The Effect of Foot Massage on Acute Postoperative Pain in Indonesian Patients after Abdominal Surgery

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ABSTRACT

Foot massage is a non-pharmacological nursing intervention that can be used as a complementary therapy in relieving acute postoperative pain in patients after abdominal surgery. This randomized-controlled trial aimed to examine the effects of foot massage on pain intensity and pain distress of patients after abdominal surgery.

Forty subjects were randomly assigned to either the experimental group or the control group. Five hours and seven hours after patients had received Ketorolac 30 mg injection IV, the 30-minute foot massage was applied to the experimental group for two sessions on the first day (24-48 hours) after abdominal surgery. A Visual Numeric Rating Scale (VNRS) was used to measure the pain score.

Pain intensity and pain distress were measured across four time measures: at T1 (before giving the first session of foot massage), T2 (30 minutes after T1), T3 (120 minutes after T1 or before giving the second session of foot massage), and T4 (150 minutes after T1 or 30 minutes after T2). Data were analyzed using non parametric tests including the Wilcoxon match paired rank test, Friedman's test and Mann-Whitney U test.

The findings revealed that both the pain intensity scores and the pain distress scores in the experimental group after receiving foot massage (T2 and T4) were lower than those of before receiving the foot massage (T1 and T3) ($p<.001$). The scores stepped down and the lowest scores were at T4. There were significant differences in pain intensity and pain distress between the experimental group and the control group at T2, T3, and T4. The pain scores in the experimental group were lower than those of the control group. These findings confirm that foot massage did work in reducing pain intensity and pain distress across times.

Keywords: foot massage, pain intensity, pain distress, abdominal surgery

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CHAPTER I

INTRODUCTION

This chapter describes the background and significance of the problem, the objectives of the study, research questions, the research framework, hypotheses, definition of terms, the scope of the study, and the significance of the study.

Background and Significance of the Problem

Pain is a common symptom found in patients with acute and chronic illness that causes personal hardship. Pain is also the main reason encountered by hospitalized patients in general and surgical settings in particular. Patients who have a problem with pain have sensational and emotional responses that can be called pain intensity and pain distress (Smeltzer & Bare, 2004). Tranmer, Heyland, Dudgeon, Sequires and Coulson (2003) reported that 74 % of 69 patients including postoperative patients in their study experienced pain. Postoperative pain is caused by tissue damage as a consequence of the surgical procedure.

Postoperative pain is very common and develops naturally as a warning symptom (Apfelbaum, Chen, & Mehta, 2003). After surgery, its development can be predicted and should be prevented and treated (Power, 2005). Despite the pain medications and anesthetic techniques available, the prevalence of postoperative pain is still high. The prevalence of postoperative pain is approximately 80%. Among them 86% expressed moderate, severe, or extreme pain (Apfelbaum et al., 2003). A study found that patients after extremity surgery, abdominal surgery, and spinal

surgery expressed moderate to severe pain. Among them 41% expressed moderate or severe pain on day 0, 30% on day 1 and 19%, 16%, and 14% on days 2, 3, and 4, respectively. The prevalence of moderate to severe pain in the abdominal surgery group was high (30-55%) on postoperative days 0-1 (Sommer, de-Rijke, van-Kleef, Kessel & Peters, 2008). Similarly Laporte (1999) reported that the percentage of postoperative pain experienced by patients after abdominal surgery varied from 22% to 67% was severe to unbearable pain.

Pain after abdominal surgery has a significant effect on physiological, psychological, and socio-economical aspects of patients. The physiological effect is related to impaired respiration, disturbances in sleep and appetite, and decreased mobility (Chung & Lui, 2003). The psychological effect is associated with emotional responses, such as anger, fear, anxiety, sadness or depression, which can be conceptualized as pain distress (Smeltzer & Bare, 2004). The socio-economical effect commonly is related to hospital re-admission. Pain after abdominal surgery delays the discharge of the patient from the hospital and the health care cost increases because of longer hospital stays, due to the need to treat the negative effect of pain, and it also results in the patient's loss of productivity (Black & Hawks, 2005; Huang, Cunningham, Laurito, Chen, 2001). This leads to increasing financial need. Ultimately, it can contribute to a decrease in quality of life (Richards & Hubbert, 2007). These effects are challenges for health professionals in relieving acute postoperative pain. The nurse is one of the health professionals who has a role to control and relieve acute postoperative pain by administering pain-relieving interventions including both pharmacologic and nonpharmacologic interventions.

Postoperative pain management with the pharmacologic intervention includes the regular administration of analgesic drugs, particularly opioid or opioid derivatives such as morphine. Despite the regular administration of prescribed analgesics, some postoperative patients experience pain relief for only a few hours and may suffer pain distress from recurring pain when it is not yet time for the next dose. An opioid analgesia alone may not fully relieve all aspects of acute postoperative pain (Piotrowski, Paterson, Mitchinson, Myra, Kirsh, & Hinshaw, 2003).

Complementary therapy as an adjuvant therapy may have the potential to improve pain management and palliate acute postoperative pain (Piotrowski et al., 2003). Several complementary therapies can increase the effectiveness of medical treatment and enhance the patient's comfort; for example soothing music, relaxation, mind–body techniques, reflexology, herbal medicines, hypnosis, therapeutic touch and massage (Smith, Collins, Cyna, & Crowther, 2003). Massage was chosen as an alternative nursing intervention in relieving acute postoperative pain in this present study. Several previous studies have been conducted to investigate the effect of foot massage on acute postoperative pain.

The previous study found that the application of five minutes of foot massage on each lower extremity had a significant effect on pain intensity and pain distress in 32 patients after a hip or knee replacement (Brewer, 2001). Another study was conducted by Wang and Keck (2004) and indicated that a-20 minute foot massage and hand massage significantly reduced both pain intensity and pain distress resulting from incisional pain in general surgery on the first postoperative day. Hattan, King, and Griffith (2002) found that a-20 minute foot massage (10 minutes on each lower extremity) had a mean difference between pre and post intervention pain

intensity and pain distress, compared with guided relaxation and the control group of 25 patients who had undergone Coronary Artery Bypass Graft (CABG) surgery. Degirmen, Ozerdogan, Sayiner, Kosgeroglu and Ayranci (2008) used a foot massage and hand massage on reducing postoperative pain intensity in patients who had undergone a cesarean operation in their study. They suggested that foot and hand massage together or only a foot massage can be used as an effective nursing intervention in postoperative pain control. However those studies had methodological limitations. It was recommended to examine the effect of foot massage on acute postoperative pain using more rigorous designs and in different settings.

In Indonesia, studies to investigate the effect of massage are limited. Two studies have been conducted to investigate the effect of massage on pain intensity in patients with osteoarthritis and cancer. Sumartini (2008) applied stimulation with a slow back massage method to reduce pain intensity in 10 patients with osteoarthritis. She reported that the massage significantly reduced the old people's level of osteoarthritis pain intensity. Usman (2007) investigated the effect of a massage intervention on pain intensity in patients with breast cancer. The pain intensity of the breast cancer patients in the experimental group after receiving massage therapy was lower than that of the control group who received the usual care.

Those two studies had been conducted to investigate the effect of massage on pain intensity only. They did not measure pain distress. Those studies used the back massage method to reduce pain intensity. The researchers recommended to use another type of massage including a foot massage and to measure both pain intensity and pain distress. Thus far, there is no known study that has tested massage to reduce the pain intensity and the pain distress in postoperative

patients. Therefore, the researcher used the foot massage to reduce both pain intensity and pain distress in patients after abdominal surgery. The study was carried out at Doctor Kariadi Hospital Semarang.

The number of patients undergoing abdominal surgery in Doctor Kariadi Hospital, Semarang, has increased every year. Approximately 200 – 300 patients per year underwent abdominal surgery in 2008 and 2009. The number increases by 10% each year. Those patients suffer from postoperative pain. The level of pain intensity was moderate to severe, whereas the level of pain distress was annoying to agonizing. After abdominal surgery, patients usually receive pain medication of Ketorolac 30 mg intravenously every 8 hours during the first to third day after surgery. Most of them receive health insurance from the government and according to the health insurance policy, Ketorolac is a standard pain medication for relieving pain in patients after abdominal surgery. Physicians prescribed the medication and the patients do not get any nonpharmacological interventions.

The foot massage is an appropriate nonpharmacological intervention in relieving acute postoperative pain in patient after abdominal surgery. The feet are easily accessible and can be massaged without disturbing the patient's privacy. To determine the area of massage and additional reflex points, the feet are massaged for two sessions for 30 minutes each session. The researcher had expected the pain score of the patients receiving the foot massage would be stable or decrease until receiving the next pain medication administration. Through this intervention, patients receive attention and touch, which are vital elements of care that promote comfort and well being (Puthusseril, 2006).

Based on the above reasons, the researcher was interested in investigating the effect of foot massage on acute postoperative pain intensity and pain distress in patients after abdominal surgery. The researcher expected a foot massage could reduce acute postoperative pain intensity and pain distress in patients after abdominal surgery. The nurses can complementarily apply the foot massage in managing pain. The foot massage is effective, carries low risk and is safe for patients and there is no need of additional equipment. As a result, it can enhance the body to recover, shorten a hospital stay, and reduce health care costs.

Objectives of the Study

The objectives of this study were to:

1. Compare pain intensity and pain distress within the experimental group before and after receiving a foot massage intervention
2. Compare pain intensity and pain distress within the experimental group across four-time measures
3. Compare pain intensity and pain distress between the experimental group after receiving a foot massage intervention and that of the control group

Research Questions

The research questions were as follows:

1. Is the pain intensity and the pain distress of the experimental group after receiving a foot massage intervention lower than that of before receiving a foot massage intervention?

2. Are there any differences of the pain intensity and the pain distress within the experimental group across four-time measures?

3. Is the pain intensity and the pain distress of the experimental group after receiving a foot massage intervention lower than that of the control group?

Research Framework

The conceptual framework of this study was constructed based on the Gate Control Theory of Pain proposed by Melzack and Wall (1968), the Biochemical Theory of Physical Pain and the anatomy and physiology of the body.

The sense of pain from abdominal surgery is a consequence of tissue damage. Immediately after tissue injury, 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 include 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 (Copstead & Banasik, 2005). It is the continued release of these mediators that results in the spread of pain to surrounding areas.

All of the chemical mediators lead to an increase in sympathetic tone and facilitate spinal axon reflex which leads to peripheral vasoconstriction with consequent decrease of the microcirculation in the injured tissue and adjacent muscles. In response, increased skeletal muscle tension with spasm and splinting occurs (Loser, Bulter, Chapman, & Turk, 2001). These chemical mediators influence the membrane potential of the pain receptors, and if depolarization is sufficient, the nociceptor produces action potentials and potassium is released from cells. Immune response and

the inflammatory process are also stimulated from the injuries. Thus the body releases chemical mediators that generate local pain sensation.

The peripheral sensitization has systemic effects on pain receptors and nerve impulses that are transmitted via small nerve fibers, A-delta and C, to the central nervous system which has the gate control system in the dorsal horn at the spinal cord. The transmitted nerve impulses are linked and stimulated through the excitatory interneurons and subsequently activate the transmission neuron or T-cells; as a result, the gate opens, allowing neurotransmission along the ascending system of the neuropathway. The pain message, therefore, will finally reach the brain, where the pain sensation is recognized and interpreted. The perception of pain is the end result of the neural activity of pain transmission, that is a conscious experience, and the reticular system is responsible for the emotional and behavioral response to pain.

When nociceptive pain occurs, the human body has a simultaneous system to naturally control pain level. Pain impulses can be changed or inhibited through pain modulation. The pathway involved in modulation are through the descending pain system which involves neurons originating in the brainstem that descend to the dorsal horn of the spinal cord and modulating the transmission of pain to the central nervous system (Gatlin & Schulmeister, 2007; McCaffery & Pasero, 1999). Through the pain modulation mechanisms, some modalities can be applied to inhibit pain. As the feet are a natural focus for healing, being one of the most innervated and complex surface areas of the body, with 7000 nerve endings in each foot (Bright, 2001), it has been conceived that foot massage may promote the unblocking of a terminal nerve by enhancing this pain modulation.

The foot massage has four basic movements, including effleurage, petrissage, tapotement, and friction. These movements will stimulate nerve fibers (A-

beta fibers) on the foot and dermatome layers which contain tactile and pressure receptors. The receptors subsequently transmit the nerve impulse to the central nervous system. The gate control system in the dorsal horn at the spinal cord will be activated through the inhibitory interneuron whereas the excitatory interneurons are inhibited, resulting in the inhibition of T-cell functioning thus closing the gate. The pain signal, therefore, is not transmitted along the ascending system of the neuropathy and the brain does not receive the pain message (Salvo, 2003).

In addition, foot massage stimulates the opioid peptide mediators released to control the neurotransmission of pain by inhibiting the release of substance P, glutamate and other neurotransmitters from the receptors. Opioid peptides also close the gate by inhibiting the neurotransmission from the spinal cord to the receptors in the brain (Fields & Basbaum, 1999). Moreover, tactile stimuli by foot massage can reduce stress hormones. Also, the foot massage increases the blood circulation, decreases swelling, and increases the exertion of toxic substances, waste products and algogens (Griffith, 1995). Thus, the foot massage has an overall effect of pain reduction in postoperative patients as summarized in Figure 1.

Moreover, past pain experience (Porter, Grunau &Anand, 1999), ethnicity (Suza, 2003), age (Auburn, 2007), gender (Logan & Rose (2004), concurrent pain medication (Jacques, 2009), massage preference (Spatech institute, 2010), type of abdominal surgery (Burns & Blacwell, 2008), and the length of the abdominal (Burger, Riet & Jeekel, 2002) might act as extraneous or confounding variables of the relationship between a foot massage and pain. These factors were controlled in this study to ascertain the high internal validity of the study (Figure 2).

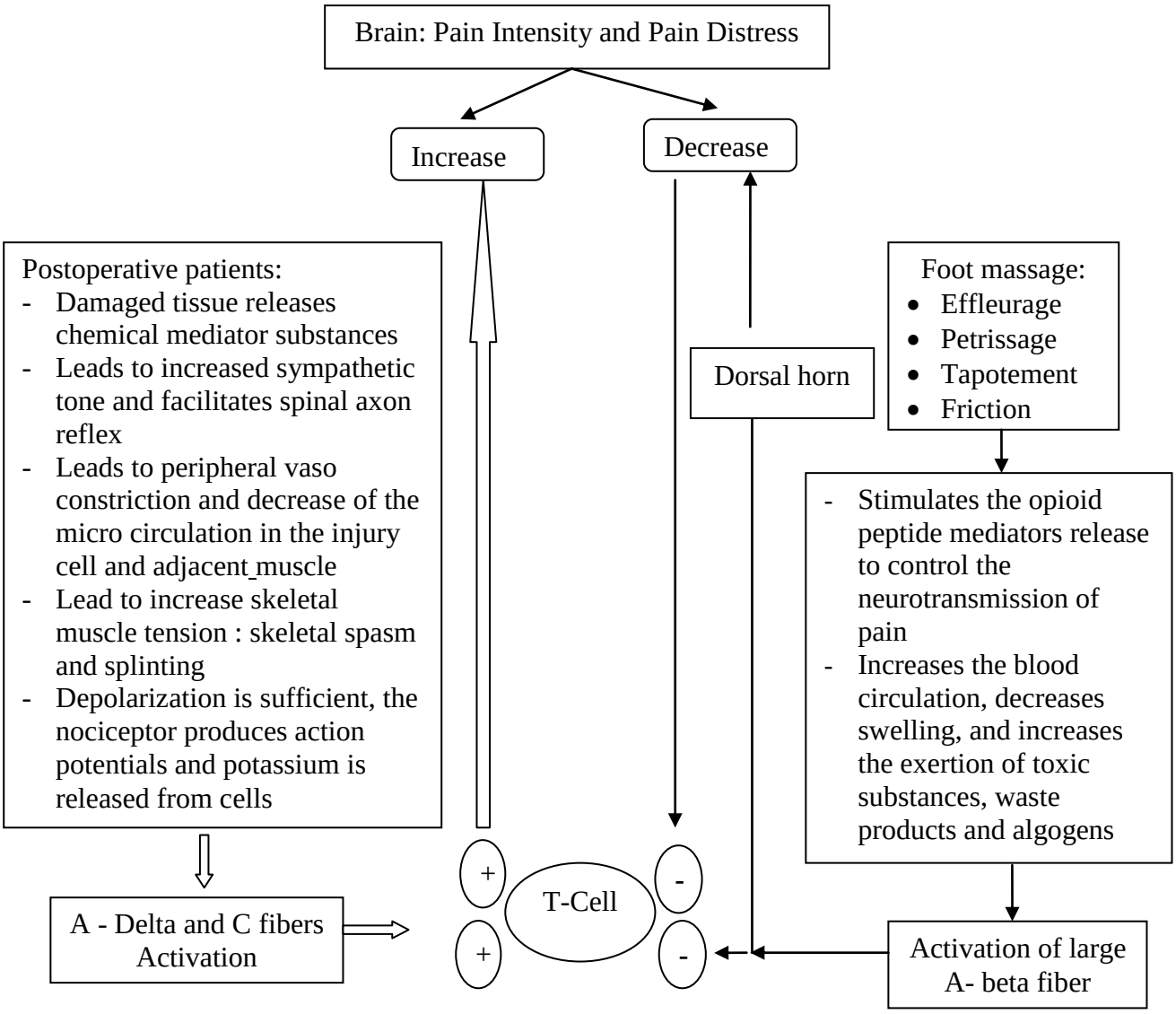

Figure 1

Theoretical Framework

(Bright, 2001; Copstead & Banasik, 2005; Loser, Bulter, Chapman, & Turk, 2001;

McCaffery & Pasero, 1999; Salvo, 2003).

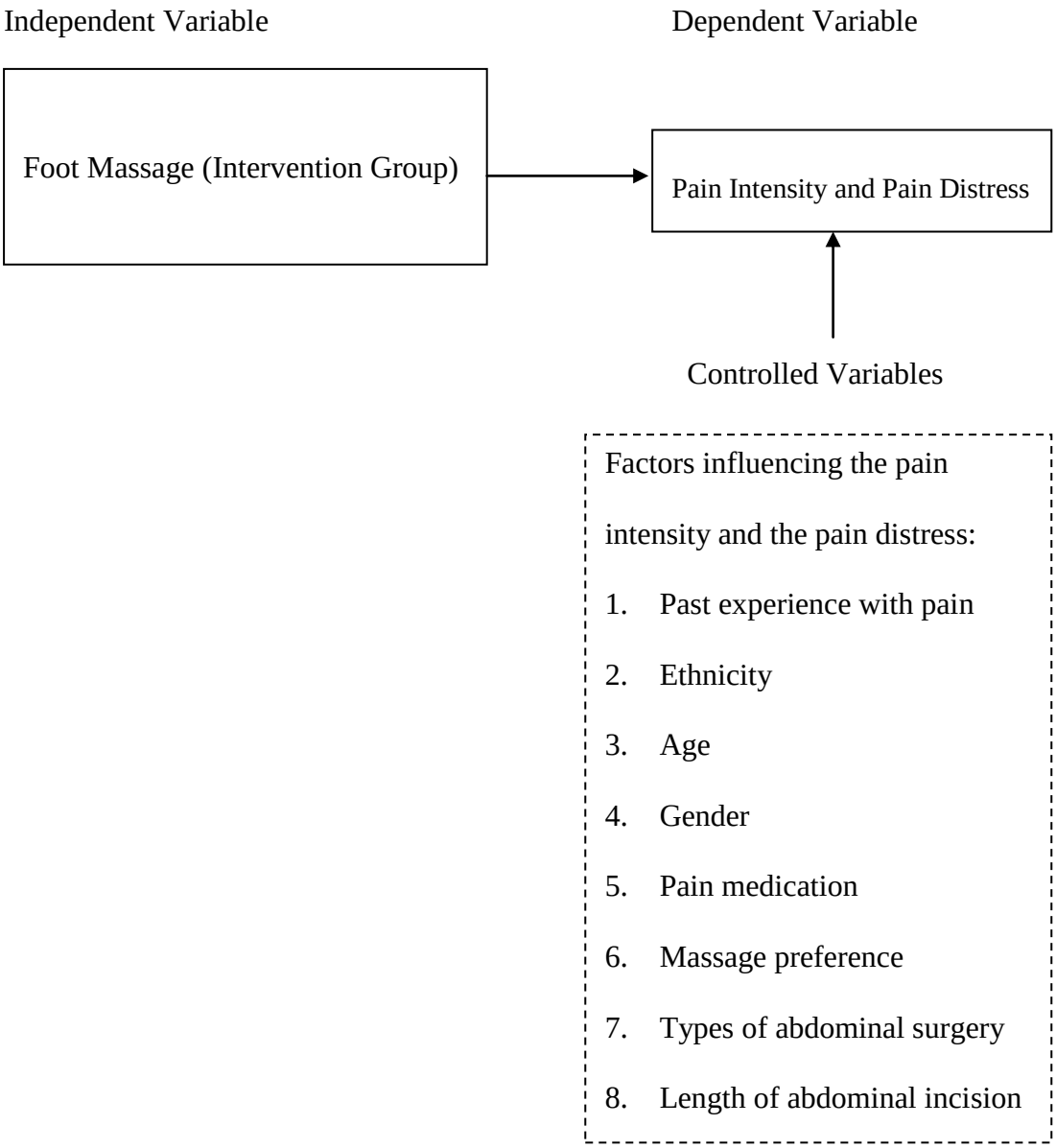

Figure 2

Research Framework

Note:

The identified variables were investigated in this present study

The identified confounding or extraneous variables were controlled in this present study

Hypotheses

The hypotheses were stated as follows:

1. The pain intensity and the pain distress of the experimental group after receiving a foot massage intervention is lower than that before receiving the foot massage intervention.

2. There are differences in the pain intensity and the pain distress within the experimental group across four-time measures.

3. The pain intensity and the pain distress of the experimental group after receiving a foot massage intervention is lower than that of the control group.

