Effect of Massage on Post-Operative Pain and Narcotic Administration in Infants with Congenital Heart Disease

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Abstract:

The prevalence of moderate to severe postoperative pain in the pediatric population was high. The presence of pain adversely affected long-term health-related quality of life after pediatric cardiac surgery. Massage therapy has been tested in various populations and found to be remarkably effective in relieving pain. This treatment includes noninvasive techniques that are cheaper, easier, and have fewer side effects than drugs. **Aim:** The study was aimed to evaluate the effect of massage therapy on post-operative pain and narcotic administration for infants with congenital heart disease. **Subjects and Methods:** A quasi-experimental research. **Subjects:** It was employed on a purposive sample of 76 infants undergoing cardiothoracic surgery in the Cardiothoracic Intensive Care Unit and Cardiothoracic ward. **Setting:** Mansoura University Children's Hospital (MUCH), Mansoura, Egypt. Three **tools were used**: Infant's bio-sociodemographic characteristic and clinical data, physiological measurement and FLACC behavioral pain assessment scale. **Results:** There was a highly statistically significant difference between the mean pain scores and narcotic doses within the study and control group. **Conclusion:** The study concluded that, massage therapy positively reduces pain and narcotic doses in postoperative infants with congenital heart disease. **Recommendations**: Massage therapy training programs and seminars should be held periodically and regularly for pediatric nurses to increase awareness of the benefits of massage therapy for infants with congenital heart disease.

Keywords: Congenital heart disease, Infants, Massage therapy, Narcotic, Post-operative Pain.

Introduction

Congenital heart disease (CHD) is one of the relatively common birth defects, with prevalence ranging from 3.5 to 17.5 per 1000 live births. They are becoming a cause of increased childhood mortality, especially in developing countries. (1) Surgical intervention remains the mainstay of treatment for CHD. Approximately 10% of CHD children may require corrective surgery during their first year of life, with a 90% long-term survival probability

following surgery.[2] However, proper postoperative care is critical for surgical wound healing, recovery, and survival. [3,4]

The prevalence of moderate to severe postoperative pain in the pediatric population is high and there is a need to develop an appropriate pain management plan because pain impairs long-term health-related quality of life after pediatric cardiac surgery. [5] Pain, defined by the International Association for the Study of Pain (IASP) as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage," is a condition that infants suffer from due to inadequate nervous system development.[6,7] According to recent studies, the immaturity of the pain modifying system causes infants to suffer more pain than adults. It is also widely recognized that pain is a sensation that begins at birth and ends at death. [8-10]

Additionally, infants have been shown to perceive, remember and exhibit enhanced pain responses to other painful interventions later in life. This is because pain is associated with physiological, biochemical, behavioral, and psychological changes that are recorded and, to some extent, measured. Therefore, untreated pain during childhood may adversely affect central nervous system development. [11]

Pain assessment is an important part of pain management. To adequately assess an infant's response to treatment, the infant's pain needs to be continuously assessed. Since pain is a subjective experience, individual self-report is the preferred method of pain assessment. However, infants cannot share this information due to their age or developmental stage. Observational and behavioral assessment tools are accepted as alternatives when valid self-reports are not available. [12,13]

Management of infants' pain requires a variety of pharmaceutical and non-pharmacological treatments. Even though excessive use of narcotic analgesics for infants runs the risk of impairing neurological development, there are a number of non-pharmacological strategies that are currently in use and are the best replacement for pharmaceutical interventions without having a negative neurological impact on infants. Non-nutritive sucking (NNS) with and without sucrose, swaddling and/or kangaroo care, music therapy, sport therapy, acupressure, acupuncture, relaxation techniques, meditation, nursing, and massage therapy are some of these approaches. [14-16]

Massage therapy is one of the non-pharmacological interventions for pain management, works by lowering serum levels of cortisol and norepinephrine, and its main effect is to improve blood flow. Rubbing and stretching the muscles improves venous return to the heart and removes acids such as lactic acid from the muscles. It improves circulation, increases blood flow and tissue oxygenation, and stimulates the release of endorphins, the body's natural pain relievers. [17,18]

Significance of the study:

