing of evidence based interventions to manage pain among critical ill patients with mechanical ventilator. The authors conducted a comprehensive systematic search of published literatures, articles, journals related to pain management in critical ill patients. Pain in the critically ill patients difficult to assess and manage. There are many sources of pain in the critical care setting, and the effect of unrelieved pain have a significant impact on the patient's recovery. When possible, the patient's self-report of pain must be obtained. When the patient's self-report is not available, behavioral indicators represent alternative measure of pain assessment (e.g., BPS, COPT) have been developed for assessment of pain in the critically ill mechanically ventilated population. Both pain management pharmacologic and nonpharmacologic can be used together in relieving pain. Using pharmacologic alone may not fully relieve all aspects of pain.*

**Keyword: Pain management, critical patients, mechanical ventilator**

## Introduction

### *Background and significance of the phenomena*

Pain is the most common experiences and stressors in the critically ill patients. Despite national and international efforts, guidelines, standards of practice, position statements, and many important discoveries in the field of pain management was existed, pain remain a major stressor for patients in critical care settings (Rotondi, 2002). Because many sources of pain are present in critical care settings, such as acute illness, surgery, trauma, invasive equipment, nursing and medical interventions (Hamill-Ruth & Marohn, 1999; Herr & Kwekkeboom, 2001). Gellinas (2007) and Puntillo (2001) in their study reported that more than 50% of critically ill patients experiences moderate to severe pain.

A study was conducted by Morris, Puntillo & Thompson (2004). They investigated the patient's responses to six procedures that are frequently performed on critical ill patients. The investigators noted that during performed femoral sheath removal procedure, the subject suffer less painful, during performed central venous catheter placement, tracheal suctioning and wound care procedure, the subjects suffer painful and during performed wound drain removal and turning procedure, the subjects suffer most painful. The investigators discovered that very few of patients (less than 20%) received opioid analgesics before their procedures. It is supported a study was conducted by Mann (2006). He reported that approximately, one-half of critical patients recalled having had pain during care in the ICU.

Pain produces many harmful effects that inhibit healing and recovery from critical illness. The autonomic nervous system responds to pain by

causing vasoconstriction and increased heart rate and contractility. Pulse, blood pressure, and cardiac output all increase. Pain has negatively affects respiratory system, gastrointestinal system and musculoskeletal system. Unrelieved pain suppresses the immune function, predisposing the patient to pneumonia, wound infection and sepsis. Patients who have a high level of uncontrolled pain during an acute hospitalization are at the risk for delayed recovery and development of chronic pain syndromes after discharge (Swope, 2002). Poor treatment of acute pain may lead to the development of serious complications (Carr & Goudas, 1999; Kehlet, 2006) which may seriously impact the patient's functioning, quality of life, and well being. The critical nurse must understand the mechanisms, assessment, and appropriate intervention in managing pain.

### *Objectives*

Aims of this study are to describe pain experienced by critical ill patients with mechanical ventilator, identify contributing factors of pain experience in critical ill patients with mechanical ventilator, the appropriate pain assessment tools among critically ill patients with mechanical ventilator and critically analyze existing of evidence based interventions to manage pain among critical ill patients with mechanical ventilator

### *Method*

The authors conducted a comprehensive systematic search of published literature, articles, journals related to pain management in critical ill patients. The articles were searched and retrieved from Science Direct, CINAHL, PubMed, and ProQuest from year 2000 to 2011, also from relevant textbooks. The universal case entry website, Google scholar was used as well. To facilitate

search of the literature, the authors used keywords including pain management, mechanical ventilator, critical ill patients.

#### *Pain experienced by critical ill patients with mechanical ventilator*

Many interventions and procedures in the critical care unit cause pain (Morris, Puntillo & Thompson, 2004). More than 50% of critically ill patients experiences moderate to severe pain (Puntillo, 2004). Critically ill patients in the intensive care unit (ICU) requiring mechanical ventilator frequently experience pain. Mechanically ventilator support is obviously painful (Sheen, 2009). Pain is described as an unpleasant sensory and emotional experience associated with actual or potential tissue damage (IASP, 1979). This definition emphasizes its subjective and multidimensional nature. It implies that the patient is able to self-report. In the critical ill patients with mechanical ventilator, many patients are unable to self-report.

Critical illness is painful (Passero & McCaffery, 2002). Pain in the critical care setting is a subjective and multidimensional experience. Pain experienced by critical ill patients is mostly acute and has multiple origins. The experience of pain includes sensory, affective, cognitive, behavioral, and physiologic components (McGuire, 1992; Melzack, 1999).