Definition of Terms

Postoperative pain refers to a patient's perception of the intensity of pain sensation and the feeling of distress from the abdominal incision wound. The pain intensity and the pain distress were separately measured by using the 0 - 10 Visual Numeric Rating Scale (VNRS) of pain intensity and pain distress. The higher the pain intensity scores and the pain distress scores, the higher level of its intensity and distress.

Foot massage refers to the application of a foot massage with effleurage, petrissage, tapotement and friction techniques using massage oil on both feet of the subjects. The foot massage was applied for two sessions for 30 minutes each session. It was applied to the subjects at 5 hours and 7 hours after receiving Ketorolac by intravenous injection on the first day (24-48 hours) after abdominal surgery.

Usual care refers to usual postoperative nursing care provided by nurses and other health team members in the male surgical ward. These include the administration of pain medication Ketorolac intravenous injection, care in response to individual need, wound care (dressing once a day), the provision of information about postoperative self-care, and the postoperative follow-up visits.

Scope of the Study

This study was conducted to investigate the effect of foot massage on acute postoperative pain in Indonesian patients after abdominal surgery. The patients were admitted to the male surgical ward of the Doctor Kariadi Hospital, Semarang Indonesia during November 2011 to February 2012.

Significance of the Study

A foot massage is a non-pharmacological nursing intervention that can be used as a complementary intervention in the care of patients after abdominal surgery. The result of this study can be used as evidence supporting an application of foot massage as a nursing intervention for the reduction of pain intensity and pain distress or as complementary therapy to pharmacotherapy for postoperative patients after abdominal surgery.

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CHAPTER II

LITERATURE REVIEW

This research is a study of the effect of a foot massage on acute postoperative pain in Indonesian patients after abdominal surgery. Related literature, textbooks and research were reviewed and presented in the following order:

1. Overview of abdominal surgery
    1.1 Types of abdominal surgery
    2.1 Line of incision of abdominal surgery
2. Acute postoperative pain
    2.1. Definition
    2.2. Pain mechanisms and pain theories
    2.3. Factors influencing postoperative pain
    2.4. Pain measurement
    2.5. Pain management
3. Foot massage
    3.1. Definition
    3.2. Thai and Javanese of foot massage
    3.3. Techniques of foot massage
    3.4. Guidelines of foot massage
    3.5. The mechanisms of foot massage in relieving pain
    3.6. Evidences supporting the effect of foot massage on pain relief
4. Summary

Overview of Abdominal Surgery

Abdominal surgery is defined as "surgery pertaining to the contents of the abdominal cavity, its walls and orifices" (American Board of American Surgery as cited in Burns & Blackwell, 2008). Abdominal surgery cuts the passages in the abdominal wall including muscles and peritoneum for the treatment of abnormalities in organs or tissues. The abnormality may be a tumor or infection in the peritoneum (peritonitis) in the abdominal organs (Raj, 2003). Abdominal surgery involves a surgical operation on organs inside the abdomen. This include on the stomach, gallbladder, small intestine, or large intestine (colon), liver, pancreas, spleen, esophagus, and appendix. Some reasons for abdominal surgery include infection, obstruction, tumors, or inflammatory bowel disease (Gralapp, 2008).

Types of abdominal surgery

The types of abdominal surgery are cholecystectomy, gastrectomy, colectomy and exploratory laparotomy (Burns & Blackwell, 2008).

Cholecystectomy

Cholecystectomy is the surgical removal of the gallbladder. The two basic types of this procedure are open cholecystectomy and the laparoscopic approach. It is estimated that the laparoscopic procedure is currently used for approximately 80% of cases. Although the laparoscopic procedure requires general anesthesia for about the same length of time as the open procedure, laparoscopy generally produces less postoperative pain, and a shorter recovery period. The laparoscopic procedure would not be preferred in cases where the gallbladder is so inflamed that it could rupture, or when adhesions (additional fibrous bands of tissue) are present.

Gastrectomy

Gastrectomy is the surgical removal of all or part of the stomach. The purpose of a gastrectomy is performed for several reasons, most commonly to remove a malignant tumor or to cure a perforated or bleeding stomach ulcer.

Colectomy

Colectomy is the excision of the colon through an upper midline incision. Bowel integrity is reestablished by an end-to-end anastomosis. A colectomy is performed for malignant lesions of the colon. A more radical procedure may be required when the lesion has perforated the greater curvature of the stomach.

Exploratory laparotomy

Exploratory laparotomy is any surgical incision into the abdominal wall, usually performed under general or regional anesthesia, often on an exploratory basis. This refers to the opening of the abdominal cavity for direct examination of its contents, for example, to locate a source of bleeding or trauma. It may or may not be followed by repair or removal of the primary problem.

Line of incisions of abdominal surgery

According to Burger, Riet and Jeekel (2002), there are four line incisions of the abdominal surgery as reviewed as follows:

Midline incision

The midline incision implies a vertical incision through skin, subcutaneous fat, linea alba, and peritoneum. Most of the fibers, crossing the linea alba in a medio-caudal and medio-proximal direction, are cut transversely. The incision is easy to perform and results in minimal blood loss, because of the avascular

nature of the linea alba. The incision can be made quickly, taking 7 minutes on average (6–9). Moreover, exposure of the abdomen is excellent. Extensions, when required, can easily be made superiorly or inferiorly, providing access to the whole abdominal cavity, including the retro peritoneum. All these qualities make the midline approach especially suitable for emergency and exploratory surgery.

Paramedian incision

An alternative for the standard midline incision is the paramedian incision. This technique stays clear of the relatively avascular linea alba, possibly avoiding impaired wound healing. This technique is more complex than the midline incision, resulting in an increased opening time (average 13 minutes) and blood loss. Exposure of the abdomen is better on the side of the incision than on the contralateral side. The possibilities for extending the incision superiorly are limited by the costal margin.

Transverse incision

A supraumbilical transverse incision offers excellent exposure of the upper abdomen. However, in case the operation area needs to be enlarged, extending the original incision is more difficult than when the midline incision is used and extensions do not always offer the desired view. When a full-length transverse incision is made, the oblique and transverse muscles, as well as the rectus abdominis muscle and linea alba are cut in a horizontal plane. Smaller transverse incisions can remain unilateral, taking less time to perform and leaving the deep epigastric arcade unharmed. The abdominal wall muscles are often cut in the same plane as the skin incision, but some surgeons open the abdominal cavity in a vertical direction, thus combining a transverse with a vertical technique.

Oblique incision

The subcostal or Kocher incision is an oblique incision that follows the profile of the costal margin and is directed in a medio-proximal direction. It provides good exposure for biliary and bariatric surgery and can be extended bilaterally if needed. Many segmental blood vessels and nerves are dissected, as well as the fibers of the external oblique, the transverse and the rectus abdominis muscles. The direction of the gridiron or McBurney incision is medio-caudal. It follows the direction of the fibers of the external oblique muscle, segmental blood vessels and nerves, damaging as little as possible. Notably, this incision splits all three muscular layers parallel to the direction of their fibers. The time to perform the incision and blood loss are comparable to those of transverse incisions.

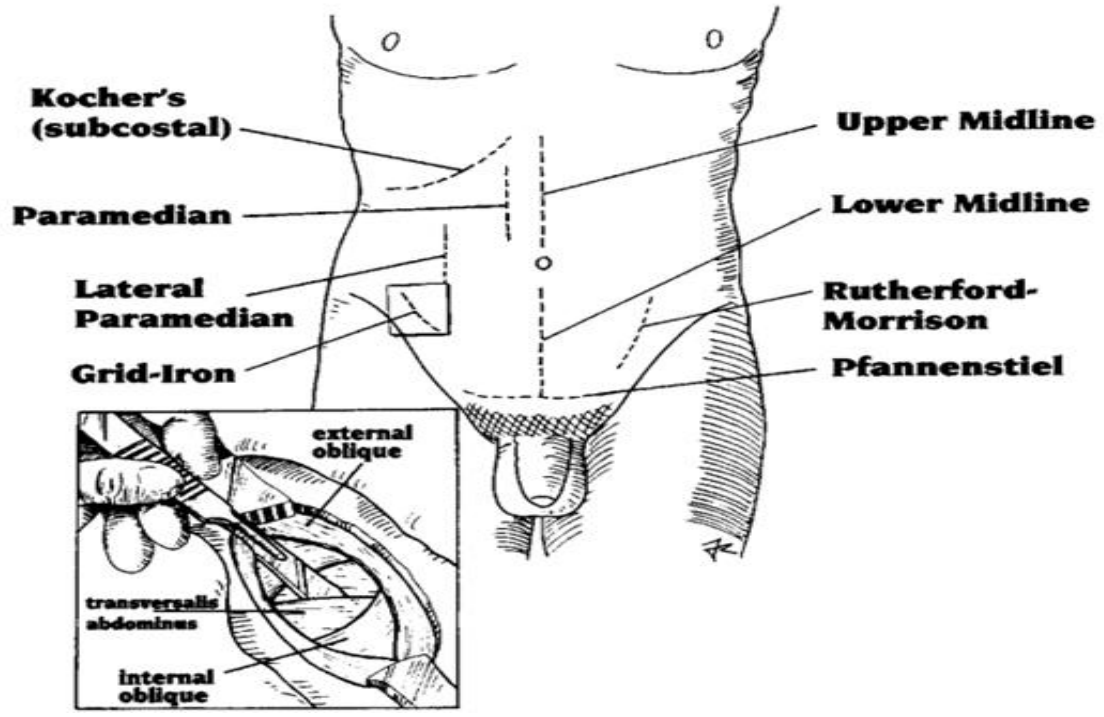


Figure 3

Line of Incisions of Abdominal Surgery (Burger, Riet & Jeekel, 2002)

As summarized, abdominal surgery is the surgery that involves an incision in the wall and the contents of abdomen to cure and correct any malformation of the organs. The surgical intervention includes cholecystectomy, gastrectomy, colectomy and exploratory laparotomy and is performed under general anesthesia. In this present study, the surgeons in the research setting used the conventional model technique. They preferred to use the midline incision to open the abdominal wall, because of its ease, speed and excellent exposure. However, as has been shown in the current review, the midline incision is associated with increasing postoperative pain compared to the transverse or oblique incision. Patients who had major abdominal surgery under general anesthesia with a midline incision were selected as the subjects.

Acute Postoperative Pain

Definition

Pain is defined as "an unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP as cited in Black & Hawks, 2005). McCaffery (as cited in Lewis et al., 2007) defined pain as "whatever the experiencing person says it is and existing whenever the person says it does". This definition means that the patient is the authority on pain. Pain is highly subjective and unique in nature.

Acute postoperative pain is pain after surgery characterized with a short duration of less than six weeks and has an identifiable, immediate onset such as incision pain after surgery. The perception of acute postoperative pain is a complex interaction involving sensory, emotional and behavioral factors (Black & Hawks, 2005). Although pain is an unwanted feeling, the sense of pain is beneficial for the

body as it is a warning sign and can be predicted (Afelbaum, Chen, & Mehta, 2003). Because pain is a subjective experience, it is difficult to give an accurate definition of pain.

Pain mechanisms

The sensory experience of pain depends on the interaction between the nervous system and the environment. The processing of noxious stimuli and the resulting perception of pain involve the peripheral and central nervous systems. There are four processes that describe the processing of pain. These processes of pain after abdominal surgery are: transduction, transmission, perception and modulation (Lewis, Heitkemper, Dirksen, O'Brien, & Bucher, 2007).

First, transduction is the conversion of mechanical or chemical stimulus into a neuronal action potential. The transduction of pain signals occurs at the level of the peripheral nerves, in particular the free nerve endings, or nociceptors. A delta fiber of primary afferent responds to noxious stimuli. Abdominal wall incision injuries induce the release of chemical mediators from the damaged cell such as prostaglandin, bradykinin, serotonin, substance P, potassium, and histamine. These chemical mediators actively sensitize the nociceptor to noxious stimuli. In order for a pain impulse to be generated, an exchange of sodium and potassium ions (depolarization and repolarization) occurs at the cell's membranes. This results in an action which is the potential in the generation of pain impulses.

Secondly, transmission is the movement of pain impulses from the site of transduction to the brain. Three segments are involved in nociceptive signal

transmission: (1) transmission along the peripheral nerve fibers to the spinal cord, (2) dorsal horn processing, and (3) transmission to the thalamus and the cerebral cortex.

The transmission process occurs all along the nociceptor fibers to the dorsal horn in the spinal cord. The pain impulses are then transmitted from the spinal cord to the brain stem through connections between the thalamus, cortex, and higher levels of the brain. The “C” fiber and “A” delta fiber terminate in the dorsal horn of the spinal cord. There is a synaptic cleft between the terminal ends of the “C” fibers and “A” delta fiber and the nociceptive dorsal horn neurons.

The pain impulses are then transmitted from the spinal cord to the brain stem and thalamus via two main nociceptive ascending pathways. These are the spinothalamic tract (STT) and the spinoreticular tract (SRT). Distinct thalamic nuclei receive nociceptive input from the spinal cord and have projections to several regions in the cerebral cortex, where the perception of pain is presumed to occur.

The next process of pain is perception. Perception occurs when pain is recognized, defined, and responded to by the individual experiencing the pain. The perception of pain is the end result of the neuronal activity of pain transmission where pain becomes a conscious multidimensional experience. The multidimensional experience of pain has affective motivational and sensory, discriminative, emotional, and behavioral components. When the painful stimuli are transmitted to the brain stem and thalamus, multiple cortical areas become active and responses are elicited. These areas are the reticular system, the somatosensory cortex and the limbic system.

Lastly, modulation involves the activation of descending pathways that exert inhibitory or facilitatory effects on the transmission of pain. These can lead to either an increase in the transmission of pain impulses (excitatory) or a decrease in

transmission (inhibition). Depending on the type and degree of modulation, nociceptive stimuli may or may not be perceived as pain (Lewis, Heitkemper, Dirksen, O'Brien, & Bucher, 2007). Descending inhibition involves the release of inhibitory neurotransmitters that block or partially block the transmission of pain impulses, and therefore produce analgesia. Inhibitory neurotransmitters involved with the modulation of pain include: endogenous opioids (encephalin and endorphin), serotonin, norepinephirine (noradrenalin), gamma aminobutyric acid (GABA), neurotensin, acetylcholine, and endoxytocin.

Endogenous pain modulation helps to explain the wide variations in the perception of pain in different patients as the individuals produce different amounts of inhibitory neurotransmitter. Endogenous opioids are found throughout the central nervous system (CNS) and prevent the release of some excitatory neurotransmitters, such as substance p, therefore inhibiting the transmission of pain impulses (Wall & Melzack, 1999).

Pain theories

Several theories have been proposed to explain the mechanisms of pain. To guide the explanation how patients after abdominal surgery experience acute postoperative pain and how to control acute postoperative pain through pain modulation mechanism, in this review two classical theories are presented: The gate control theory of pain and the biochemical theory of pain.

The gate control theory of pain

The gate control theory of pain recognizes three factors concerned with pain transmission and modulation: the arrival of nociceptive stimuli, the effect of

other converging peripheral stimuli that may exaggerate or diminish the effect of the nociceptive stimuli, and the presence of the central nervous system controls that influence the input (Wall & Melzack, 1989).

The theory proposes that peripheral stimulation produces nerve impulses that are projected to a gating mechanism in the spinal cord. Pain impulses are transmitted through small diameter fibers in the area of the substantia gelatinosa, which can inhibit or facilitate the pain impulses. The substantia gelatinosa acts as a gate control system to modulate (inhibit) the flow of nerve impulses from peripheral fibers to the central nervous system (Figure 4).

There are central transmissions or trigger cells (T cell) that act as a central nervous system control to stimulate selective brain processes that influence the gate control system. If T cell activity is inhibited, the impulse is not transmitted to the brain because the gate is closed. The T cells activate neural mechanisms in the brain that are responsible for pain perception and response. If pain signals are persistent, the fraction of impulses allowed through the various gates gradually declines. This is partly controlled by the transmitters, enkephalin, and serotonin. These transmitters partly regulate the release of substance P, the peptide that conveys pain information.

The central control system rapidly activates two cognitive subsystems in the brain. This activation selectively modulates or inhibits peripheral nerve impulses before they are projected to the brain. Specifically, the central control system activates the descending efferent fibers in the brain stem reticular formation and cortex. The central control system regulates activity in the sensory discriminative, motivational-affective, and cognitive-evaluative system. These systems determine pain response. These sensory-discriminative systems are mediated through the brain

stem and cerebral processing centers. It processes pain intensity and pain distress and strength along with the character of the event producing the experience. It is the learned response to the perception of pain and is thought to be the area where pain modulation may be enhanced. It is a system that interacts with control activities, such as foot massage may intervene between the stimulus and response (McCaffrey & Beebe, 1989; Sternbach, 1989). The activated central control system can inhibit or facilitate pain perception. Therefore, the brain does not receive the pain message (Wall & Melzack, 1989).

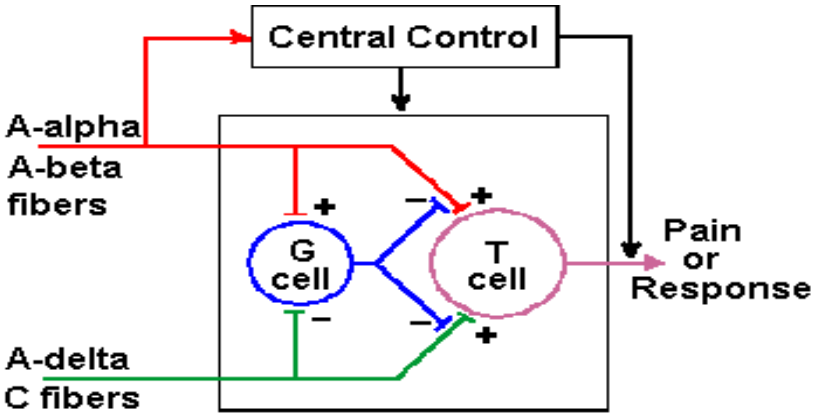


Figure 4

The Gate Control Theory of Pain

(McCaffrey & Beebe, 1989; Sternbach, 1989; Wall & Melzack, 1989).

The biochemical theory of pain

The biochemical theory of pain is the theory proposing that nociceptive and neuropathic pain, acute pain, peripheral and central pain including windup, neuroplasticity and central sensitization are a continuum of inflammation and the inflammatory response.

Tissue damage because of abdominal surgery leads to an inflammation response. There are three phases of an inflammatory response: initiation, maintenance and termination. Upon tissue injury or painful stimulation, specialized blood cells in the area such as basophiles, mast cells and platelets release inflammatory mediators: serotonin, histamine and nitric oxide. Subsequent to the binding of serotonin to its receptor, there is inflammation of the adjacent nerves and the nerve endings release short-lived inflammatory peptide proteins such as substance P, calcitonin gene-related peptide (CGRP).

In addition, clotting factors in the blood produce and activate potent inflammatory mediator peptide proteins called neurokinin A, bradykinin, kallidin and T-kinin. All of these proteins increase blood flow to the area of injury and stimulate arachidonic acid metabolism to generate inflammatory mediators prostaglandins and attract specialized immune cells to the area.

The first immune cells to the area are tissue macrophages, which provide the front line defense against bacterial infection. Macrophages release powerful enzymes to digest any bacteria that are present and produce potent inflammatory chemical mediators (called cytokines) to attract and activate other cells of the immune system. Shortly thereafter the area of bacterial invasion or tissue injury is invaded by the other immune cells, which include white blood cells such as T helper cells, lymphocytes, neutrophils, eosinophils, and other cells such as fibroblasts and endothelial cells. These immune cells respond to the chemical mediators, release destructive enzymes to kill any invading organism and release more chemical mediators to attract more immune cells. A consequence of this immune response is tissue damage, pain and spasm. In a sense the initial immune reaction ignites a

cascade of immune reactions and generates an inflammatory soup of chemical mediators.

These chemical mediators produced by the immune cells include prostaglandin, nitric oxide, tumor necrosis factor a, interleukin 1-a, interleukin 1-b, interleukin-4, interleukin-6 and interleukin- 8, histamine, serotonin. In the area of injury and subsequently in the spinal cord, enzymes such as cyclooxygenase increase the production of these inflammatory mediators. These chemical mediators attract tissue macrophages and white blood cells to localize in an area to engulf (phagocytize) and destroy foreign substances. The chemical mediators released during the inflammatory response give rise to the typical findings associated with inflammation (Omoigui, 2002).

In summary, tissue damage resulting from an abdominal incision induces a release of chemical mediators to generate local pain sensation. The local pain sensation has systemic effects on pain receptors and nerve impulses that are transmitted via nerve fibers A-Delta and C to the central nervous system which has the gate control system. Subsequently activating the T-cells, and as a result the gate is open. Therefore, the pain message reaches the brain. Patients after abdominal surgery then experience acute postoperative pain. They have high authority to determine their pain. When postoperative pain occurs, the human body has simultaneous system to control pain. Pain can be inhibited through pain modulation. Through the pain modulation mechanisms, some modalities can be applied to inhibit pain.

Factors influencing postoperative pain

Acute postoperative pain in patients after abdominal surgery is influenced by a number of factors, including past experiences with pain, culture and ethnicity, age, gender, pain medication, massage preference, types of abdominal surgery, and the line of incision of abdominal surgery. These factors may increase or decrease the patient's perception of pain, increase or decrease their tolerance for pain, and affect the manner of responses to pain (Smeltzer & Bare, 2004). In regards to the types of abdominal surgery and the incision lines of abdominal surgery, the factors have been discussed in the previous section.

Past experience with pain

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. Often, the more experience a patient has had with pain, the more frightened he or she is about subsequent painful events. This patient may be less able to tolerate pain; that is, he or she wants relief from pain sooner and before it becomes severe (Smeltzer & Bare, 2004).

