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The Impact of Massage and Reading on Children's Pain and Anxiety after Cardiovascular Surgery: A Pilot Study

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Abstract

Objective—The purpose of this pilot study was three-fold: 1) to evaluate the safety and feasibility of instituting massage therapy in the immediate postoperative period after congenital heart surgery, 2) to examine the preliminary results on effects of massage therapy versus standard of care plus three reading visits on postoperative pain and anxiety, and 3) to evaluate preliminary effects of opioid and benzodiazepine exposure in patients receiving massage therapy compared with reading controls.

Design—Prospective, randomized controlled trial (RCT).

Setting—An academic children's hospital.

Subjects—Sixty pediatric heart surgery patients between ages 6 and 18 years.

Interventions—Massage therapy and reading.

Measurement and Main Results—There were no adverse events related to massage or reading interventions in either group. Our investigation found no statistically significant difference in pain or state-trait anxiety scores in the initial 24 hours after heart surgery (T1) and within 48 hours of transfer to the acute care unit (T2) after controlling for age, gender, and RACHS-1 score.

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However, children receiving massage therapy had significantly lower state-trait anxiety scores after receiving massage therapy at time of discharge (T3, p=0.0075) than children receiving standard of care plus three reading visits. We found no difference in total opioid exposure during the first three postoperative days between groups (Median [IQR], 0.80 mg/kg morphine equivalents [0.29–10.60] vs. 1.13 mg/kg morphine equivalents [0.72–6.14]). In contrast, children receiving massage therapy had significantly lower total benzodiazepine exposure in the immediate three days following heart surgery (Median [IQR] 0.002 mg/kg lorazepam equivalents [0–0.03] vs. 0.03 mg/kg lorazepam equivalents [0.02–0.09], p=0.0253, Wilcoxon rank-sum) and number of benzodiazepine PRN doses (0.5 [0–2.5] PRN vs. 2 PRNs [1–4]; p=0.00346, Wilcoxon rank-sum).

Conclusions—Our pilot study demonstrated the safety and feasibility of implementing massage therapy in the immediate postoperative period in pediatric heart surgery patients. We found decreased state-trait anxiety scores at discharge and lower total exposure to benzodiazepines. Preventing postoperative complications such as delirium through nonpharmacologic interventions warrants further evaluation.

Keywords

heart surgery; child; intensive care

Introduction

Pediatric heart surgery is a major life event that is accompanied by both physical and psychological discomfort. Postoperative discomfort is further compounded by required hospital activities such as turning, coughing and deep breathing exercises, ambulation, and invasive catheters and chest tubes. Unrelieved pain and anxiety may interfere with patients' ability to participate in their postoperative recovery and may also have detrimental physiological and psychosocial effects such as activating the stress response. In addition to the subjective discomfort postoperative heart surgery patients experience, there is mounting evidence that postoperative pain, anxiety, and tension can impair immune function, and slow wound healing [1]. Opioids and benzodiazepines are routinely administered to manage acute postoperative pain and anxiety and support patients to engage fully in their postoperative recovery. Recently, investigations have demonstrated the concomitant use of massage therapy has reduced pain scores and anxiety in the immediate postoperative period following adult heart surgery and in other critically-ill adult patients [2].

In the pediatric population, there has been limited research on the concomitant use of massage therapy for children with congenital heart disease (CHD) undergoing heart surgery. CHD is a common, complex, and life-long condition typically requiring surgery during childhood due to abnormal cardiovascular physiology [3]. As these children with CHD grow, they may require multiple surgical procedures to optimize their physiology, and they are at significant risk for developing fear of hospitalization, altered pain processing, and tolerance to opioids and benzodiazepines during subsequent hospitalizations due to repeated exposures [4]. We hypothesized that the addition of a concomitant massage therapy intervention in the immediate postoperative period would reduce pain and anxiety and result in decreased opioid and/or benzodiazepine use in postoperative pediatric heart surgery patients. The purpose of this pilot study was three-fold: 1) to evaluate the safety and feasibility of instituting massage therapy in the immediate postoperative period, 2) to examine the preliminary effects of massage therapy versus standard of care plus three reading visits on postoperative pain and anxiety, and 3) to evaluate preliminary findings related to opioid and benzodiazepine exposure in patients receiving massage therapy and in reading controls.

