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Use of Facilitated Tucking for Nonpharmacological Pain Management in Preterm Infants

A Systematic Review

Hala Obeidat, PhD, RN; Inaam Kahalaf, PhD, RN; Lynn Clark Callister, PhD, RN, FAAN; Erika Sivarajan Froelicher, PhD, MPH, MA, RN, FAAN

Background: Neonatal care demands attention to interventions that effectively reduce pain with pharmacological and nonpharmacological methods in preterm infants during invasive procedures. **Purpose:** The aim of this systematic review was to determine the efficacy of facilitated tucking as nonpharmacological pain management in preterm infants. **Method:** Electronic searches were conducted using the following databases: Ovid, Blackwell Synergy, ScienceDirect, PsychINFO, and CINAHL and with the following key words: facilitated tucking, preterm infant's pain responses, and randomized clinical trials for the period of 1995 to May 2008. **Results:** The search generated 15 articles; 5 articles fit to the criteria of the systematic review. The following outcomes were statistically significant: heart rate; increase in oxygen saturation; sleep-wake state; Premature Infant Pain Profile scores; and neonate infant pain scores. **Conclusion:** The studies reviewed provide important preliminary findings that suggest facilitated tucking may be beneficial to preterm infants in attenuating their responses to painful procedures. **Key words:** *facilitated tucking, Premature Infant Pain Profile, preterm infants, randomized clinical trials*

Pain is a complex and multidimensional phenomenon that preterm infants experience in the neonatal intensive care unit (NICU).¹ In the NICU, infants are exposed to a high number of painful procedures. Neonatal care involves many diagnostic and therapeutic procedures that are associated with pain. For

example, Stevens et al² described an average of 134 painful procedures within the first 2 weeks of life for each of 124 preterm infants with a gestational age of 27 to 31 weeks. In a study utilizing 54 preterm infants, more than 3000 painful interventions were documented during their entire hospitalization period, with 74% of the painful interventions occurring in preterm infants younger than 31 weeks' gestation.³ Most of the painful interventions were heel stick or suctioning.⁴

As the delivery of neonatal care demands attention to nursing interventions that reduce pain effectively, pharmacological and nonpharmacological methods are used to decrease pain among preterm infants during invasive procedures. Nurses and other health-care professionals need to know how to control pain with both pharmacological and nonpharmacological methods. Pharmacological interventions are those that use medication for pain relief while all interventions that are done to control pain without the use of

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medication are nonpharmacological interventions. *Facilitated tucking* is one nonpharmacological nursing intervention defined as the gentle positioning of preterm infants with arms and legs in a flexed, mid-line position close to body while in either a side-lying or prone position.^{4,5}

The most prevailing theory of pain control is the gate control theory, which purports to act through activation of the gate control mechanism. According to this theory, the use of nonpharmacological methods leads to an endogenous endorphin dispersal, which contributes to the modulation of the pain impulse at the level of the spinal cord, and has the effect of relieving pain.⁶ These interventions can also activate the attention of preterm infants, distract them from the pain, and reduce the pain by preempting hypersensitivity, thus modifying the pain.^{7,8}

This review evaluates the efficacy of facilitated tucking in reducing pain in preterm infants as a nonpharmacological nursing intervention. Nursing measures can be beneficial in minor pain and stress, but severe or prolonged pain may also require pharmacological interventions. Opioids such as morphine can decrease pain in preterm infants, but can cause significant adverse effects. Pain can be reduced either with facilitated tucking alone or in combination with a lower dose of medication to minimize the adverse effects of opioids.⁹ Therefore, placing preterm infants in a facilitated tucking position could reduce stress and promote growth.^{4,5} One of the suggested benefits of facilitated tucking was pain relief with a significant reduction in the pulse rate.⁵ According to Ward-Larson et al,⁴ facilitated tucking can be used as complementary and developmentally sensitive care for relief from stressful responses and pain in preterm infants in the NICU.

PURPOSE

The purpose of this study was to systematically review the literature to determine the efficacy of facilitated tucking as nonpharmacological pain management in preterm infants.

METHODOLOGY

In line with the objective of the systematic review, electronic searches were conducted using the following databases: Ovid, Blackwell Synergy, ScienceDirect, PsychINFO, and CINAHL with the following search words: facilitated tucking, preterm infant's pain responses, and randomized clinical trials (RCTs). The lit-

erature search covered the period from 1995 to May 2008.