The sensory component of pain is the perception of many characteristics of pain, such as intensity, location, and quality. For the affective component, it includes negative emotions such as unpleasantness, anxiety, and fear that may be associated with the experience of pain, whereas the cognitive component refers to the interpretation of pain by the person who experiences it. The behavioral component includes the strategies used by

the person to express, avoid, or control pain, and the physiologic component refers to nociception and the stress response.

#### *Factors contributing to pain in the critical ill patients with mechanical ventilator*

Three factors contribute to pain in the critical ill patients. These factors include physical, psychosocial, and intensive care unit environment or routine (Morton & Fontaine, 2009).

##### *Physical factors*

The physical factors that contribute to pain in the critical ill patients with mechanical ventilator including symptoms of critical illness (e.g., angina, ischemia, dyspnea), wounds (post-trauma, postoperative, or post procedural), sleep disturbance and sleep deprivation, immobility to move to a comfortable position because of tubes, monitors, restraints. Other physical factors are temperature extremes associated with critical illness and the environment (fever, hypothermia).

The most common illness or injuries treated in the ICU: Myocardial infarction, thoracic and neuro surgery, and multiple trauma cause painful. All are associated with severe pain. For some of these patients, the pain is considered continuous because it persists for more than half of each day (Pasero & McCaffery, 2002).

##### *Psychosocial factors*

The psychosocial factors that contribute to pain in the critical ill patients with mechanical ventilator including anxiety and depression, impaired communication, inability to report and describe pain, fear of pain, disability, separation from family and significant others, and boredom or lack of pleasant distractions.

Many factors affect the patient's pain experience including anxiety, unfamiliar and unpleasant surroundings and separation from family. A study reported that the patients in ICU need the feeling safe to control pain. The feeling safe was gotten from family and friends, ICU staff, religious beliefs, and feelings of knowing, hoping, and trusting. If the patients cannot get the need, they fear and feel separation from family that contribute the pain (Hupcey, 2000).

#### *Intensive care unit environment factors*

The Intensive care unit environment or routine factors that contribute to pain in the critical ill patients with mechanical ventilator including continuous noise from equipment and staff, continuous or unnatural patterns of light, awakening and physical manipulation every 1-2 hours for vital signs or positioning, continuous or frequent invasive, painful procedures, and competing priorities in care (unstable vital signs, bleeding, dysrhythmias, poor ventilation (may take precedence over pain management)). Many procedures in the critical ill patients cause pain as well.

A study was conducted by Puntillo et al., (2004) reported that during procedures in the critical ill patients, 15 % of them experienced least painful, 50 % of them experienced painful, and 35 % of them experienced most painful. They suggested that the patient's response must be monitored during the procedures. In addition, the nurse can use nursing interventions such as imagery, distraction, and family support during the procedures.

#### *Pain assessment*

Patients in the critical ill with mechanical ventilator, they can communicate verbalize and nonverbalize. When the patient's self report is impossible to obtain, the appropriate pain assessment

use the observable or objective component. The observations of physiological and behavioral indicators are strongly emphasized in clinical recommendations and guidelines for pain assessment in nonverbal patients (AHCPR, 1992; Jacobi, 2002).

#### *Physiologic Indicators*

Physiologic vital sign as indicators of pain have received little attention in critically ill adults. Although vital sign values generally increase during painful procedures (Gelinas, 2007; Young, 2006), they are not consistently related to the patient's self report of pain, nor are they predictive of pain (Gelinas, 2007). For example, none of the monitored vital signs (heart rate (HR), mean arterial pressure (MAP), respiratory rate (RR), transcutaneous oxygen saturation (SpO<sub>2</sub>), and end-tidal CO<sub>2</sub>) predicted the presence of pain in ICU patient (Gelinas, 2009).

The American Society for Pain Management Nursing (ASMPN) recommendations, it emphasizes that vital signs should not be considered as primary indicators of pain, because they can be attributed to other distress conditions, homeostatic changes, and medications (Herr, 2006). Changes in the vital signs should rather be considered a cue to begin further assessment of pain or other stressors (Foster, 2001). Physiologic measures other than vital signs can support the clinicians in detecting the presence of pain in critical ill, nonverbal patients, especially when behavioral indicators are no longer available.

#### *Behavioral Indicators*

A study of 257 mechanically ventilated intensive care unit adults, it was found that patients who experienced pain during turning showed significantly more intense facial expression (e.g., grimacing, muscle rigidity, and less compliance with the ventilator (e.g., fighting the ventilator)

compared with patients without pain (Gelinas & Arbour, 2009). Behavioral indicators are strongly recommended for pain assessment in nonverbal patients, and several tools has been developed and tested in critical ill adults: Behavioral Pain Scale (BPS), Critical Care Observation Tool (CPOT), Post Anesthesia Care Unit Behavioral Pain Rating Scale (PACU-BPRS), and Pain Assessment and Intervention Notation (PAIN) algorithm (Herr, 2006; Anand & Craig, 1996). The BPS and CPOT are supported by experts as appropriate for use with uncommunicative

critically ill adult patients with mechanical ventilator.