Materials and Methods

The Stanford Institutional Review Board deemed this study not human subjects research, as all care provided was consistent with existing clinical care protocols. Sixty patients were enrolled in this single-center prospective, randomized trial (RCT). Inclusion criteria were as follows: children 6 through 18 years of age undergoing congenital heart surgery and English-speaking. Exclusion criteria included the following: children with labile postoperative physiology, those requiring delayed sternal closure, those at high risk for pulmonary hypertensive crisis, those with severe coagulopathy and/or parental/child declination. Labile physiology was defined as significant hypotension (i.e., children requiring escalation of vasoactive infusions or IV fluid boluses to achieve a normal blood pressure for age), hypoxia ($PaO_2 < 60$ mmHg in those with no right-to-left cardiac shunting), and/or determination by the Cardiac Intensive Care Unit (CICU) intensivist or heart surgeon that the patient's hemodynamics or respiratory status were fragile or otherwise unstable.

Patients were recruited to participate during their preoperative appointment by a Collaborative Institutional Training Initiative (CITI)-trained advanced practice provider (APP) oriented to the study [5]. After patients and parents were educated, the patient verbally assented (when appropriate), and the parents verbally consented to participate in the study (written consent was not obtained due to our not human subjects research designation), the APP placed the child's age, gender, and Risk Adjustment for Congenital Heart Surgery (RACHS-1) score into block randomization on R [6,7]. Following randomization into either the massage therapy group or the reading group, the APP then notified the principal investigator or her designee of the enrolled patient and his/her group assignment.

Interventions

Massage Therapy (Intervention Group)—In our study, massage therapy was defined as manual manipulation to soft tissues and muscles of the body through application of rhythmic, systematic hand movements intended to promote the health and well-being of children [8,9]. An inpatient massage protocol was developed and included a variety of techniques appropriate for each subject's condition, desires, and reactions. The massage intervention consisted of massage therapy two to three times per week starting within 24 hours after surgery and continued throughout the hospital stay. In addition, massage therapy was performed at three specific data collection points: 1) within 24 hours of surgery, 2) within 24 hours of transfer to the cardiology ward, and 3) within 48 hours prior to discharge from hospital. Each session was no more than 30 minutes and usually took place with the patient in his/her bed, bedside chair, or recliner. Each session required another adult (e.g., nurse or parent) to be present. Appropriate hand hygiene occurred directly before patient contact. Gloves were not used unless the patient was on contact precautions or the massage therapist otherwise deemed their use was warranted. Patients were encouraged to provide feedback and direction throughout the massage therapy session regarding any planned massage technique as well as how and where they were touched.

The first study massage (or reading) intervention occurred within the first 24 hours after heart surgery. Patients at this initial time point were often sedated. The massage therapist communicated closely with the parent(s) and bedside nurse, monitored for evidence of physiologic stress (e.g., vital signs, peripheral oxygen saturation) in collaboration with the bedside nurse, and made joint decisions about the appropriateness of the massage techniques selected as practiced in existing standardized care protocols. If the child experienced significant changes (more than a 20% change) in heart rate, blood pressure, oxygen saturation, or other invasive monitoring, the massage would be aborted.

The massage therapists chose from a variety of techniques modified (e.g., amount of pressure) to be appropriate to the participant's condition, preferences, and reactions. These techniques included Swedish massage, craniosacral therapy, myofascial release, energy-based modalities (i.e., Reiki and/or healing touch), acupressure or Shiatsu, and neuromuscular therapy. When possible and appropriate, the massage therapist attempted to provide gentle touch to the child's chest (avoiding the incision site). Appendix 1 provides the details of the massage therapy protocol, including introduction, preparation, positioning, and techniques. Our protocol was consistent with studies of massage therapy in adult heart surgery patients [2,10,11]. However, we modified massage techniques based on the child's medical status, safety concerns, and the child's or parent's reaction to the intervention.

