Massage as Adjuvant Therapy in the Management of Acute Postoperative Pain: A Preliminary Study in Men

Marcia M Piotrowski, RN, MS, Cynthia Paterson, RN, MSA, Allison Mitchinson, MPH, Hyungjin Myra Kim, ScD, Marvin Kirsh, MD, FACS, Daniel B Hinshaw, MD, FACS

BACKGROUND: Opioid analgesia alone may not fully relieve all aspects of acute postoperative pain. Complementary medicine techniques used as adjuvant therapies have the potential to improve pain management and palliate postoperative distress.

STUDY DESIGN: This prospective randomized clinical trial compared pain relief after major operations in 202 patients who received one of three nursing interventions: massage, focused attention, or routine care. Interventions were performed twice daily starting 24 hours after the operation through postoperative day 7. Perceived pain was measured each morning.

RESULTS: The rate of decline in the unpleasantness of postoperative pain was accelerated by massage ($p = 0.05$). Massage also accelerated the rate of decline in the intensity of postoperative pain but this effect was not statistically significant. Use of opioid analgesics was not altered significantly by the interventions.

CONCLUSIONS: Massage may be a useful adjuvant therapy for the management of acute postoperative pain. Its greatest effect appears to be on the affective component (ie, unpleasantness) of the pain. (J Am Coll Surg 2003;197:1037–1046. © 2003 by the American College of Surgeons)

Acute postoperative pain is a nearly universal experience after major surgical procedures. Studies have demonstrated that many patients have a substantial degree of unrelieved discomfort after an operation.[1-8] Pain limits physical functioning, including the ability to cough and deep breathe, move, sleep, and perform self-care activities. This may contribute to unintended and serious postoperative complications including fever, atelectasis, pneumonia, and ileus.[1,9-13] Ineffective relief may result in significant psychologic distress, potentially leading to sensory overload, confusion, and even delirium.[4-16] Surgical patients report that pain is one of the highest environmental stressors they encounter.[17–18]

Pain has both sensory and affective components. The sensory experience is conveyed by neurohumoral mechanisms arising locally at the surgical incision. Ultimately, by transmission through the dorsal horn of the spinal cord, discomfort is consciously perceived at the cortical level as a well-localized undesirable sensation. Sensory qualities are described in relationship to time, intensity, and location of pain as well as other properties such as pressure and thermal gradients. The affective component of pain relates to the patient's experience or perception of the pain within an emotional context, often described in terms of unpleasantness. The unpleasantness of the pain is further defined relative to tension, fear, and autonomic responses that accompany the pain.[19-22] The affective component is related closely to suffering.[23] Although opioid analgesia is the mainstay of acute postoperative pain management, pharmacologic interventions alone may not effectively address all the sensory and affective factors involved in experiencing pain.

Patient and clinician barriers often limit the effectiveness of drug treatment. These barriers are complex, may be poorly defined, and have proved to be resistant to

No competing interests declared.
This research was supported by a grant from the Department of Veterans Affairs, Veterans Integrated Service Network (VISN 11), Ann Arbor, MI.

Received July 16, 2003; Accepted July 16, 2003.
From the Performance Improvement Department (Piotrowski, Paterson), the Center for Practice Management and Outcomes Research, Health Services Research and Development (Mitchinson), the Department of Surgery (Kirsh, Hinshaw), and the Palliative Care Program(Hinshaw), VA Ann Arbor Healthcare System, and the Center for Statistical Consultation and Research (Kim), the Department of Surgery (Kirsh, Hinshaw), and the Palliative Care Program (Hinshaw), University of Michigan, Ann Arbor, MI.
Correspondence address: Daniel B Hinshaw, MD, FACS, Department of Surgery and Palliative Care Program, VA Ann Arbor Healthcare System and University of Michigan, 2215 Fuller Rd, Ann Arbor, MI 48105.

ISSN 1072-7515/03/$21.00
doi:10.1016/j.jamcollsurg.2003.07.020

change. For example, patients frequently fear chemical dependency, are concerned about undesirable side effects of pharmacologic agents, believe that suffering should be accepted without complaint, or have a low expectation that their pain will be relieved. Physicians and nurses may possess personal biases, cultural attitudes, or knowledge deficits that influence their approach to the patient in pain and lead them to prescribe or administer ineffective doses of analgesia.[2,7,24-34]

The continuing undertreatment of pain persists despite many reports of ineffective analgesic practices. Education, although essential, has proved insufficient alone to overcome ingrained clinician behavioral patterns.[35] Pharmacologic agents are available that may provide effective pain relief. Their availability, however, has not necessarily translated into improved patient outcomes. Making pain a fifth vital sign and implementing new pain standards by the Joint Commission for Accreditation of Healthcare Organizations (JCAHO) are recent attempts to address the issue at an organizational level.[35-42] New or alternative approaches to managing postoperative pain that supplement and extend current practice may prove more effective than efforts at achieving better compliance with opioid administration alone. Surgery as a discipline has always expressed a strong empiricism with respect to the solution of urgent clinical problems. This pragmatic approach to patient care has given surgeons an openness to new modalities that have demonstrated value on an empirical basis, but may not yet have a clear rationale based on a known physiologic mechanism (eg, acupuncture). There may be no more urgent problem confronting a surgeon caring for a patient in the early postoperative period than achieving relief of the patient's pain. Complementary therapies using nonpharmacologic approaches may provide surgeons with additional tools for more effective relief of postoperative pain.

