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Does massage therapy promote weight gain in preterm infants?

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ABSTRACT

OBJECTIVE: The objective of this systematic review is to determine whether or not massage therapy promotes weight gain in preterm infants.

STUDY DESIGN: Review of three randomized controlled trial studies published between 2007 and 2009.

DATA SOURCES: Randomized controlled trials comparing infants receiving massage therapy to infants receiving usual nursery care alone were found using Ovid MEDLINE and Cochrane databases.

OUTCOME MEASURED: In each of the three trials, daily recordings of infant weight throughout the study period measured outcomes. Weight, caloric intake, and nutritional method for infants receiving massage and control infants were recorded daily.

RESULTS: Three randomized controlled trials were included in this review. Two of the studies, by Gonzalez and Diego, found that the massage group gained significantly more weight over the study period than the control group. The third study, by Massaro, did not find an effect of massage in the overall study population.

CONCLUSIONS: The results of two of the trials demonstrate that massage interventions may promote weight gain in preterm infants. Infants receiving massage had a larger weight gain in comparison to the control group. There was also evidence that infant massage therapy may reduce length of hospital stay in preterm infants. Additional research, including long-term follow up of patients is needed to further quantify the impact of massage therapy on preterm infants.

KEY WORDS: preterm, infant, massage, weight gain

Introduction

In the United States, prematurity is one of the leading causes of infant mortality. The incidence of prematurity in our country is a growing public health problem. Preterm births are defined as infants born before 37 weeks gestation. This accounts for approximately 12-15% of births in the United States.⁴ With the modern neonatal intensive care unit (NICU) and medical interventions, mortality among preterm infants declined in recent years.² However, these infants are susceptible to a great deal of complications including mental retardation, visual and hearing impairments, learning disabilities, and poor health and growth. In the past few decades a number of studies have examined the physiologic consequences of preterm birth and stressful environment in the NICU. Infants in the NICU lack the tactile stimulation that they would experience in-utero or in general mothering care. Massage therapy is an intervention that has been advocated to accelerate weight gain in preterm infants by decreasing stress and providing tactile stimulation. This paper evaluates three randomized controlled trials comparing weight gain in preterm infants receiving massage therapy versus standard nursery care alone.

The economic and psychosocial impacts of preterm deliveries are relevant not only to the afflicted families, but Physician Assistants in practice today. Whether practicing in pediatrics, obstetrics and gynecology, emergency medicine, surgery, or a medical subspecialty, PA's will undoubtedly encounter and treat medical complications associated with preterm deliveries.

The economic burden associated with preterm birth in the US was \$26.2 billion in 2005, which amounts to \$51,600 per infant born preterm.⁴ Approximately two thirds of this total cost was for medical care. Special education costs associated with medical conditions among premature infants such as cerebral palsy, mental retardation, vision and hearing problems add another \$1.1 billion, or \$2,200 for each preterm infant. Another important factor to consider is the impact of a premature infant on individual families. Lost household productivity associated with preterm birth disabilities in 2005 contributed \$5.7 billion, or \$11,200 per infant.⁴

In recent years, mortality among preterm infants has decreased, with survival rates of up to 87%.² With more infants surviving, research has started to focus on minimizing environmental stressors preterm neonates are exposed to in the NICU. A number of studies assessed the outcome of various types of tactile therapy on the growth and development of premature infants.³ Interventions such as tactile stimulation, gentle “still touch,” and physical activity were proposed as a way to reduce stress and promote growth in preterm infants. Infant massage appears to decrease stress for the infant through tactile stimulation, and has been recommended as a way to accelerate weight gain in premature infants.

Objective

The objective of this systematic review is to determine if massage therapy promotes weight gain in preterm infants. Previous randomized, controlled trials concluded the

addition of infant massage to usual nursery care resulted in increased weight gain among preterm newborns.

Methods

The author completed a detailed search using search engines MEDLINE, Cochrane Database of Randomized Controlled Trials, and Cochrane Database of Systematic Reviews. Studies included had a population looking at neonates with a gestational age ranging from 27-35 weeks. Each of the selected studies was a randomized controlled trial comparing premature infants receiving massage therapy to premature infants receiving usual nursery care alone. Key words used in the search were “preterm,” “infant,” “massage,” and “weight gain.” These were used in combination to search for articles in peer-reviewed journals published between 2007 and 2009. The articles were selected based on date of publication, clinical relevance to the selected topic, and whether outcomes mattered to patients.

Articles that focused on term infants receiving massage were excluded. In addition, articles published prior to April 2004 were excluded due to a Meta-Analysis written at that time. Studies included were conducted in a randomized, controlled fashion, dated after April 2004. Statistics reported or used included p-values with a value of <0.05 being statistically significant. Under these criteria, three randomized controlled clinical trials were identified and are included in this review. Table 1 includes the demographics of the included studies.