In recent years, there has been a focus on complementary therapies to treat or relieve pain. These treatments are simple, inexpensive, and feature many non-invasive techniques with fewer side effects compared to drugs. [19] Massage therapy is a form of complementary therapy and is considered an integral part of health and well-being. Massage therapy has been tested in various children and found to be significantly effective in relieving pain. [20,21]

Nurses who care for postoperative infants find it difficult to manage pain in infants. Therefore, there has been a great need for scientifically validated, simple and effective pain management interventions. There is growing evidence that massage therapy is important in the healing process of infants undergoing common surgeries. However, little is known about its effects on infants undergoing heart surgery. [22,23]

Aim of the study:

This study aimed to evaluate the effect of massage therapy on post-operative pain and narcotic administration for infants with congenital heart disease.

Research hypothesis:

-H1: Infants with congenital heart disease in the study group who receive massage therapy during the postoperative period would exhibit less pain than infants who receive routine post-operative care only.

-H2: Infants with congenital heart disease who receive massage therapy during the post-operative period would exhibit to need for a small dose of narcotics for short period after surgery than infants who receive routine post-operative care only.

Subjects and Method

Research design:

A quasi-experimental research design was used in the present study.

Setting:

The study was carried out at Cardiothoracic Intensive Care Unit (CICU) and Cardiothoracic unit affiliated to Mansoura University Children's Hospital.

Subjects:

A purposive sample of 76 infants undergoing cardiothoracic surgery at the previously mentioned settings that fulfilled the following inclusion and exclusion criteria. The sample was divided into two equal groups, a study and a control group (38 infants for each).

1. **The study group** received massage therapy and measuring vital signs and prescribed narcotic administration.
2. **The control group** received routine post-operative nursing care.

Sample Size:

The sample size can be determined using the formula below based on a study of a similar nature conducted. [25] Considering a level of significance of 5% and a power of study of 80%.

Inclusion Criteria:

Infants were selected when they met the following inclusion criteria:

1. Age from 2 months to 12 months of age.
2. Diagnosed with congenital heart illnesses, irrespective of the condition's intricacy, such as Tetralogy of Fallot, transposition of the great arteries, and any single ventricle heart disease.
3. Scheduled for sternotomy-involved cardiothoracic surgery.

Exclusion Criteria:

Infants were excluded when they have the following criteria:

1. Have undergone surgery before as the body's response to pain after the operation can vary. [24]
2. Utilizing paralytics or being deemed unstable by CICU staff during the first 48 hours after surgery.

Tools

Tool I: Bio-sociodemographic characteristics and clinical data sheet of infants.

This tool was developed by the researcher to identify the infant's demographic, clinical, and physiological data. It included three parts:

-Part 1: Sociodemographic characteristics of infants such as age in months, gender, birth order, and residence.

-Part 2: Infant's clinical data such as type of heart anomalies. Name, dose, and frequency of used narcotics.

Tool II: Infant's Physiological Parameters Measurements. Which included: Measuring heart and respiratory rates, body temperature, blood pressure, and oxygen saturation.

Tool III: FLACC behavioral pain assessment Scale (Face, Legs, Activity, Cry, Consolability scale (FLACC scale). [26] Created the FLACC scale to assess post-operative pain in children between the ages of 2 months and 7 years who are unable to adequately express it. It has a total score that ranges from 0 to 10, and its five behavioral areas are individually scored on a scale of 0 to 2. A total score of 0 denotes no pain, 1-3 denotes mild pain, 4-6 denotes moderate pain, and 7–10 denotes severe pain.

Scoring system:

Face

-Points (zero) awarded if the infant has no particular expression or smile.

-Points 1 awarded if the infant has occasional grimace/ frown, withdrawn or disinterested.

-Points 2 awarded if the infant has frequent to constant frown, clenched jaw, quivering chin.

Legs

-Points (zero) awarded if the muscle tone and motion in the limbs are normally positioned or relaxed.

-Points 1 awarded if uneasy, restless, or tense.

-Points 2 awarded if the infant has kicking, or leg is drawn up.

Activity

-Points (zero) awarded if the infant lies quietly, normal position, and moves easily.

