

Does Foot Massage Relieve Acute Postoperative Pain? A Literature Review

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Purpose: This study aimed to examine the current state of knowledge regarding foot massage to determine if foot massage has an effect on relieving acute postoperative pain.

Method: The following questions were used to guide this review: How does pain occur? What is the pain management modalities used in relieving acute postoperative pain? Does foot massage relieve acute postoperative pain? A comprehensive systematic search of published literature and journal articles from Science Direct, CINAHL, PubMed, ProQuest and from relevant textbooks was conducted. The universal case entry website, Google-scholar was used as well. The following keywords were used: foot massage, pain management, and postoperative pain. Eight studies on foot massage and more than thirty related articles were reviewed.

Result: Postoperative pain is caused by tissue damage that induces release of chemical mediators from the surgical wound. The four processes of pain are transduction, transmission, perception and modulation. Pain medication is the goal standard for acute postoperative pain relief. In addition, foot massage is a modality that can be used in relieving acute postoperative pain. Massage stimulates large nerve fibers 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 is activated through the inhibitory interneuron, thus closing the gate. Subsequently, the brain does not receive the pain message. Eight reviewed studies demonstrated that foot massage relieves acute postoperative pain. However, there were some methodological limitations of these studies.

Conclusion: It is recommended to examine the effect of foot massage on acute postoperative pain with high homogenous samples using various duration of massage and range of time for pain measurement at different settings.

Key words: foot massage, pain management and postoperative pain.

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Background

Pain is a common symptom found in patients with acute and chronic illness. Pain is also the main reason encountered by hospitalized patients in general and surgical patients in particular. Tranmer et al. (2003) reported that 74 % of 69 patients including postoperative patients experienced pain. Despite the drugs and anesthetic techniques available, the prevalence of post operative pain is still high (Apfelbaum, Chen, & Mehta, 2003; Power, 2005).

A study found that patients after surgery expressed moderate to severe pain. Among them 41% expressed moderate or severe pain (Sommer, de-Rijke, van-Kleef, Kessel & Peters, 2008). Similarly Ignatavicus and Workman (2002) reported that 20% of patients who underwent surgery experienced severe pain, 20% to 40 % experienced moderate pain, and 40% to 70% experienced severe pain. Apfelbaum et al. (2003) reported that the prevalence of acute postoperative pain was approximately 80%. Among them, 86% had moderate, severe, or extreme pain.

Nurse has a role to control and relieve acute postoperative pain by using both pharmacologic and nonpharmacologic approaches. Pharmacological management includes non-opioids, opioids and anesthesia. Opioid analgesia alone may not fully relieve all aspects of acute postoperative pain. Complementary therapy as an adjuvant therapy may potentially relieve acute postoperative pain (Piotrowski, Paterson, Mitchinson, Myra, Kirsh, & Hinshaw, 2003). In recent years, many complementary therapies such as massage, soothing music, relaxation, mind–body techniques, reflexology, herbal medicines, hypnosis, and therapeutic touch have proved decrease pain level to help manage pain (Smith, Collins, Cyna, & Crowther, 2003).

Foot massage is independent nursing intervention that can be applied to patients who are pain. Foot massage is easy to apply, costless and no need special equipment. It could

be added in to daily nursing activities. However, a pertinent question is whether foot massage relieves acute postoperative pain. It needs a critical analysis to determine if foot massage has an effect on relieving acute postoperative pain.

Objectives

This study aimed to examine the current state of knowledge regarding foot massage to determine if foot massage has an effect on relieving acute postoperative pain.

Method

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

The inclusion criteria of the literature review were the articles and textbooks investigating about foot massage, postoperative pain, and pain management in English language. The data were extracted, validated among the authors, and then categorized. The major findings are presented in the following sections.

Nature of Postoperative Pain and its Management

Postoperative pain is a consequence of tissue damage from surgical incision. Immediately after tissue damage, sensory nerve endings are suddenly exposed to a variety of cellular breakdown products and inflammatory mediators that trigger acute nociceptive activity. These chemical mediators generate local pain sensation. The pain message will reach the brain through dorsal horn. Furthermore the pain sensation is recognized and interpreted.

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 (Copstead & Banasik, 2005; Lewis, Heitkemper, Dirksen, O'Brien, & Bucher, 2007).

Acute postoperative pain needs to be managed. The modalities used in relieving acute postoperative pain include both pharmacologic and non pharmacologic management. Pharmacological pain management needs collaboration with the physician. The physician prescribes specific medications for pain or may establish an intravenous (IV) or epidural route for administering analgesics medications (Smeltzer & Bare, 2004).