Both the BPS and CPOT is recommended by the physician and critical nurse to assess the pain in critical ill patients with mechanical ventilator. The BPS and CPOT are similar, but different using in communicate verbal. The BPS is valid and reliable measurement for use in non verbal ICU patients, but the CPOT can be used for verbalize and nonverbalize ICU patients. For detail explanation can be seen in the table 1. The table 1 show the comparison among BPS and CPOT.

Table 1: *Comparison among BPS and CPOT*

Comparing factors	BPS	CPOT
Dimensional measures	Uni-dimensional	Uni-dimensional
Indicators measured	to 1. Face 2. Restlessness 3. Muscle tones 4. Vocalization 5. Consolability	1. Facial expression 2. Body movement 3. Muscle tension 4. Compliance with ventilator or vocalization
Range of value	0-10	0-8
Strengths of the assessment tool	Findings from 3 studies suggest that the BPS is a valid and reliable measure for use in nonverbal ICU patients	Easy to use and can be utilized for verbalize and nonverbalized patients with mechanical ventilator because the unique descriptors
Weaknesses of the assessment tools	<ul style="list-style-type: none"> <li>The lack of body movement equates with a pain free state</li> <li>Research shows that nurses reported observing slow, decreased, or no movement as a pain behavior in nonverbal ICU patients.</li> </ul>	The responsiveness of behaviors to painful stimuli in deeply sedated patients remains to be determined.

Source: Li, Puntillo and Christine Miaskowski (2008)

*Evidence based interventions to manage pain among critical ill patients with mechanical ventilator*

To control pain in critical ill patients, Nurse in ICU can use pharmacologic, nonpharmacologic, or combination of the two therapies.

*Pharmacologic management*

Pharmacology pain management is divided into three categories of action: Opioids, Non opioids, and adjuvants (anti convulsants, antidepressants, and local anesthetics).

*Opioid Analgesics*

The opioid are commonly used and recommended as first line analgesics are

the agonist. Opioid analgesics are derived from natural opium alkaloids and their synthetic derivatives. Many opioids drugs are used in pharmacological management, such as Morphine, Fentanyl, Codeine, Methadone, etc.

#### *Morphine*

Morphine is the most commonly prescribed opioid in the critical care unit. Morphine is indicated for severe pain. It has additional actions that are helpful for managing other symptoms. Morphine dilates peripheral veins and arteries, making it useful in reducing myocardial workload. Morphine is also viewed as an anti anxiety agent because of the calming effect it produces.

#### *Fentanyl*

Fentanyl is a synthetic opioid preferred for critically ill patients with hemodynamic instability or morphine allergy. It is a lipid-soluble agent that has a more rapid onset than morphine and a shorter duration (Liu & Gropper, 2003). The metabolites of fentanyl are largely inactive and nontoxic, which makes it an effective and safe opioid. The use of fentanyl in the critical care unit is growing in popularity, and it is the preferred agent for acutely distressed patients.

#### *Codeine*

Codeine has limited use in the management of severe pain. It is rarely used in critical care unit. It provides analgesia for mild to moderate pain. It is usually compounded with a non-opioid (e.g, acetaminophen). To be active, codeine must be metabolized in the liver to morphine (Mc Caffery & Passero, 1999). Codeine is available only through oral, intramuscular, and subcutaneous routes, and its absorption can be reduced in the critical care patient be altered gastrointestinal motility and decreased tissue perfusion.

#### *Nonopioids Analgesics*

In the Society of Critical Care Medicine (SCCM) guidelines, the use of non opioid in combination with an opioid is recommended in selected critical care patients (Jacobi, 2002). This may reduce the opioid requirement and provide greater analgesic effect through action at the peripheral and central levels. Many Non opioids drugs are used in pharmacological intervention, such as Acetaminophen and Nonsteroid Anti-inflammatory Drugs (NSAIDs).

#### *Adjuvants*

Adjuvants are rarely used in the critical care patients, but it can be helpful for pain relief in patients with complex pain syndromes such as neuropathic pain or for other specific purposes. Many adjuvants that used in pharmacologic intervention are including anticonvulsant and antidepressant. Anticonvulsants are first analgesics for lancing neuropathic pain. Antidepressants are also considered as analgesics in variety of chronic pain syndromes.