The way a patient responds to pain is a result of many separate painful events during a lifetime. For some, past pain may have been constant and unrelenting, as in prolonged or chronic persistent pain. The patient who has pain for months or years on end may become irritable, withdrawn, and depressed. The impact of past experiences may cause the patient to perceive the next episode more intensely even though the medical conditions may be similar.

A study was conducted by Porter, Grunau and Anand (1999). They found that past experience with pain affects the way current pain is perceived. A

patient, who has negative experiences with pain, has reported greater difficulties with managing pain.

Culture and ethnicity

Pain is an individual experience and is influenced by culture and ethnicity. Culture and ethnicity are a critical factor in one's response to pain (Cleeland et al. as cited in Black & Hawks, 2005). These factors influence all responses, including responses to pain (how the pain is described) (Calvillo & Flaskerud as cited in Smeltzer & Bare, 2004). Pain is expressed behaviorally and verbally, and differently in different cultures and ethnics according to the individual situation.

Culture influences beliefs about how to prevent and treat illness and what constitutes good care. More specifically, it influences how each person experiences and responds to pain, including when and how to ask for treatment. Although experimentally controlled pain studies generally show that the intensity at which most people perceive a sensation and the point at which it becomes painful are approximately the same, the members of some ethnic groups have a higher tolerance for pain than others and can endure increasing levels of a pain stimulus for longer periods. Because pain has psychological, social, and spiritual as well as physical dimensions, it is greatly influenced by cultural factors (Narayan, 2010).

Thus, patients of different cultures respond differently to pain. Patients from cultures that value stoicism tend to avoid vocalizing with moans or screams when they are in pain. Suza (2003) found that the Javanese and Bataknese patients in Indonesian patients responded to pain differently. She found that Javanese patients tried to ignore pain and just kept silent, showed stoicism, and tried to divert the pain through religious activities. It means that Javanese patients have the capability to

manage her or his pain. On the other hand, Bataknese patients responded to pain by yelling, crying, or getting angry in order to get attention from others, thus showing expressiveness. The findings of this study indicated that patients with different culture expressed in different way which influence on pain perception.

Another study was conducted by Tan et al. (2008) in the ethnicity groups of Chinese, Malay, and Asian Indians. They found that ethnicity influences the perception of pain and consequent self administration of morphine. Ethnic groups differing in self reports on pain levels, and the amount of analgesic self administered have implications for the optimal management of acute post-operative pain.

Age

Age has a significant role in the perception and expression of pain. Adult patients have different responses to pain than the elderly patients. Pain is considered a natural manifestation of aging. This is interpreted in two ways. First, pain is a normal part of the aging process. Second, it is seen as a sign of aging. Also age is considered an important factor in the dosing of medications. Metabolic changes in older adults affect their response to opioid analgesics.

Many studies have been conducted to investigate the age on pain perception and the results have been inconsistent. Washington, Gibson and Helme (2000) found that older adults require a higher intensity of noxious stimuli than do younger adults before they report pain. Others studies have found that there were no differences in the responses of younger adults and older adults (Edwards & Fillingham, 2000). Li, Green-wald and Gennis (2001) reported that pain in elderly patients is part of the aging process. Elderly patients reported significantly less pain than younger patients.

Gender

Gender is an important factor in response to postoperative pain. Women reported more pain in more bodily areas with greater frequency and for longer duration as compared with men (Robinson & Tamres as cited in Keogh, 2005). Logan and Rose (2004) studied a sample of 100 patients to determine gender differences in coping with anticipated emotional distress. The results indicated that girls and boys differed on their lowest daily pain ratings and average daily pain ratings, with girls reporting more pain in both cases. Gender was found to moderate the relationship between the anticipatory distress and post-operative pain. Greater and higher anticipatory distress about post-operative pain before surgery was predicted for girls, but not for boys.

Massage preferences

Massage preference of patient has an influence on whether the patient would like to have a foot massage or not. A patient has the authority to choose and determine whether they would like or not like a foot massage. Patients cooperated during the study while receiving a foot massage and furthermore, the foot massage had a positive effect on acute postoperative pain.

A survey study was conducted by Spatech Institute (2010). The survey involved 11.000 peoples and asked the subjects “what type of massage do you want”? The study reported that 34 % selected relaxation or stress reduction massage, 28 % selected deep tissue massage, 16 % selected polarity, 11 % selected Swedish massage, 8 % selected others, and 3 % selected Shiatsu.

Massage preference influences on what type and kind of massage that a wants. Regarding massage preference, before the researcher applied the foot massage,

the subjects receive informed consent. If the subject in the experimental group, he received a foot massage for two 30 minute sessions.

In conclusion, many factors can contribute to the pain perception of an individual. These factors include past experiences with pain, culture and ethnicity, age, gender, pain medication, massage preference, the type of abdominal surgery, and the line of incision of the abdominal surgery. Depending on these factors, patients may feel mild, moderate, or severe pain from their abdominal surgery.

In order to control these factors, in this present study, only adult Javanese male patients who did not have experience previous surgery and who underwent major abdominal surgery using the midline abdominal incision under general anesthesia were selected as subjects. Therefore, they had high homogeneity regarding demographic and surgical-related data.

Pain measurement

Pain is a subjective psychological state and can be assessed through a patient's verbal or non-verbal report. Effective pain management requires appropriate assessment of pain that closely reflects' the feelings of the patient. Pain usually is measured in three ways as described below (Turk & Melzack, 2011):

Self report

There are several self reporting tools used to measure acute postoperative pain. Some of the measures are a single aspect of the pain assessment, for example the assessment of pain intensity and pain distress.

Pain intensity and pain distress is a common self report tool used to measure pain perception. Pain intensity and pain distress are a quantitative estimate of

the severity or magnitude of perceived pain. The three most commonly used methods to assess pain intensity and pain distress are the Verbal Rating Scale (VRS), Visual Analog Scale (VAS), and Visual Numeric Rating Scale (VNRS).

Verbal Rating Scale (VRS)

A verbal rating scale consists of a list of adjectives describing different levels of pain perception. An adequate VRS of pain perception should include adjectives that reflect extremes of this dimension (e.g. from no pain to extremely intense pain), and sufficient additional adjectives to capture the gradations of pain intensity that may be experienced. Patients are asked to read over the list of adjectives and select the word or phrase that best describes their level of pain on the scale.

VRS is usually scored by listing the adjectives in order of pain severity, and assigning each one a score as a function of its rank. In the fifth point, VRS used by Seymour (1982), for example no pain would be given a score of 0, mild pain a score of 1, moderate pain a score of 2, and severe pain score of 3. The number associated with the adjectives chosen by the patient would constitute his or her pain intensity score.

Visual Analogue Scale (VAS) and Graphic Rating Scale (GRS)

A VAS consists of a line, usually 10 cm long, which is labeled with extremes of pain (e.g., “no pain” to “pain as a bad as it could be”). A VAS may have specific points along the line that are labeled with intensity denoting adjectives or numbers. Such a scale is called a graphic rating scale (GRS). Patients are asked to indicate which points along the line best represent their pain intensity. The distance from the no pain end to the mark made by the patient’s is that patient denotes the patient’s pain intensity score.

Visual Numeric Rating Scale (VNRS*)*

A Visual Numeric Rating Scale (VNRS) is a common self report tool used to assess of pain intensity and pain distress. It is a box scale, which consists of 11 numbers (0 through 10) presented in ascending order and surrounded by a box. There are two kinds of Visual Numeric Rating Scales including the Visual Numeric Pain Intensity Scale and the Visual Numeric Pain Distress Scale. These are two separate, but similar format scales.

The Visual Numeric Pain Intensity Scale and the Visual Numeric Pain Distress Scale enable gauging of pain intensity and pain distress on a scale of 0 representing no pain to 10 representing the worst pain imaginable or unbearable pain). For the box scales patients are asked to place an "X" through the number that represents their pain. For all of the scale, the patient's pain intensity and pain distress score is simply the number she or he has indicated.

The validity of VNRS has been well documented that have positive and significant correlations with other measures of pain intensity and pain distress. The VNRS demonstrated sensitivity to treatments expected to impact pain intensity and pain distress. The VNRS is simply and easy to administer and score, because VNRS do not require special materials (e.g., pencils, printer cards, or papers).

Behavioral observation measures

This is a multi-dimensional tool or a check list that guides the health care professionals/nurses in examining the patient's behavior in response to their pain. The checklist was developed for pain measurement in children, but can also be used for adult patients, depending on the post-operative conditions that relate to the activity of the patient. This measurement can be used after surgery or when experiencing a

sharp, acute pain during a procedure where patients are unable to self-report. Behavior examples may cover faces, legs, activities, cries and consolability. These measures rely on behavioral indicators to assess pain scores and scores are produced for interpretation (Wall & Melzack, 1999).

Behavioral indicators are strongly recommended for pain assessment in nonverbal patients, and several tools has been developed and tested including Behavioral Pain Scale (BPS) and Critical Care Observation Tool (CPOT) (Herr, 2006). Both the BPS and CPOT is recommended by the physician and critical nurse to assess the pain in critical ill patients. 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. The BPS and CPOT are supported by experts as appropriate for use with uncommunicative critically ill adult patients.

Physiological measures

The assessment of physiological is an important part of the initial evaluation of pain in patients. It is necessary for the effective management of postoperative pain. The assessment of blood pressure is a common clinical examination and is an important measure of health.

Changes in physiological status may be an indication for the need of initial or additional analgesia and for adverse effects from systemic or neuraxial analgesia. Acute pain stimulates neurohumoral responses that can lead to significant increases in the heart rate, blood pressure, and respiratory rate. Increasing blood pressure, heart rate, and respiratory rates may be a sign of over medication, such as too many sedatives or opioids (Mace et al., 2006). This can be assessed by frequent

assessment in nursing care. Frequent assessments of physiological measures are necessary which include patterns of blood pressure, such as hypertension or hypotension; patterns of heart rates, such as bradycardia or tachycardia; and 20 patterns of respiratory rates, such as rate, depth, and regularity of breathing. Overall, changes in physiological states may be the first sign of complications directly related to post-operative pain (Black & Jacob, 1997).

In addition, pain is a subjective experience. The standard for assessing pain is the patients' self report as they are the only persons who recognize the intensity and distress of pain. A study conducted by Zhou, Petpichetchian, and Kitrungrote (2011) compared the psychometric properties of five evidence-supported tools (VDS, VNRS, FPS, CAS, and BS-21) in the adults varying in ages including those with mild cognitive impairment in a Chinese population. The major finding this study showed that the FPS is the best scale as it demonstrated good validity and reliability as well as the highest face validity, followed by the VDS and the VNRS, particularly for aged patients.

The Visual Numeric Rating Scale was chosen to measure both the pain intensity and the pain distress in the present study because the tool is simple. Zhou et al.'s study (2011) was used as a reference to determine the validity and reliability of this tool. Zhou et al. reported that the VNRS is a tool that has good validity and reliability. Furthermore, the researcher did not test the validity and reliability of this tool in the present study. In addition, according to the researcher's observation during data collection, this tool had been used by the nurses in the male surgical ward. They used this tool to assess a patient's pain. Therefore, the patients in the male surgical ward are familiar with this tool.

Pain management

Postoperative pain management for patients after abdominal surgery should be started when patients are admitted to the ward for the most effective outcomes (Black & Hawks, 2005). Early reporting of pain is recommended for effective pain management. Various approaches are available for postoperative pain management and the selection of approaches depends on the type of pain, physical condition and risk, including clinical practically. Pain management strategies include both pharmacological and nonpharmacological approach.

Pharmacological management

Managing a patient's pain pharmacologically is accomplished in collaboration with the physician or other primary care providers, the patient, and often the family. The physician prescribes specific medications for pain or may establish an intravenous (IV) or epidural route for administering analgesics medications (Smeltzer & Bare, 2004). Pharmacological management in acute postoperative pain is divided into three categories: non-opioid analgesics, opioid analgesics, and anesthetic agents.

Non-opioid analgesics

Non-opioid analgesics are pain medications for mild to moderate pain. Non-opioid analgesics include NSAIDs, such as ibuprofen, as well as other analgesics such as acetaminophen and aspirin. These medications also include adjuvant analgesics, which are those that relieve pain even though pain relief is not their primary purpose (Jacques, 2009).

Non-opioid analgesics may be short acting or long acting pain medication. They may be taken alone for pain management, though they may also be taken in combination with opioids to relieve moderate to severe pain. The non-opioid

analgesics mostly used are the non steroidal anti-inflammatory drugs. Non-opioids consist of NSAIDs and acetaminophen (Jacques, 2009).

NSAIDs have long been used for treating nonsurgical pain syndromes because of their well known anti-inflammatory, antipyretic, and analgesic properties. However, with the introduction of parenteral preparations of NSAIDs (e.g., Ketorolac and Diclofenac), these drugs have become more popular in the management of pain associated with ambulatory surgery.

Ketorolac is a non-steroidal anti inflammatory drug (NSAID) of heterocyclic acid derivative, often used as an analgesic, but has anti inflammatory and antipyretic effect as well. Ketorolac is indicated for the short-term management of moderate to severe pain, most frequently for postoperative pain. It is administered by the oral, intra muscular, intra venous and topical routes. The efficacy of IV administration is similar to that of morphine and opioid analgesics (Aschenbrenner, 2010).

The primary mechanism of Ketorolac is the inhibition of prostaglandin synthesized by the competitive blocking of the enzyme cyclooxygenase (COX). The result is a decreased formation of prostaglandin precursors; has antipyretic, analgesic, and anti inflammatory properties.

Ketorolac is rapidly and completely absorbed following intramuscular administration. Ketorolac can be administered by both intramuscular injection and intravenous injection. To reach the efficacy, Ketorolac has an onset duration of 30 minutes and has an analgesic effect for 6-8 hours after administration. Ketorolac reaches peak effect in 2 to 3 hours after having given a single dose of 30 mg. The plasma half-life time elimination is an average of 5 hours in young adults and

7 hours in elderly people (average age 72 years). After 5 hours, the concentration of the Ketorolac in the blood decreases until 8 hours. After administering a single intravenous dose, the average volume of distribution is 0.25 L/kg. Ketorolac and its metabolites (conjugates 6.1%) are excreted in the feces (American Pharmacist Association, 2010; Aschenbrenner & Venable, 2010).

Acetaminophen is potentially one of the most useful, yet it is vastly under used non-opioid analgesics in the ambulatory setting. When administered in an appropriate oral or rectal dose, acetaminophen can be a very useful adjuvant during the perioperative period and compares favorably to the NSAIDs (White, 2002).

Acetaminophen becomes a toxin when taken in large doses or if, over the long term, large amounts are ingested or under other specific conditions. Conditions like these may enhance hepatotoxicity. Moreover, acetaminophen can cause hypersensitivity if the patient has an allergy history. The following conditions show side effects and allergic reactions which include: swelling, difficulty in breathing, closing of the throat, abdominal pain, nausea, unusual bleeding or bruising, and even death (Clayton & Stock, 2004).

Opioid analgesics

Opioid analgesics are derived from natural opium alkaloids and their synthetic derivatives. Opioid analgesics are added to the medication regimen when pain is moderate to severe and non-opioid analgesics are insufficient to manage pain effectively. Tolerance and physical dependence can be seen in the long term administration and are not associated with short term opioid treatment (Black & Hawks, 2005).

Many opioid drugs are used in pharmacological interventions, such as morphine, codeine, fentanyl, methadone, etc. Practically all drugs have side effects that cause effects other than those that are desired. Some side effects from using morphine in pain management include respiratory depression, hypotension, constipation, urinary retention, decreased urinary output, dizziness, nausea, and vomiting. These side effects can even be life threatening. As is the case with opioid, these side effects are often related to the drug dosage or more correctly to the concentration of opioid in the circulation (Aschenbrenner & Venable, 2010; Black & Hawks, 2005).

Anesthetic agents

An anesthetic agent is a pharmacologic substance that, in addition to abolishing pain, generally causes loss of feeling and sensation. Anesthetic agents include three types of anesthesia: regional, local anesthesia, and general anesthesia.

Local anesthetic agents may be applied topically (on the skin or mucous membranes), infiltrated locally, used for specific nerves blocks or administered intravenously, depending on the reason for their use. Local anesthetic agents act by temporarily blocking nerve impulses between the peripheral structures and the nerves regain their function over a period of minutes to hours. Local anesthetics are divided in two classes, both the ester (e.g., procaine) and the amides (e.g., lidocaine) (Black & Hawks, 2005).

Regional anesthesia is used in minor surgery and other procedures in the infiltration of local anesthetics in to the skin and subcutaneous tissue to produce loss of sensation, whereas the general anesthesia usually is accompanied by that of the

unconsciousness and reflex along with amnesia regarding the experience (Black & Hawks, 2005).

In summary, pharmacological medication has three categories: non-opioid analgesics, opioid analgesics, and anesthetic agents. All medication management is used to relieve pain during and after an operation and must be allocated in accordance with the condition of the patients. Every pharmacological treatment has many side effects that can be life threatening. Therefore, when a physician prescribes the pharmacologic medication he or she should consider the side effects from these drugs. Therefore, good management is needed to manage the side effects those drugs.

Each drug has different pharmacokinetic and pharmacodynamic properties. The pain medication of each drug has different of analgesic duration effect, analgesic peak effect, and an average half life time elimination. Moreover, these drugs give different responses to a patient's pain. In order to control the patients having the same response during the study; the researcher recruited the patients as subjects who received the same pain medication. Ketorolac was chosen the pain medication that was given to patients. The patients received the pain medication Ketorolac only by intravenous injection.

Non-pharmacological management

Besides pharmacological intervention, there are non-pharmacological interventions to manage acute postoperative pain. Many non-pharmacologic therapies are used to reduce the pain intensity and pain distress. In recent years, 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 evidence from a wide range of studies is needed to show their efficacy so as to enhance the applicability of these therapies. In the current literature, there are some evidences that non-pharmacologic intervention relieves acute postoperative pain.

Relaxation

Relaxation is one of the methods to decrease pain which has many variations including relaxation, music or a combination between relaxation and music intervention (Good, Anderson, Hicks, & Makii, 2002). Relaxation can counteract the effect of the fight or flight response and promote mental and physical freedom from tension and stress. Physical and mental tension can aggravate any pain.

Good et al. (2002) studied the effect of three nonpharmacologic nursing interventions include relaxation, music, and the combination of relaxation and music on pain following gynecological (GYN) surgery. Patients who received the interventions plus patient-controlled analgesia (PCA) had 9% to 29% less pain than the controls who used PCA alone. Reduced pain was related to the amount of activity (ambulation or rest), the mastery of the use of the intervention, and decreased pulse and respiration. Another group of researchers (Ikedo, Gangahar, Quader & Smith, 2007) studied the effects of praying and relaxation techniques during general anesthesia on the recovery outcomes of cardiac surgery patients. They compared relaxation and praying and found there is a positive relationship among relaxation and praying techniques. The study found that relaxation and praying would assist conventional medical treatments.

Guided imagery

Guided imagery helps a client visualize a pleasant experience. The client is coached to visualize a scene (e.g., relaxing on a beach). The coach instructs the client to imagine the sensory aspects of the scene: the sounds, sights, and emotion expressed. Visualization may be combined with soft, lyrical, relaxing music. Audiotapes for guided imagery are available (Lewis, Heitkemper, Dirksen, O'Brien, & Bucher, 2007).

Albert (2001) conducted a study on the effect of guided imagery and music on pain and anxiety during laceration repair. It showed that partial correlation analyses revealed that situational anxiety was significantly related to pain sensation while controlling for distress and that situational anxiety was also significantly related to pain distress. Using multiple regressions, the combination of GIM did not significantly decrease pain sensation, pain distress, and situational anxiety. Although effects on pain outcomes were not found, the patients reported that the intervention was slightly to very beneficial. The researcher suggests that a guided imagery and music intervention helps clients to reduce their pain and anxiety levels.

Meditation

Meditation is one of the non-pharmacological strategies that can improve physical health, reduce pain, enhance immune responses, improve emotional well- being, and foster spiritual growth (Ikedo, Gangahar, Quader & Smith, 2007). Meditation is an exercise, which usually involves training the individual to focus his or her attention or consciousness on one object, sound or word (Cardoso et al., 2004). Meditation has five basic components such as relaxation, concentration, altered state of consciousness, logic relaxation, and attitude to self observation (Craven, 1989). A

study conducted by Sitepu (2009) used Zikr meditation to relieve acute postoperative pain in Muslim patients who had undergone abdominal surgery. Sitepu found that pain intensity was significantly different in the experimental group compared with the control group. The pain intensity in the experimental group after the intervention was lower than before the intervention and was lower compared with the control group

Meditation is one of the proven alternative therapies. It can be broadly classified under mind/body medicine. Cardoso (2004) proposed that meditation or contemplation involves focusing the mind upon a sound, phrase, prayer, object, visualized image or the breath in and out. This is done in order to increase awareness of the present moment, promote relaxation, reduce stress, and enhance personal or spiritual growth. Meditation is grouped into basic approaches such as concentrative meditation and mindfulness meditation.

Hypnosis

Hypnotic therapy is a structured technique that enables a patient to achieve a state of heightened awareness and focused concentration that can be used to alter the patient's pain perception (Barber as cited in Lewis, Heitkemper, Dirksen, O'Brien, & Bucher, 2005). Hypnosis is based on the suggestion, dissociation, and the process of focusing attention (Black & Hawks, 2005). Research support has been proved by Grondahl and Rosvold, (2008). The treatment group improved from their symptoms, (changed from 62.5 to 55.4), while the control group deteriorated (changed from 37.2 to 45.1). The 12 patients who completed the treatment showed a mean improvement from 51.5 to 41.6. One year later the corresponding result was 41.3, indicating a persisting improvement. This study indicates that hypnosis

treatment may have a positive effect on pain. Considering the limited number of patients, more studies should be conducted to confirm the results.