-Points 1 awarded if the infant squirming, shifting back and forth tense.

-Points 2 awarded if the infant is arched, rigid, or jerking.

Cry

-Points (zero) awarded if the infant has no cry or moan, awake or asleep.

-Points 1 awarded if the infant has occasional moans, cries, whimpers, occasional complaint.

-Points 2 awarded if the infant cries steadily, screams or sobs, frequent complaints.

Consolability

-Points 0 awarded if the infant is content, relaxed.

-Points 1 awarded if the infant reassured by occasional touching, hugging.

-Points 2 awarded if the infant difficult to console or comfort or being talked to, distractible.

Method

Validity and reliability:

Five pediatric nursing professionals evaluated the tools' content validity and amended them for comprehensiveness, clarity, relevance, and applicability. For tools I and II, the dependability of internal consistency as measured by the Cronbach's alpha coefficient was 0.96 and 0.752, respectively. Coefficient alpha used to measure overall reliability for two tools was 0.946.

Pilot study:

To assess the tools' applicability, a pilot study including 8 infants (10%) of the sample size, was conducted. There was no adjustment required. These infants were not included in the study's subjects.

Fieldwork

Data Collection Period:

- Data collection took place over a period of 6 months from the beginning of February 2023 to the end of July 2023.
- Researchers adhered to the following general ethical principles in clinical research: The study was approved by both faculty of nursing and faculty of medicine, at Mansoura University.
- Following an explanation of the study's aim, the director of the cardiothoracic unit granted official permission.
- The researchers guarantee that, there is no risk of studying subjects while applying the study.
- Verbal consent was obtained from infants' caregivers who participated in the study, after explaining the nature and aim of the study.
- Confidentiality and anonymity were assured.
- Infants' caregivers assured that, they have the right to refuse participation at any time and to exclude their infants from the study freely without any responsibility.
-The researcher approached the infants and their caregivers in the department.
-The researcher began by introducing herself to the infant's caregivers, outlining the study's aim and nature, and asked them about what they anticipated. At the initial meeting, the researcher collected the demographic and clinical data. Data was gathered from the child's medical records.
-Time spent to fill out the demographic and clinical data sheet was about 15-30 minutes for each infant.
-Infants who met the requirements for inclusion in the study were divided randomly between the experimental group and the control group based on their admission to the study setting.
-Both groups receive routine post-operative care, but only the infants in the experimental group received the research intervention, which was implemented as follows:

-Control Group: The infant who received routine post-operative nursing care.

-Study Group: The infants in this group got massage therapy sessions in addition to the standard post-operative nursing care provided by the CICU. Beginning on the day of surgery (Day 1), each infant had a 30-minute massage over a seven-day period as follows:

1. The massage therapy sessions were given by one of the study researchers, who is a Physical medicine specialist while another researcher documented infants' pain scores that were blinded to the study group.
2. To maintain consistency in procedures, a standard massage treatment protocol based on Swedish massage principles was applied. During the 30-minute massage treatment session, accessible head, face, lower extremities, upper extremities, and back of the infant were all given light friction, kneading, stroking, and passive contact. Typical hospital lotion was implemented.

- **Swedish massage**: Effleurage, which is a lengthy, gliding stroke that increases blood and lymph circulation, and tapote, a percussion stroke that stimulates nerves, muscles, and circulation, are typical Swedish massage techniques. Vibrations can be carried either swiftly or slowly to provide the desired effects. These movements entail rocking, shaking, and trembling the hand on the skin. To resonate tissues and ease muscular tension, these vibrations are used].

3. Massage therapy sessions were provided at the CICU 2 hours later after arrival of the infant's post-surgery and continued if the infant transferred to the ordinary cardiothoracic unit, massages were continued until the infant was discharged

home, or until the protocol of 7 days was completed, whichever occurred first.

