PAIN MANAGEMENT IN THE CRITICAL ILL PATIENTS WITH MECHANICAL VENTILATOR: A Case Study

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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 experience in critical ill patients with mechanical ventilator, identify the influencing factor for pain among critically ill patients with mechanical ventilator and evaluate the outcomes of evidence based interventions to reduce pain level among critically ill patient with mechanical ventilator. The author used descriptive study for critical patients who administered mechanical ventilator and associated with a significant degree of pain. They were hospitalized in the Surgical Intensive Care Unit (SICU) and/or Surgical Respiratory Care Unit (SRCU). Moreover, selection criteria in this study include male or female patients who get mechanical ventilator, have either medical or surgical intervention and administered by using morphine injection 10 mg/ml sig 3 mg or fentanyl injection sig 30 mcg IV q 3 hr IV as primary pain medication. Used both pharmacologic and nonpharmacologic pain management, the pain score decreased after intervention. 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.

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.

In recent years, many complementary therapies such as massage, soothing music, relaxation, mind–body techniques, reflexology, herbal medicines, hypnosis, and therapeutic touch have been used to help manage pain (Smith, Collins, Cyna, & Crowther, 2003). However, it is evident that sound evidences from a wide range of studies will be needed to show their efficacy so as to enhance the applicability of these therapies.

Objectives of the study

1) To describe pain experience in critically ill patients with mechanical ventilator
2) To identify the influencing factor for pain among critically ill patients with mechanical ventilator
3) To evaluate the outcomes of evidence based interventions to reduce pain level among critically ill patient with mechanical ventilator

Methodology of the study

Study subjects are critical patients who administered mechanical ventilator and associated with a significant degree of pain. They were hospitalized in the Surgical Intensive Care Unit (SICU) and/or Surgical Respiratory Care Unit (SRCU). Moreover, selection criteria in this study include:

Male or female patients who get mechanical ventilator

Have either medical or surgical intervention

Administered by using morphine injection 10 mg/ml sig 3 mg or fentanyl injection sig 30 mcg IV q 3 hr IV as primary pain medication.

Data collection tools used in this study consist of (1) Demographic data and (2) Pain assessment used self report and observational indicator, which includes Numeric rating Scale and or Critical-care Pain Observation Tool (CPOT). Demographic data consist of 12 items, which utilize to collect the subject demographic data including age, gender, marital status, educational level, religion, medical diagnosis, type of operation and etc.

Moreover, the pain score is measured by using Numeric Rating Scale or Critical-care Pain Observation Tool (CPOT). If patient is able to report regarding their pain experiences, The Numeric Rating Scale was used to assess pain score. Behavioral indicators by using CPOT are used to determine the level of pain in critically ill with mechanical ventilator who cannot provide self-report regarding their pain experiences. The higher score reflects to the higher perceived of pain that feel by the subjects.

Data collection technique is based on nursing process, started from assessment, data analyzing, planning, implementation, and evaluation. In the assessment part, the information for demographic data were collected by using interview method with the family, physical

examination, sought from hospital information system (via computer), and patient medical record. Then, continued with measuring pain level by using the instrument that has been developed based on physiological and behavioral indicators to determine patient pain level.

The obtaining data then analyzed by using mind mapping technique to develop nursing diagnosis related to patient problem. Furthermore, nurse plan for intervention based on developing map to provide holistic care and found appropriate pain intervention which suitable for patient. In term of reducing pain, nurse offers music therapy, foot massage therapy, relaxation (simple breathing) and therapeutic touch technique to the patients as complementary therapies. Each patient will be administered by one intervention to be implemented for at least 10-20 minutes during any nursing intervention that provokes to develop significant pain. After the implementation, then nurse will reassess the level of pain by using same instrument to evaluate whether this intervention is effective or not to relieve pain.