A hypnotic intervention for pain typically begins with induction and suggestions for deepening the trance state. These are followed by various suggestions for reduced pain or discomfort. For chronic pain management, posthypnotic suggestions are almost always given that any pain reduction achieved will last beyond the session, and/or for the patient to recreate a sense of comfort and relaxation outside of the session by use of a simple cue (e.g. closing one's eyes and taking a deep breath) (Stoileb, Molto & Patterson , 2009)

Hypnotic analgesia interventions also frequently make use of self-hypnosis training and patients are provided with a CD or a recording of one or more sessions so they can practice the skills they have learned on their own between sessions. For acute pain, providing suggestions for pain relief can be a straightforward issue; for chronic pain, suggestions for pain relief often must be accompanied by suggestions that address the complex psychosocial issues that frequently accompany this health condition (Jensen & Patterson, 2008).

Massage

Massage is the manipulation of the superficial and deep layers of muscle and connective tissue to enhance function, aid in the healing process, and promote relaxation and well-being (Calvert, 2002). Massage involves acting on and manipulating the body with pressure structured, unstructured, stationary, or moving tension, motion, or vibration, done manually or with a mechanical aid. Target tissues include muscles, tendons, ligaments, fascia, skin, joints, or other connective tissue, as well as lymphatic vessels, or organ gastrointestinal system. A massage can be applied

with the hands, fingers, elbows, knees, forearm, and feet (National Center for Complementary and Alternative Medicine, 2006).

Massage is a non-pharmacological intervention that can be used as a complementary adjunct in the care of patients after surgery. Massage has been proved to relieve acute postoperative pain. Wongsdara (2004) found that postoperative patients after receiving a local back massage reported a reduction in pain level throughout the 2 hour study period or until the 135th minute of the study. Similarly Piotrowski et al. (2003) found that the rate of decline in the unpleasantness of postoperative pain was accelerated by massage. Massage also accelerated the rate of decline in the intensity of postoperative pain. Massage can be a complementary therapy to relieve acute postoperative pain.

For this present study, the above nonpharmacological interventions would not be tested because these interventions have been proven to reduce postoperative pain. The foot massage would be tested because this intervention was a new technique that was applied in the research setting. The researcher used a more rigorous design as explained in chapter 3.

Foot Massage

Definition

Foot massage is a technique by which both the feet of the recipient are held at various positions, stroked gently and rhythmically to attain a relaxation response (Puthusseril, 2006). Foot massage employs soft tissue manipulation to influence the whole person, improving circulation, relaxing muscular and nervous tissue and speeding up the elimination of waste products.

In the Ayurvedic tradition, foot massage is said to balance the bodily characteristics, or doshas – vata, pitta and kapha. All this special attention helps to detoxify and balance the body's energies, leaving the recipient of the massage feeling refreshed and relaxed (Bright, 2001).

In this present study, reflex points on the feet were used to determine the area of massage. Or in the other words, the foot massage is the application of pressure onto particular areas of the soles of the feet. A reflex action in another part of the body is stimulated by the manipulation of each specific area.

Thai and Javanese foot massage

The Thai foot massage and Javanese foot massage are chosen as a source of massage therapy in this present study. The Thai foot massage is a massage of the lower legs and feet that involves hands on stretching and massaging to "open" Sen (energy) Lines, along with the use of a stick to stimulate the reflex points on the feet which correspond to the internal organs of the body. Thai foot massage stimulates these points to promote general health and well-being. Thai foot massage is directly related to Ayurvedic principles. Ayurvedic bodywork is a form of therapy based on the theory of the flow of energy between specific points on the periphery of the body and the internal organs. Thai massage is considered to be energy–work rather than body-work (Salguero, 2004).

The Javanese foot massage is a type of treatment that has adopted its own strength and endurance, by giving a touch of massage on locations and places that have been mapped by zone therapy. The zone serves to explain the boundaries and location of the reflex related organs (Pamungkas, 2009).

Both Thai foot massage and Javanese foot massage take their origins from China where the art has been practiced for over 5000 years. The Thai foot massage and the Javanese foot massage have developed from Chinese, Japanese, and Korean foot massage. Massage balances the elements of the mind and body, while foot massage stimulates the internal organs, giving the receiver a holistic treatment (Gall, 2011).

According to Pamungkas (2009) and Salguero (2004), both the Thai foot massage and Javanese foot massage have a similarity in basic techniques. These techniques range in pressure, and involve the precise use of body mechanics on the part of the massager. These basic techniques consist of four basic techniques of foot massage.

First, the palm press is the most basic technique in a massage. Second is the palm circle. This is a lighter touch than the palm press, although the principles are the same. Third, the thumb press is the basic technique massage method for applying acupressure. The thumb press is used mainly on muscles and energy meridians. It should be stimulating and strong, but not overwhelming. Lastly, the finger press or the "bladed hand" is used when the thumb press does not provide proper leverage, or when trying to press a very thin area.

Both the Thai foot massage and the Javanese foot massage use similar basic techniques. There are four basic techniques of foot massage and these are effleurage, petrissage, tapotement, and friction (Hollis 1998; Salvo, 1999). These techniques have a mechanism in relieving pain as reviewed in the following section.

Techniques of foot massage

Foot massage has physical and psychological benefits to the whole person (Puthusseril, 2006). While massage, the nurse can assess the feet, stimulate circulation, decrease edema and provide a local form of passive exercise. Through this therapy patients receive attention and touch, which are vital elements of care that promote comfort and well being (Puthusseril, 2006). The foot massage is specific form of massaging which uses the four following basic techniques (Hollis, 1998; Salvo, 1999). These techniques have a mechanism in relieving pain. For more detail explanation is discussed as below:

Effleurage

Effleurage is the gliding manipulation of the superficial tissues. Effleurage is used to apply a lubricant and to spread it over the surface. Warming the surface layer of the tissue reflexively creates a smooth relaxing flow and rhythm for the application of the stroke (Goldstein & Casssanelia, 2008).

Effleurage or deep stroking has an effect on the blood flow in the veins, which have internal valves to prevent recurrent blood flow. Residual blood in peripheral blood pressure will flow into the veins and the heart more easily. As a result, the blood supply to the skin, as well as skin temperature increases and subcutaneous tissues are stretched out thus reducing fibrosis formation. The flow of lymph fluid is stimulated, leading to an increased drainage of waste products (Andrade & Clifford, 2001). Effleurage strokes are capable of enhancing blood and lymph circulation, inducing relaxation, improving the quality of sleep, reducing the pain experience uplifting mood and reducing abnormal muscle contraction (Fritz, 2000; Salvo, 2003).

Petrissage

Petrissage is a group of techniques that repetitively lift, roll, grasp, stretch, compress or squeezes the underlying tissue. When performing petrissage, the therapist lifts, rolls, stretches, compresses, kneads or squeezes the underlying tissue or structures between their hands (Salvo, 2003). The basic petrissage technique includes kneading, wringing, skin rolling, squeezing, and compression.

All petrissage movements enhance blood flow. The compression and release on the muscles stimulate the venous blood flow in subcutaneous tissues and muscles resulting in decreased blood retention in peripheral vessels and increased drainage of the lymph. Slow kneading with sufficient pressure can induce arterial dilation which increases the blood supply to the area being massaged. For the muscular system, compressive movements increase the blood supply and improve the effectiveness of muscular contractions as well as the drainage of waste products of the muscles. Slow kneading also helps reduce tension in the muscles, inducing a sense of relaxation and comfort (Salvo, 2003).

Tapotement

Tapotement is repeated rhythmical, percussive firm striking manipulation of the superficial and low deep tissues that is followed by a quick rebound. Tapotement is equally referred to as percussion (Andrade & Clifford, 2001).

When applied on the skin, tapotement/gentle percussion stimulates the blood flow to the massaged area. Hard percussion will cause a red mask on the skin. Percussion also stimulates the axon reflect, inducing vasoconstriction at first followed by vasodilatation, which generates a warm temperature on the skin. It also has an effect on the muscles by enhancing muscular contraction. Tapotement induces muscle

relaxation, stimulates digestion, enhances respiratory function, relieves pain, increases lymphatic return, and increases arousal (Dedomenico & Woods, 1997; Liston 1995; Rattray & Ludsing, 2000).

Friction

Friction is a specific repetitive, non gliding technique where superficial tissues are moved over the underlying structures with the purposes of improving tissue mobility, increasing blood flow and decreasing pain (Simon & Travell, 1999). Friction techniques are often recommended for the management of injuries, when the inflammatory process is controlled (Brukner & Khan, 2001; Lowe, 2003). It is proposed that friction manipulation promotes the healing of an injury by encouraging the healthy alignment of connective tissue during the healing process. It is proposed that a friction manipulation has strong analgesic effects (Hammer, 1999). The anesthetic effect of friction manipulation according to the gate control theory of pain is that there may be a stimulation of the large fiber mechano receptors that cause presynaptic inhibition at the spinal cord, preventing the small diameter (slower) fibers from reaching consciousness.

In summary, the four techniques of foot massage have an effect on relieving acute postoperative pain. The effect is related to the perception and threshold of pain. A Foot massage induces changes in local circulation and has effects on the reduction of noxious substances released by decreasing nociceptor sensitization. Moreover, a foot massage stimulates large diameter a-delta fibers and generates presynaptic inhibition, thus reducing or preventing neurotransmission to the perception at the brain, therefore pain levels decrease.

Guidelines of foot massage

The general procedure of foot massage is developed from the massage principle using four basic techniques that have been conducted by previous researchers (Brewer 2001; Puthusseril, 2006; Wang & Keck, 2004). The general guidelines of foot massage consist of three phases; preparation phase, implementing phase, and finishing phase (Appendix E). The steps are developed according to the reflex points on the feet. The steps and techniques of a foot massage can be summarized as below:

Preparations phase

1. Set the environment, the patient's position.

2. Warm the foot by soaking the patient's feet using warm water mixed with natural herbs for around 5 - 10 minutes and drain.

3. Start the warm up for the foot massage: Lubricate the foot starting from the right foot, apply natural oil to the foot for comfort, and warm up the foot by rubbing it all over and applying the oil in a sweeping motion including the top of the foot, the heel and arch.

Implementing phase

The foot massage is started from the left foot until finished, then the right foot, massage the reflex points on the feet as described below:

1. Using the friction technique, compress the feet using the thumb or a stick at the reflex points of the: heart, adrenal gland, solar plexus, kidneys, ureters, bladder, penis, stomach, duodenum, and pancreas.

2. Using the petrissage technique, compress the feet using the thumb or a stick at the reflex points of the: small intestines, transversal colon, descending

colon, rectum and anus, heart and spleen, pituitary gland, thyroid gland, and parathyroid gland.

3. Using technique of effleurage with deep stroke, compress the feet at the reflex points of the: genital gland.

4. Using the friction technique, compress the feet at the reflex points of the: prostate and frontal sinus, temporal area, neck, head, cerebellum, nose, eye and ear balance organ, shoulder, trapezoid, scapula and elbow joint, knee, cervical vertebra, dorsal vertebra, and lumbar vertebra.

5. Using the petrissage technique, compress the feet at the reflex points of the: coccyx reflex, hip joint.

6. Using the effleurage (superficial stroke) technique, compress the feet at the reflex points of the: tonsils, maxilla lower jaw, and sub maxilla upper jaw reflex.

7. Using the petrissage technique, compress the feet at the reflex point of the: larynx, wind pipe and lymph cistern.

8. Using the friction technique, compress the feet at the reflex points of the: lung, bronchi, breast and diaphragm.

9. Using the petrissage technique, compress the feet at the reflex points of the: ribs and groin, relaxation of the abdomen, rectum, and hips, lymph glands of the upper body and abdominal lymph gland.

Finishing phase

1. When finished, cover the feet with warm towels for 1-3 minutes.

2. The foot massage ends with some stretching techniques for the foot and calf muscles. Unwrap the towel from the foot and clean the excessive oil and tap in the soles of the feet.

The Mechanisms of foot massage in relieving postoperative pain

The effects of a massage on the pain mechanism are related to the perception and threshold of pain. Postoperative pain is caused by tissue damage that induces the release of chemical mediators from the surgical wound. The chemical mediators include prostaglandin, proton, serotonin, histamine, bradikynin, cytokines and neuropeptides to generate local pain sensation (Copstead & Banasik, 2005).

The local pain sensation has systemic effects on pain receptors and nerve impulses that are transmitted via nerve fibers A-Delta and C to the central nervous system which has the gate control system subsequently activating the T-cells, as a result the gate is open. Therefore the pain message reaches the brain. Finally postoperative is recognized and interpreted (Fields & Basbaum, 2000).

When postoperative pain occurs, the human body has the simultaneous systemic to control pain. Pain can be inhibited through pain modulation (Gatlin & Schulmeister, 2007; McCaffery & Pasero, 1999). Through the pain modulation mechanisms, some modalities can be applied to inhibit pain. As the feet are a natural focus for healing, being one of the most innervated and complex surface areas of the body, with 7000 nerve endings in each foot (Bright, 2001), it has been conceived that foot massage may promote the unblocking of a terminal nerve by enhancing this pain modulation.

The foot massage has four basic movements, including effleurage, petrissage, tapotement, and friction. These movements stimulate nerve fibers (A-beta fibers) on the foot and dermatome layers which contain tactile and pressure receptors. The receptors subsequently transmit the nerve impulse to the central nervous system. The gate control system is activated through the inhibitory interneuron whereas the excitatory interneuron is inhibited, resulting in the inhibition of T-cell functioning thus closing the gate. The pain message is not transmitted to the central nervous system, therefore, the brain does not receive the pain message (Salvo, 2003). Ultimately, the pain is not recognized and interpreted. Thus, a foot massage has an overall effect of pain reduction in postoperative patients as summarized in Figure 5.

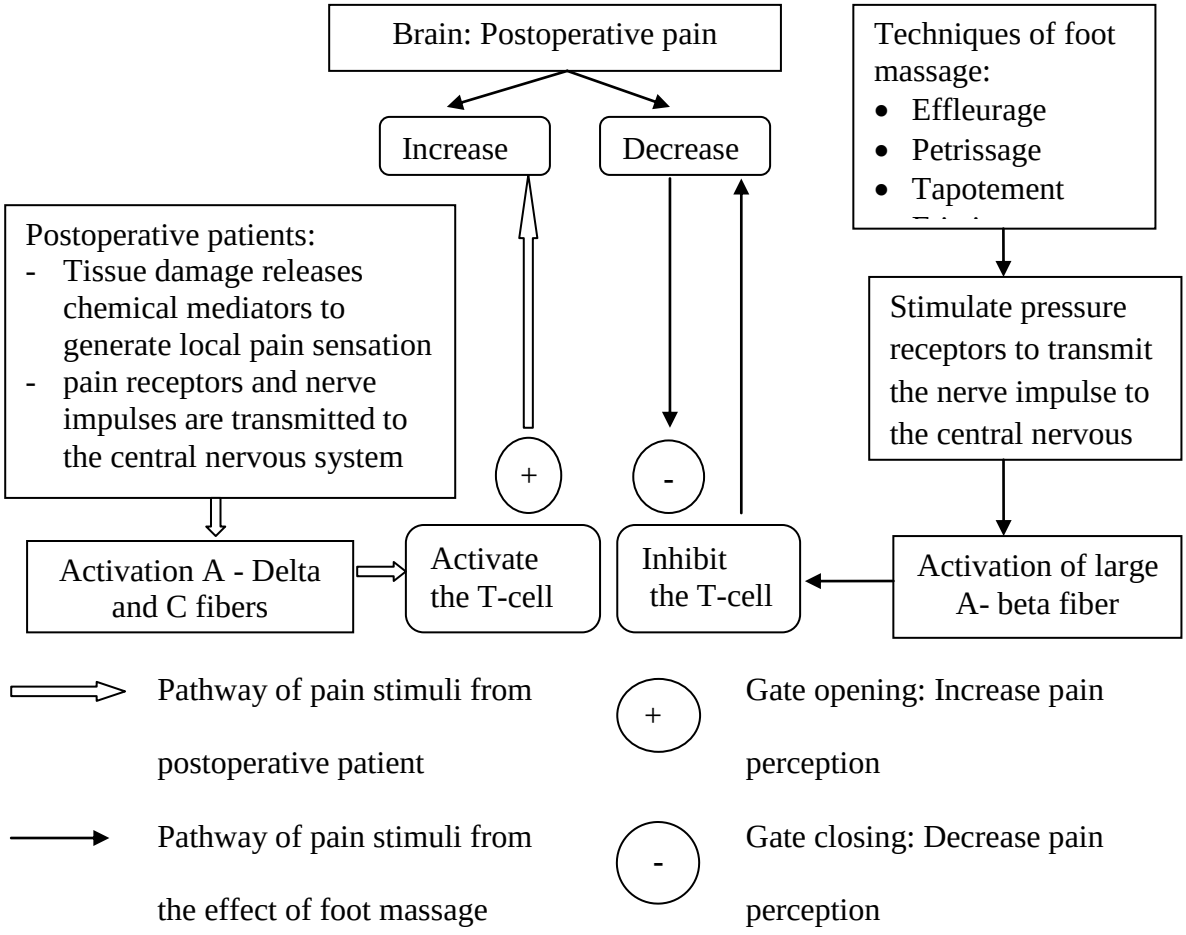


Figure 5

Mechanisms of Foot Massage in Relieving Acute Postoperative Pain

(Bright, 2001; Copstead & Banasik, 2005; Field & Basbaum, 2000; McCaffery & Pasero, 1999; Salvo, 2003).

In summary, the foot massage involves four techniques. The foot is as a represent of the organs in the body. Using the reflex points on the feet and the gate control theory of pain to guide the mechanism of the foot massage in relieving acute postoperative pain, these techniques have an overall effect on pain reduction.

Evidences supporting the effect of foot massage on pain relief

Several previous studies had been conducted to investigate the effect of a foot massage on acute postoperative pain (Appendix G). These studies found that the foot massage had positive outcomes in relieving acute postoperative pain as reviewed below.

Five studies were randomized control trials (RCTs) (Asazidaker et al., 2007; Degirmen, et al., 2008; Hattan, 2002; Hulme, 1999; Kim et al., 2002) and three studies were quasi experiments (Brewer, 2001; Han et al., 2005; Wang & Keck, 2004). Five studies used the foot massage in relieving pain, and three studies used the foot massage in combination with a hand massage in relieving pain. The common techniques were petrissage, effleurage, tapotement, and friction. Seven studies applied the foot massage at 4 hours after pain medication was given on the first day after surgery. One study applied the foot massage at 6 hours and 12 hours after surgery. The duration of the foot massage was 5 to 20 minutes in one to two sessions.

The results of these studies demonstrated that there were significant differences in the pain score at pre and post intervention in the experimental group and there were significant differences in the pain score compared between the experimental and the control group. The pain score decreased after receiving the foot massage intervention. However, there were some methodological limitations of these studies.

Many factors contributed to the pain scores in those studies. These included age, past experience with surgery, gender, and the type of pain medication that had been used. Three studies (Brewer, 2001; Kim et al., 2002; Wang & Keck, 2004) found significance differences in age between the groups. Brewer's study used

a single group, but the range of age was wide (18 – 65 years old) which can contribute to the different perceptions of pain in the subjects.

Six studies found significant differences in gender (Asazidaker et al., 2007; Brewer, 2001; Han et al., 2005; Hattan, 2002; Kim et al., 2002; Wang & Keck , 2004). Gender is an important factor in the response to postoperative pain. Women reported more pain in more bodily areas with greater frequency and for a longer duration as compared with men (Robinson & Tamres as cited in Keogh, 2005).

All of the studies used different pain medication which can contribute to the different analgesic effects in each patient. Each drug has different pharmacokinetic and pharmacodynamic properties. Each drug has the different analgesic duration effect, peak effects, and average half life time elimination rates. Therefore, these drugs give different responses in a patient's pain. Thus, research studies need to control the effect of pain medication, for example by having similar pain medication given to each patient.

Four studies (Degirmen, et al., 2008; Han et al., 2005; Hattan, 2002; Wang & Keck, 2004) found significant differences in the pre-test scores. The researchers did not control the pre-test scores which may interact with post-test scores. Subject need to be selected with a high homogenous relation to the pre-test pain score.

The types of surgery and the line of incision can contribute to pain perception as well. Seven studies selected the samples that had homogenous relationship to the type of surgery and line incision. Only one study (Wang & Keck, 2004) selected samples that had a difference in the type of surgery and the line of incision. Five studies (Asazidaker et al., 2007; Brewer, 2001; Degirmen, et al., 2008; Hattan, 2002; Wang & Keck, 2004) applied a foot massage for one session, whereas

three studies (Han et al., 2005; Hulme, 1999; Kim et al., 2002) applied a foot massage for two sessions.

Based on the above limitations, it is recommended to examine the effect of foot massage on acute postoperative pain with high homogenous samples using various durations of massage and ranges of time in which pain is measured at different settings.

In this present study, the researcher used the foot massage only in the experimental group, and did not use hand massage, because hand massage could not be applied to patients after abdominal surgery. They received medication via the intravenous route. The experimental group received a foot massage for two sessions for 30 minutes each session at 5 hours and 7 hours after receiving Ketorolac. The researcher expected that 5 hours and 7 hours after receiving Ketorolac, the pain score would be low and still constant until the patients received the next dose of Ketorolac.

The foot massage as a complementary therapy in pain management is a non pharmacologic intervention that is effective, low risk, safe for patients, and has no need for the equipment. The foot massage is easier than other types of massages. The foot is easily accessible and requires no repositioning. Foot massage can be used as a pain management modality in patients with acute postoperative pain. Nursing staff can also introduce or teach foot massage to patients and care providers, thus encouraging caring for the postoperative patients.

Summary

In summary, pain is subjective to a sufferer. Patients have high authority to report their pain. Patients after abdominal surgery have physiological and

emotional responses that can be represented by their report of pain intensity and pain distress. The nurse is one of the health professionals who has a role to manage pain using pharmacological and nonpharmacological methods. Pharmacological pain management uses medication including non-opioid analgesics, opioid analgesics, and anesthetic agents. Whereas, nonpharmacological pain management uses nursing interventions, such as relaxation technique, guided imagery, meditation, hypnosis, and massage. Foot massage is one of the nursing interventions that is appropriate to relieve acute postoperative pain.