Pharmacologic pain management is divided into three categories: non-opioids, opioids, and anesthetic agents (Aschenbrenner & Venable, 2010; Black & Hawks, 2005, Jacques, 2009). Practically these medications have side effects that can be life threatening. The common side effects include respiratory depression, hypotension, constipation, urinary retention, decrease urinary output, dizziness, nausea, and vomiting (Aschenbrenner & Venable, 2010; Black & Hawks, 2005). Therefore, it needs management of these side effects. Pharmacologic management alone may not fully relieve acute postoperative pain (Piotrowski, Paterson, Mitchinson, Myra, Kirsh, & Hinshaw, 2003).

Complementary therapy as a non-pharmacological pain management has the potential to palliate acute postoperative pain (Piotrowski et al., 2003). There is some evidence supporting use of non-pharmacologic interventions in relieving acute postoperative pain. These include relaxation (Good et al., 2001), guided imagery (Albert, 2001), zikr meditation (Sitepu, 2009), and music therapy (Good et al., 2002).

These interventions had been proved to relieve postoperative pain. Foot massage is another alternative non-pharmacologic pain management may have potential to improve outcome of pain management. Foot massage can be applied independently by the nurse and

does not need prescription from the doctor. Foot massage is effective, easy, low cost, safe for patients and can be applied to patients in some cultures.

Effect of foot massage on Acute Postoperative Pain. Eight of experimental studies were reviewed to determine if foot massage has an effect on relieving acute postoperative pain as summarized in the Table 1.

Table 1. *Studies Determining the Effect of Foot Massage in Relieving Acute Postoperative Pain*

No	Author	Sample	Design	Technique	Duration	Intervention	Findings
1	Asazidake 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 & h surgery	Quasi	Effleurage, petrissage, kneading	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., 2010	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 reflexology 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.
6	Hulme, 1999	Women laparoscopic	RCT	Petrissage, kneading, tapotement	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.

Table 1 (Continued)

No	Author	Sample	Design	Technique	Duration	Intervention	Findings
7	Kim et al., 2002	Abdominal surgery	RCT	Petrissage, kneading, tapotement	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.

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., 2010; 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.

All of researchers in these studies used basic technique of foot massage. The common techniques were petrissage, effleurage, tapotement, and friction. Similarly Hollis (1998) and Salvo (1999) stated that the basic techniques/movements in foot massage are effleurage or stroking movement, petrissage, tapotement or percussive movement, and friction movement. These techniques have an overall effect in relieving pain.

Effleurage

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

Effleurage or deep stroking has effect on 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, 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 increased drainage of waste product (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 retentions in peripheral vessels and increased drainage of lymph. Slow kneading with sufficient pressure can induce arterial dilation which increase blood supply to the area being massage. For the muscular system, compressive movements increase blood supply and improve the effectiveness of muscular contraction as well as the drainage of waste products of the muscles. Slow kneading also help to reduce tension in the muscles, inducing the sense of relaxation and comfort (Salvo, 2003).

Tapotement

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

When applies on skin, tapotement/gentle percussion stimulates blood flow to the massage area. Hard percussion will cause red mask on the skin. 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, enhance respiratory function, relieves pain, increases lymphatic return, and increases arousal (Dedomenico & Woods, 1997; Liston 1995; Rattray & Ludsing, 2000).

Friction

Friction is 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 manipulations promote the healing of injury by encouraging healthy alignment of connective tissue during the healing process. It is proposed that friction manipulations have strong analgesic effect (Hammer, 1999). The anesthetic effect of friction manipulation according to the gate control theory of pain is that there may be the stimulations of large fiber mechano receptors that cause presynaptic inhibition at the spinal cord, preventing the small diameter (slower) fibers from reaching consciousness. These massage techniques applied in the reviewed studies have a mechanism in relieving acute postoperative pain as further described.