Study finding and discussion

From the initial assessment by using instrument, observation, and patient medical record, the completed profile of each subject was described in table (see Table 1)

Table 1. *Demographic data*

No	Data	Patient 1	Patient 2	Patient 3
	Patient Initial	**Mr. RS**	**Mrs. W**	**Mr. CY**
1	Age	55 years old	57 years old	63 years old
2	Gender	Male	Female	Male
3	Marital status	Married	married	married
4	Ethnicity	Indonesia	Thai	Malay
5	Religion	Christian	Buddhist	No assessed
6	Medical Diagnosis	Pleura & pericardial effusion	SAH	Blast injury
7	Postoperative diagnosis	Postoperative median sternotomy	Postoperative craniotomy	Postoperative amputation both legs
8	Type of surgery	Major surgery	Major surgery	Major surgery
9	Type incision	Midline incision	Oblique incision	Moslem
10	Previous history of hospitalization	No history	No history	No history
11	Duration of intubation	7 days	5 days	6 days
12	Cigarette smoking	Yes	no	No assessed

Table 2 Pain related factors

No	Pain related factors	Patient1	Patient2	Patient 3
1	**Physical factors**			
	Current Illness	Postop median sternotomy, NSTEMI	Postoperative craniotomy with aneurism clipping	Blast injury, 50 % burn, postoperative amputation
	Equipment support	ICD, intubation, ventilator	Intubation, ventilator	ICD, intubation, ventilator
2	**Psychosocial factors**			
	Separation from family	No separation	No separation	Separation
	Impaired communication	Able to communicate	Able to communicate	unable to communicate
3	**ICU environment**			
	Noise	No	Noise	No
	Procedures:			
	Suctioning	Yes	Yes	Yes
	Wound dressing	Yes	Yes	Yes
	Turning position	Yes	Yes	Yes
	Wound drain removal	Yes	No	Yes
	Other procedures	X-ray, wound dressing	Reintubation, wound dressing	Debridement, wound dressing

Table 3 Pain management in critically ill patients with mechanical ventilator

No	Patient	Pain management	Day 1	Day 2	Day 3
1	Mr. RS	Pharmacologic	Fentanyl sig 30 mcg IV q 3 hr	Fentanyl sig 30 mg IV q 3 hr	Fentanyl sig 30 mg IV q 3 hr
		Nonpharmacologic	-	Foot massage for 20 minutes	Music thery
2	Mrs. W	Phamacologic	Fentanyl sig 30 mcg IV q 3 hr	-	Fentanyl sig 30 mg IV q 3 hr
		Nonpharmacologic	-	Therapeutic touch	Therapeutic touch
3	Mr. CY	Pharmacologic	Fentanyl sig 30 to 50, then to 75 mcg q 1 hr	Fentanyl sig 30 mcg IV q 3 hr	-
		Nonpharmacologic	-	Simple breathing	-

Table 4 Pre and post-test pain management in critically ill patients

No	Patient's initial	Day 1		Day 2		Day 3		Note and outcome
		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	
1	Mr. RS	7	4	6	3	5	sleep	Used the NRS, pain score decreased after intervention
2	Mrs. W	7	sleep	7	6	7	sleep	Used the NRS, pain score decreased after intervention
3	Mr. CY	7	3	7	3	-	-	Used the CPOT, pain score decreased after intervention

Discussion

Patient 1

Pain is the major problem in this patient. Past experiences with pain, ethnicity, age, gender and type of surgery factors influence on pain. Those factors may increase or decrease the patient's perception of pain, increase or decrease tolerance for pain, and affect the manner of responses to pain (Smeltzer & Bare, 2004).

Age, gender, and ethnicity influence on the pain perception if compare with other cases. Mr. RS, 55 years old is adult age. Adult age is less tolerant with pain. It is different with elderly age. Many elderly reluctant to seek help even when in severe pain because they consider pain to be part of normal aging (Smeltzer & Bare, 2004). For gender factor influence on pain as well, but not significant. A man more tolerant with pain than woman (Logan & Rose as cited in Keogh, Mccracken & Eccleston, 2005). Mr. RS did not have past experience with surgery or pain. This factor also influence on the pain perception. A patient who has had multiple or prolonged experiences with pain will be less anxious and more tolerant of pain than one who has had little pain (Smeltzer & Bare, 2004). Mr. RS is Indonesian patient with bataknese ethnic. Suza (2004) stated Bataknese ethnic in Indonesian patients responded to pain by yelling, crying, or getting angry in order to get attention from others, thus showing expressiveness.