Table 1- Demographics and Characteristics of included studies

Study	Type	#Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Gonzalez, 2008 (2)	RCT	68	Neonates with corrected gestation age of 30 to 35 weeks	Clinically stable, receiving orogastric tube feeding	Infants w congenital abnormalities or hx of maternal drug abuse	8	Vimala massage provided 15-20 minutes 2x daily for 10 days
Massaro, 2008 (3)	RCT	60	Gestational age < 32 weeks, postnatal age > 7 days	Birthweight <1500g and/or gestational age < 32 weeks; postnatal age >7 days, current weight >1000g; medically stable	Major congenital anomaly; restricted in movement or ability to undergo the intervention	2	Massage therapy 2x daily for 15 minutes; or massage therapy with exercise 2x daily for 15 minutes
Diego, 2007 (1)	RCT	80	Infants classified as "preterm neonate," recruited from NICU	Medically stable preterm neonates	Infants who required surgery, genetic anomalies, HIV (+), hx of maternal drug use	10	Massage therapy provided for three 15-min periods per day for 5 days

Outcomes Measured

The primary outcome measured in all three studies was infant weight gain. Each study consisted of daily recordings of infant weight and caloric intake throughout the study period. Neonatal feeding was given in two ways: fortified breast milk or premature infant formula.

Secondary outcome measures differed in each of the three studies. Diego, et al. measured the effects of massage on vagal activity and gastric motility. In addition, they noted whether light pressure stroking versus moderate pressure made a difference in overall weight gain. Massaro, et al. studied secondary outcomes including the change in head circumference and length, and duration of hospital stay for each group. Gonzalez, et al. also examined the length of hospital stay for infants in the massage group versus the control group.

All outcomes measured were POEMS. The positive effects of infant massage such as improved weight gain, reduced length of hospital stay and increased gastric motility are important results to patients. Any measures leading to a less stressful environment for a vulnerable premature infant matter to patients.

Results

The three randomized controlled trials presented in this review are clinical trials with intention to study the effects of infant massage on weight gain in premature infants based on clinical criteria. In the Diego study, neonates were excluded from the study if they 1) required surgery, received respiratory support, antibiotics or phototherapy, 2) had genetic

anomalies, 3) were HIV-positive or immunocompromised, or 4) if their mothers had a history of diabetes, syphilis, hepatitis B, or alcohol/illicit drug use. There were originally 80 preterm neonates assigned to a control group (n = 40) or a massage group (n = 40). Due to “unusable data or equipment malfunctions,” 10 neonates were excluded from the study, with a final sample size of 70 preterm infants.¹ The Gonzalez study had the second highest number of participants with a total of 68 newborns involved in the trial. Eight were unable to complete the study due to clinical protocols. 60 clinically stable preterm newborns with a corrected gestational age of 30-35 weeks were included. The study included neonates with a corrected gestational age of 30 to 35 weeks who were clinically stable. Infants with congenital anomalies, known cardiovascular or abdominal pathologies that could impact weight gain, history of maternal drug abuse or who were experiencing seizures or receiving central nervous system depressor medications or parenteral nutrition were excluded.² The Massaro study inclusion criteria were as follows: birthweight < 1500g and/or gestational age \leq 32 weeks; postnatal age > 7 days and current weight > 1000g and relative medical stability. Infants with major congenital anomalies were excluded. During the study period, 147 low birthweight infants were admitted to the NICU. Of the eligible infants, 44 families declined consent leaving 60 infants enrolled in the study. 2 infants were excluded after beginning the study, leaving a total of 58 infants completing the study.³

Diego, et al. reported that preterm infants in the massage therapy group had 30% greater weight gain than those in the control group. Analyses of variance and chi-square

analyses were used to compare the infant massage and control groups based on study entry characteristics and weight gain and calorie intake during the study. Although the infants in the massage therapy group exhibited greater weight gain, they did not consume more calories (Table 2).¹

Table 2- Study entry characteristics, weight gain and calorie intake during the 5-day treatment period (Means and standard deviations in parentheses under means).

	Control	Massage	<i>p</i>
Mother's Age	30.59 (6.53)	28.53 (6.78)	<i>N.S.</i>
Gestational Age at Birth (Wks)	29.68 (2.75)	29.63 (2.37)	<i>N.S.</i>
Birthweight (g)	1,250 (329)	1,163 (257)	<i>N.S.</i>
Days on NICU	30.7 (24.1)	31.09 (16.99)	<i>N.S.</i>
Day 1 Weight (g)	1,634 (260)	1,639 (244)	<i>N.S.</i>
Mean Daily Calorie Intake (Kcal)	153.58 (29.88)	158.95 (29.71)	<i>N.S.</i>
Mean Daily Weight Gain (g)	17.11 (9.01)	22.31 (10.55)	< .05
% Daily Weight Gain (g/Kg)	1.27% (-0.64%)	1.57% (0.62%)	< .05

Gonzalez, et al. found the massage group gained significantly more weight (28%) than the control group over the 10-day trial period. A repeated-measures ANOVA was conducted, the daily weight gain averaged $29.2 \pm 5.3\text{g}$ for the massage group and $20.9 \pm 7.6\text{g}$ for the controls ($P < 0.001$). By the third day of the study, the individual α -corrected Bonferroni univariate test demonstrated the massage group had gained significantly more weight than the control group ($F = 5.01$, $P < 0.001$, power = 0.99). By the last day of the study, preterm infants receiving massage had gained a mean of $188.2 \pm 41.20\text{ g/kg}$

compared with 146.7 ± 56.43 g/kg for the usual nursery care alone group ($p < 0.001$).