Massage, a complementary medicine technique, is defined as any systematic form of touch or manipulation performed on the soft tissues of the body that provides comfort and promotes health.[43-45] The earliest association between massage and medicine has, to a great extent, been lost in ancient history and prehistory.[46] Through the centuries there have been multiple examples of the use of touch and massage in the treatment of pain.[47] Integrated with pharmacologic treatment, massage may be useful in the management of acute postoperative pain.

Table 1. Exclusion Criteria

Mental incompetence
Mental illness
Disseminated cancer or met palliative care index
Significant unanticipated event during perioperative period
Confused or delirious
Insufficient eyesight to complete instruments
Unable to maintain lateral recumbent position
Rash, skin lesion, or wound on the back
Screened positive for depression

Although several case reports and experimental studies have addressed the potential benefits of massage on pain,[48-55] only one clinical trial has been performed that measured the effect of massage on acute postoperative pain.[56] Patients between the ages of 41 and 60 years received longer massages and experienced reduced pain levels when compared with younger adult subjects. The investigators were uncertain whether massage duration or patient age was the most critical factor. The study also had several limitations: it had a limited number of participants (20 experimental, 19 control); massage method, length of session, times of day, and anatomic sites varied between subjects; details on the use of narcotics were lacking; and pain intensity was measured, but not pain unpleasantness.

The primary objective for this randomized clinical trial was to test the hypothesis that the use of nurse-administered massage in conjunction with opioid analgesia is more effective than opioids alone in relieving acute postoperative pain. In particular, the study focused on evaluating the effect of massage on postoperative pain during days 2 through 7. Other hypotheses tested were that patients receiving massage would use less opioid analgesia and would be more satisfied with their pain management when massage was used as adjuvant therapy for their acute postoperative pain.

METHODS

Subjects

The study population was defined as patients who underwent operations associated with a significant degree of postoperative pain. All subjects who were hospitalized after an operation requiring either a sternotomy or an abdominal incision that entered the peritoneal cavity and was 8 cm or more in continuous length were considered eligible. Patients were excluded if they met the exclusion criteria listed in Table 1. Patients were re-

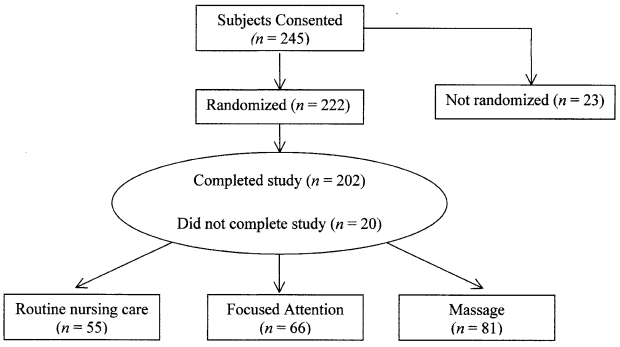

Figure 1. Patient flow through the study.

cruited for the study between April 2000 and February 2001 at the Veterans Affairs Ann Arbor Healthcare System (VAAAHS) in Ann Arbor, MI.

Approval was obtained from the VAAAHS Institutional Review Board. Two hundred forty-five patients gave written informed consent to participate and, of these, 23 were not randomized to one of the study groups after surgery (Fig. 1) for the following reasons: on ventilator continuously for more than 3 days (7), requested to withdraw from study (4), returned to operating room (4), operation was not performed (2), suffered cardiac arrest in operating room (2), confused (2), diagnosed with disseminated cancer (1), or transferred to another facility (1).

Procedure

Patients who would potentially meet study eligibility criteria were identified on the surgery service operative schedule. A research assistant approached patients either the evening before or the morning of the operation before administration of preanesthetic agents. In addition, 57 participants were enrolled in the postoperative period. These enrollments occurred when an operation was performed urgently or emergently, preventing a discussion with the patient before the operation. Before a patient was approached, he or she had to be extubated, alert, medically stable, and at least 24 hours postoperative.

Shortly after a patient consented, the research assistant obtained baseline demographics from the patient including gender, race, history of homelessness, and history of treatment for posttraumatic stress disorder. Information on history of military service–connected injuries was collected through the computerized patient record system.

If patients consented to study participation before their operations, then the morning after the operation the research assistant, research nurse, or both observed the patient at the beside and reviewed the medical record to ensure the participant met the eligibility criteria. If the patient was ineligible (Table 1) on postoperative day 1, then the daily observations continued through day 3. No patient was randomized after day 3.

Seven part-time research nurses (registered nurses) provided interventions to the two experimental groups, focused attention and massage. These research nurses were hired exclusively for the study and were not employed in any other capacity at the medical center. They had no formal instruction in massage therapy. Before performing massage, each research nurse received 3 to 4 hours of training from a certified massage therapist, including a repeat demonstration of an effleurage massage on both a colleague and a patient. Interventions took place on inpatient units, including the surgical intensive care unit, thoracic intensive care unit, a general surgery ward, and a thoracic surgery ward.

Interventions

Patients randomized to the control group received routine care from unit nursing staff, without any intervention by a research nurse. The unit nursing staff adhered to physician orders and elements of appropriate nursing care. Routine care included interventions such as administering and monitoring medications and intravenous infusions, checking patients for safety and comfort, monitoring vital signs, maintaining turning schedules, and performing wound care and other dressing changes.