Several studies demonstrated that a foot massage had a significant effect on relieving acute postoperative pain. Those studies had some methodological limitations. It was recommended to examine the effect of foot massage on acute postoperative pain using more rigorous designs and in different settings. The researcher expected that the foot massage could reduce acute postoperative pain in the research setting. Furthermore, findings from this study are expected to provide a good evidence supporting that foot massage can be applied as a nonpharmacological intervention in relieving acute postoperative pain.

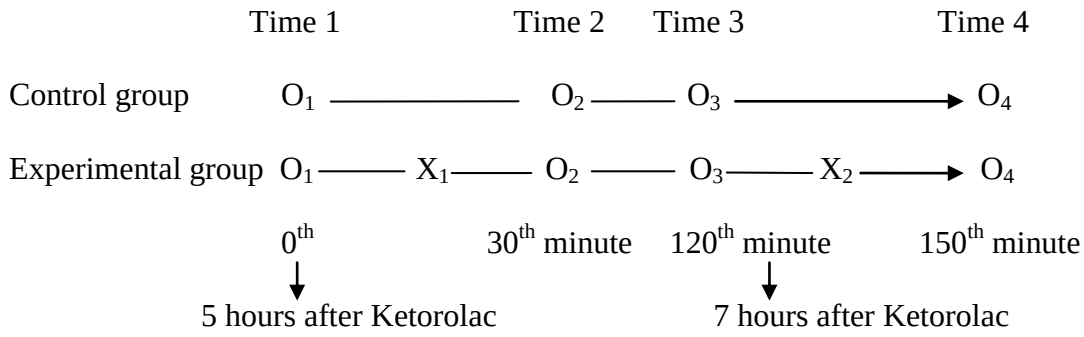
CHAPTER III

METHODOLOGY

This chapter describes the research design, variables, research setting, population and sample, instrumentation, study protocol, ethical considerations and data analysis.

Research Design

The study is a randomized controlled trial, using repeated measures. It aimed to examine the effects of foot massage on the pain intensity and the pain distress of patients after abdominal surgery. The research design is as follows:



Note:

$O_{1,}$ $O_{2,}$ $O_{3,}$ O_4 refer to the measurement of pain intensity and pain distress after abdominal surgery across four-time measures.

$X_{1,}$ X_2 refers to the foot massage intervention.

The foot massage was applied in the experimental group for two sessions by the researcher. The first session was applied at 5 hours after Ketorolac administration and the second session at 7 hours after Ketorolac administration. The half life time elimination average of Ketorolac is 5 hours. After 5 hours, the

concentration of Ketorolac decreased until 8 hours. As the effects of Ketorolac decreased, the pain intensity and the pain distress would be high again. For this reason, the application of the foot massage as a complementary therapy at 5 hours after Ketorolac was an appropriate time to reduce the pain intensity and the pain distress. Whereas, the application of foot massage at 7 hours after Ketorolac may provide additive effects of foot massage in relieving acute postoperative pain. In this present study the researcher would like to investigate if providing foot massage for two sessions would show this addictive effect.

Variables

The independent variable in this present study was the foot massage and the dependent variables were pain intensity and pain distress. Factors that may affect the experiment or the outcomes included past pain experience, ethnicity, age, gender, current pain medication use, type of abdominal surgery, and the length of the incision of the abdominal surgery and the patient's massage preference. Therefore, these factors were methodologically controlled and statistically controlled. Details are presented subsequently in the appropriate section.

Research Setting

The study was conducted at the male surgical ward, Doctor Kariadi Hospital Semarang, Central Java Province, Indonesia to control for gender effect. Doctor Kariadi Hospital is the biggest government hospital and the referral hospital in Central Java Province, Indonesia. It is also a teaching hospital for medical and nursing students.

Doctor Kariadi Hospital provides patients care with 779 beds. The surgical department has a total number of 120 beds. Among those, 50 beds are for women, 45 beds are for men and 30 beds are for patients after neurosurgery. Pain is routinely a common problem in most patients. The first day after surgery, patients routinely receive pain medication Ketorolac 30 mg intravenous injection every 8 hours. Some of the patients receive a combination of Ketorolac and Acetaminophen. The hospital did not use opioid analgesics or its derivatives in pain management for postoperative patients. The patients do not receive any nonpharmacological interventions.

Population and Sample

The population of this present study was hospitalized patients after abdominal surgery under general anesthesia. Patients who met the inclusion criteria were recruited.

Inclusion criteria

The samples were selected if they met the following inclusion criteria in order to control for the identified confounding or extraneous variables:

1. Aged between 18 - 60 years old
2. Major abdominal surgery, including exploratory-laparotomy, colectomy, gastrectomy, choledecoduodenostomy and jejunostomy
3. Midline incision in the abdomen
4. No history of previous surgery
5. Javanese. This is to control for the effect of ethnicity.

6. Pain intensity and pain distress score was greater than 3. This is to control for the floor effect of the intervention.

7. No allergy to an oil massage

8. Received Ketorolac injection intravenously for pain relief every 8 hours

9. Did not have a foot ulcer

10. Did not have intellectual or cognitive impairment and communication problems including dyslexia, blindness, or deafness.

Exclusion criteria

The subjects who developed postoperative complications were excluded from the study including decreased level of consciousness, or drowsiness, confusion, and severe vomiting and deep vein thrombosis (DVT). In the actual study, there was no subject excluded from the study.

Sample size

The study of Wongsdara (2004) examined the effect of local massage on the pain level of 30 postoperative abdominal surgery patients was used as a reference for calculating the sample size. The sample size was calculated on the basis of the mean and standard deviation taken. The mean pain intensity of the experimental group ($M = 3.4$, $SD = 1.3$) was significantly lower than that of the control group ($M = 5.0$, $SD = .90$). The sample size was estimated at an alpha of .05 and a power of .80.

The calculation of the effect size in Wongsdara (2004) study was as follows:

$ES = M_1 - M_2 /_{Pooled}\ SD$

Where $_{Pooled}\ SD = \sqrt{[(SD_1^2 + SD_2^2 /2)]}$

Where $M_{1:}$ Mean of the experimental group

$M_{2:}$ Mean of the control group

$_{Pooled}$ SD: Standard deviation of the control group and the experimental group

$_{Pooled}\ SD = \sqrt{[(SD_1^2 + SD_2^2 /2)]}$

$= \sqrt{1.35}$

$= 1.16$

$ES = M1 - M_2 /_{Pooled}\ SD$

$= 5.7 - 3.4 / 1.16$

$= 1.98 \longrightarrow 1.4$

According to Cohen ((1988), Table 2.4.1 on page 54), the sample size for a significant criterion of .05, power = .80 and effect size = 1.4 was determined to be a minimum of 7 subjects per group.

Foot massage was a new technique applied to pain management nursing intervention in the research setting. Moreover, the technique applied in this study was different from Wongsdara's study. There may be some variation in its efficacy. Thus, in order to ensure that the results of the study achieved the desired power and conclusive, the researcher took the sample size of 20 subjects per group.

Sample assignment

The staff nurses at the target ward helped the researcher to identify the eligible subjects and introduce the researcher to them. Next, the researcher approached them and asked for their agreement to participate in the study. The researcher gave an explanation about the purpose of this study, data collection procedures, risks, benefits and ethical issues concerning human rights including voluntary involvement and confidentiality. Patients who agreed to participate and signed the informed consent form were randomly assigned to either the experimental group or the control group using the coin tossing method.

Instrumentation

The research instruments composed of the data collection instruments and the intervention instrument.

Personal information record form

This record form was used for collecting the patient's personal information comprising of age, marital status, religion, educational level, occupation, the type of abdominal surgery and the length of the abdominal incision.

Measurement of pain

Pain intensity and pain distress were measured by using the Visual Numeric Pain Intensity Scale adopted from McCaffery and Beebe (1993) and the Visual Numeric Pain Distress Scale adopted from Rockville (1992). The Visual Numeric Pain Intensity Scale and the Visual Numeric Pain Distress Scale are a type of numeric rating scale using whole numbers (integers). The scale uses a horizontal line format. The line is marked with whole numbers from 0 to 10.

Each patient was asked to mark the number that best described how much pain intensity and pain distress he was experiencing at that moment, and then the number was recorded. For the description of the Visual Numeric Pain Intensity Scale, the left end of the line with the number zero represented no pain, numbers 1 to 3 represented mild pain, numbers 4 to 6 represented moderate pain, numbers 7 to 9 represented severe pain, and numbers 9 to10 represented worst possible pain (McCaffery & Beebe, 1993). Whereas for the Visual Numeric Pain Distress Scale, the left end of the line with number zero represented no pain distress, numbers 1 to 2 represented annoying, numbers 3 to 4 represented uncomfortable, number 5 to 6 represented dreadful, numbers 7 to 8 represented horrible and numbers 9 to 10 represented agonizing (Lacetti & Kazanowski, 2009).

Foot massage guideline

The technique of the foot massage for postoperative patients in this present study was developed from the massage principle that had been conducted by several researchers (Brewer 2001; Puthusseril, 2006; Wang & Keck, 2004) and in consultation with three experts in foot massage. The experts were from the Faculty of Nursing, Prince of Songkla University, Thailand who had expertise in massaging. The techniques of foot massage included effleurage, petrissage, tapotement and friction.

The guideline of the foot massage consisted of three phases: preparation phase, implementing phase and finishing phase. For the preparation phase, the researcher prepared the environment, equipment and set the patient's position. At the start for the warm up of the foot massage the effleurage technique was used. Whereas in the implementing phase, the researcher started to implement the foot massage using four techniques to massage at the reflex points of the feet. The foot

massage started on the left foot until finished and then continued on the right foot. The finishing phase is the end of the foot massage. At that phase, the researcher provided stretching techniques with tapping on the soles of the feet. For more detailed explanations see the guidelines of the foot massage in Appendix E.

The foot massage intervention was applied to subjects on the first day (24-48 hours) after abdominal surgery. Five hours and seven hours after the patients had received Ketorolac 30 mg injection IV, the foot massage was applied to subjects for two sessions, 30 minutes in each session.

Usual care

Usual care in this present study refers to usual post-operative nursing care provided by nurses and other health team members in the male surgical ward. Usual care was applied both in the experimental and the control group. For the experimental group they received the foot massage intervention, whereas the control group received usual care only. The intervention of usual care included the administration of pain killers as prescribed, care in response to individual need, wound care (dressing once a day), the provision of information about postoperative self-care, and the postoperative follow-up visits.

Study Protocol

The protocol of this present study composed of two phases: the preparation phase and the study procedures.

The Preparation phase

The preparation phase of this present study was composed of four steps described as follows:

The researcher's preparation

The researcher had been enrolled in the training course to gain fundamental knowledge and techniques concerning foot massage. The fundamental knowledge included how to do effleurage, petrissage, tapotement, and friction. The training of a foot massage practice was held at the Thai Traditional Medicine of Songkla School. The training duration was 18 hours. It took 6 days within a one-month period. After training, the researcher was tested for his ability to perform a foot massage by three massage experts of the Faculty of Nursing, Prince of Songkla University, Thailand. The experts confirmed that the guidelines of the foot massage could be used in the study and the researcher was qualify in giving a foot massage.

Research assistant

A research assistant was selected by the researcher under the following criteria: had experience in surgical nursing for at least three years, and was not the researcher's colleague to avoid unintentional bias. The research assistant was trained in how to use the Visual Numeric Rating Scale for assessing pain intensity and pain distress. The research assistant was informed about the objectives of the study before the data collection. The research assistant was responsible for data collection at all time points. After the researcher recruited the potential subjects, the research assistant was called to collect the data. No blind technique was applied due to the infeasibility of subject concealment.

Examination of validity and reliability of the instruments

Validity

The foot massage intervention was content validated by three experts. The three experts examined the coverage of the language used in order to the ensure

appropriateness for the utilization with patients after abdominal surgery. The researcher modified the guidelines based on the experts' advise. The validity of the foot massage was applied to 3 subjects in a pilot study.

The Visual Numeric Pain Intensity Scale and the Visual Numeric Pain Distress Scale are measuring tools that have been standardized. These tools have been reported to be valid for measuring pain intensity and pain distress. The previous study used the tool to assess pain intensity and pain distress (Brewer, 2001, Wang & Keck, 2004, Zhou, Petpichetchian, & Kitrungrote, 2011). In Zhou at al.'s study (2011), the Visual Numeric Rating Scale had high validity (r= .80 to .83). With this regard, the researcher did not test the validity of the pain intensity and pain distress tools.

Reliability

The reliability of Numeric Pain Intensity Scale and Numeric Pain Distress Scale has been reported to be reliable for measuring pain intensity and pain distress. In Zhou et al.'s study (2011), the Visual Numeric Rating Scale had high reliability. Thus, the researcher did not test the reliability of pain intensity and pain distress tools.

Pilot study

A pilot study is a small experiment designed to test the feasibility and gather information prior to a larger study, in order to improve the later study's quality and efficiency (Altman et al., 2006). The purpose of the pilot study of this study was to determine the feasibility of the experimental protocol and recruitment of subjects. A pilot study was conducted at Tugu Hospital Semarang in Central Java. The number of subjects in the pilot study was 3 subjects.

The results from the pilot study showed that the research assistant understood how to use the pain tool (Visual Numeric Rating Scale) in pain assessment. Also the subjects understood how to describe their pain according to the number in the pain tool. The study procedures could be applied to the subjects.

Study procedures

The experiment protocol and the data collection procedures were conducted in the following steps (Figure 6).

1. A letter from the Faculty of Nursing Prince of Songkla University was submitted to the Director of Doctor Kariadi Hospital Semarang, requesting permission for data collection at the hospital.

2. The researcher met the director of the nursing department and the head of male surgical ward at Doctor Kariadi Hospital to explain the details about the objectives and the process of the research and to ask for permission to conduct the study.

3. The intervention and data collection were conducted as follows:

3.1. The researcher conducted the study at the target ward every day from 08.00 a.m. to 09.00. p.m.

3.2. The researcher approached samples as described earlier.

3.3. For patients who required preoperative preparation, the researcher met them before the surgery, but in cases of emergency surgery, the researcher met the patient after surgery. At the first meeting, the researcher introduced himself and informed the patients about the objectives and process of the study. The patients were asked if they were willing to participate in the study. Once the patients

willingly agreed to participate, they were informed about the protection of their rights and were asked to sign an informed consent form.

3.4. The researcher recorded the data obtained from the interview with the patients and from their medical records.

3.5. The first day (24-48 hours) after abdominal surgery, if the patients were present with good consciousness and reported a pain level higher than three out of ten, the researcher continued the study as follows:

a) The researcher investigated the patient's record of pain medication, ensuring that the last dose was administered five hours ago.

b) The research assistant assessed the pain score before the researcher performed the foot massage intervention.

c) The researcher performed the foot massage for 30 minutes for two sessions.

d) The research assistant, who was waiting in another place, immediately evaluated the patient's pain score after receiving the foot massage.

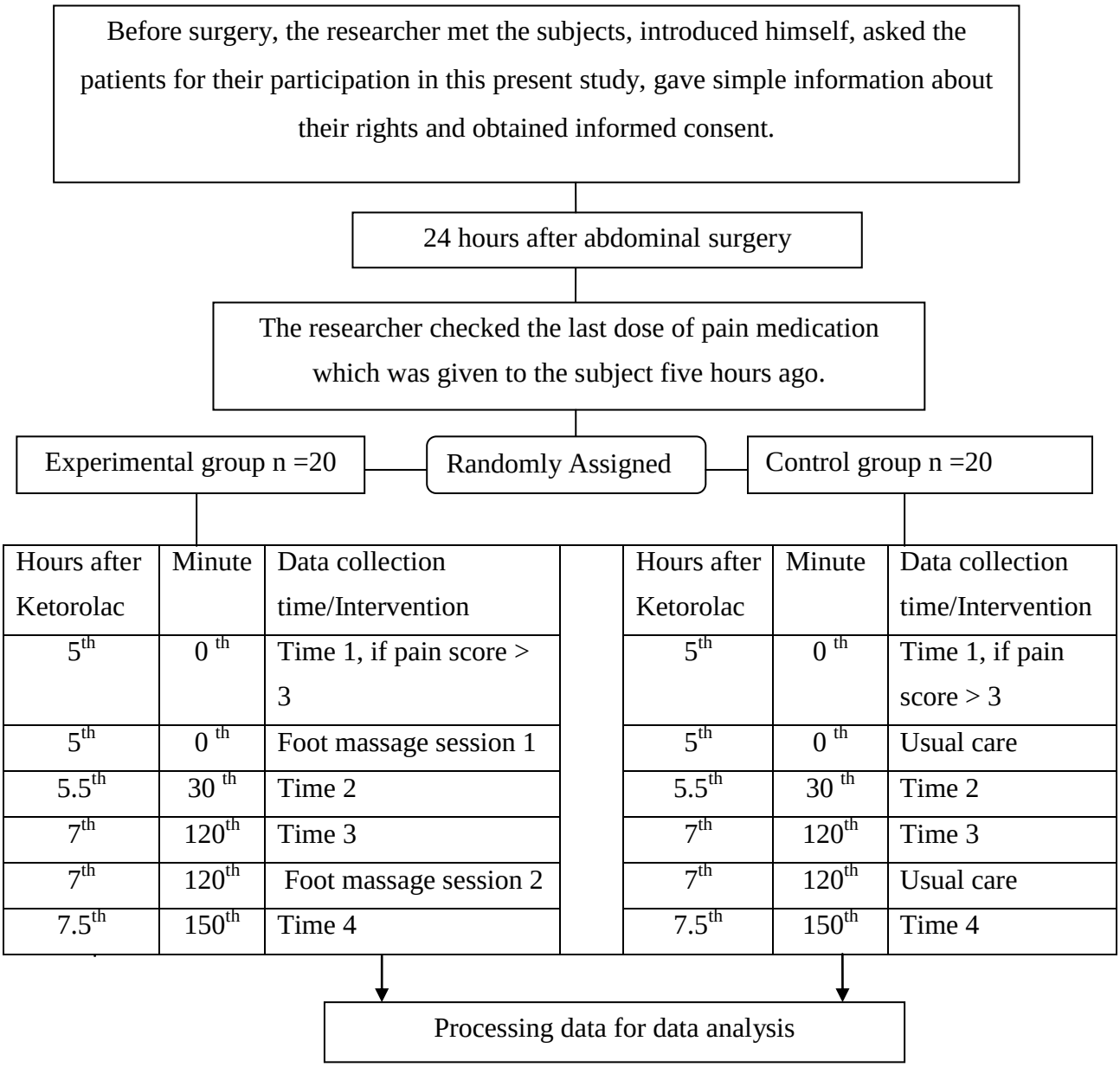


Figure 6

Study Procedures

Ethical Considerations

The research proposal was submitted and approved by the Research Ethics Committee of the Faculty of Nursing, Prince of Songkla University. Permission for data collection was obtained from the director of Doctor Kariadi

Hospital Semarang, Central Java Province, Indonesia. The objectives and procedures of the study were explained to the nursing staff and the surgeon at the hospital to ask for their collaboration.

After being enrolled and assigned to the experimental or the control groups, the subjects are informed about the objectives and procedures of the study (Appendix A). In the experimental group, the activities and time spent on them were discussed individually, to ensure the full understanding of the subjects. The subjects were given at least 30 minutes to decide whether they agreed or did not agree to participate as subjects. The subjects were assured about the confidentiality of the results.

The data were kept and then destroyed upon the completion of the study. The data were treated anonymously. For the control group, the subjects were informed that they can receive the foot massage intervention after data collection was completed, if they were prepared to practice the same as that of the experimental group. In addition, the subjects were informed that there was no known physical risk involved by participating in this present study. They were free to refuse to participate at any time during the study. In addition, they were informed that there were no charges for participation and neither will they receive any payment. The informed consent form was signed by each subject without coercion (Appendix B). For subjects who might feel reluctant to sign the consent form, verbal consent was accepted.

Data Analysis

General information data were analyzed by using frequency, percentage, and mean. The mean and standard deviation were used to analyze the

mean scores of the pain intensity and pain distress at each time points. Data were computed using descriptive statistics, including age, gender, marital status, religion, level of education, occupation, types of abdominal surgery and the length of the incision. The Chi-square test, Fisher's exact test and Independent-test were used to determine the significance of the demographic characteristics between the experimental group and the control group or Mann-Whitney was used if the assumptions of the parametric statistics were violated.

The assumptions of normality and homogeneity of variance of the variables were tested using inferential statistics and were checked before the appropriate statistical analysis was performed. The results showed that the data had non normality in distribution. Therefore, comparisons of pain intensity and pain distress within the experimental group before and after receiving the foot massage were conducted using the Wilcoxon match paired signed rank test. Comparisons of pain intensity and pain distress within the experimental group across four-time measures used the Friedman's test. Whereas comparisons in the differences of pain intensity and pain distress between in the experimental group and the control group across the four-time measures were conducted with the Mann-Whitney test. All hypothesis testing were set at a significant α value of .05.

CHAPTER 4

RESULT AND DISCUSSION

This chapter presents and discusses the research findings of the present study. The results are presented in three parts: Part I: the demographic characteristics and surgical-related data; Part II: pain intensity and pain distress at the first 24 hours after abdominal surgery; and Part III: the effects of foot massage on pain intensity and pain distress across four-time points, at T1 (before giving the first session of foot massage), T2 (30 minutes after T1), T3 (120 minutes after T1 or before giving the second session of foot massage), and T4 (150 minutes after T1 or 30 minutes after T2).

Results

Part I: Demographic characteristics and surgical-related data

Demographic characteristics and surgical-related data of the sample of the 40 subjects are shown in Table 1. The mean age of the subjects in the experimental group was 43.8 years (SD=13.12), and in the control group was 52.3 years (SD=7.57). The majority of the subjects were married (75% in the experimental group and 95% in the control group). All of the subjects in the experimental group were Muslim, whereas those in the control group were 80%. Only 10% of subjects in both groups had an education level higher than high school. There were more subjects in the experimental group (80%) than in the control group (45%) who worked as a private employee. There were no statistical differences in demographic characteristics of the subjects between the experimental and the control group, except age. Subjects

in the control group were significantly older than those in the experimental group (52.3 years vs 43.8 years), t= -2.502, $p < .05$). This variable was then treated as a covariate in the subsequent analysis.