#### *Nonpharmacologic management*

Nonpharmacologic methods can be used to supplement analgesic treatment, but they are not intended to replace analgesics. Research has shown that the combination of nonpharmacologic and pharmacologic interventions provides better pain control, with less use of opioid analgesics. The nonpharmacologic intervention includes relaxation, music therapy, touch therapy, and massage (Pellino et al, 2005).

#### *Relaxation*

Relaxation is a well-documented method for reducing the distress associated with pain. Although not a substitute for pharmacology, relaxation is an excellent adjunct for controlling pain (Houston & Jesurum, 1999). Relaxation decreases oxygen consumption and muscle tone, and

it can decrease heart rate and blood pressure. Relaxation gives the patients a sense of control over the pain and reduces muscle tension.

A study was conducted by Houston and Jesurum (1999). Results indicated that men 70 years of age who received QRT in conjunction with analgesics reported less than half the amount of pain experienced by those who did not receive QRT. In comparison, women 70 years old or older reported much higher pain intensity scores when QRT was used. Preliminary results suggest that for most patients, the combination of analgesics and relaxation exercises is not more effective in decreasing pain during CTR than when analgesics are administered without relaxation exercises.

#### *Music Therapy*

Music therapy is commonly used intervention for relaxation. Music therapy is pleasing to the patient may have soothing effects (Biley, 2000). The music should be supplied by a small set of headphones. It is important to educate the patient and family regarding the role of music in relaxation and pain control and to provide music of the patient's choice.

Almerud and Petersson (2003) conducted a study whether music therapy had a measurable relaxing effect on patients who were temporarily on a respirator in an intensive care unit (ICU) and after completion of respirator treatment investigate those patients' experiences of the music therapy. This study found that significant fall in systolic and diastolic blood pressure during the music therapy session and a corresponding rise after cessation of treatment. They suggest intensive care nursing staff can beneficially apply music therapy as a non-pharmacological intervention.

#### *Touch Therapy (TT)*

Historically, one of the greatest contributions nurses have made is the comfort and caring or presence and touch. These contributions still have an important place in highly technological ICUs. Nurse may feel that touching is too simple to be effective. However, few medical advances can replace the benefits of warm and caring touch. Nurses when using touch are usually trying to convey understanding, support, warmth, concern and closeness to the patient. Touching not only contributes to the patient's sense of well-being but also promotes physical recovery from disease. It has a positive effect on perceptual and cognitive abilities and can influence physiological parameters, such as respiration, and blood flow. Touch represents a positive therapeutic element of human interaction.

A study indicated that there was no significant difference between pre-, during and post-physiologic variables in response to TT. However psychodynamic responses demonstrated significant correlations in terms of relaxation and sleep. The non significance of physiologic change in variables pre-, during and post-administration of TT indicates critically ill patients remained physiologically stable. Significant correlations of psychodynamic responses demonstrated it is possible for critically ill patients to experience periods of relaxation and sleep in an otherwise stressful environment. TT was found to be a useful therapy to enhance relaxation and sleep in critically ill patients (Cox & Hayes, 1999).

#### *Massage*

Superficial massage initiates the relaxation response and has been shown to increase the amount of sleep in ICU patients, promotes relaxation and reduces pain. Hand, feet, and shoulders are good sites for massage. Massage is an excellent intervention for family members to use in

their attempts to provide comfort to the critically ill. A study in which a five-minute foot massage was offered to 25 patients (68 sessions in total) as a stress-reduction intervention is described. Results indicated foot massage had the potential effect of increasing relaxation as evidenced by physiological changes during the brief intervention administered to critically ill patients in intensive care (Hayes & Cox, 1999).

### Conclusion

Pain in the critically ill patients difficult to assess and manage. There are many sources of pain in the critical care setting, and the effect of unrelieved acute pain can have a significant impact on the patient's recovery. When possible, the patient's self-report of pain must be obtained. A simple yes or no communicated by head nodding from a mechanically ventilated patient is considered a valid self-report of pain. When the patient's self-report is not available, behavioral indicators represent alternative measure of pain assessment, and assessment tools (e.g., BPS, COPT) have been developed for assessment of pain in the critically ill mechanically ventilated population.

In some situations, behavioral indicators may be impossible to assess accurately. The use of physiologic indicators is then crucial. However, vital signs do not represent valid information for pain assessment. Innovative physiologic measures are being explored and may support the clinicians in the pain assessment process.

### Recommendation

Result from this literature review has recommendation for the management for patients in critical care setting. The recommendation is both pain management pharmacologic and nonpharmacologic can

be used together in relieving pain. Using pharmacologic alone may not fully relieve all aspects of pain. Pharmacologic drugs have a side effect that can be a life threatening, such as a side effect from morphine can cause depression in the respiratory system. Physician must consider side effect from this medication.

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