Patients in the focused attention group received, in addition to routine care, dedicated time (10 uninterrupted minutes) with the research nurse twice daily, in late morning and early evening, starting 24 hours after surgery and continuing through postoperative day 7. If the patient was discharged before day 7 the study interventions ended. The primary purpose of this group was to assess the effect of emotional support independent of massage on pain relief. The intervention took place with no visitors present and while the patient was awake. When possible, the room door was closed. If the patient was in a multiperson room, the curtain was drawn around the bed in order to minimize distractions and to provide privacy. The nurse sat close to the bed, facing the individual, at a comfortable speaking distance. This focused attention time was to provide an opportunity for

patient-nurse interaction. Either party could initiate a conversation. Whenever possible, the nurse would answer the patient's questions about health topics. If the patient shared information on care needs, the research nurse would let the unit nursing staff know of those needs. Remaining silent was an acceptable option.

In addition to routine care, patients in the massage group received a 10-minute effleurage back massage provided by the research nurse twice daily. Other than the type of intervention, the methodologies for the massage group and the focused attention group were identical with respect to timing and duration of interventions, room preparation, and opportunity for patient-nurse interaction. Ideally a back massage would be given with the patient in the prone position. Because patients had either a sternal or abdominal incision, positioning was modified by placing each patient in a lateral recumbent position supported by pillows. The research nurse would stand at approximately the level of the hips, facing the patient's back, and administer an effleurage massage over the exposed area of the back, starting at the base of the spine and moving upward toward the shoulder area. In most instances, subjects received a massage over some portion of their back and shoulders while in a lateral recumbent position, although some were massaged while sitting up in a chair. A pattern of moderately firm massage strokes was used. Regardless of the breadth of the area massaged, patients were instructed to relax and encouraged to inform the research nurse if they became uncomfortable, wanted to change position, wished the massage to be stopped, or required the technique to be modified.

Pain perception scales

Postoperatively, a research assistant asked the patient to rate the intensity and unpleasantness of pain. Beginning on postoperative day 1 and continuing through day 7 (or until discharge if earlier), patients in all three groups had data collected between 8:00 and 9:00 AM, a time before the daily interventions were given. More than half the patients missed pain measurements before their first intervention period on postoperative day 1. There were several reasons for this situation, including the patient sleeping, still on ventilatory support, or not yet enrolled in the study. But by the evening of the first postoperative day many of these same patients were ready for and received their first intervention. This led to the frequent absence of preintervention pain data.

Both pain unpleasantness and intensity were assessed using visual analogue scales (VASs). These VASs were anchored by word phrases at opposite ends. There was a 100-mm unbroken line between the phrases. First the patient was asked to mark with a pen the point on the scale that most accurately described the intensity (strength of pain) that he or she was experiencing at that time. The anchoring phrases were "no pain" and "pain as bad as it can get." Next the patient was asked to focus on a second scale, marking the point that best described the unpleasantness (how bad the pain felt) that he or she was experiencing at that time. The anchoring phrases were "not at all unpleasant" and "as unpleasant as can be."

Health topics

For the two experimental groups the research nurse recorded categoric data on the health topics discussed during each intervention period. Predetermined categories were medications, pain, wound care, fear and anxieties, and physical activity and limitations. There was also an open response category in which the nurse recorded other topics. When the patient chose to remain silent no items were marked.

Opioid analgesia use

A research nurse collected data on daily use of opioid analgesics, including the name of each drug, dose, route, and time of administration. When patient controlled analgesia (PCA) pumps were used, the times of delivered and attempted (but undelivered) doses were gathered from pump records. If the patient received epidural analgesia, the time of each dosing was also recorded. For individuals receiving injectable or oral opioid analgesics, data were obtained from both the opioid delivery system and written medication administration records. The total amount of daily analgesic use was normalized for all subjects by converting the daily opioid dose to the oral morphine equivalent for 24 hours.

Patient satisfaction

Patients in the massage and focused attention groups completed a questionnaire at the end of their participation in the study regarding their satisfaction with pain management. They were specifically asked to rate the impact that the intervention had on their pain. Patients could select one of the following choices: did not receive the intervention; intervention made the pain a great deal worse; intervention made the pain somewhat worse; in-

tervention had no effect on pain (ie, pain was neither better nor worse); intervention made the pain somewhat better; or intervention made the pain a great deal better. If the patient left the facility before there was an opportunity for him or her to rate the intervention, then the question was mailed to the subject's residence. The research assistant conducted a telephone followup of initial nonresponders.

Statistical analysis

Baseline comparisons of demographic variables across the three treatment groups were analyzed using chi-square test if the variables were categoric (ie, type of incision) or analysis of variance (ANOVA) if the variable was continuous (eg, age).

For comparison of the effect of the interventions over time, the repeated measures of pain intensity and pain unpleasantness scores were first explored graphically. The daily mean pain scores were plotted for each postoperative day across the three groups. In addition, because the lines joining the daily means did not necessarily show the trend in an individual subject, patient-specific pain scores were plotted over time for each patient. To account for the potential correlation that might occur when pain measurements are collected from the same patients over multiple days and to model the trend for pain to decrease over time, a random effect growth-curve model was used.[57] The model included two dummy variables each, for the focused attention group and the massage group, and each subject as a random effect to adjust for the within-subject correlation. It included time as days-since-randomization to model the decrease in pain over time. The time-by-intervention dummy variable interaction terms model the potential differences in the rate of pain decrease for the intervention groups relative to the control group. The coefficient of the interaction term being close to zero would suggest no differential rate of decrease in pain for the intervention group relative to the control group. The model also included the time-varying variable of opioid usage to adjust for differences in the amount of daily opioids used.