4. Massages were scheduled twice in the morning shift 3 hours apart (at 9 am and at 12 am) and twice in the afternoon shift (at 3 pm and at 6 pm).
5. Standard infection control precautions were followed, including hand hygiene, gowning, and gloving.
6. For both groups, the pain was assessed, pain scores were taken on each of the seven consecutive study days, 30 minutes before and 30 minutes after the massage therapy or restricted time. Using a tool (III).
7. Limit care activities before and after massage.
8. Heart rate, respiratory rates and blood pressure were remeasured before and after the massage therapy and recorded for each child using (Tool II).
9. Oxygen saturation was measured before and after the massage therapy and recorded for each child using (Tool II) to determine if infants require additional oxygen therapy to maintain O_2 saturation or not).
10. Infants in the interventional group who were unstable at the time of scheduled massage their message were delayed. Infants were excluded from the study if they missed more than two massage sessions because of physiological instability.

Narcotic Used:

Data on all analgesic drugs given to infants during the study period were taken out of their medical records.

The total daily dose is calculated as the sum of the basal rate for continuous infusion, plus the bolus dose per kilogram of body weight. In addition, bolus doses were extracted from drug administration records. Continuous infusion data were extracted as volumes administered from the profile and calculated according to the dose administered using narcotic concentrations and infant weight in kilograms as follows: [narcotic volume (mL) x narcotic concentration (dose/mL)] / infant weight (kg) = dose/kg.

Statistical analysis:

Data were then organized, coded, categorized, and moved into forms designed to be fed into computers after being collected. The statistical analysis was carried out using SPSS (Statistical Product and Service Solutions) v20. The Friedman test was utilized to compare more than two related groups. Two normally distributed variables were compared between related groups using pairwise t-tests. Homogeneity between study groups was tested for qualitative variables by chi-square analysis, significance level was set at 5% (p-value). The results are considered significant when the probability of error is less than 5% ($p < 0.05$).

Results

Table (1) revealed that 44.7% and 50% of infants in the study and control group were at age group seven to twelve months with a mean age was 7.21 and 7.28(3.20), respectively. According to gender the highest percentage in both the study and control group were female (73.7% and 68.4%, respectively). The majority of the infants were from rural (3.2 residence (89.5 for study group and 81.6% for control group).

Table (2) represents the highest percentage of infants in the study and control group discovered congenital heart disease during a routine examination (71.1% and 65.8%, respectively). More than half of the studied infants were diagnosed with ventricular septal defect (68.4% for the study group and 52.6% for the control group). Regarding types of symptoms that appeared it was found that 89.5% of infants in the

study group and 76.3% of infants in the control group suffer from respiratory distress.

Table (3) shows that there was no statistically significant difference between the study group and the control group in relation to systolic blood pressure, diastolic blood pressure, heart rate and respiratory rate on the first day of massage (P = 0.136, 0.280, 0.710 and 0.801 respectively). Although there were statistically significant differences between the study and control groups regarding systolic blood pressure, diastolic blood pressure, heart rate and respiratory rate on the seventh day of massage therapy (P ≤ 0.001, 0.045), (0.048 and 0.015, respectively).

Figure (1) shows that all infants in both the study and control group required additional oxygen therapy in the first and second postoperative days (100% for each). The same figure also illustrated that none of the studied infants required oxygen therapy on the sixth and seventh days of applying massage therapy. While 78.9% of the control group on the sixth postoperative day and 50% of them on the seventh postoperative day required additional oxygen therapy to maintain O2 saturation. There was a statistically significant difference between the study and control group in relation to their requirement for additional oxygen therapy. This means that massage has a positive effect on reducing the requirement for additional oxygen therapy in post-operative infants with congenital heart disease.

Table (4) showed that there is a highly statistically significant difference between the total mean score of observed pain scores within seven days among the studied infants in the study group (p=≤0.001). On the other hand, the same table showed that there were no statistically significant differences between the total mean scores of observed pain scores within seven days among the studied infants in the control group (P=0.089). This means that massage therapy has a positive effect on decreasing pain in post-operative in infants with congenital heart disease.

Table (5) shows that there was no statistically significant difference between the study group and the control group in terms of narcotic doses on the first, second, and third day of massage therapy (P+ 0.564, 0.118, and 0.139, respectively). Although there was a statistically significant difference between the two groups in narcotic doses on the fourth, fifth, sixth, and seventh day of massage therapy (P = 0.001, 0.000, 0.000, 0.000, respectively). This means that massage therapy has a positive effect on reducing narcotic doses in infants after congenital heart surgery.