Reading (Attention Control Group)—The attention control group consisted of up to 20 minutes of reading at our three specific data collection points: 1) within 24 hours of surgery, 2) within 24 hours of transfer to the cardiology ward, and 3) within 48 hours prior to discharge from hospital. Reading was chosen as our comparator, as it has been used as such in other studies involving massage therapy for children and mimics the amount of time and attention received by our treatment group [12–15]. Only one published study specified the book author, Dr. Seuss (Theodor Seuss Geisel) [13]. After reviewing the literature and consultation with the hospital librarian and clinical staff, three books by Dr. Seuss were chosen: *The Lorax*, *Horton Hears a Who!*, and *Oh, the Places You'll Go!* Appendix 2 lists the steps for the protocol to be used by the massage therapists for each of the three reading interventions. The massage therapists were instructed not to intervene physically in any way with the patient, including touching or offering suggestions for things such as patient positioning or patient behavior (e.g., breathing or closing eyes). The massage therapists also were instructed not to raise the topic of massage therapy. If a patient or parent requested massage, they were informed that it could be provided after the final reading visit and study data collection (which would be within 48 hours before anticipated discharge), if scheduling permitted.

Training of Interventionist—The massage therapy team consisted of one male and five female massage therapists, having a range of 6–22 years of experience with inpatient massage therapy. Two massage therapists (KB and LE) attended CICU clinical rounds. The massage therapy team met and discussed the clinical evidence, appropriate techniques, and safety considerations prior to implementation of the study protocol.

Concomitant Care—Opioids and benzodiazepines were prescribed to alleviate a patient's pain and anxiety as the medical team deemed appropriate. Opioids and benzodiazepines were not routinely given at time of massage or reading unless the bedside nurse deemed it appropriate; our hospital requires treatment for pain score > 4. Other discomfort medications included aspirin, dexmedetomidine, propofol, ketorolac, acetaminophen, and ibuprofen. Other treatment for pain and anxiety included patient and family support and education about appropriate wound management to minimize incisional and sternal pain.

Measures

We collected patient demographics including age, gender, RACHS-I score, number of previous surgeries, and/or critical care admissions [6]. Hours of mechanical ventilation, respiratory rate, intensive care length-of-stay, and hospital length-of-stay were also recorded. Outcome variables included safety events, fidelity of the intervention, pain scores, state-trait anxiety scores (state), and opioid and benzodiazepine exposure, including doses and number of as needed (PRN) medications of the two types administered.

Massage Therapy/Reading Sessions—A clinical research form (CRF) was completed for each study participant. For the intervention group, the massage therapist documented his/her name, the date, the duration of the massage, the type of techniques used, the areas of the body to which massage was applied, and any relevant comments. For the control group, the massage therapist documented his/her name, the date, title of book read, minutes read, timing of the reading intervention, and any relevant comments. Subsequently, these data were de-identified and entered into a REDCap® database [16]. REDCap® is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources [16].

Safety Events—Safety was evaluated by monitoring for any adverse events during study interventions (including occurrences of psychological distress, clinical deterioration, or inadvertent equipment disruption). Clinical deterioration was defined as children having greater than 20% detrimental change in their hemodynamics or oxygen saturation. If an adverse event occurred, the massage therapists were instructed to stop the intervention and report the event both to the participant's bedside nurse and the principal investigator for clinical management and documentation.

Fidelity—Fidelity of the study was measured by the extent to which delivery of an intervention adheres to our protocol. Adherence to our protocol was documented by the massage therapists. Our threshold for ensuring the fidelity of the study was each participant was required to receive 2 or more interventions or they were excluded from the study. All participants included in this study received 2 or more interventions.