Topics discussed during intervention periods and patient satisfaction with care were compared between the focused attention group and massage group using a chi-square test. For satisfaction, the categories were collapsed into satisfied (somewhat better or a great deal better) versus not (no effect, somewhat worse, or a great deal worse), and percent satisfied were compared between the massage and focused attention groups. For all analyses, statistical significance was set at 0.05, and all modeling was done using SAS (Statistical Analysis System).

RESULTS

Of 222 patients who were randomized, 20 (5 from the control group, 8 from the focused attention group, and 7 from the massage group) did not participate in the study: 5 were reintubated and on a ventilator after weaning, 5 requested to withdraw from study, 4 were returned to the operating room, 5 were confused, and 1 was unable to maintain a lateral recumbent position. These patients were not included in the data analyses. Of the remaining 202 participants, 55 were assigned to the control group, 66 to the focused attention group, and 81 to the massage group (Fig. 1). There were no significant differences across the three groups in terms of age, type of incision, route of analgesia on postoperative day 1, history of military combat, or history of treatment for substance abuse or dependence (Table 2). More than half of the participants were age 60 or older and the participants were overwhelmingly male (97%). The sternum was the most common incisional site (77%). Other patient characteristics are summarized in Table 3.

In those patients whose preintervention pain scores were measured on day 1 ($n = 57$), no statistical differences were seen across the three groups in their pain intensity or unpleasantness (Table 4, $p = 0.9$ for intensity and $p = 0.8$ for unpleasantness using ANOVA). In all three groups both pain unpleasantness (Fig. 2) and intensity (Fig. 3) declined over time. On postoperative day 2 the means (standard deviations) of the combined groups were 42 mm (2.8 mm) for pain unpleasantness and 43 mm (2.7 mm) for pain intensity. By postoperative day 7 the means decreased to 22 mm (2.4 mm) and 24 mm (2.5 mm), respectively. Though both pain unpleasantness and intensity decreased at different rates across the three groups (pain levels in the two intervention groups declined faster than pain levels in the control group), by postoperative day 6 pain reached a similar level for all three groups (Figs. 2 and 3). So to model this difference in the rate of decrease in pain across the three groups, the pain scores were modeled using data from before the time their pain levels merge: from days 1 to 5 and from days 2 to 5. Data from days 2 to 5 were modeled because we were concerned that a large proportion

Table 2. Patient Characteristics Between Treatment Groups (n = 202)

Variable	Treatment group n					
	Routine nursing care n = 55	Focused attention n = 66	Massage n = 81	n	%	p Value*
Age, y						
<60	22	23	26	71	35.2	0.86
60–70	17	19	25	61	30.2	
>70	16	24	30	70	34.7	
Type of incision						
Sternotomy	42	48	65	155	76.7	0.56
Abdominal	13	18	16	47	23.3	
Route of analgesic administration on postoperative day 1						
Epidural	2	2	1	5	2.5	0.78
Intravenous patient-controlled analgesia	14	19	16	49	24.2	
Intravenous bolus as needed	37	41	57	135	66.8	
Intramuscular	0	0	1	1	0.5	
Combination	2	4	6	12	5.9	
Combat history						
Yes	9	12	15	36	17.7	0.94
No	46	54	66	166	82.3	
History of treatment for substance abuse/dependence						
Yes	4	7	14	25	12.4	0.19
No	51	59	67	177	87.6	

*Demographic data are not statistically different between treatment groups ($p > 0.05$, chi-square test).

of missing day 1 data might bias the comparison of rates of decline in pain across the three groups. The results from the two were similar, and we report here the result from modeling data from days 1 to 5.

Table 3. Other Patient Characteristics (n = 202)

Variable	n	%
Gender		
Male	195	96.5
Female	7	3.5
Ethnicity		
Caucasian	173	89.6
African American	15	7.8
Asian or Pacific Islander	0	0
American Indian or Alaskan native	3	1.6
Other	2	1.0
Service-connected injuries		
Yes	68	33.7
No	134	66.3
History of homelessness		
Yes	13	6.4
No	189	93.6
History of posttraumatic stress syndrome		
Yes	13	6.4
No	189	93.6

When the pain unpleasantness was modeled using a random-effects model, after controlling for opioid dose used, the unpleasantness of the perceived pain decreased at a significantly faster rate in the massage group than in the control group (Fig. 2). Pain unpleasantness decreased at a mean rate of 2.0 mm per day in the control group; this can be translated as a reduction in the pain unpleasantness level of 8.0 mm ($= 2.0 \times 4$) from postoperative days 1 to 5 (Table 5). In comparison, pain unpleasantness declined significantly faster in the massage group by an additional 3.7 mm per day ($p = 0.05$). The estimated difference in the rate of decline in pain unpleasantness was large partly because of the greater level of pain in the massage group on day 1. Pain unpleasantness in the group receiving focused attention also seemed to decline faster than the control group by an additional 1.0 mm per day but it was not significantly different (Table 5).