Table (1): Percentage distribution of the studied post-operative infants with congenital heart disease according to the bio sociodemographic data

Items		Study group n= (38)		Control group n= (38)	
		No	%	No	%
Age in months:	**2-<7**	21	55.2	19	50
	7<12	17	44.7	19	50
$\bar{X}$(SD		7.21(3.21)		7.28(3.20)	
Gender:	**Male**	10	26.3	12	31.6
	Female	28	73.7	26	68.4
Birth order	**1st**	6	15.8	7	18.4
	2nd	11	28.9	9	23.7
	3rd	14	36.8	16	42.1
	4th	7	18.4	6	15.8
Residence	**Rural**	34	89.5	31	81.6
	Urban	4	10.5	7	18.4

Table (2): Percentage distribution of the studied post-operative infants with congenital heart disease according to their clinical data

Items	Study group n=(38)		Control group n= (38)		P-value
	No	**%**	**No**	**%**	
When discovered the disease					
Immediate after delivery	11	28.9	13	34.2	0.622
During routine exam	27	71.1	25	65.8	
Age of child during discover disease					
$\overline{X}$(SD	4.28(1.02)		3.71(1.04)		0.694
Type of heart anomalies*					
Ventricular septal defect	26	68.4	20	52.6	0.159
Atrial septal defect	9	23.7	13	34.2	0.312
Aortic stenosis	6	15.8	12	31.6	0.105
Mitral stenosis	6	15.8	10	26.3	0.260
Transposition of great arteries	14	36.8	19	50	0.247
Pulmonary return	5	13.2	10	26.3	0.150
Tetralogy of Fallot	12	31.6	18	47.4	0.159
Types of Symptoms appeared*					
respiratory distress	34	89.5	29	76.3	0.128
Cyanosis	14	36.8	17	44.7	0.484
respiratory distress during feed or sleep	31	81.6	30	78.9	0.773
Malnutrition	25	65.8	29	76.3	0.312
Growth retardation	22	57.9	27	71.1	0.231
Receiving medical care					
Clinic	5	13.2	2	5.3	0.234
Hospital	33	86.8	36	94.7	

Table (3): Mean and standard deviation of vital signs among the studied post-operative infants with congenital heart disease

Items	Study group n= (38)	Control group n= (38)	P-value
	$\bar{X}$(SD	$\bar{X}$(SD	
Systolic blood pressure			
1st day	125.52(16.39)	120(15.59)	t*=1.50 P= 0.136
7th day	104.21(16.04)	120(15.59)	t*=4.35 P ≤0.001*
P-value between 1st and 7th day of massage	t**=6.35 P ≤0.001*	NA	
Diastolic blood pressure			
1st day	83.55(14.08)	80.26(12.18)	t*= 1.08 P=0.280
7th day	75.65(12.31)	82.10(15.09)	t*= 2.04 P =0.045*
P-value between 1st and 7th day of massage	t**=3.45 P ≤0.001*	t**= 1.41 P=0.164	
Heart rate			
1st day	88.78(11.83)	87.78(11.48)	t*= 0.374 P=0.710
7th day	83.57(9.64)	88.52(11.92)	t*= 2.05 P =0.048*
P-value between 1st and 7th day of massage	t**=4.96 P ≤0.001*	t**= 0.392 P =0.697	
Respiratory rate			
1st day	23.10(2.65)	22.94(2.77)	t*=0.253 P=0.801
7th day	21.31(2.04)	22.73(2.84)	t*=2.50 P=0.015*
P-value between 1st and 7th day of massage	t**=4.76 P ≤0.001*	t**=0.561 P=0.578	

t**: Paired t-test, **t***: Independent t-test, **NA:** Not applicable**, P** Significance * Significant (p≤ 0.05)