The Mechanism of Foot Massage in Relieving Acute Postoperative Pain

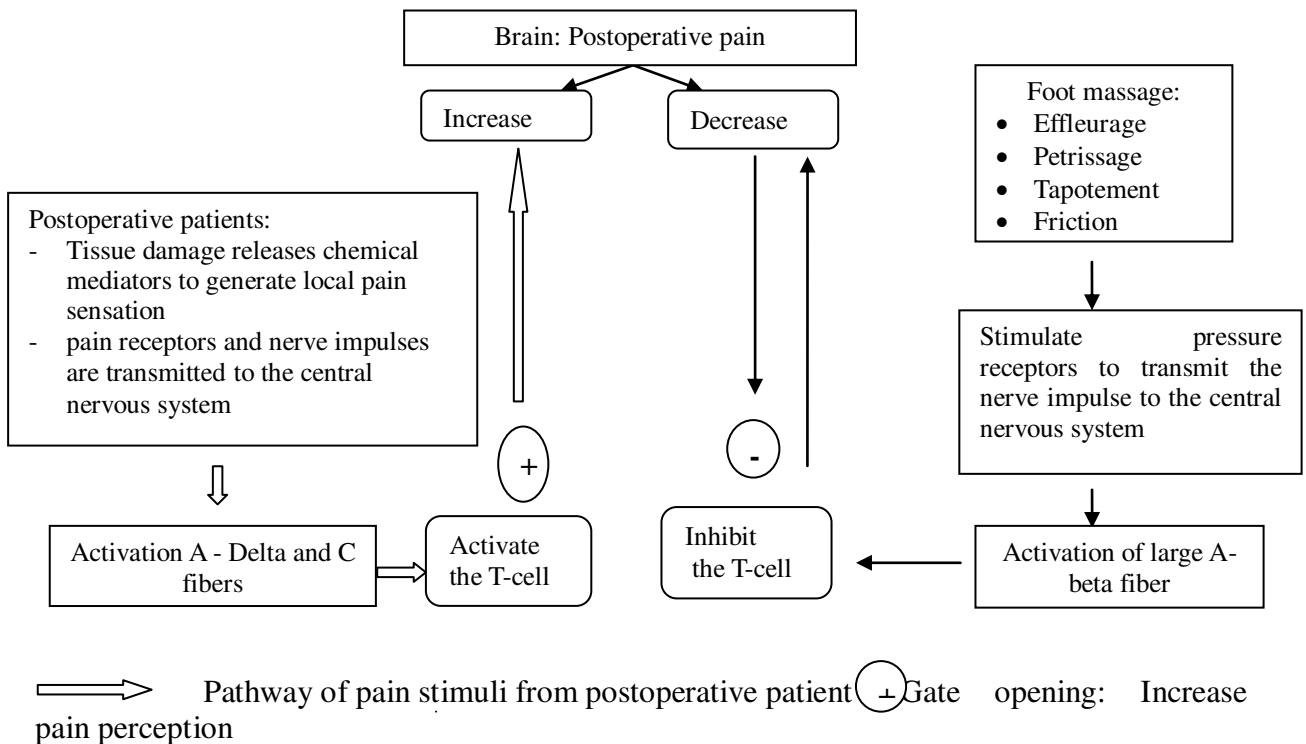
Postoperative pain is caused by tissue damage that induces release of chemical mediators from the surgical wound. The chemical mediators include prostaglandin, proton, serotonin, histamine, bradykinin, cytokines and neuropeptides to generate local pain sensation (Copstead & Banasik, 2005).

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 activate the T-cell, 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 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 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 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-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, foot massage has an overall effect of pain reduction in postoperative patients as summarized in Figure 1.



→ Pathway of pain stimuli from the effect of foot massage ⊖ Gate closing:
Decrease pain perception

Figure 1.

Mechanism of Foot Massage in Relieving Acute Postoperative Pain

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

Conclusion

According to review of the literature and evidence based supports that foot massage had been proved relieve acute postoperative pain among postoperative patients. Several studies had been conducted by Asazidaker et al. (2007); Brewer. (2001); Degirmen et al. (2008); Han et al. (2005); Hattan, (2002); Hulme, (1999); Kim et al. (2002); Wang and Keck, (2004). Those studies provided support for the efficacy of foot massage to decrease acute postoperative pain. These studies are important, because it supported the use of simple form of easily to apply foot massage for relieving acute postoperative pain.

Foot massage is easy to implement, effective, costless, and no need more equipment. Foot is easy accessible and requires no repositioning. Foot massage can be used as a guideline for health care team members in applying pain management in acute postoperative pain. Nursing staff also can introduce of foot massage to patients and patient's family, thus encouraging in caring for the postoperative patients.

Recommendations

Result from this literature review has recommendation for the management of acute postoperative pain. The recommendation is both pain management pharmacologic and nonpharmacologic can be used together in relieving pain. Using pharmacologic alone may not fully relieve all aspects of acute postoperative pain. Pharmacologic drugs have a side effect that can be a life threatening, such as a side effect from morphine can cause depression in the respiratory system. Physician must consider side effect from this medication. Foot massage potentially palliate acute postoperative pain

Foot massage as an independent nursing intervention can be applied for the reduction of acute postoperative pain. Foot massage is easy, no need special equipment, low cost, safe and can be applied to patients in some cultures. For further study need to investigate the effect of foot massage on acute postoperative pain with high homogenous samples using various duration of massage and range of time pain measurement and different settings is recommended.

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