Although not statistically significant, a similar trend was found for pain intensity, where the pain intensity level decreased more rapidly in the massage group than it did in the control group (Fig. 3). Pain intensity decreased at a mean rate of 2.7 mm per day in the control

Table 4. Pain Perception Scores in the Three Treatment Groups

		Postoperative day since randomization						
Pain scale	**Group**	**1* Baseline**	**2**	**3**	**4**	**5**	**6**	**7**
Unpleasantness	Control	46† (33,58)‡	40 (30,51)	34 (25,43)	39 (32,47)	36 (27,44)	27 (19,35)	22 (12,33)
	Attention	42 (24,60)	38 (28,49)	28 (18,38)	27 (19,34)	29 (22,36)	26 (18,33)	22 (15,29)
	Massage	50 (34,65)	47 (39,56)	35 (28,42)	29 (22,35)	30 (22,38)	27 (19,36)	23 (14,33)
Intensity	Control	48 (35,61)	45 (34,56)	36 (27,45)	38 (30,46)	36 (27,44)	26 (19,33)	24 (14,34)
	Attention	45 (29,62)	36 (27,46)	28 (19,37)	28 (20,36)	28 (21,35)	27 (19,35)	22 (14,29)
	Massage	51 (35,67)	47 (39,55)	31 (24,38)	30 (22,37)	31 (24,38)	25 (18,33)	26 (16,36)

Numbers are daily means (95% confidence intervals).
*Preintervention measurements.
†Daily mean is the average pain measurement in millimeters on a 100-mm visual analogue scale.
‡Low and high limits of the confidence interval are integers in millimeters on a 100-mm visual analogue scale.

group, but decreased faster in the massage group by an additional 2.6 mm per day ($p = 0.16$). After controlling for the opioid dose administered, no difference in the pain intensity trend was found between the focused attention group and the control group (Table 5).

Mean opioid dose declined daily for patients in all groups, reaching a similar level by day 5 (Fig. 4). The mean opioid dose on day 1 was not significantly different across the groups ($p = 0.44$), and when daily opioid doses were modeled, no differential rate of decrease in the amount of opioids was seen across the groups either.

During 82% of the focused attention sessions and 71% of the massage sessions, participants discussed health-care concerns. Figure 5 summarizes the frequency with which each predetermined category of health topic was discussed. For both intervention groups, the two most common topics were pain, followed by physical activities and limitations. There were a variety of other topics recorded in the open response section including family issues, assistance with home care, respiratory status, sleep, nutrition, constipation, nausea, discharge status, past operations, future treatment decisions, and career/jobs. Patients often raised more than one issue.

Figure 6 summarizes results of patient satisfaction with the experimental interventions. Seventy-seven percent of patients in the massage group and 82% of those in the focused attention group answered this question. Combining two categories, pain somewhat better and pain a great deal better, patients in the massage group believed that this treatment decreased discomfort 77% of the time; those receiving focused attention believed the intervention decreased pain 64% of the time. This difference was not statistically significant ($p = 0.16$).

DISCUSSION

This preliminary study is the largest prospective randomized trial of massage as adjuvant therapy for the relief of acute postoperative pain to date. Although the

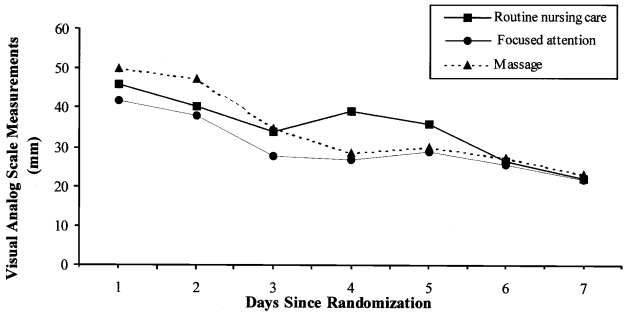

Figure 2. Mean pain unpleasantness scores, controlled for opioid dose administered, during postoperative days 1 through 7 (all postoperative day 1 is preintervention). The comparison is between three groups: control (n = 55), focused attention (n = 66), and massage (n = 81). The rate of decline was found to be significantly different between control and massage groups ($p = 0.05$) in a random-effects model.

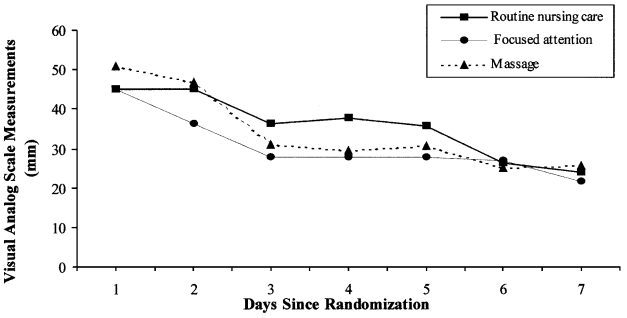

Figure 3. Mean pain intensity scores, controlled for opioid dose administered, during postoperative days 1 through 7 (all postoperative day 1 is preintervention). The comparison is between three groups: control (n = 55), focused attention (n = 66), and massage (n = 81). The rate of decline between groups was not significantly different ($p > 0.05$).