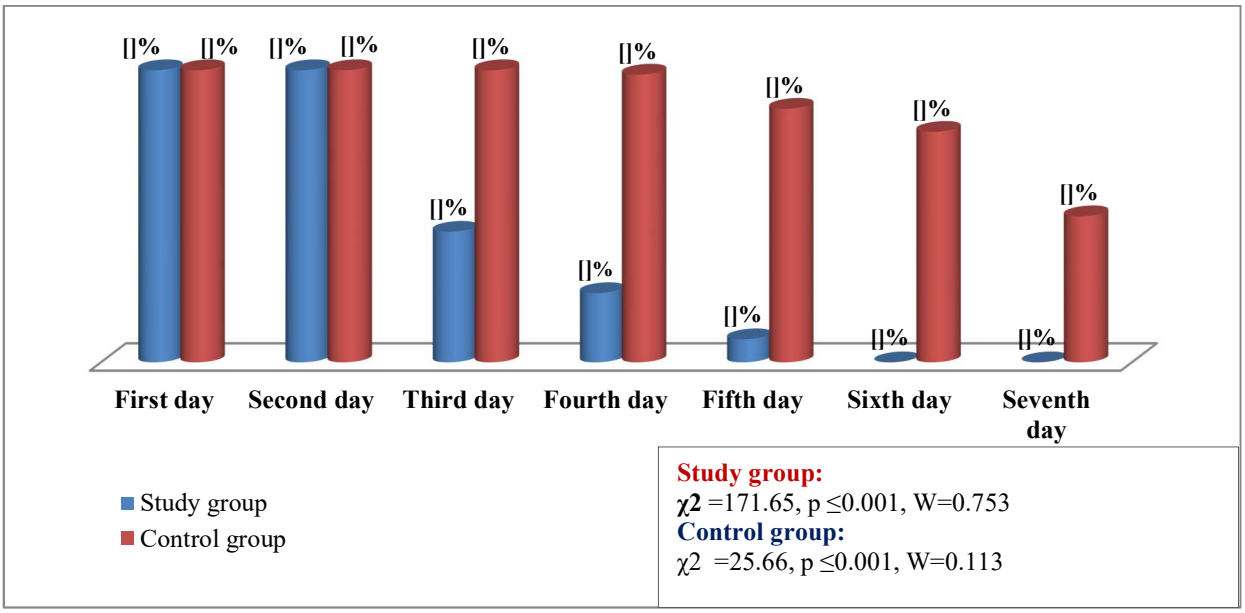

Fig (1): Post-operative infants with congenital heart disease according to their requirement of oxygen therapy

Table (4): Mean and standard deviation of compute of four observations of pain score within 7 days of massage therapy among the studied post-operative infants with congenital heart disease

Items	Study group n= (38)							Significance test	Control group n= (38)							Significance test
	1st	2nd	3rd	4th	5th	6th	7th		1st	2nd	3rd	4th	5th	6th	7th	
	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD		$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	$\overline{X}$(SD	
Pain level																
No pain (Score 0)	------	------	------	------	------	------	0.0 (0.0)	NA	----	------	------	------	------	------	------	NA
Mild (Score 1:3)	2.57 (0.53)	6.71 (2.13)	3.85 (1.46)	2.42 (0.53)	2.14 (0.37)	2.28 (0.48)	----	F=24.15 p=≤0.001	2 (0.0)	3.75 (3.5)	2 (0.0)	3.75 (3.5)	2 (0.43)	2 (0.64)	2 (0.0)	F=1.0 P=0.45
Moderate (Score 4:6)	5.54 (0.52)	5.09 (2.84	2.09 (0.53)	2.09 (0.53)	2.09 (0.3)	1.45 (0.93)	----	F=28.85 p=≤0.001	5.0 (0.0)	5.22 (2.48)	4.33 (1.32)	5.22 (2.48)	4.34 (1.32)	4.3 (1.32)	4.31 (0.50)	F=1.41 P=0.23
Sever (Score 7:10)	9.2 (0.41)	5.65 (1.59)	3.85 (1.49)	2.35 (0.48)	2.30 (0.47)	1.75 (0.96)	----	F=192.44 p=≤0.001	9.0 (0.0)	8.04 (1.74)	8.24 (1.85)	7.88 (1.83)	8.24 (1.85)	7.76 (2.1)	7.77 (1.36)	F=2.44 P=0.075
Total pain score	6.92 (2.67)	5.68 (2.13)	3.34 (1.49)	2.28 (0.51)	2.21 (0.41)	1.76 (0.91)	0.0 (0.0)	F=98.39 p=≤0.001	7.31 (2.5)	6.92 (2.63)	6.65 (2.82)	6.81 (262)	6.65 (2.82)	6.34(2 .76)	6.34 (2.37)	F=2.34 P=0.089