Other factors are physical factors (current illnes and equipment support in the body), impaired to communicate with other, and ICU environment (Noise and ICU procedures). During hospitalization, Mr. RS developed problem with NSTEMI. He complained chest pain. ECG on September 4, 2011 showed that there is ST depression. Mr. RS stated that he felt pain in the oral endo tracheal tube. When the nurse did suction, the pain increased. He said that before suction, pain score was 4, but during suction the pain score was 7. From this data can be concluded that current illness (NSTEMI), oral endo tracheal tube, ICU procedures are source of pain. The most common illness or injuries treated in the ICU cause painful (Pasero & McCaffery, 2002).

Many procedures in ICU and equipment support contribute to the pain such as intubation, suctioning, ICD, turning position. All of the patients got equipment support in the body and routine medical and nursing procedures (Puntillo et al., 2003). 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.

Type of surgery also influence on the pain experience. Mr. RS underwent postoperative median sternotomy, where it is a major surgery. After surgery, the level of pain was severe pain, then the level deceased after received pain medication combine with nonpharmacological intervention.

Patient 2

Patient number 2 is Thai woman. 57 years old is adult age. If compare case number 1, Age and gender may influence on the pain. Patient is woman and adult age. Adult and woman patient is more difficult to tolerant with pain (Smeltzer & Bare, 2004). Women reported more pain in more bodily areas with greater frequency and for longer duration as compared with men (Logan & Rose as cited in Keogh, Mccracken & Eccleston 2005). Patient did not have past experience with surgery. Patient said that source of pain is in the wound. She had wound in the cranial. It is the first patient's experience with surgery, so she couldn't manage her pain. She said that the pan score was 7 (severe pain).

Physical factor (current illness and equipment support in the body), psychosocial factor (impaired communication and ICU environment (Noise and routine care in ICU) are influence on the pain as well. Current illness in this patient is postoperative craniotomy. Type of craniotomy is major surgery. Patient with major surgery have more pain than minor surgery.

After craniotomy, patient complained pain in the wound. Pain is caused by tissue damage from surgical incision. Immediately after tissue damage, sensory nerve endings are suddenly exposed to a variety of cellular breakdown products and inflammatory mediators that trigger acute nociceptive activity. The chemical mediators of pain includes prostaglandin, proton, serotonin, histamine, bradykinin, cytokines, substance K^+, H^+, and neuropeptides that act as specific receptors on the sensory fibers and also have important synergistic interaction. It is the continued release of these mediators that

results in the spread of pain to surrounding areas (Copstead & Banasik, 2005).

Patient got intubation endotracheal tube. Patient said that beside source of pain from the wound, intubation also cause of pain. When the nurse did suction, the pain was increased. Puntillo and colleagues (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.

Patient 3

Similar with case number 1 and 2, age, gender, and ethnicity may influence on the pain perception, but different responses. Patient is 63 years old, elderly age. Many elderly reluctant to seek help even when in severe pain because they consider pain to be part of normal aging, but this factor is not significant influence on the pain. The pain in elderly patients can be complex because it is related to pharmacodynamic and pharmacokinetic factors. Pharmacodynamic interactions may occur with synergistic effects when taking more than one sedative, or anticholinergic agents (Auburn, 2007). Patient is male Malay patient. Tan and colleagues (2008) reported that ethnicity influences the difference perception of pain between Malay, Chinese, and Asian Indian patients.

Psychosocial factor also influence on the pain. 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 contributes the pain (Hupcey, 2000). The level of pain is highest than case no 1 and 2. Compare with case number 1 and 2, they didn't separate from family. During hospitalization, their family accompanied. Contrast with case number 1. During hospitalization, he separate with family, and also he was caring in isolation room. He was restricted to visited by his family.