For the surgical-related data, nearly half of the subjects in both groups were undergoing a laparotomy (45%). The mean length of the abdominal incision in the experimental group and the control group was 16.90 and 16.70, respectively. There were no statistical differences in the surgical characteristics between the two groups (Table1).

Table 1

Frequency, Percentage, Mean and Standard Deviation of Demographic Characteristics and Surgical-Related Data of the Experimental Group and the Control Group (N = 40)

Characteristics	Experimental group (n = 20)		Control group (n = 20)			
	n	%	n	%	Test value	*p*
Age (years)	M=43.8, SD=13.12 Min-Max= 22 - 59		M=52.3, SD=7.65 Min-Max= 36 - 60		-2.50[a]	.02
Marital status					1.76[c]	.18
Single	5	25	1	5		
Married	15	75	19	95		
Religion					2.50[c]	.10
Muslim	20	100	16	80		
Christian/Catholic	0	0	4	20		
Level of education					1.83[c]	.77
Elementary	6	30	5	25		
Junior high	7	35	6	30		
Senior high	5	25	7	35		
Diploma	2	10	1	5		
Bachelor	0	0	1	5		

Table 1 (Continued)

Characteristics	Experimental group (n = 20)		Control group (n = 20)			
	n	%	n	%	Test value	*p*
Occupation					6.78[c]	.08
Government employee	0	0	3	15		
Farmer/Gardener	4	20	7	35		
Private employee	16	80	9	45		
Retired	0	0	1	5		
Type of abdominal surgery					1.62[d]	.96
Laparotomy	9	45	9	45		
Cholecystectomy	3	15	4	20		
Colectomy	4	20	2	10		
Gastrectomy	2	10	3	15		
Jejunostomy	1	5	1	5		
Choledecoduodenostomy	1	5	1	5		
Length of incision (cm)	M=16.9, SD=4.67 Min-Max= 7 - 20		M=16.7, SD=4.70 Min-Max= 7 - 20		-0.12[b]	.90

[a] t-test, [b]Mann-Whitney U, [c] Chi-square test-Continuity correction, [d] Fisher's exact test

Part II: Pain intensity and pain distress at the first 24 hours after abdominal surgery

This part describes pain intensity and pain distress at the first 24 hours experienced by the patients after abdominal surgery. The data were collected at the 5th hour after patients had received 30 mg of Ketorolac injection intravenously, a major analgesic drug being used at the studied hospital. It was found that on average, postoperative patients had experienced moderate to severe pain, both in their report of

pain intensity and pain distress as evidenced by the range of scores from 4 to 9 out of 10 and a median score of 5 and 6 (IQR = 2), respectively (Table 2).

Table 2

Pain Intensity and Pain Distress Scores at Pretest or T1, the Fifth Hour After Ketorolac Injection (N=40)

Variable	Min	Max	*M*	*SD*	*Mdn*	*IQR*
Pain intensity	4	9	5.30	1.36	5	2
Pain distress	4	9	5.80	1.49	6	2

Min = Minimum score, Max = Maximum score, *Mdn* = Median, *IQR* = Interquartile Range

Part III: Effects of foot massage on pain intensity and pain distress

Within-subjects effect

In order to determine the within-subjects effect of foot massage, two sets of analyses were conducted to test hypotheses 1 and 2. Firstly, the mean scores of pain intensity and pain distress before and immediately after receiving the foot massage (pretest-posttest scores) were compared. Since there were non-normal distributions of several datasets and the individual pain intensity and pain distress scores were measured at the ordinal scale level, the comparisons of the these differences were conducted using the Wilcoxon matched-pair signed rank test (test of hypothesis 1). Secondly, the test of the difference across the four-time measures was conducted using the Friedman's test (test of hypothesis 2). The findings are presented as follows.

Hypothesis 1: The pain intensity scores and the pain distress scores of the experimental group immediately after receiving a foot massage are lower than

those of before receiving a foot massage. This hypothesis was completely supported. For pain intensity (Table 3), at the first massage session, after the massage the pain intensity score (*Mdn* = 3.0) was lower than before the massage (*Mdn* = 5.5), $Z = 3.99$, $p < .001$). Similarly, at the second massage, the pain intensity score (*Mdn* = 1.0) was lower than before the massage (*Mdn* = 1.0), $Z = 3.36$, $p < .001$. For pain distress, the findings were similar to pain intensity (Table 4). At the first massage session, after massage the pain distress score (*Mdn* = 3.0) was lower than before massage (*Mdn* = 6.0), $Z = 3.97$, $p < .001$. Indeed, at the second massage, the pain distress score (*Mdn* = 1.0) was also lower than before the massage (*Mdn* = 1.0), $Z = 3.02$, $p < .001$. Not surprisingly, these differences were not found in the control group for both pain intensity and pain distress ($p < .05$).

Hypotheses 2: There are differences of pain intensity and pain distress within the experimental group across the four-time measures.

This hypothesis also was supported. Table 5 shows that both the pain intensity scores and pain distress scores at T2, T3, and T4 were significantly lower than those of T1, $\chi^2 = 55.16$, $p < .001$ and $\chi^2 = 55.43$, $p < .001$, respectively. The scores stepped down and the lowest scores were at T4 in both pain intensity and pain distress. Figure 7 and Figure 8 demonstrate that there were different patterns of changes in the control group. In other words, for the control group, the pain intensity scores and the pain distress scores went up, and peaked at T4.

Table 3

Comparison of Pain Intensity Before and After Receiving Foot Massage at the First Session (T1-T2) and the Second Session (T3-T4) Using Wilcoxon Matched-Pair Signed Rank Test

Different Pain Intensity Scores	*n*	*Mdn (IQR)*		Mean Rank	Sum Rank	*Z*	*p*
T2-T1 (After-Before the First Massage Session)		T1	T2				
Experimental Group	20	5.5 (3)	3.0 (2)	-	-	3.99	.000
After < Before	20	-	-	10.5	210.0		
After > Before	0	-	-	0.0	0.0		
After = Before	0	-	-	-	-		
Control Group	20	4.5 (1)	4.5 (1)	-	-	1.00	.317
After < Before	0	-	-	0.0	0.0		
After > Before	1	-	-	1.0	1.0		
After = Before	19	-	-	-	-		
T4-T3 (After-Before the Second Massage Session)		T3	T4				
Experimental Group	20	2.0 (2)	1.0 (1)	-	-	3.56	.000
After < Before	14	-	-	7.50	105.0		
After > Before	0	-	-	0.0	0.0		
After = Before	6	-	-	-	-		
Control Group	20	5.5 (1)	5.5 (1)	-	-	0.58	.564
After < Before	1	-	-	2.0	2.0		
After > Before	2	-	-	2.0	2.4		
After = Before	17	-	-	-	-		

Table 4

Comparison of Pain Distress Before and After Receiving Foot Massage at the First Session (T1-T2) and the Second Session (T3-T4) Using Wilcoxon Matched-Pair Signed Rank Test

Different Pain Distress Scores	*n*	*Mdn (IQR)*		Mean Rank	Sum Rank	*Z*	*p*
T2-T1 (After-Before the First Massage Session)		T1	T2				
Experimental Group	20	6.0 (3)	3.0 (2)	-	-	3.97	.000
After < Before	20	-	-	10.5	210.0		
After > Before	0	-	-	0.0	0.0		
After = Before	0	-	-	-	-		
Control Group	20	5.0 (2)	5.0 (2)	-	-	1.00	.317
After < Before	0	-	-	0.0	0.0		
After > Before	1	-	-	1.0	1.0		
After = Before	19	-	-	-	-		
T4-T3 (After-Before the Second Massage Session)		T3	T4				
Experimental Group	20	2.0 (1)	1.0 (1)	-	-	3.02	.003
After < Before	16	-	-	8.5	136.0		
After > Before	1	-	-	17.0	17.0		
After = Before	3	-	-				
Control Group	20	6.0 (2)	6.0 (2)	-	-	0.58	.564
After < Before	1	-	-	2.0	2.0		
After > Before	2	-	-	2.0	2.4		
After = Before	17	-	-	-	-		

Table 5

Comparison of Pain Intensity and Pain Distress Across Four-Time Measures of the Experimental Group Using Friedman's Test

Time	Pain Intensity					Pain Distress				
	Mdn	*IQR*	Mean Rank	χ^2	*p*	*Mdn*	*IQR*	Mean Rank	χ^2	*p*
T1	5.3	3	4.00	55.16	.000	6.0	3	4.00	55.43	.000
T2	3.0	2	2.82			3.0	2	2.80		
T3	2.0	2	1.98			2.0	1	2.05		
T4	1.0	1	1.20			1.0	1	1.15		

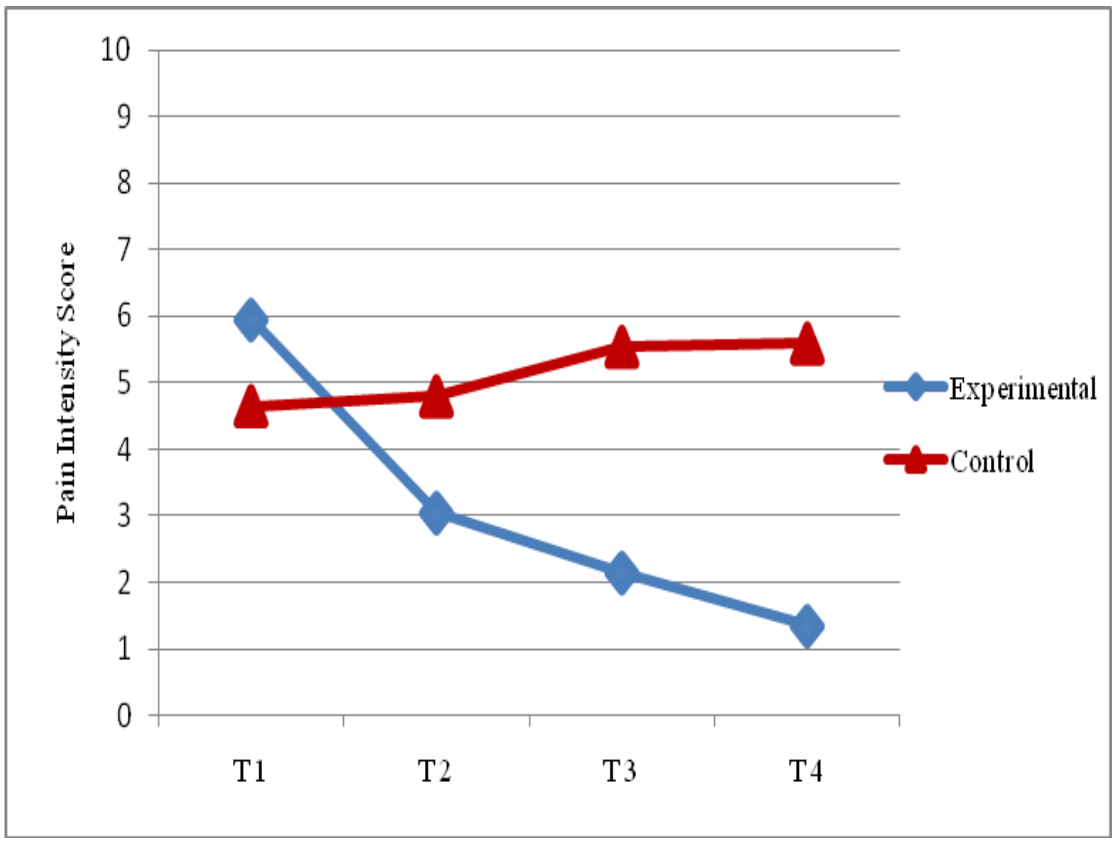


Figure 7

Comparison of Pain Intensity Across Four-time Measures

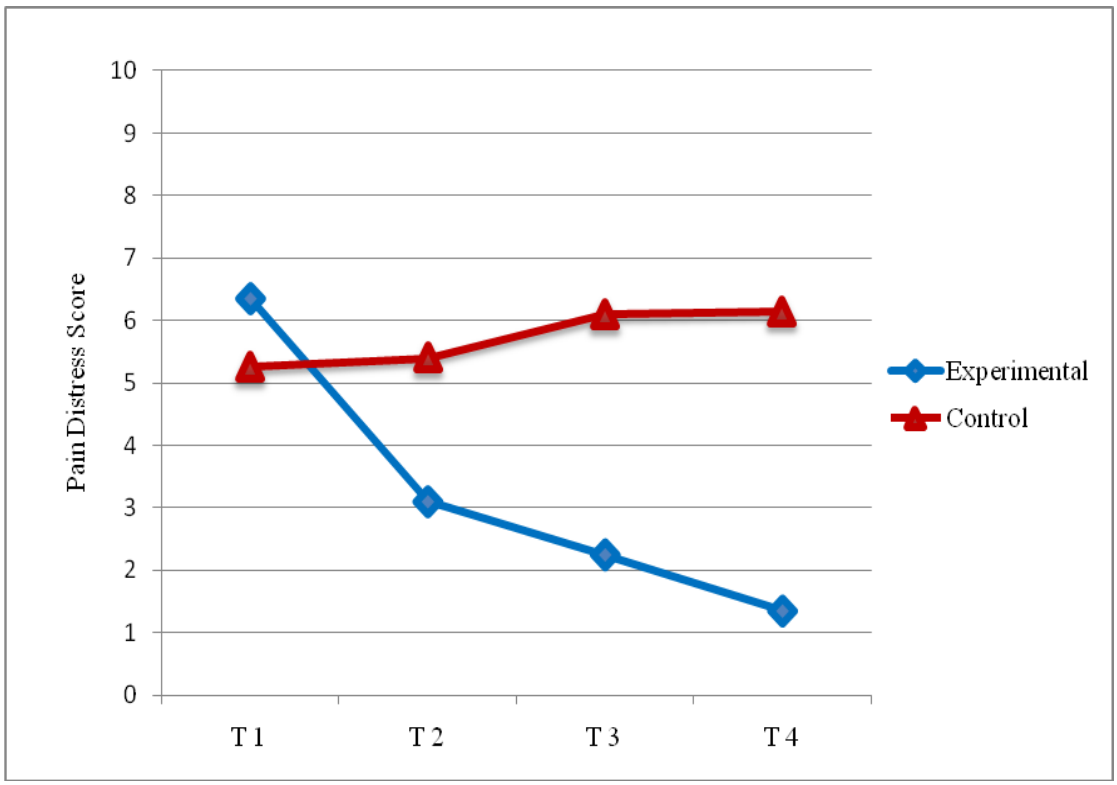


Figure 8

Comparison of Pain Distress Across Four-time Measures

Between-subjects effect

Before the between-subjects effect was tested, the effects of identified confounding variables were examined. The pain intensity and the pain distress scores of the experimental and the control group at T1 were examined. It was revealed that there were significant differences of these two variables at T1, in which the experimental group had higher pain intensity and pain distress than those of the control group (Table 6). Moreover, the control group was significantly older than the experimental group (Table 1). Therefore, the pain intensity and pain distress scores at T1 and age were treated as covariates. Unfortunately the analysis of covariance

(ANCOVA) could not be validly used due to unmet assumptions of normality, sphericity, and homogeneity of regression.

Table 6

Comparison of Pain Intensity and Pain Distress Scores at T1 Between Groups Using Mann-Whitney-U (N=40)

Variable/Group	*n*	*Mdn (IQR)*	Mean Rank	Sum Rank	*Z*	*p*
Pain Intensity					-2.92	.003
Experimental Group	20	5.5 (3)	25.68	513.5		
Control Group	20	4.5 (1)	15.32	306.5		
Pain Distress					-2.23	.025
Experimental Group	20	6.0 (3)	24.52	490.5		
Control Group	20	5.0 (2)	16.48	329.5		

In order to treat the T1 scores as a covariate for analyzing two sets of analysis: pain intensity and pain distress, the solution was made to construct the new variables by subtracting the scores at T2, T3, and T4 from the scores at T1 so that these new variables could represent the scores at T2, T3, and T4, taken into account the scores of T1. These yielded the different scores: D1 (T1-T2), D2 (T1-T3), and D3 (T1-T4) for T2, T3, and T4, respectively. Tabachnick and Fidell (1996) suggested using difference scores when the ANCOVA cannot be used by making these different scores when the covariate was measured using the same scale as the dependent variable. Thus, D1, D2, and D3 were used to test the difference between the experimental group and the control group at each repeated measure (T2, T3, and T4) to test the following hypothesis.

Hypotheses 3: Pain intensity and pain distress of the experimental group after receiving the foot massage intervention are lower than those of the control group. This hypothesis was also supported. Table 7 shows that there were significant differences of pain intensity and pain distress between the experimental group and the control group at T2, T3, and T4 after controlling for the effect of T1. For all time points, the difference scores of the experimental group were significantly larger than those of the control group, Z scores ranging from -2.49 to -2.56, $p < .05$.

Table 7

Comparisons of the Pain Intensity and Pain Distress Different Scores at T2 (D1), T3 (D2), and T4 (D3) Between the Experimental Group and the Control Group (N = 40)

Pain Variables	Experimental Group (*n* = 20)				Control Group (*n* = 20)				*Z*	*p*
	Min	*Max*	*M (SD)*	*Mdn (IQR)*	*Min*	*Max*	*M (SD)*	*Mdn (IQR)*		
Pain Intensity										
D1 (T1-T2)	2	4	2.90 (0.72)	3.00 (1.00)	-3	0	-0.15 (0.67)	0.00 (0..00)	-2.56	.012
D2 (T1-T3)	2	6	3.80 (0.95)	4.00 (1.00)	-3	0	-0.90 (0.72)	-1.00 (0.75)	-2.52	.012
D3 (T1-T4)	3	6	4.60 (1.27)	4.00 (1.75)	-3	0	-0.95 (0.69)	-1.00 (0.95)	-2.49	.012
Pain Distress										
D1 (T1-T2)	1	5	3.25 (1.02)	3.50 (1.75)	-3	0	-0.15 (0.67	0.00 (0..00)	-2.51	.012
D2 (T1-T3)	2	7	4.10 (1.16)	4.00 (1.75)	-3	0	-0.85 (0.74	-1.00 (1.00)	-2.48	.012
D3 (T1-T4)	-15	8	4.10 (4.69)	5.00 (2.00)	-3	0	-0.90 (0.72	-1.00 (0.75)	-2.49	.012

Concerning the confounding effect of age, subgroup analysis was conducted. The variable "age" was categorized into two groups, using the mean age of the total sample (M = 48.05, SD = 11.44) as a cutoff point: younger adults ($\leq$ 48 years old) and older adults (> 48 years old). Two sets of analyses were conducted to test the differences of pain intensity and pain distress between the experimental group and the control group separately from the younger adults group (n = 17) to the older adults group (n = 23). It was found that the differences between the experimental group and the control group of the difference score at T2, T3, and T4 (D1, D2, and D3) of both pain intensity and pain distress existed when examining separately in the younger adults (p < .01) (Table 8) and the older adults (p < .001) (Table 9). These findings confirm that the foot massage did work in reducing pain intensity and pain distress across times even after controlling for the effects of the pretest score (T1) and age.

Table 8

Comparisons of the Pain Intensity and Pain Distress Different Scores at T2 (D1), T3 (D2), and T4 (D3) Between the Experimental Group and the Control Group in Younger Adults Group (n = 17)

Pain Variables	Experimental Group (*n* = 12)				Control Group (*n* = 5)				*Z*	*p*
	Min	*Max*	*M (SD)*	*Mdn (IQR)*	*Min*	*Max*	*M (SD)*	*Mdn (IQR)*		
Pain Intensity										
D1 (T1-T2)	2	4	3.00 (0.74)	3.00 (1.50)	-3	0	-0.60 (1.34)	0.00 (1.50)	-3.27	.001
D2 (T1-T3)	2	6	3.83 (1.17)	4.00 (1.75)	-3	0	-1.00 (1.23)	-1.00 (2.00)	-3.21	.001
D3 (T1-T4)	3	7	4.50 (1.31)	4.00 (2.50)	-3	0	-1.20 (1.09)	-1.00 (1.50)	-3.20	.001
Pain Distress										
D1 (T1-T2)	2	5	3.34 (0.98)	3.50 (1.75)	-3	0	-0.60 (1.34)	0.00 (1.50)	-3.24	.001
D2 (T1-T3)	2	7	4.08 (1.24)	4.00 (1.50)	-3	0	-1.00 (1.23)	-1.00 (2.00)	-3.24	.001
D3 (T1-T4)	-15	8	3.33 (5.91)	5.00 (1.75)	-3	0	-1.20 (1.09)	-1.00 (1.50)	-2.67	.008

Table 9

Comparisons of the Pain Intensity and Pain Distress Different Scores at T2 (D1), T3 (D2), and T4 (D3) Between the Experimental Group and the Control Group in Older Adults Group (n = 23)

Pain Variables	Experimental Group (*n* = 8)				Control Group (*n* = 15)				*Z*	*p*
	Min	*Max*	*M (SD)*	*Mdn (IQR)*	*Min*	*Max*	*M (SD)*	*Mdn (IQR)*		
Pain Intensity										
D1 (T1-T2)	2	4	2.75 (0.71)	3.00 (1.00)	0	0[a]			-4.58	.000
D2 (T1-T3)	3	5	3.75 (0.671)	4.00 (1.00)	-2	0	-0.87 (0.52)	-1.00 (0.00)	-4.12	.000
D3 (T1-T4)	3	7	4.75 (1.28)	4.50 (1.75)	-2	0	-0.87 (0.52)	-1.00 (0.00)	-4.11	.000
Pain Distress										
D1 (T1-T2)	1	4	3.12 (1.12)	3.50 (1.75)	0	0[a]			-4.57	.000
D2 (T1-T3)	2	5	4.12 (1.12)	4.50 (1.75)	-2	0	-0.80 (0.56)	-1.00 (1.00)	-4.06	.000
D3 (T1-T4)	3	7	5.65 (1.49)	5.50 (2.75)	-2	0	-0.80 (0.56)	-1.00 (1.00)	-4.05	.000

[a] There was no variation. The scores were treated as constant.