Pain—Pain is defined as "…an unpleasant sensory and emotional experience associated with actual or potential tissue damage…" [17]. Age appropriate scales were utilized to assess pain symptoms. These included the Faces, Legs, Activity, Cry and Consolability (FLACC) tool, the Wong-Baker faces scale, and the Numeric Rating Scale (NRS) [18–20]. The FLACC tool has been tested in children undergoing a variety of surgical procedures, is widely utilized, and has been found to have high inter-rater reliability [18]. Preliminary evidence of validity was provided by the significant decrease in FLACC scores related to administration of analgesics. Validity was also supported by the correlation with scores assigned by the NRS and nurses' global ratings of pain. In addition, sensitivity and specificity of the FLACC were 89.9% (95% CI: 78.5–96.8%) and 87.8% (95% CI: 78.6–95.2%), respectively [18]. The Wong-Baker FACES pain rating scale reportedly is the preferred method for reporting pain severity in children older than three years of age [19]. The FACES rating scale explains to the child that the Face 0 "doesn't hurt at all" through Face 10 which "hurts as much as you can imagine"; it is generally preferred by investigators in pediatric pain [19]. In contrast, the NRS is designed to evaluate acute pain in children aged 8–17 years and who have an understanding of the linear nature of numbers. The NRS has good test-retest reliability with 95% limits of agreement of −0.9 and 1.2 [20]. Finally, children in pain are likely to be have increased respiratory rates thus respiratory rates were gathered before and after interventions [21]. Respiratory rate was defined as the number of respirations per minute.

Anxiety—Anxiety was defined as "….an emotion characterized by feelings of tension, worried thoughts, and physical changes like increased blood pressure" [22]. We chose to evaluate state anxiety, and used Spielberger's State-Trait Anxiety Inventory Child (STAIC) for this measurement [23]. The STAIC comprises two 20-item scales that measure state and trait anxiety in children [23]. Each item begins with I feel… [23]. The child gives answers to these items based on how he/she feels. Each item is rated on a three-point scale, with 1 indicating almost never, 2 indicating sometimes, and 3 indicating often [23]. STAIC scores range from 20 to 60. The scores from 20 to 33 indicate mild anxiety, 34 to 46 moderate anxiety, and 47 to 60 severe anxiety [23].

Drug Exposure—We collected data on all comfort medications received by study participants. All data on opioids administered were collected and converted to mg/kg of morphine equivalents. Similarly, data on all benzodiazepines administered were collected and converted to mg/kg of lorazepam equivalents. Finally, the total number of comfort medications administered (e.g., aspirin, dexmedetomidine, propofol, ketorolac, acetaminophen, and ibuprofen) was calculated. Exposure was measured in 24 hour increments and compared between groups.

Data Collection Procedures

We collected data on patient demographics at time of enrollment and upon discharge from the CICU and hospital. These data were placed directly into a REDCap® database. Pain scores and exposure to opioids and benzodiazepines were collected daily throughout hospitalization. These data were obtained from the electronic medical records of participants and placed onto CRFs by a co-investigator (CA) and later placed into the database (CA). At three critical time points during hospitalization - within 24 hours after surgery (T1), within 24 hours after transfer from CICU to the acute care unit (T2), and within 48 hours of expected discharge (T3) - pain and state-trait anxiety scores were collected before and after a massage or reading session and data were placed directly into the REDCap® database. Massage and reading sessions were documented on a CRF. These data were later entered into REDCap® by one of the co-investigator massage therapists (KB).

Statistical Analysis—Descriptive analysis was used to describe sample demographics and outcome variables. The two sample t-test, Wilcoxon rank sum test, or Chi-square test were utilized to assess for any differences between the two study groups. The Analysis of Covariannce (ANCOVA) model was used to study the group difference in the postoperative pain or anxiety scores at each time point (T1, T2 and T3) controlling for pre-score, age, gender and RACHS-1 score. The Wilcoxon rank sum test was applied to compare comfort medication use between the two groups. The internal reliability of the STAIC instruments was checked via Cronbach's Alpha. Type III sums of squares were used to test the effects in the models. Hence, the results were corrected for the imbalanced design statistically. Data were analyzed employing SAS statistical software, version 9.3 (SAS Institute, Cary, N.C.). A two-sided significance level was set at 0.05.

Data Presentation—Our data is presented using the Standards for Reporting Interventions in Clinical Massage (STRICT-M) format [24]. STRICT-M guidelines require descriptions of 1) massage rationale, 2) details of massage technique, 3) treatment regimen related to dosing, 4) other components of treatment, 5) practitioner background, and 6) control or comparator interventions.

Results

Sixty children participated in the study. The study groups were found to be comparable for age, gender, RACHS-1 scores, lengh of mechanical ventilation, and intensive care days (see Table 1).