Case number 3, many sources of pain. The main source of pain is tissue damage. He had blast injury, burn with 50 %, underwent amputation in the both legs. Amputation in the both legs is major surgery. Until three four days hospitalization, the pain score was high. By using CPOT reported that the pain score was 7 (Worst pain). The doctor ordered increasing the dose fentanyl from 30 mcg up to 50 mcg and then up to 75 mcg combine with sedative dormicum IV (1:2) IV 4 ml/hr.

ICU procedures also influence on the pain experience. During turning position and suction, patient's feel expression seems tense to grimacing. Patient didn't have experience with surgery previously. It will influence on the how patient can manage his pain by using past experience. A patient who has had multiple or prolonged experiences with pain will be less anxious and more tolerant of pain than one who has had little pain (Smeltzer & Bare, 2004).

Evidence based practice

Non-pharmacological intervention had been performed to reduce pain was including foot massage therapy, music therapy, relaxation (simple breathing exercise) and therapeutic touch.

Foot massage

This intervention was given to patient number 1. During intervention, patient said that he felt relax and comfortable. The pain score decreased. Before intervention, the pain score was 6, after intervention was 3. The combination between pharmacological intervention Fentanyl sig 30 mg IV q 3 hr with foot massage intervention, the pain management is more effective than pharmacological alone.

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.

Music Therapy

Music therapy as a complimentary therapy was applied to patient no 1 at second day. From the assessment obtain the information if those patients more likely to listen Indonesia music. He preferred a dangdut music. During intervention, patient relax and fallen to slept. The pain score decreased after received music therapy from 5 to sleep. This

intervention is effective in relieving patient's pain during hospitalization in ICU. After completion music therapy, nurses teach to patient and family that music therapy can be used for relaxation and relieve pain

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.

Touch Therapy (TT)

Therapeutic touch was applied to patient no 2 at day 2 and day 3. In the day 2, patient did not receive pain medication. She received therapeutic touch only. Result of this intervention there was significant different before and after intervention. The pain score before intervention was 7, after intervention was 6. If compare with day 3, there was significant different the pain scores before and after intervention. Before intervention the pain score was 7, and after intervention patient fallen to slept. In the day 3, patient received combination between Fentanyl sig 30 mg IV q 3 hr and therapeutic touch.

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 replaces 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.

Simple breathing relaxation

Simple technique breathing relaxation is independently nursing intervention that appropriate to applied in this patient. Patient was conscious and can follow nurse order. Patient was easy to wake up when he was called. He could hear and understand what the nurse said. During performed this intervention, patient could follow and understand. Patient's expression relaxes. With combination between pharmacological and nonpharmacological intervention in pain management, the pain outcome was effective. The doctor ordered to increase the dose fentanyl from 75 mcg q 1 hr be 30 mcg q 1hr. The pain score after received both interventions decreased. The pain score was 2 (Mild pain) using CPOT.

Conclusion

Pain is the most common experiences and stressors in the critically ill patients. 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. Many interventions and procedures in the critical care unit cause pain. Mechanically ventilator support is obviously painful as well. Critical nurse has role to control and relieve pain using pharmacological and nonpharmacological intervention.

Pain medication alone may not effective. Patients need non-pharmacologic approach as well. Many techniques useful for relieving pain with non-pharmacological intervention include music therapy, foot massage therapy, simple breathing and therapeutic touch. These therapies are independently nursing intervention that can be applied to patient without prescribed from doctor. Nurse also can teach to patient's family and involve them in caring patient.

Recommendation

As a recommendation, both pain managements pharmacologic and non-pharmacologic can be used together in relieving pain. Non-pharmacologic intervention is as an adjuvant therapy to more effectiveness effect of pharmacologic intervention. This therapy gives support to improve effectiveness of pain medication. Pharmacologic drugs has side effect that can be a life threatening, such as side effect from morphine or fentanyl can cause depression in respiratory system. Physician must consider the side effect from these medications.

To improve pain management in critical care setting, nurse must try to apply the evidence based in managing pain. As result, pain management is effective and can reduce the dose and dependently pain management using medication that have side effect for patients.

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