Discussion

The findings revealed that both the pain intensity scores and the pain distress scores in the experimental group after receiving a foot massage were lower than those of before receiving a foot massage. The scores stepped down and the lowest scores were at T4. There were significant differences of pain intensity and pain distress between the experimental group and the control group at T2, T3, and T4. The pain scores in the experimental group were lower than those of the control group. These findings confirm that a foot massage did work in reducing pain intensity and pain distress across times.

The findings are discussed according to the objectives and hypothesis of the study. The discussions are presented in three parts. The first part is the demographic characteristics and surgical-related data. The second part is pain intensity and pain distress at the first 24 hours after abdominal surgery and the third part is the effects of foot massage on pain intensity and pain distress.

Part I: Demographic characteristics and surgical-related data

The population of this present study was hospitalized patients after abdominal surgery under general anesthesia. Many factors could contribute to the pain in this present study. These factors were gender, ethnicity, pain medication and past experience with postoperative pain. In order to control these factors, the researcher selected subjects who met the inclusion criteria and randomly assigned them to either the experimental group or the control group using the coin tossing technique. The subjects were selected who matched of gender, ethnicity, pain medication, past experience with postoperative pain. There were no statistical differences in the

demographic characteristics of the subjects and surgical-related data between the experimental and the control group, except for age.

Only adult patients were selected as subjects in this present study. The mean age of the subjects in the experimental group and the control group was 43.8 years and 52.3 years, respectively. Subjects in the control group were significantly older than those in the experimental group. Age may have an influence on pain intensity and pain distress (Smeltzer & Bare, 2004). In order to control the variable of age, subgroup analysis was conducted. The variable"age" was categorized into two groups: younger adults (≤ 48 years old) and older adults (> 48 years old). The finding confirmed that the difference of age between the groups did not influence the pain scores across the four-time measures. It can be assumed that age was not likely to be directly linked to postoperative pain. The finding of this study was similar to a previous study. Edwards and Fillingham (2000) found that there were no differences in the response of pain between younger adult patients and older adult patients.

Subjects in this present study were admitted to the male surgical ward. They were undergoing abdominal surgery. Nearly half of the subjects in both groups were undergoing a laparotomy (45%) followed by a cholecystectomy, colectomy, gastrectomy, jejunostomy, and choledecoduodenostomy. Abdominal surgery can be classified as major abdominal surgery and minor abdominal surgery. All of the patients were undergoing major abdominal surgery with a midline incision of abdominal surgery. The line was vertical.

Major abdominal surgery is related to a high sensation of postoperative pain. The findings revealed that on average, the level of postoperative pain was moderate to severe pain, both in their report of pain intensity and pain distress. It was

supported by Burger, Riet and Jeekel (2002) as they stated that patients who were undergoing major abdominal surgery experienced more pain than that of the minor abdominal surgery. In addition, the midline incision of abdominal surgery was related to a high sensation of postoperative pain as well. Burger et al. (2002) stated that the midline incision is associated with increased postoperative pain compared to transverse or oblique incisions.

Other factors that could contribute to pain intensity and pain distress were the length of the abdominal incision. These 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). The mean length of the abdominal incision in the experimental group and the control group was 16.90 and 16.70, respectively.

Additional analysis was conducted to test whether the length of abdominal incision contributed to the pain scores at T1. Since the data showed no normal distribution, Spearman's rho test was conducted. The analysis revealed that there was a correlation between the length of the abdominal incision and the scores of pain intensity at T1 ($p < .05$). The length of the abdominal incision is related to pain intensity (Burger et al., 2002). Similarly Abdo (2008) found that the length of an operation was one factor that contributes to the pain intensity in patients after abdominal surgery.

The pain distress was different. Pain distress is mostly related to postoperative complications. A Patient who develops postoperative complications may increase pain distress (Smeltzer & Bare, 2004). In this present study, no subjects experienced postoperative complications. The additional analysis revealed that there

was no correlation between the length of an abdominal incision and pain distress ($p > .05$).

To summarize, the characteristics of the subjects and surgical-related data in this present study were quite similar to those of the subjects in several previous studies. Thus, it was expected that the characteristics of the subjects in this present study indicated an accurate representation of patients after abdominal surgery, particularly in Indonesia.

Part II: The Pain intensity scores and pain distress at the first 24 hours after abdominal surgery

On the first day after surgery, patients experienced postoperative pain. Even though pain medication of Ketorolac injection intravenously was administered, 5 hours after the pain medication postoperative patients experienced postoperative pain. They reported that the level of postoperative pain was moderate to severe pain, both in their report of pain intensity and pain distress. This is related to the pharmacokinetics of Ketorolac and the pain mechanism.

The half life time of Ketorolac injection intravenous administration is five hours in adult patients. After five hours post injection, the concentration of the drug in the blood decreased. As a result, the effect of the analgesic from the drug decreased. Tissue damage from the abdominal incision led to postoperative pain occurring.

Postoperative pain is very common and develops naturally as a warning symptom that can be predicted and should be prevented and treated (Apfelbaum, Chen, & Mehta, 2003; Power, 2005). Despite the pain medications and

anesthetic techniques available, the prevalence of postoperative pain is still high (Apfelbaum, Chen, & Mehta, 2003).

The sense of pain from abdominal surgery is a consequence of tissue damage that induces the release of chemical mediators from the surgical wound. The chemical mediators include prostaglandin, proton, serotonin, histamine, bradikynin, cytokines and neuropeptides generating local pain sensations (Copstead & Banasik, 2005).

The local pain sensation has systemic effects on pain receptors and nerve impulses that are transmitted via nerve fibers A-Delta and C to the central nervous system which has the gate control system. Subsequently activating the T-cells, as a result the gate is open. Therefore, the pain message reaches the brain. Finally postoperative pain is recognized and interpreted. The perception of pain is the end result of the neural activity of pain transmission, that is a conscious experience, and the reticular system is responsible for the emotional and behavioral response to pain (Fields & Basbaum, 2000).

The findings of this present study reported that the level of postoperative pain was moderate to severe. Postoperative pain is a very common symptom that is found in patients on the first day after abdominal surgery. The finding was supported by Sommer, de-Rijke, van-Kleef, Kessel and Peters (2008). They reported that the prevalence of postoperative pain in patients after abdominal surgery was high (30-55%) on postoperative days 0-1 who experienced moderate to severe pain. Similarly Laporte (1999) reported that the percentage of postoperative pain in patients after abdominal surgery varied from 22 to 67% was severe to unbearable pain.

To summarize, in the first 24 hours after abdominal surgery, patients experienced postoperative symptoms of pain intensity and pain distress. Postoperative pain is caused by tissue damage which is the release of chemical mediators from the surgical wound. The level of postoperative pain is moderate to severe both in pain both of pain intensity and pain distress.

Part III: Effects of foot massage on pain intensity and pain distress

Within-subjects effect

Test of hypothesis 1. This hypothesis was accepted. The pain intensity scores and the pain distress scores of the experimental group immediately after receiving a foot massage were lower than those of before receiving a foot massage. It indicated that foot massage was good technique in relieving acute postoperative pain in patients after abdominal surgery. This technique was appropriate to apply to the patients. This technique has a relaxation effect. According to the researcher's observation, most patients fell asleep while receiving the foot massage intervention. According to the gate control theory of pain and biochemical theory of pain, the effect of foot massage has a mechanism in relieving acute postoperative pain.

Patients after abdominal surgery have tissue damage that leads to the inflammation response. The chemical mediators released during the inflammatory response give rise to the typical findings associated with inflammation. The chemical mediators actively sensitize the nociceptor to noxious stimuli. Furthermore, generating pain impulses from pain local sensation. The local pain sensation has systemic effects on pain receptors and nerve impulses that are transmitted via nerve fibers A-Delta and C to the central nervous system which has the gate control system.

Subsequently activating the T-cells, as a result the gate is open. Therefore, the pain message reaches the brain. Patients after abdominal surgery experience acute postoperative pain. When postoperative pain occurs, the human body has simultaneous systemic to control pain. Pain can be inhibited through pain modulation. Through the pain modulation mechanisms, the foot massage was applied to inhibit pain to block the transmission of pain impulses, and therefore produce analgesia. Therefore, the pain level after receiving the foot massage intervention decreased.

In addition, the researcher in this study used four basic techniques of foot massage (see the Appendix E). These techniques are effleurage, petrissage, tapotement and friction and have an overall effect in relieving postoperative pain as well (Salvo, 2003).

Effleurage or deep stroking has an effect on blood flow in the veins, which have internal valves to prevent recurrent blood flow (Andrade & Clifford, 2001). Effleurage strokes are capable of enhancing blood and lymph circulation, inducing relaxation, improving the quality of sleep, reducing the pain experience uplifting mood and reducing abnormal muscle contraction (Fritz, 2000; Salvo, 2003).

The second technique, petrissage movements enhance blood flow. The compression on the muscles stimulate the venous blood flow in subcutaneous tissues and muscles resulting in decreased blood retentions in peripheral vessels and increased drainage of lymph. The slow petrissage technique of kneading helps in reducing tension in the muscles, inducing the sense of relaxation and comfort (Salvo, 2003).

The third, tapotement was applied on the skin, tapotement/gentle percussion stimulates blood flow to the massage area. Percussion also stimulates axon

reflect, inducing vasoconstriction at first followed by vasodilatation, which generates a warm temperature on the skin. It also has effects on muscles by enhancing muscular contraction. Tapotement induces muscle relaxation, stimulates digestion, enhances respiratory function, relieves pain, increases lymphatic return, and increases arousal (Dedomenico & Woods, 1997; Liston 1995; Rattray & Ludsing, 2000).

The last, friction technique improves tissue mobility, increasing blood flow and decreasing pain (Simon & Travell, 1999). Friction techniques are often recommended for the management of injuries, when the inflammatory process is controlled (Brukner & Khan, 2001; Lowe, 2003). It is proposed that friction manipulations promote the healing of injury by encouraging the healthy alignment of connective tissue during the healing process. It is proposed that friction manipulations have a strong analgesic effect (Hammer, 1999). The anesthetic effect of friction manipulation according to the gate control theory of pain, foot massage can inhibit the transmission of pain.

The findings of this present study were similar to several previous study that have been conducted by Han et al. (2005), Hulme (1999) and Kim et al. 2002). They applied foot massage for two sessions in their study.

Han et al. (2005) reported that the experimental group receiving foot reflexology massage 6 hours and 12 hours after a gastrectomy had a significantly less score of postoperative pain than before receiving the intervention. The findings were similar to Kim et al. (2002). They found that the severity of pain decreased significantly in the experimental group after receiving the foot massage intervention, also Hulme (1999) stated that there was a significant difference in the mean pain

within the group before and after receiving a foot massage for two sessions in adult female laparoscopic patients.

As summarized, the pain intensity scores and the pain distress scores of the experimental group immediately after receiving a foot massage were lower than those of before receiving a foot massage. It was related to the technique of foot massage. In this present study, the researcher used four techniques of foot massage. According to the gate control theory of pain, these techniques of foot massage inhibit the transmission of pain impulses to the brain, as a result the pain decreases. These techniques have a positive effect in relieving postoperative pain.

Testing hypotheses 2: This hypothesis was accepted as well. There were differences of pain intensity and pain distress within the experimental group across the four-time measures (T1, T2, T3 and T4). The pain scores at T4-T3 (after-before the second massage) were lower than at T2-T1 (after-before the first massage session). It demonstrated that the administration of foot massage for two sessions had a stronger effect than one session.

The administration of foot massage for two sessions may provide an additive effect or accumulating effect of foot massage in relieving pain intensity and pain distress. The additive effect is the term used when two or more drugs are taken at the same time and the action of one plus the action of the other results in an action as if just one drug had been given (Ruth, 2008). Similar to foot massage as a complementary therapy in relieving pain intensity and pain distress, the additive effect of foot massage refers to the combined effect produced by the action of two sessions of foot massage, being equal to the sum of their separate effects.

In addition, a foot massage as a nonpharmacological intervention in pain management needs time to reach the maximum effect dose in relieving both pain intensity and pain distress. The result showed that the efficacy of a foot massage at 90 minutes after foot massage session 1 (T4) was stronger than at 30 minutes after foot massage session 1. It indicated that the administration of a foot massage for two sessions was better than one session. There are several reasons underpinning the positive outcomes of this present study.

When the foot massage was applied at the second session, the mechanism was similar to the first session. Foot massage techniques activate inhibitory interneurons and also inhibit excitatory interneurons. Foot massage generates stimuli on tactile and pressure receptors. When these receptors were stimulated by touch and pressure, the nerves impulses were transmitted to the gate stronger than the first session. As a result, the gate control of pain was closed and the pain score was lower than before.

All of the subjects in this present study underwent a midline incision. Burger, Riet & Jeekel (2002) stated that the midline incision is associated with increasing postoperative pain compared to other incisions. The result of this present study showed that the level of pain was moderate to severe pain. On the other hand, during the intervention no subjects dropped out from the study. The pain score after receiving the foot massage for two sessions was lower than the first session. It supports the effectiveness of a foot massage in relieving acute postoperative pain.

The finding was supported by Wongsdara, (2004). The researcher used local back massage in relieving the pain intensity of patients after abdominal surgery for two sessions. The pain intensity was significantly different at T2 and T4. The

mean of pain intensity in the experimental group after receiving a local back massage for two sessions (T4) was lower than after receiving a local back massage for one session only (T2). Another study by Hulme (1999) found that there was a significant difference within the group when the mean pain scores were analyzed overtime. Similarly two studies were conducted by Han et al. (2005) and Kim et al. (2002). Han et al. (2005) stated that the experimental group after receiving a foot reflexology massage at the 12 hours had lower pain scores than 6 hours after gastrectomy. Kim et al. (2002) stated that the severity of pain scores in patients after abdominal surgery was decreased following a foot massage for two sessions.

This indicated that foot massage worked in relieving postoperative pain. The researcher had expected foot massage could reduce acute postoperative pain intensity and pain distress in patients after abdominal surgery in managing pain, therefore, the patients will be free from postoperative pain until they receive their next pain medication. The foot massage is effective, low risk or safe for patients with no need of additional equipment. As a result, it can enhance the body to recover; shorten a hospital stay, and reduce health care costs.

In conclusion, the pain scores at T4-T3 (after-before the second massage) were lower than at T2-T1 (after-before the first massage session) and are related to the additive effect of foot massage. The administration of a foot massage for two sessions had a stronger effect than one session which supports the effectiveness of foot massage.

Between-subjects effect

Testing hypothesis 3: This hypothesis also was accepted. The research design mentioned that both groups received different interventions in pain management for postoperative patients. The experimental group received pain medication Ketorolac injection intravenously plus a foot massage for two sessions at 5 hours and 7 hours after the pain medication, whereas the control group received pain medication Ketorolac injection intravenously only for pain management for postoperative patients. The findings demonstrated that there was a significant difference of the pain intensity scores and the pain distress scores across T2, T3 and T4 between the two groups. The pain intensity and the pain distress of the experimental group after receiving foot massages was lower than that of the control group. Foot massages had a direct mechanism effect in relieving postoperative pain.

When postoperative pain occurs, the human body has simultaneous systemic to control pain. Pain can be inhibited through pain modulation (Gatlin & Schulmeister, 2007; McCaffery & Pasero, 1999). Through the pain modulation mechanisms, some modalities can be applied to inhibit pain. As the feet are a natural focus for healing, being one of the most innervated and complex surface areas of the body, with 7000 nerve endings in each foot (Bright, 2001), it has been conceived that foot massage may promote the unblocking of a terminal nerve by enhancing this pain modulation.

The foot massage has four basic movements, including effleurage, petrissage, tapotement, and friction. These movements stimulate nerve fibers (A-beta fibers) on foot and dermatome layers which contain tactile and pressure receptors. The receptors subsequently transmit the nerve impulse to the central nervous system.

The gate control system is activated through the inhibitory interneuron whereas the excitatory interneuron is inhibited, resulting in the inhibition of T-cells functioning thus closing the gate. The pain message is not transmitted to the central nervous system, therefore, the brain does not receive the pain message (Salvo, 2003). Ultimately, the pain is not recognized and interpreted, furthermore pain scores decrease. Thus, the foot massage had an overall effect of pain reduction in postoperative patients.

In contrast to the control group, the pain intensity scores and the pain distress scores was higher. The control group received pain medication of Ketorolac injection intravenously only every 8 hours as a standard care in pain management.

A single 30 mg dose of Ketorolac will reach peak analgesic effect in 2 to 3 hours. Plasma half-life time elimination average of 5 hours in young adults and 7 hours in elderly people (average age 72 years). After 5 hours, the concentration of the Ketorolac in the blood will decrease until 8 hours (Aschenbrenner & Venable, 2010).

Ketorolac has efficacy in relieving pain intensity and pain distress for 5 hours after the injection. Furthermore, as the efficacy decreases, then the pain scores increase. The findings show that the pain intensity scores and the pain distress in the control group increased at T1, T2, T3 and T4. An opioid alone did not potentially palliate acute postoperative pain (Piotrowski et al., 2003).

The findings were supported by Asazidaker et al. (2007). There were significant differences of pain intensity, type and amount of additional sedative drug between the experimental and the control groups. Another study by Degirmen et al. (2008) found that pain intensity scores of subjects in the foot and hand massage group

and foot massage group significantly decreased after receiving a massage. Hattan (2002) also found that the foot massage group had a mean difference between the pre- and post intervention pain scores, compared with that of the guided relaxation group and the control group. Similarly a study by Kim et al. (2002) stated that the severity of pain decreased significantly in the experimental group as compared to the control group following foot massage.

Foot massage as a complementary therapy in pain management should be used to enhance conventional treatments for effective pain management. It was expected that foot massage could keep the pain intensity scores and the pain distress stable and low levels. Ultimately patients could be free from suffering pain intensity and pain distress until receiving their next Ketorolac medication.

Piotrowski et al. (2003) stated that massage may be a useful adjuvant therapy for the management of acute postoperative pain. Its greatest effect appears to be on the affective component (i.e., unpleasantness) of the pain. In her study it was found that the rate of decline in the unpleasantness of postoperative pain was accelerated by massage. Massage also accelerated the rate of decline in the intensity of postoperative pain but this effect was not statistically significant. Use of opioid analgesics alone was not altered significantly. Patients who received opioid analgesics did not experience any change in post operative pain.

In conclusion, the effect of foot massage in the experimental group after receiving a foot massage at session 1 and session 2 reported that the pain intensity scores and the pain distress scores was lower than that of before receiving a foot massage, were significantly different across four-time measures compared with the control group ($p < .001$). On the contrary, during the period of usual care the

control group reported an increased the pain intensity scores and the pain distress scores.

Summary

As summarized, the application of the foot massage as a complementary therapy was effective for the reduction of pain intensity and pain distress on the first day in patients after abdominal surgery. Both the pain intensity scores and the pain distress scores in the experimental group after receiving a foot massage were lower than those of before receiving foot massage. The pain scores in the experimental group were lower than those of the control group. Pain medication only is not enough for the reduction of postoperative pain. Foot massage can be added as a daily nursing intervention for relieving acute postoperative pain.

The foot massage is known as an independent nursing intervention. The nurse in the surgical ward can use the foot massage as a guideline. The nurses can complementarily apply the foot massage in managing pain. The foot massage is effective, low risk and safe for patients with no need of additional equipment. As a result, it can enhance the body to recover; shorten a hospital stay, and reduce health care costs.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusions and recommendations. It is divided into three parts: First, the summary of the study that includes its strengths and limitations, second, the implication of the findings on nursing practice and the nursing curriculum, and thirdly is the recommendations that are presented to suggest several further studies.

Conclusion

This study was a prospective randomized controlled trial with repeated measures. It aimed to examine the effects of foot massage on pain intensity and the pain distress of patients after abdominal surgery. The samples of this present study consisted of 40 adult patients older than 18 years who underwent major abdominal surgery under general anesthesia. The patients were admitted to the male surgical ward of the Doctor Kariadi Hospital, Semarang, Central Java Province Indonesia during November 2011 to February 2012. The subjects, who met the inclusion criteria, were assigned to either the experimental group or the control group using the coin tossing technique. The experimental group received the usual care from staff nurses and health team members plus a foot massage for two sessions from the researcher of this study in pain management, whereas the control group received usual care only from staff nurses and health team members.

The research instruments were composed of the demographic data questionnaire/personal data record and the measurement of pain intensity and pain distress using the Visual Numeric Rating Scale (VNRS). A manual guideline of foot massage also was developed for the intervention.

For data collection, a research assistant measured the pain intensity scores and the pain distress scores at the times determined by the researcher including pretest-posttest 1 (T1 and T2) and pretest-posttest 2 (T3 and T4) in both the experimental group and the control group. During the intervention, the research assistant was responsible for data collection at all the time points. After the researcher recruited the potential subjects, the research assistant was called to collect the data. The research assistant measured the pain intensity scores and the pain distress scores at 5 hours after the Ketorolac injection (T1). If the pain scores were more than 3, then the researcher gave the foot massage intervention at the first session for 30 minutes. The research assistant measured the patient's pain immediately after the foot massage was finished at the first session at T2. Ninety minutes later, the research assistant measured the patient's pain at T3. After that, the researcher continued to give the foot massage at the second session for thirty minutes. Finally, the research assistant measured the patient's pain after foot massage was finished at the second session at T4.

No blind technique was applied due to the infeasibility of subject concealment. The times of pain measurement in the control group were similar to the experimental group. Therefore, the pain intensity and pain distress scores at T1 and the age of the patients showed significant differences between the groups; those variables were treated as covariates. Unfortunately the analysis of covariance

(ANCOVA) could not be validly used due to the unmet assumptions of normality, sphericity, and homogeneity of regression. The data were analyzed using the Friedman's test.