The review comprised 3 phases: (1) a systematic search of the literature by using criteria and key search words and (2) initial screening of studies for titles, key words, and fit with inclusion criteria. Inclusion criteria included articles published in English between 1995 and 2008; facilitated tucking of preterm infants; and RCTs or crossover design. The third phase was evidence of the efficacy of facilitated tucking. Fifteen studies were found but 10 were excluded because they were not intervention studies and/or were cross-sectional descriptive studies failing to meet the criteria.

In preterm infants developmental changes are very rapid; therefore, it is the state of the science with this population to utilize a random sequence crossover design with preterm infants serving as their own control. The relevant Consolidated Standards of Reporting Trials (CONSORT) guide for evaluation of the quality of studies was used in this review.¹⁰ The CONSORT is an evidence-based, set of recommendations for reporting RCTs. It offers a standard way for researchers to prepare reports of trial findings, facilitate their complete and transparent reporting, reduce the influence of bias on their results, and aid their critical appraisal and interpretation. The CONSORT statement consists of a 22-item checklist and a flow diagram, along with some brief descriptive text. The checklist items focus on reporting how the trial designed, analyzed, and interpreted; the flow diagram displays the progress of all participants through the trial.¹¹

RESULTS

Features of the studies

The 5 studies reviewed used a crossover design with preterm infants, serving as their own controls. The preterm infants were observed during 2 data collection points: 1 intervention situation (facilitated tucking) and 1 control situation.

There are 2 advantages for using crossover design in that subjects become their own controls, thereby reducing the error variance and eliminating individual subject differences from the overall treatment effect, thus enhancing statistical power. Therefore, the differences observed among treatment conditions are more likely to reflect treatment effects and not variability among subjects. The second advantage is that crossover design is more economical, requiring fewer subjects. It requires fewer subjects.¹² There are 2 weaknesses of crossover designs. First, the observations are

biased by carryover effects, the persistence of a treatment effect from one administration to the next. The second weakness is the potential for order effects, also known as practice effects.

The 5 studies taking into consideration were by using crossover design. Preterm infants' age ranged from 23 to 36 weeks; the sample size was 12 to 40; and the most frequent source of pain used to evaluate pain control was heel stick or endotracheal suctioning. Outcome measures used to evaluate the efficacy of facilitated tucking were the Premature Infant Pain Profile (PIPP), which measures behavioral responses (crying, grimacing, etc), physiological heart rate (HR), SaO_2 , post conceptual age, and Neonatal Infant Pain Scale (NIPS) (Table 1).

Description of studies related to facilitated tucking

This systematic review was based on 5 studies by using descriptive crossover designs. None were RCTs. Facilitated tucking is the gentle positioning of preterm infants with arms and legs in a flexed, midline position close to body while it is in either a side-lying or prone position.⁴ Earlier study emphasized that flexing preterm infants' limbs through facilitated tucking position could attenuate their stress and promote their growth.⁵

Corff et al⁵ conducted a study to identify the effectiveness of facilitated tucking, as a nonpharmacological nursing intervention in modulating preterm infants' physiological and behavioral responses to minor pain. The study utilizes crossover design in which 30 preterm infants, 25 to 35 weeks' gestation, underwent facilitated tucking position during a heel stick blood draws. The study hypothesized that preterm infants would have less variation in HR and hemoglobin oxygen saturation, sleep disruption times, and less fluctuation in sleep states in response to the painful stimulus of a heel stick with facilitated tucking than without facilitated tucking.⁵ Results identified that infants demonstrated a lower mean HR 6 to 10 minutes poststick ($P < .04$), shorter mean sleep disruption time ($P < .001$), and fewer sleep-state changes ($P = .003$) after heel stick with facilitated tucking than did without facilitated tucking. Researchers concluded that facilitated tucking is an effective comfort measure in attenuating premature neonates' psychological and behavioral responses to minor pain. Limitations to the study included nonvalidated tools for outcome measures and a small sample size, which was not justified by power analysis.