Total caloric intake at study onset and during the study did not differ between groups (ANOVA test: $F = 0.51$, $p = 0.823$, Table 3).

In addition, the Gonzalez study found infants in the massage group had a shorter hospital stay, 15.36 ± 5.41 days in the massage group, compared to 19.33 ± 7.92 days in the controls ($P = 0.03$).²

Table 3- Caloric intake (kcal/kg/d) and Weight during the trial (g/d), Mean \pm SD

Day	Massage & usual care (Kcal/kg/d)	Usual care only (kcal/kg/d)	p	Massage and usual care (g/d)	Usual Care only (g/d)	p	Power
3	140 ± 12	137 ± 22	0.13	1427 ± 173	1372 ± 209	0.02	0.3380
5	142 ± 12	139 ± 22	0.10	1456 ± 179	1395 ± 214	0.003	0.6412
7	142 ± 11	141 ± 21	0.34	1483 ± 184	1419 ± 218	0.0007	0.8106
10	142 ± 11	143 ± 19	0.60	1526 ± 194	1451 ± 226	0.000001	0.9991

The Massaro study differed in design as enrolled neonates were randomly assigned to one of three groups. They received either no intervention (control), massage therapy alone or massage with kinesthetic stimulation (M/KS). Average daily weight gain over the study period was 28.9 ± 1 , 27.1 ± 1.4 , and 30 ± 1.2 g for the control, massage, and M/KS groups respectively. These values were not statistically significant by univariate analysis with ANOVA and Kruskal-Wallis test. However, after separating participants by body weight, average daily weight gain was significantly higher in preterm infants

with body weight > 1000g (ANOVA P = 0.008, KW P = 0.012). Massaro et al attributed this difference to the massage group receiving kinesthetic stimulation; as this remained significant after controlling for covariates in a regression model. This study was the first RCT to measure the outcome for preterm infants with massage with KS compared to massage alone. While there was not an effect of massage/KS on weight gain in the overall study population, after stratification by birth weight, there was evidence that preterm infants receiving massage with KS leads to improved weight gain.

With regards to length of stay (LOS), the Massaro study reported that the difference in median LOS was not significant between the groups. After excluding two outliers in the massage group that required hospital transfer due to complications, the LOS was shorter in the intervention groups (ANOVA P = 0.021, KW P = 0.033). However, the difference lost statistical significance after controlling for gestational age, gender, sepsis and bronchopulmonary dysplasia.³

Discussion

Despite equal caloric intake in both groups, two of the randomized controlled trials included in this review demonstrated significant improvement in weight gain when comparing controls receiving usual care with infants receiving massage. In contrast with the other studies, the third study (Massaro, et al.), did not find an effect of massage on weight gain in the overall study population. However, they demonstrated statistically significant improvement in weight gain in a subset of premature infants who received massage with KS versus control and massage groups alone.

The variation in weight gain across studies may be related to the different types of massage administered to the preterm infants. Each of the three studies included employed different means of administering massage. The Gonzalez study used parent-administered massage; the Massaro study had NICU nurses administer massage, while the Diego study had massage therapists trained in the study protocol administer massage to the neonates. An additional point of interest is whether parent-administered massage may offer additional benefits as it facilitates additional mother-infant bonding.

In all three trials, there were no reports of complications or adverse effects of the massage. Each of the studies was limited as there was no follow-up of the preterm infants after conclusion of the trial. Long-term follow up of these infants is necessary to determine if the effect on weight gain is sustained and translated into catch-up growth throughout infancy and early childhood. An additional limitation is that only stable preterm infants were studied. At this point it is not known whether infant massage is effective in promoting weight gain in unstable or complicated preterm infants. Lastly, each of the three studies failed to record use of medications that may affect nutrient absorption or metabolic rate.

Conclusion

The studies reviewed demonstrate that massage therapy promotes weight gain in preterm infants. Based on the three studies, infant massage increases weight gain in stable preterm infants and can contribute to shortened hospital stays with associated cost savings. After showing various types of massage can lead to increased weight gain in infants, future research should explore the comparative effectiveness of different types of massage on premature neonates. In addition, further exploration should address the

clinical outcomes when using parent-administered massage versus practitioner-administered massage.

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