F: RM-ANOVA, **P** Significance * Significant (p≤ 0.05)

Table (5): Mean of computed narcotics doses within 7 days of massage therapy among the studied post-operative infants with congenital heart disease

Items	Study group n= (38)	Control group n= (38)	P-value
	$\overline{X}$(SD	$\overline{X}$(SD	
Dose per 1st day	294.03 (92.32)	298.53(96.89	t*=0.207 P= 0.564
Dose per 2nd day	236.92 (90.58)	298.53 (96.89)	t*=2.864 P= 0.118
Dose per 3rd day	136.12 (70.62)	235.16 (90.03)	t*=5.335 P= 0.139
Dose per 4th day	109.57 (51.77)	217.26 (81.88)	t*=6.852 P= 0.001
Dose per 5th day	7.97 (28.82)	80.44 (88.08)	t*=4.820 P= 0.000
Dose per 6th day	0.00 (0.00)	55.04 (55.58)	t*=6.104 P= 0.000
Dose per 7th day	0.00 (0.00)	37.95 (54.04)	t*=4.329 P= 0.000

Independent t-test, **P** Significance * Significant ($p \leq 0.05$)

Discussion

Survival rates following infants' cardiac surgery have increased dramatically as a result of advances in surgical procedures and preoperative treatment. [27] Post infants' cardiac surgery, pain is very common and develops naturally as a warning symptom. However, its occurrence is predictable and should be Post and treated. [28]

Effective pain management in infants undergoing cardiac surgery is evolving with innovative methods of both assessment and treatment using new drugs or new routes of administration. So, the purpose of this research was to evaluate the safety and feasibility and effect of massage therapy as a novel non-pharmacological, cost-effective, and noninvasive pain management route with no adverse effects versus routine care on postoperative pain and doses of narcotic exposure in the postoperative period immediately after congenital heart surgery.

Regarding the demographic characteristics and clinical data of the studied infants, the finding of the current study revealed that there were no statistically significant differences between the study and control group in relation to their demographic data characteristics and clinical data at baseline (Table 1,2). These results are consistent with the study of **Bailey**, (**2018**) [29] , who mentioned a study titled "The association between massage, postoperative pain, drug use, and maternal anxiety in infants." infants with congenital heart disease" and reported that the studied and control groups were not significantly different at baseline for any of the study characteristics or variables. Concerning the distribution of both the study and control group in relation to their clinical data, it was found that the most common congenital heart anomaly in both the study and control group was a ventricular septal defect (Table 2). This finding was on the same track with the finding of study of **Ayad, Y., & Almamoury, A. (2023)** [30] who pointed out that one of the most common CHD is a ventricular septal defect. Also, this finding is supported by study of El**-Gilany, Yahia, Wahba (2017),** [31] who reported that the majority of the studied children have CHD was the ventricular septal defect.

Untreated pain has repercussions for the neonates in terms of physiological and metabolic changes, as directly influences the sympathetic nervous system and, consequently, affects systems such as the cardiovascular and respiratory. Therefore, it is essential to observe physiological parameters such as heart rate, breathing rate, oxygen saturation and blood pressure to detect possible changes resulting from pain [32] the present study clarified that there were no statistically significant differences between the study and control groups in systolic blood pressure, diastolic blood pressure, heart rate, and respiratory rate on the first day of massage therapy. Although there were statistically significant differences between the study and control groups in systolic blood pressure, diastolic blood pressure, heart rate, and respiratory rate on the seventh day of massage (table 3). In accordance with another Egyptian study conducted at Zagazig university by **El-Dakhakhny, et al., (2015)** [33] where their study results revealed that there was a

statistically significant difference between the two groups in the mean value of the heart rate, respiration rate, and post-operative pain score, which decreased after using the massage technique.