Fidelity

Thirty-six patients were randomized to massage. Of the 31 patients randomized to reading, 24 participated in the study. One patient assigned to reading suffered from cognitive delay, four declined participation after a reading session because they felt it was not useful, and two were removed from the study due to medical reasons. See Table 1. The differences in age and gender between the groups were not statistically significant. Swedish massage was the most common technique used, followed by craniosacral therapy or myofascial release, and then energetic therapies. The massage therapists typically used a variety of techniques during each session. The most common areas that were massaged were the extremities (typically the legs and feet), head and face, neck and shoulders, and the back. The chest was touched at least half of the time. The duration of massage therapy was typically at least 15 minutes but could be as long as 30 minutes. The mean number of minutes read to our participants was 15.6 at T1, 17.3 for T2, and 17.1 for T3. The mean number of reading episodes per hospitalization was 2.7 and mean number of massage episodes per hospitalization was 3.6.

Safety

No adverse events related to the interventions occurred in either group.

Pain and Anxiety

The median daily pain score for children receiving massage therapy was 0.93 (IQR 0.54--1.8) and for children receiving standard of care plus three reading visits was 0.96 (IQR 0.72--1.85). We found no statistically significant difference in pain at T1 or STAIC scores at T2 after controlling for age, gender, and RACHS--1 score. However, children receiving massage therapy had marginally significantly (p=0.07 and 0.05) lower pain score at T2 and T3 with a medium and large effect size (partial η^2=0.07 and 0.14), and significantly lower (p=0.0075) STAIC scores at time of discharge T3 with a large effect size (partial η^2=0.23) after receiving massage therapy than children receiving standard of care plus three reading visits (see Table 2). We collected respiratory rates before and after interventions and found no clinically- or statistically significant changes in respiratory rates.

Exposure to Opioids and Benzodiazepines

We found no difference in total opioid exposure during the first three postoperative days between groups (Median [IQR], 0.80 mg/kg morphine equivalents [0.29--10.60] vs. 1.13 mg/kg morphine equivalents [0.72--6.14]). Children receiving massage therapy had significantly lower total benzodiazepine exposure in the immediate three days following heart surgery (Median [IQR] 0.002 mg/kg lorazepam equivalents [0--0.03] vs. 0.03mg/kg lorazepam equivalents [0.02--0.09], p=0.0253, Wilcoxon rank--sum, r=0.29) and number of benzodiazepine PRN doses (0.5 [0--2.5] PRN vs. 2 PRNs [1--4]; p=0.035, Wilcoxon rank-sum, r=0.27) with a close to medium effect size. There was no statistical difference in the number of different comfort medications received by children in the intervention group compared with the control group in the first three postoperative days. (see Figures 1 & 2).

Discussion

In this prospective pilot study of massage therapy in postoperative pediatric heart surgery patients, we found that massage was safe and feasible to be used immediately following surgery. Overall, massage therapy was a well-tolerated treatment throughout the course of a child’s hospitalization. There were several challenges we had to overcome that included providing the first massage within 24 hours of return from the operating room, interruptions during the massage, and coordinating data collection with other staff. However, even with our participants being intubated, sedated, and having multiple invasive lines and monitoring equipment, massage therapists were able to access much of the patient’s body areas, albeit very gently. Typically, the most common areas addressed during a massage were the feet, head, face, back of the neck, shoulders, and back. Another common challenge of providing our interventions during the postoperative period was interruptions. While clinical staff can postpone unnecessary interruptions (e.g., housekeeping and picking up the food tray), many times it was necessary for the clinical staff to interrupt an intervention to provide ongoing medical care. During these times, the massage therapists waited, and if appropriate, resumed the intervention. Once participants were transferred to the cardiology unit, interruptions during the intervention were less frequent. Finally, collecting data before and after the interventions within scheduled time windows (24 hours after surgery, 24 hours after transfer to the floor unit, and 48 hours before discharge) was challenging at times were able to be overcome.

Children in the massage therapy group required less benzodiazepine medication than those receiving a reading intervention. There is growing concern that benzodiazepines may be linked with important adverse outcomes such as abnormal hippocampal growth, cognitive dysfunction, abnormal brain development, and delirium in the ICU; all of which may be linked with adverse long-term neurocognitive and/or neuropsychologic outcomes [25–29]. Future studies targeting modifiable risks to reduce the potential long-term burden such as reducing benzodiazepine exposure in postoperative pediatric heart surgery patients are worthwhile [25–29]. More research is required to elucidate the effect of massage therapy on reducing comfort medication exposure in children following heart surgery.