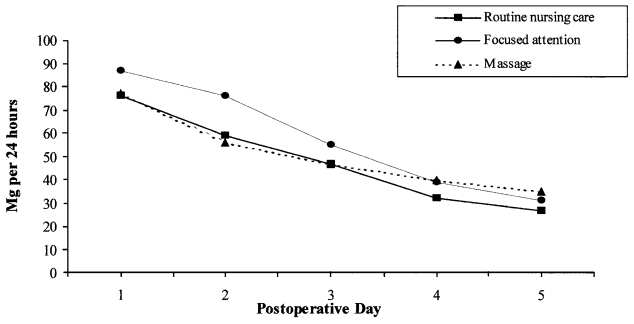

Figure 4. Mean dose of opioid (in mg) for postoperative days 1 through 5. The opioid dose was converted to the oral morphine equivalent for 24 hours. Doses were not significantly different among the three experimental groups ($p > 0.05$).

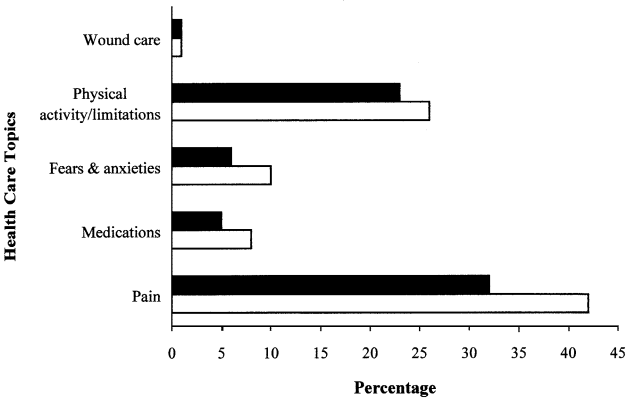

Figure 5. Percentage of patients discussing varied health-care topics during the experimental treatment sessions in the massage and focused attention groups (open bars, focused attention group; solid bars, massage group).

number of patients studied in each group was small, some interesting observations were made. The most compelling finding of this investigation was that massage significantly accelerated the rate of decline in pain unpleasantness as perceived by the patients. It appears that the primary effect of massage is on an aspect of perceived pain that may not be particularly responsive to opioids.[58,59] Most efforts to control pain address the sensory experience. Physicians and nurses often measure the intensity, duration, and frequency of pain when evaluating the impact of treatment modalities. Yet the affective component, expressed as pain unpleasantness, is often not addressed. This is a vital, albeit less recognized aspect of the pain experience.

An earlier descriptive investigation found that postoperative pain declined rapidly and was considerably reduced in about two-thirds of patients by day 4. If the pain extended beyond day 4, it was linked to the development of postoperative complications.[60] In this study the rate of decline in acute postoperative pain followed a similar pattern, albeit slightly longer, with all groups experiencing a similar level of pain by day 5. The greatest impact of both massage and focused attention was noted during the first 72 hours after an operation, suggesting that adjuvant interventions should begin as soon as feasible postoperatively. Beyond postoperative day 3, either massage or focused attention might have less impact on pain perception.

When rating satisfaction with treatment, patients in both experimental groups perceived that the interventions improved pain control. This perception was more pronounced in the massage group. Although the secondary gain associated with the extra attention given by the

Table 5. Random-Effects Model Estimates of the Rate of Change in Pain Scores During Postoperative Days 1 to 5

Pain scale	Group	Estimate* (mm)	Standard error	p Value
Unpleasantness	Control	−2.0	1.3	0.14†
	Attention	−1.0	1.9	0.58‡
	Massage	−3.7	1.9	0.05§
Intensity	Control	−2.7	1.4	0.05†
	Attention	0.04	1.9	0.99‡
	Massage	−2.6	1.9	0.16§

*The estimates are obtained from random-effects models, adjusted for opioid use. For focused attention and massage groups, the estimates are relative to the rate of the control group.
†The p value is obtained from the test of the control group's rate of decline being different from zero.
‡The p value is obtained from the test of the focused attention group's rate of decline being different from that of the control group.
§The p value is obtained from the test of the massage group's rate of decline being different from that of the control group.

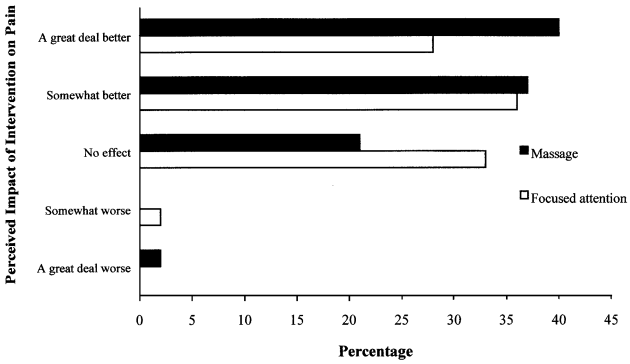

Figure 6. Percentage of patient satisfaction with pain treatment in the massage and focused attention groups. Three percent of patients in the massage group and 12% of the patients in the focused attention group stated they did not receive the interventions.

nurse in the experimental groups may be an important factor in the more rapid decline in perceived pain unpleasantness compared with that in the control group, the greater effect of massage suggests that physiologic responses to the massage may also be important.

Based on the findings of the average daily decline in pain intensity in the massage group compared with those in the focused attention and routine care groups, it appears that a sample of 194 patients per group ($n = 582$) will give 80% power to detect a moderate (ie, 2 mm per day) difference in the rate of decrease in pain intensity. Clarification of these potential differences and the impact of massage on functional recovery after surgical procedures, self-administration of opioid analgesics by postoperative patients receiving patient-controlled analgesia, levels of anxiety, incidence of postoperative complications, and length of stay await a larger-scale randomized trial.