The findings of this present study are summarized as follows:

Demographic and surgical-related data, the mean ages of the subjects in the experimental group were significantly different. Subjects in the control group were significantly older than those in the experimental group (52.3 years vs 43.8 years, $t = -2.502$, $p < .05$). They were married (75% in the experimental group and 95% in the control group). All of the subjects in the experimental group were Muslim, whereas those in the control group were 80%. Only 10% of subjects in both groups had a level of education higher than high school. There were more subjects in the experimental group (80%) who worked as a private employee than those in the control group (45%). There were no statistical differences in the demographic characteristics of the subjects between the experimental and the control group, except for age.

For the surgical-related data, nearly half of the subjects in both groups were undergoing a laparotomy (45%). The mean length of the abdominal incision in the experimental group and the control group was 16.90 and 16.70, respectively. There were no statistical differences in the surgical characteristics between the two groups.

The effects of a foot massage on pain intensity and pain distress, after receiving a foot massage in both sessions (5 hours and 7 hours after Ketorolac injection or T2 and T4), the pain intensity scores and the pain distress scores were significantly lower than those of before receiving a foot massage (T1 and T3) (p

<.001). Similarly at across four-time measures both the pain intensity scores and pain distress scores at T2, T3, and T4 were significantly lower than those of T1 (p <.001). After controlling for the effect of T1 and age as covariates, it was found that there were significant differences of pain intensity and pain distress between the experimental group and the control group at T2, T3, and T4 (p <.001). The patients in the control group reported an increase in the pain intensity scores and the pain distress scores. It indicated that foot massage had an effect in relieving pain intensity and pain distress in patients after abdominal surgery.

Strengths and limitations

This study was a prospective randomized controlled trial design. Across four-time measurements of pain intensity and pain distress were used after the first intervention and the second intervention. The coin tossing technique was used to assign subjects to either the experimental group or the control group. This can minimize the selection bias of the subjects. Before the start of the intervention, the identification and the examination of various confounding variables including age, ethnicity, past experience with postoperative pain, gender, pain medication, type of abdominal surgery, and the length of the abdominal incision which could have a weighty effect on the findings, was carried out. The foot massage was implemented only by the researcher. As a result the effect was equal in each subject. Post-hoc power analysis revealed that the power in this present study was higher than that of the previous study (Appendix H). The power of this present study was .99. Wongsdara's study (2004) reported the power as .96 (.99 vs .96). This present study used the Visual Numeric Rating Scale standard for pain assessment. It was reported as

having a high validity and reliability and has been used for Indonesian patients by previous researchers. The researcher had been enrolled in the a training course to gain fundamental knowledge and techniques concerning foot massage then was tested for his ability to perform a foot massage by a massage expert of the Faculty of Nursing, Prince of Songkla University, Thailand.

In spite of these strengths, several limitations of this study also were noted including the sample size and selection of subjects. The sample size of this study was small. The sample size affected to the performing statistical analysis in advance. Thus, further studies need larger sample sizes to increase the power and the effect size of the study. Another limitation was the selection of the subjects. The subjects were selected who had pain intensity scores and pain distress scores were more than 3 which could impact on having no homogenous of the samples. Result showed that there were differences in the pain score at the T1 measurements between the groups. The pain scores between the two groups were varied (4-10). For further study there needs to be a rigorous selection criteria of the subjects related to the pain scores. Another limitation in the selection of the subjects was the differences in the causes of abdominal surgery which might impact on the differences of pain intensity and pain distress. A further study needs to recruit the samples that have a similarity in the cause for abdominal surgery.

Implications and Recommendations

The findings of this study have important implications for the nursing profession and health care professionals. Nurses should apply foot massage as a nursing activity to reduce pain intensity and pain distress and to complement other

medical treatment. In addition, the foot massage intervention can be used as a guideline in relieving pain intensity and pain distress; nurses also can teach the patient's family to apply the foot massage as a complementary therapy in relieving pain intensity and pain distress.

Foot massage should be included in to the nursing curriculum in order to teach nursing students, how to use it to reduce pain after abdominal surgery. Thus, it can be one of the nonpharmacological strategies and can be combined with pharmacological strategies to have a more positive effect on postoperative pain in patients after abdominal surgery and also this therapy does not have any side effects or harm to patients during the intervention.

This study provides some evidence of the effect of foot massage in relieving pain intensity and pain distress in patients after abdominal surgery. However, the results of this study cannot be generalized to all patients because of the limitation in the number of subjects. For a future study on the effect of foot massage on acute postoperative pain in patients after abdominal surgery it should be conducted with a higher number of subjects and higher homogenous criteria of the subjects. In addition, a future study should be conducted to investigate the effect of foot massage with other groups of patients. For example, a comparative study on the effect of foot massage in postoperative pain patients with a midline incision (vertical) and in those with oblique and transverse line incisions (horizontal). Or the effect of foot massages in postoperative pain patients after chest surgery. And also it may be able to be applied to investigate the effect of foot massage on power extremity in stroke patient.

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Appendix A

Informed Consent

RESEARCH INFORMATION SHEET

My name is Chanif. I am a Student Master of Nursing Science at the Faculty of Nursing, Prince of Songkla University, Thailand. I am conducting a research study with the title "The effect of foot massage on acute postoperative in Indonesian patients after abdominal surgery". This is to fulfill the requirement of my study in Thailand.

This study and its procedures have been approved by the Institutional Review Board (IRB) of Prince of Songkla University, Thailand and also have been granted permission by Doctor Kariadi Hospital, Semarang Central Java, Indonesia. You are asked to participate in this research project. Your participation will be beneficial to improve the quality of nursing care provided for postoperative patients.

If you decide to participate in this study voluntarily, I will initiate the following procedure:

Explanation on procedure

a. Grouping

1. You will be assigned to either the intervention group who will receive a foot massage or the control group who will receive the usual nursing care from nurses on the male surgical ward, Doctor Kariadi Hospital using the coin tossing technique.
2. If you are in the experimental group, you will be given a foot massage for two sessions with 30 minutes in each session. You will still receive routine care from your nurse, doctors, and other providers according to standard nursing care for postoperative patients in this hospital.
3. If you are in the control group, you will be given routine nursing care as a standard care in Doctor Kariadi Hospital similar to what you usually have received.

b. Evaluation and Forms
    1. You will be asked to fill in the forms asking about your personal information (demographic data questionnaire) one time prior to the study.
    2. You also will be asked about your pain intensity and pain distress using the Visual Numeric Rating Scale (VNRS) and choose one number appropriate to describe your pain after abdominal surgery.
    3. If you are in the experimental group, you will be given a foot massage for two sessions for 30 minutes each session. After the foot massage, you will be asked your pain using the Visual Numeric Rating Scale and to choose one number appropriate to describe your pain after abdominal surgery.

Risks and Comfort

There are no foreseeable risks or harm to you to join this study. There is no payment to participate in this study.

Benefits

The result of this study can be used as a protocol for nurses and other health care professionals to provide foot massage therapy as an independent nursing intervention in pain management patients after abdominal surgery. The data from this research will be used to write a research paper. It also will provide useful information for future research related to this area.

Confidentiality

All information and your responses in this study will remain confidential. Only the researcher is eligible to access the data. Neither your name nor identifying personal information will be used in the report of the study. Furthermore, the data in the report will be presented as a group rather than individually.

Participation and Withdrawal from Participation

Your participation in this study is voluntary. Signing the informed consent or agreeing verbally to participate and returning the form given indicates that you understand what is involved and you consent to participate in this study project. During any time of this study, you have the right to withdraw from participation. No penalty will be incurred if you decide to withdraw and there will no influence on your medical service or medical treatment.

If you have any questions, suggestions or cannot participate in this study, you can directly contact the researcher (me) on my mobile phone (+62 81390209378). Lastly, if you agree to participate in this research study, please kindly sign your name on the consent form or verbally state your agreement to participate in the study.

Thank you for your cooperation

(Chanif)

Researcher

RESEARCH INFORMATION SHEET: FOOT MASSAGE
(EXPERIMENTAL GROUP)

If you are in the foot massage intervention group, I will initiate the following procedures:

1. At the beginning, you will be asked to fill in the form of the demographic data questionnaire.
2. Before you receive the foot massage therapy, you will be asked your pain intensity and pain distress using the Visual Numeric Rating Scale and choose one number appropriate to describe your pain after abdominal surgery.
3. On the first day after abdominal surgery, five hours and seven hours after receiving Ketorolac you will receive the foot massage consisting of three phases:
    a. The preparation phase
    b. The implementing phase
    c. The finishing phase
4. After you receive the foot massage, you will be asked your pain level using the Visual Numeric Rating Scale and choose one number appropriate to describe your pain after abdominal surgery.
5. Beside the therapy, you will receive routine care as your usual care.
6. You have the right to withdraw from the program without any penalty.

Risk and Comfort

There are no foreseeable risks or harm to you to join this study.

Appendix B
INFORMED CONSENT FORM

Title : The effect of foot massage on acute postoperative pain in Indonesian patients after abdominal surgery

Researcher : Mr. Chanif
Master of Nursing Science student, Faculty of Nursing, Prince of Songkla University, Thailand

I, _____ , have been informed of the details of the research entitled "The effect of foot massage on acute postoperative pain in Indonesian patients after abdominal surgery", and are guaranteed that no part of my personal information and research results shall be individually exposed to the public. If any concerns or issues come up, I can discuss them with the researcher. I have the right to withdraw from this study at any time without any effects on any medical services and treatment. I am willing to participate in this research study, and hereby is my signature.

With consideration of the above, hereby, I decide without force from any side, therefore to agree to participate as a respondent in this research.

Semarang,

Researcher Participant

(Chanif) (……..)

Appendix C

Demographic Data Questionnaire (DDQ)

Code : Group; Experimental/Control* Hospital*:

Date :

Instruction: Please fill in the blank and mark (√) in the bracket appropriate to your answer where indicated. Statements marked (*) are filled in by the Researcher or data collector. Thank you.

Age :

Marital status

( ) Single ( ) Divorced

( ) Married ( ) Widowed or Widower

Religion

( ) Islam

( ) Christian/Catholic

( ) Buddhist

( ) Hindu

Level of Education

( ) Elementary School ( ) Diploma

( ) Junior High School ( ) Bachelor

( ) Senior High School ( ) Graduate School

Occupation

( ) Student ( ) Private Employee

( ) Government Employee ( ) Retired

( ) Farmer/Gardener ( ) Housewife

Type of abdominal surgery :

Length of abdominal incision :

Appendix D

Visual Numeric Pain Intensity Scale and Visual Numeric Pain Distress Scale

Code*: Group: Experimental/Control* Date*:

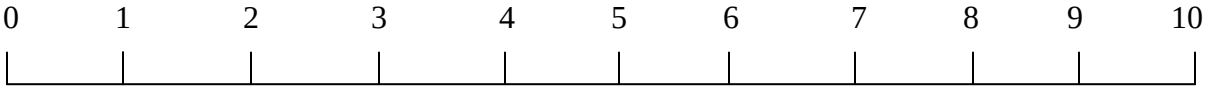
Instruction:

A number of statements which people have used to describe the feeling of pain you are feeling right now. The numbers start at 0 and continued 10. Please choose one of the eleven numbers as you feel your pain right now and then mark the appropriate number which indicates how you are feeling of pain right now.

Visual Numeric Pain Intensity Scale

No pain Moderate pain Worst pain

Visual Numeric Pain Distress Scale



No pain Distressing pain Unbearable pain

Appendix E

Guidelines of Foot Massage

Reflex Points on the Feet (Bright, 2001)

Preparations Phase

1. Set the environment.
2. Set the patient's bed. Adjust the surface height.
3. Remove the watch, and then wash hands.
4. Warm the foot by soaking the patient's feet using warm water mixed with natural herbs for around 3-5 minutes and drain.
5. Assist the patient into supine position.

Warming up for foot massage

1. Using petrissage technique, starting gently, working slowly and rhythmically. Compress ankle and toes, then release**,** repeat 3-5 times this action.

2. Using petrissage technique, push toes forwards by leaning in, then release, repeat 3-5 times this action.

3. Using petrissage technique, cross foot, compress ankle and toes, then release**,** repeat 3-5 times this action.

4. Using effleurage technique, lubricate the foot starting with the right foot. Apply massage oil to the feet for comfort. Warm up the feet by rubbing it all over and

applying the oil in a sweeping motion. Include the top, heel and arch. Gliding strokes work best.

5. Using tapottement technique, tap the foot repeatedly using alternately palms.

6. Using tapottement technique, place the center of the palms of the hands, one on the medial side on the 1st metatarsal head and one on the lateral side on the 5th metatarsal head, with the fingers relaxed, and then move the hands rapidly back and forth.

7. Using tapottement technique, place the heel of the hands below the anklebone, one on the medial side and one on the lateral side, then move the hands rapidly back and forth, the hands will be going in the opposite direction from each other, the foot will shake from side to side.

8. Using tapottement technique, ankle rotation- firstly gentle move the ankle side to side to loosen the ankle joint. Grasp all toes, support the heel and rotate the foot three times clockwise and three times in the anticlockwise direction.

9. Cover the right foot with a towel and repeated the similar steps of warming up for the left foot, continue to the massage procedure.

Implementing phase

Foot massage is started with the left foot until finished, then the right foot, do the massage on the reflex points on the feet as described below:

1. Using friction technique, compress the heart reflex point using a thumb or a stick on the left foot for five times. The right foot does not have a heart reflex point.

2. Using friction technique, compress the adrenal gland and solar plexus reflex points five times on the feet using two thumbs.


3. Using friction technique, compress five times the kidneys, ureters, bladder, and penis reflex points.


4. Using friction technique, compress five times the stomach, duodenum, and pancreas reflex points on the feet using a thumb or a stick.


5. Using petrissage technique, moderately compress five times the small intestines reflex point using the back of the right hand.


6. Using petrissage technique, moderately compress five times the tranversum colon, descending colon, rectum and anus reflex points on the left feet using a stick. For the right foot, compress the small intestines reflex point.

7. Using petrissage technique, compress the heart and spleen reflex points on the feet using a thumb or a stick.

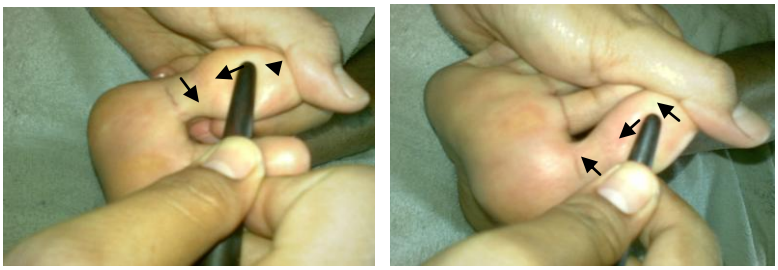
8. Using petrissage technique, compress five minutes the pituitary gland, thyroid gland, and parathyroid gland reflex points using a thumb or a stick.

9. Using technique effleurage/deep stroke, compress five times the genital gland reflex point on the feet using a stick.

10. Using friction technique, compress five times the prostate and frontal sinus reflex points on the feet with using a stick.

11. Using friction technique, compress five times the temporal area and the neck reflex points on the feet using a stick.

12. Using friction technique, compress five times the head, cerebellum, and nose reflex points on the feet using a stick.



13. Using friction technique, compress five times the eye and the ear reflex points on the feet using a stick.

14. Using friction technique, compress five times the balance organ reflex point on the feet using the back of the four fingers of the right hand.

15. Using a friction technique, compress five times the shoulder, the trapezoid, scapula and the elbow joint reflex points on the feet using a stick.

16. Using friction technique, compress five times the knee, cervical vertebra, dorsal vertebra, and lumbar vertebra reflex points on the feet using a stick.

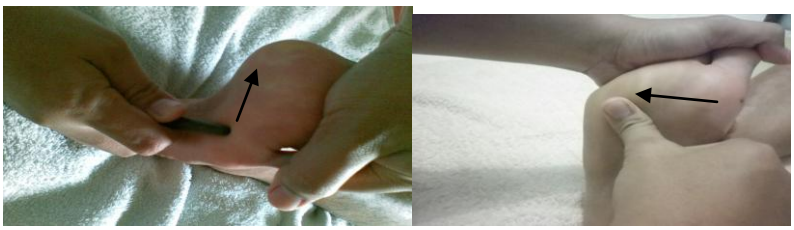
17. Using petrissage technique, compress five times the coccyx reflex point on the feet using the thumb.

18. Using petrissage technique, compress five times the hip joint reflex point on the feet using a thumb.

19. Using effleurage (superficial stroke) technique, compress five times the tonsils, maxilla lower jaw, and sub maxilla upper jaw reflex points on the feet using a stick.

20. Using petrissage technique, compress five times the larynx, wind pipe and lymph cistern reflex points in the feet using to finger of the right hand.

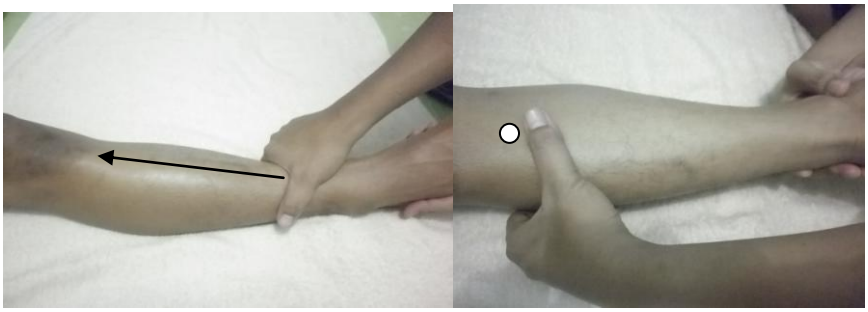
21. Using friction technique, compress five times the lung, bronchi, and breast reflex points on the feet using a thumb or a stick.



22. Using friction technique, compress five times the diaphragm reflex point on the feet using the four fingers of the right hand.

23. Using petrissage technique, circularly compress five times the ribs and groin reflex points on the feet using two thumbs.

24. Using the petrissage technique, compress the relaxation of the abdomen, rectum, and hips reflex points, make a “V” shape in the right hand for compressing five times.



25. Using petrissage technique, circularly compress five times on the upper body lymph gland and lymph gland abdominal reflex points on the feet using two thumbs.

Finishing phase

1. When finished, cover the feet with warm towels for 1-3 minutes.

2. The foot massage ends with some stretching techniques for foot and calf muscles. Unwrap the towel and clean off the excessive oil and tap the soles of the feet.

Appendix F

Table 10

Correlation between Length of Abdominal Incision and the Scores of Pain Intensity and Pain Distress at T1 Using Spearman's rho (N=40)

Variables	r	*p*
Pain intensity	.37	.039
Pain distress	.127	.434

Appendix G

Table 11

Studies determining effect of foot massage in relieving acute postoperative pain

No	Author	Sample	Design	Technique	Duration	Intervention	Findings
1	Asazidaker et al. 2007.	Cardiac surgery	RCT	Effleurage, petrissage, kneading	20 minutes	Foot and hand massage	There were significant differences of pain intensity, type and amount of additional sedative drug between the experimental and the control groups.
2	Brewer, 2001	Knee & hip surgery	Quasy	Effleurage, petrissage, kneading	Foot 10 minutes	Foot massage	There was a significant decrease in pain intensity of patients following a 10- minute massage intervention applied to the patient's feet.
3	Degirmen, et al., 2008	Cesarean section	RCT	Petrissage, kneading, friction	20 minutes	Foot & hand massage	Pain intensity scores of subjects in the foot and hand massage group and foot massage group significantly decreased after receiving massage.
4	Hattan, 2002.	CABG	RCT	Petrissage, kneading, friction	20 minutes	Foot massage and relaxation	The foot massage group had a mean difference between pre- and post intervention pain scores, compared with that of the guided relaxation group and the control group.
5	Han et al., 2005	Gastrectomy	Quasi	Effleurage, petrissage, kneading	20 minutes	Foot reflex massage	The experimental group receiving foot reflexology massage 6 hours and 12 hours after the operation had significantly less score of postoperative pain than that of the control group.

Table 11 (Continued)

No	Author	Sample	Design	Technique	Duration	Intervention	Findings
6	Hulme, 1999	Women laparoscopic	RCT	Petrissage, kneading, tapottement	5 minutes	Foot massage	The two groups were found to be similar. There was no overall significant difference between the two groups regarding reports of postoperative pain, but there was a significant difference between the two groups when the mean pain scores were analyzed overtime in which the mean pain score of the experimental group was lower than that of the control group.
7	Kim et al. 2002	Abdominal surgery	RCT	Petrissage, kneading, tapottement	20 minutes	Foot massage	The severity of pain decreased significantly in the experimental group as compared to the control group following foot massage.
8	Wang & Keck , 2004	Among postoperative	Quasi	Kneading, petrissage, friction.	20 minutes	Foot and hand massage.	A 20-minute foot and hand massage significantly reduced both pain intensity and pain distress resulting from incisional pain on the first postoperative day.

Appendix H

Post-hoc Power Analysis

The calculation of the effect size in this present study is as follows:

ES = M1 – M2 /Pooled SD

Where Pooled SD = $\sqrt{[(SD1^2 + SD2^2 /2)]}$

Where M1: Mean of the experimental group

M2: Mean of the control group

Pooled SD: Standard deviation of the control group and the experimental group

Pooled SD = $\sqrt{[(SD1^2 + SD2^2 /2)]}$

= $\sqrt{1.529}$

= 1.23

ES = M1 – M2 /Pooled SD

= 3.05 – 4.8 / 1.23

= 1.42

According to Cohen ((1988), Table 2.3.5 on page 36), the sample size for this present study was 20 subjects in each group, the effect size = 1.42. The power for this present study was .99

A priory analysis Wongsdara's study (2004), the sample size for the study was 15 subjects in each group, the effect size = 1.4. the power for the study was .96

VITAE

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