Children's pain was well managed in both study groups. While there was a trend toward lower pain scores at discharge, we found no difference either in daily pain scores or pain at T1–T3 in either cohort. This finding is to be expected, as the patients were closely monitored and, in cases where pain was found to be present, additional comfort medications were administered. This is a common finding in postoperative studies, and postoperative pain may be best studied by measuring changes in opioid requirement in the postoperative period. However, we found no important difference in opioid utilization or requirement between groups. While results are mixed, there are some clinical investigations of adult heart surgery patients in which massage therapy was found to reduce pain scores [15]. Further study is warranted to evaluate if massage therapy can reduce the perception of pain in pediatric heart surgery patients. For a future formal inferential RCT study, 110 children with 55 children in each of massage and reading group will be able to detect the medium and large effect in pain score at T2 and T3 with 80% statistical power.

We found children receiving massage therapy had lower STAIC scores at discharge. The mechanism of action for massage may include decreasing cortisol levels and a subsequent reduction in anxiety [30,31]. Clinical investigations have reported repeated massage therapy has reduced cortisol levels [31]. Our findings on lower STAIC scores at the time of discharge may be related to a cumulative "massage dose" over time. Guan et al. described the positive effect of massage therapy on autonomic activity in critically-ill children that persisted over time when repeated massage therapy sessions were offered [32]. The physiologic processes underlying the positive effects of massage require further delineation.

Limitations

This pilot study has several limitations. Our sample size is small, and we cannot generalize our results to other populations. Also, there is a difference in group size (i.e., massage therapy n=36; reading n=24) while this difference was found to not be statistically significant, it does represent imbalanced group sizes. While our work was based on the best-available evidence, perhaps our duration and frequency of massage were inadequate given our patients' surgery type, length of stay, and recovery process. Our patients could not lie prone due to their sternotomies, and this may have been a factor in our pain and pain management findings. There may have been habituation bias in our findings because respondents were asked to answer STAIC questions before and after massage or reading sessions. Additionally, there may have been a halo effect associated with receiving massage therapy. Massage therapy may be seen in a positive (or negative) light based on the child's age, developmental state, or gender. For example, an adolescent female may equate massage with having a "spa day", whereas an adolescent male may have been more uncomfortable with therapeutic touch. In addition, older children may have not been engaged sufficiently with our choice of reading material to achieve a therapeutic response. Due to the high level of medical acuity in our patient population, we were not able to standardize opioid and benzodiazepine dosing regimens; instead we followed the CICU's pain and sedation protocols. Our STAIC scores at discharge may have been biased because of the positive outlook associated with discharge to home. Finally, variation in practices inherent with different care providers and the patient's clinical condition over time do exist and may have influenced our study findings.