The timing of the massage and focused attention may not have been optimal for many patients. Ideally, interventions would have been provided when the patient requested treatment. Pain is whatever the patient says it is and exists whenever the patient says it does.[24] The timing of interventions, then, should also be in the individual's control to the greatest extent possible. In a clinical trial, it is difficult to provide interventions of massage or focused attention at flexible times that patients request. If not being able to provide the interventions at optimal times has led to potential bias in our results, it is likely that the difference across the groups will be underestimated rather than overestimated.

In summary, despite the study limitations, massage was found to accelerate the rate of decline in both the unpleasantness and intensity of acute postoperative pain, although the impact on the affective domain (ie, pain unpleasantness) was more pronounced and was statistically significant. Focused attention alone did not fully account for the effects seen with massage. Patients receiving massage reported somewhat greater satisfaction with their pain management than patients receiving focused attention. Of the several health-care professions, nurses usually have the longest and most frequent contact with postoperative patients. They are at the bedside around the clock and are potentially available to help patients in pain at the time of greatest need. Massage may be a useful tool expanding the nurse's ability to palliate the postoperative distress of surgical patients.

Author Contributions

Study conception and design: Piotrowski, Mitchinson, Kim, Kirsh, Hinshaw
Acquisition of data: Piotrowski, Paterson, Kirsh
Analysis and interpretation of data: Piotrowski, Paterson, Mitchinson, Kim, Hinshaw
Drafting of manuscript: Piotrowski
Critical revision: Piotrowski, Mitchinson, Kim, Hinshaw
Statistical expertise: Mitchinson, Kim
Obtaining funding: Piotrowski, Hinshaw
Supervision: Hinshaw

REFERENCES

1. Acute pain management: operative or medical procedures and trauma. Clinical practice guideline no. 1 (AHCPR Pub. No. 92-0032). Rockville, MD: US Department of Health and Human Services, 1992:1,3–4.
2. Cohen FL. Postsurgical pain relief: patients' status and nurses' medication choices. Pain 1980;9:265–274.
3. Donovan BD. Patient attitudes to postoperative pain relief. Anaes Intensive Care 1983;11:125–129.
4. Kuhn S, Cooke K, Collins M, et al. Perceptions of pain relief after surgery. BMJ 1990;300:1687–1690.
5. Navas M, Sommer C. Providing effective pain control: a survey of hospitalized veterans yields several recommendations for improving pain management. Federal Practitioner 1999;16:37–44.
6. Oden RV. Acute postoperative pain: incidence, severity, and the etiology of inadequate treatment. Anesthes Clin of North Am 1989;7:1–15.
7. Puntillo KA. Pain experiences of intensive care unit patients. Heart Lung 1990;19:526–533.
8. Tittle M, McMillan SC. Pain and pain-related side effects in an ICU and on a surgical unit: nurses' management. Am J Crit Care 1994;3:25–30.
9. Bonica JJ, Benedetti C. Postoperative pain. In: Condon RE, DeCosse JJ, eds. Surgical care: a physiologic approach to clinical management. Philadelphia: Lea and Febiger; 1980:394–414.
10. Hewlett AM, Branthwaite MA. Postoperative pulmonary function. Br J Anaesth 1975;47:102–107.
11. Moossa AR, Hart ME, Easter DW. Surgical complications. In: Sabiston DC Jr, Lyerly HK, eds. Textbook of surgery: the biological basis of modern surgical practice. 15th ed. Philadelphia: WE Saunders; 1997:341–359.
12. Puntillo K, Weiss SJ. Pain: its mediators and associated morbidity in critically ill cardiovascular surgical patients. Nurs Res 1994;43:31–36.
13. Kehlet H, Rosenberg J. Surgical stress: pain, sleep, and convalescence. In: Kinney JM, Tucker HN, eds. Physiology, stress, and malnutrition: functional correlates, nutritional intervention. Philadelphia: Lippincott-Raven; 1997:95–112.
14. Spiro HR. Psychiatric reactions associated with surgery. In: Condon RE, DeCosse JJ, eds. Surgical care: a physiologic approach to clinical management. Philadelphia: Lea and Febiger; 1980:451–456.