Moreover, the current study's findings are consistent with the study of **Harrison et al. (2020)** [25] who conducted a study on "Massage Therapy's Effects on Post-Operative Pain in Infants with Complex Congenital Heart Disease" and concluded that massage therapy improved postoperative outcomes in infants with complex congenital heart disease, including heart rate and respiratory rate. In the contrary, the current results are inconsistent with previous findings by study of **Liu et al., (2022)** [34] who conducted a systematic review and meta-analysis study entitled "The effectiveness of massage therapy on procedural pain in infants "and reported that massage therapy was ineffective in improving respiratory or heart rate.

In relation to the distribution of the studied cardiothoracic surgery infants of both groups according to their requirement for additional oxygen therapy to maintain O2 saturation, the current study found a statistically significant difference between the study and control groups in terms of their need for additional oxygen therapy (Figure, 1). These findings are consistent with studies of **Harrison et al., (2020) and Liu et al., (2022)** [25,34] who discovered that massage therapy was helpful for raising blood oxygen saturation.

The findings of the present study showed that there is a highly statistically significant difference of the total mean score of observed pain score within seven days among the studied infants in the study group ($p=\leq 0.001$). On the other hand, the same table showed that there was no statistically significant difference of the total mean score of observed pain score within seven days among the studied infants in the control group (P=0.089). This means that massage has a positive effect on decreasing pain in post-operative infants with congenital heart disease (Table 5). From the researchers' point of view, this may be related to a cumulative "massage dose" over time. This explanation comes in harmony with a study of **Guan et al (2014)** [35] who stated that the positive effects of massage therapy on autonomic functioning in critically ill children persisted over time when repeated sessions of massage therapy were administered.

The present findings are supported with the results of many other studies **regarding massage therapy** by **(Martorella, Michaud, Gélinas 2014; Kukimoto, Ooe, Ideguchi 2017;Zimpel, Torloni, Porfírio, Flumignan, Silva 2020; Momeni, Dehghan, & Ahmadinejad, 2020)** [36-39] they found and proved that massage therapy was effective on decrease pain after cardiac surgery and that Pain level decreased rapidly in the first days after surgery, especially on the 4th day. [40,25] Also, other study found that massage therapy has had positive results in reducing pain intensity in infants with procedural pain. [20] Similarly, a systematic literature review was carried out to evaluate the effects of massage therapy on a total of 1416 participating infants from 0-12 months.

Identifies that one of the positive effects of infant massage is relieving pain. Although, Infant massage had no negative impacts.[41] Additionally, another study reported that the massage was effective in improving infants' pain response compared to routine care ($P < .01$). [34]

Regarding the Mean and standard deviation of computed narcotics doses within 7 days of massage therapy among the studied cardiothoracic surgery infants of both the study and control group, it was found that during the first, second, and third days of massage therapy, there were no statistically significant variations in the narcotic doses between the study and control group. While during the fourth, fifth, sixth, and seventh days after beginning massage therapy, there were statistically significant variations between the two groups with regard to the narcotic doses. This means that massage has a positive effect on reducing narcotic doses in post-operative in infants with congenital heart disease. These results are consistent with the study of **Staveski et al. (2018)** [42] **which** discovered that infants who received massage treatment needed less benzodiazepine medication overall. It also supports the findings of **(Ali, et al., 2019)** [28]. which discovered that children who received massage treatment experienced significantly less overall benzodiazepine exposure in the first three days after having heart surgery. They also discovered no distinction in the groups' overall opioid exposure throughout the first three postoperative days. This may be attributed to the cumulative effect of massage therapy in which noticeable improvements are seen only after 3 to 5 sessions.

Conclusion

The present study concluded that infants with coronary artery disease who were exposed to massage therapy experienced lower postoperative pain intensity and required a small dose of narcotic compared with infants in the control group who received only routine postoperative care.

Recommendations

Based on the results obtained from the present study, the following recommendations have been suggested

- Massage therapy should be considered part of routine postoperative nursing care for infants with congenital heart disease.
- Scientifically established regimens for the management of postoperative pain in neonates with congenital heart disease should be designed and established by pediatric nurses.
- Massage therapy training programs and seminars should be held periodically and regularly for pediatric nurses to increase awareness of the benefits of massage therapy.

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