Conclusions

The results of this randomized, controlled, pilot clinical study demonstrate the safety and feasibility of implementing massage therapy in the immediate postoperative period in pediatric heart surgical patients. We found decreased STAIC scores at discharge and lower total exposure to benzodiazepines. Preventing complications such as delirium through nonpharmacologic interventions warrant further evaluation. Massage therapy was well tolerated and may be a promising adjuvant therapy as part of perioperative treatment protocols that could improve postoperative anxiety as well as increase patient and family satisfaction. Further studies are needed to delineate physiological and clinical responsiveness to this potential therapy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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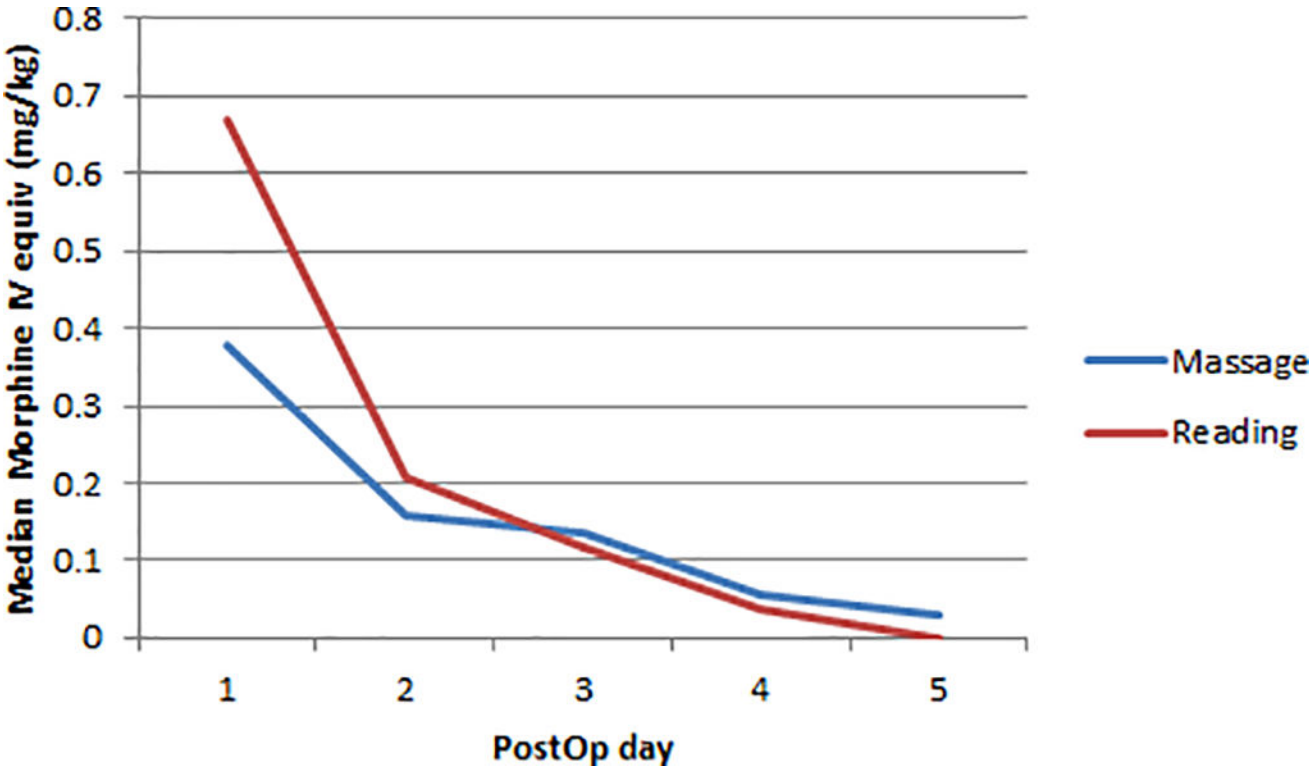