15. Kehlet H. Acute pain control and accelerated postoperative surgical recovery. Surg Clinic North Am 1999;79:431–443.
16. Fischer JE, Fegelman E, Johannigman J. In: Schwartz SI, Shires GT, Spencer FC, eds. Principles of surgery. 7th ed. New York: McGraw-Hill; 1999:441–483.
17. Ballard KS. Identification of environmental stressors for patients in a surgical intensive care unit. Issue Ment Health Nurs 1981; 3:89–108.
18. Nastasy EL. Identifying environmental stressors for cardiac surgery patients in a surgical intensive care unit (abstract). Heart Lung 1985;14:302–303.
19. Melzack R. The McGill pain questionnaire: major properties and scoring methods. Pain 1975;1:277–299.
20. Melzack R, Torgerson WS. On the language of pain. Anesthesiology 1971;34:50–59.
21. Melzack R. The puzzle of pain. New York: Basic Books; 1973: 46,148–149.
22. Melzack R, Wall PD. The challenge of pain. New York: Basic Books; 1983:215–217, 240–243.
23. Lewis CS. The problem of pain. New York: Macmillan; 1962: 90.
24. McCaffery M, Pasero C. Pain clinical manual. 2nd ed. St. Louis: Mosby; 1999:17, 39–44.
25. McCaffery M, Ferrell BR. Correcting misconceptions about pain assessment and use of opioid analgesics: educational strategies aimed at public concerns. Nurs Outlook 1996;44:184–190.
26. Lavies N, Hart L, Rounsefell B, Runciman W. Identification of patient, medical and nursing staff attitudes to postoperative opioid analgesia: stage 1 of a longitudinal study of postoperative analgesia. Pain 1992;48:313–319.
27. Cartwright PD. Pain control after surgery: a survey of current practice. Ann R Coll Surg Engl 1985;67:13–16.
28. Navas M, Cooke K, Colins M, et al. Perceptions of pain relief after surgery. BMJ 1990;300:1687–1690.
29. Sriwatanakul K, Weis OF, Alloza JL, et al. Analysis of narcotic analgesic usage in treatment of postoperative pain. JAMA 1983; 250:926–929.
30. Kuhn S, Cooke K, Colins M, et al. Perceptions of pain relief after surgery. BMJ 1990;300:1687–1690.
31. Marks RM, Sachar EJ. Undertreatment of medical inpatients with narcotic analgesics. Ann Intern Med 1973;78:173–181.
32. Maxam-Moore VA, Wilkie DJ, Woods SL. Analgesics for cardiac surgery patients in critical care: describing current practice. Am J Crit Care 1994;3:31–39.
33. Weiss OF, Sriwatanakul K, Alloza JL, et al. Attitudes of patients, housestaff, and nurses toward postoperative analgesic care. Anesth Analg 1983;62:70–74.
34. Ward SE, Gordon DB. Patient satisfaction and pain severity as outcomes in pain mnagement: a longitudinal view of one setting's experience. J Pain Symptom Manage 1996;11:242–251.
35. Max MB. Improving outcomes of analgesic treatment: is education enough? Ann Intern Med 1990;113:885–889.
36. Joint Commission on Accreditation of Healthcare Organizations. Comprehensive accreditation manual for hospitals: the official handbook. (Standards RI.1.2.7, PE.1.4, TX.3.3, TX.5.4, PF.3.4, CC.6.1, PI.3.1). Oakbrook Terrace, IL: 2001.
37. Berry PH, Dahl JL. The new JCAHO pain standards: implications for pain management nurses. Pain Manag Nurs 2000;1:3–12.
38. Simmons JC. Pain management: new initiatives arise to provide quality care. Qual Lett Healthc Lead 2001;13:2–11.
39. Sandlin D. The new Joint Commission accreditation of healthcare organizations' requirements for pain assessment and treatment: a pain in the assessment? J Perianesth Nurs 2000;15:182–184.
40. Anonymous. Pain management is high priority for surveyors. Hosp Peer Rev 2002;27:20–23.
41. Merboth MK, Barnason S. Managing pain: the fifth vital sign. Nurs Clin North Am 2000;35:375–383.
42. Kirsch B, Berdine H, Zablotski D, et al. Implementation of a pain management strategy: identifying pain as the fifth vital sign. Veterans Health System J 2000;5:48–57, 59.
43. Lidell L. The book of massage: the complete step-by-step guide to eastern and western technique. New York: Simon and Schuster; 1984:16.
44. Snyder M. Independent nursing interventions. 2nd ed. Albany: Delmar; 1992:199–200.
45. Tappan F. Healing massage techniques: holistic, classic, and emerging methods. Norwalk, CN: Appleton and Lange; 1988: 3–4.
46. Ramsey SM. Holistic manual therapy techniques. Prim Care 1997;24:759–786.
47. Fulop-Miller R. Triumph over pain. New York: Literary Guild of America; 1938:11–26.
48. Cawley N. A critique of the methodology of research studies evaluating massage. Eur J Cancer Care 1997;6:23–31.
49. Labyak SE, Metzger BL. The effects of effleurage backrub on the physiological components of relaxation: a meta-analysis. Nurs Res 1997;46:59–62.
50. Richards KC. Effect of a back massage and relaxation intervention on sleep in critically ill patients. Am J Crit Care 1998;7: 288–299.
51. Schoenhofer SO. Affectional touch in critical care nursing: a descriptive study. Heart Lung 1989;18:146–154.
52. Weiss SJ. Effects of differential touch on nervous system arousal of patients recovering from cardiac disease. Heart Lung 1990; 19:474–480.
53. McCorkle R. Effects of touch on seriously ill patients. Nurs Res 1974;23:125–132.
54. Field T. Touch therapy. Edinburgh, London: Churchill Livingstone; 2000:48–91.
55. Hemphill L, Kemp J. Implementing a therapeutic massage program in a tertiary and ambulatory care VA setting. Nurs Clin North Am 2000;35:489–497.
56. Nixon M, Teschendorff J, Finney J, Karnilowicz W. Expanding the nursing repertoire: the effect of massage on post-operative pain. Aust J Adv Nurs 1997;14:21–26.
57. Laird NM, Ware JH. Random-effects models for longitudinal data. Biometrics 1982;38:963–974.
58. Price DD, Harkins SW, Baker C. Sensory affective relationships among different types of clinical and experimental pain. Pain 1987;28:297–307.
59. Katz J, Melzack R. Measurement of pain. Surg Clin North Am 1999;79:231–252.
60. Melzack R, Abbott FV, Zackon W, et al. Pain on a surgical ward: a survey of the duration and intensity of pain and the effectiveness of medication. Pain 1987;29:67–72.