FIGURE 1.
Opioid exposure per day

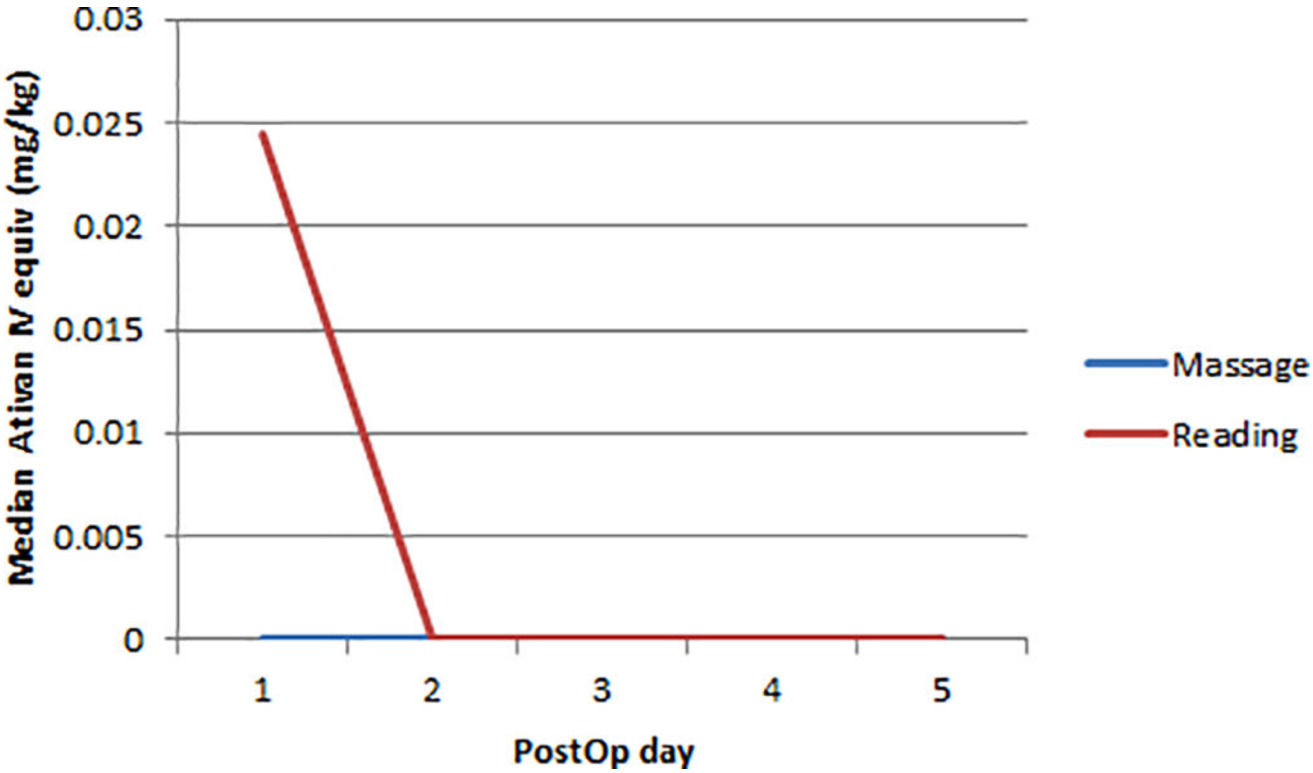

FIGURE 2.
Benzodiazepines exposure per day

TABLE 1

Sample Characteristics

Characteristic	Massage(n = 36)	Reading (n = 24)	p-value
Age (yr), Median (IQR)	12 (8.5–15)	11 (9–13.5)	0.5410[#]
Male, n (%)	14 (39%)	15 (63%)	0.0730[^]
RACHS-1, Mean (SD)	2.35 (0.88)	2.57 (0.66)	0.4954[*]
Previous Surgeries/Critical Care Admissions, Mean (SD)	1.71 (1.49)	1.65 (1.3)	0.8551[*]
Hours of Mechanical Ventilation, Mean (SD)	18.16 (26.79)	10.01 (7.60)	0.7136[*]
ICU LOS, Mean (SD)	3.78 (2.68)	2.89 (1.62)	0.3669[*]
Hospital LOS, Mean (SD)	9.47 (7.70)	6.52 (2.02)	0.3915[*]

[#] Two-sample t-test;

[^] Chi-square test;

[*] Wilcoxon rank sum test.

TABLE 2

Pain, Anxiety and Respiration Rate Scores

	Massage (n = 36)		Reading (n = 24)		p-value*
	Pre	**Post**	**Pre**	**Post**	
Pain Score, Mean (SD)					
T1	2.32 (2.88)	1.88 (2.35)	1.96 (2.48)	1.54 (1.98)	0.39
T2	1.81 (1.54)	1.00 (1.03)	1.95 (1.68)	1.45 (0.14)	0.07
T3	1.43 (1.28)	0.48 (0.81)	0.55 (1.04)	0.73 (1.11)	0.05
STAIC Score, Mean (SD)					
T2	34.33 (6.37)	29.20 (5.86)	33.94 (6.26)	31.06 (7.50)	0.21
T3	31.50 (5.60)	26.10 (3.29)	31.31 (4.15)	29.69 (4.87)	0.008
Respiration Rate, Mean (SD)					
T1	19.4 (6.55)	20.60 (8.14)	19.71 (7.54)	18.38 (5.90)	0.05
T2	23.56 (7.85)	21.70 (5.24)	20. 57 (4.86)	20.39 (4.53)	0.67
T3	23.65 (6.06)	22.14 (4.80)	20.71 (4.21)	19.31 (2.36)	0.25

* ANCOVA