Ward-Larson et al⁴ investigated the effectiveness of facilitated tucking in relieving stressful responses and

Table 1. Summary of studies using repeated measures with random sequencing of the order of facilitated tucking as nonpharmacological quasi-experimental pain management intervention in preterm infants

Authors	Design	Intervention	Subjects	Procedure	Outcome measures	Results
Corff et al, ⁵ United States	Crossover design	Facilitated tucking. Usual position	30 PN GA 25–35 wk	Heel stick	Sleep-wake state, HR, SaO_2	Facilitated tucking position significantly decreased HR, crying time, sleep disruption time, and fewer sleep-state changes. SaO_2 variable did not show statistically significant difference between control group and experimental group.
Huang et al, ⁷ Taiwan	Crossover design	Facilitated tucking. Swaddling	32 PN GA 25–36 wk	Heel stick	HR, SaO_2 , facial expression and PIPP score	Swaddling group HR returned to baseline more quickly. PIPP scores were not statistically significant.
Ward-Larson et al, ⁴ United States	Crossover design	Facilitated tucking Standard NICU care	40 PN GA 23–32 wk	Endo tracheal suctioning	PIPP	Facilitated tucking. Significantly lower PIPP scores for facilitated tucking
Hill et al, ¹³ United States	Crossover design	Facilitated tucking Usual position	12 PN GA 25–34 wk	Routine care	PIPP	Lower PIPP score with facilitated tucking
Axelin et al, ¹⁴ Turkey	Crossover design	Facilitated tucking Usual position	20 PN GA 24–33 wk	Endotracheal/pharyngeal suctioning	NIPS	Statistically significant differences in median NIPS scores were 3 during facilitated tucking and median 5 without facilitated tucking

Abbreviations: GA, gestational age; HR, heart rate; NIPS, Neonatal Infant Pain Scale; PIPP, Premature Infant Pain Profile; PN, preterm newborn; SaO_2 , oxygen saturation.

pain during endotracheal suctioning, among a group of 40 intubated preterm infants between 23 and 32 weeks' gestation. The study utilized a prospective randomized crossover design. Preterm infants were observed twice during endotracheal suctioning experience: one suctioning was done according to normal nursery routine while another was done by using facilitated tucking position. The outcome measures of the study were PIPP to measure the preterm infant's response, and severity of illness of each preterm infant was measured by the neonatal acute physiology; repeated-measures analysis of variance determined the efficacy of facilitated tucking for reducing procedural pain. The study concluded that there was a statistically significant difference in the PIPP score for tucking and nontucking position ($P = .001$). Although regression analysis examined the relationship of gestational age, severity of illness, and number of painful procedures to the pain response, all predictors taken together did not significantly predict preterm infants responses to pain in the tucked position ($P = .11$) or nontucking position ($P = .57$). Facilitated tucking was an effective measure in relieving procedural pain of endotracheal suctioning in very low-birth-weight preterm infants. According to Ward-Larson et al,⁴ facilitated tucking described as an intervention can be easily taught to NICU nurses and other healthcare professionals as well as to parents, making it simple, easy, and cost-effective nonpharmacological interventions for pain relief in preterm infants. The strengths of this study included the use of valid and reliable tool PIPP and the sample size justification through power analysis.

Hill and associates¹³ conducted prospective randomized crossover design to compare the effect of facilitated tucking during routine nursing assessments performed under 2 conditions. One condition incorporated a second caregiver, supporting the preterm infants in a facilitated tucking position, whereas the second condition did not. The study utilized 12 preterm infants, ages 25 to 34 weeks' gestation, assigned to either facilitated tucking position or usual position. Preterm infants were evaluated by using the PIPP scale, during the 2 caregiving conditions. The level of significance was set at $P = .05$. The result of the study revealed that there were significant differences, with 9 of the 12 preterm infants receiving a lower PIPP score when facilitated tucking was used. By incorporating facilitated tucking, the stress level of preterm infants was reduced, and they were more stable in their autonomic, motor, and state systems. However, the sample size was small and was not justified by power analysis.

Axelin et al¹⁴ conducted a randomized crossover design study to examine the effectiveness of facilitated

tucking by parents (a parent holds the infant in a flexed position) in pain management during endotracheal/pharyngeal suctioning of preterm infants. In addition, the parental perception of the method was studied. The study utilized 20 preterm infants with ages 24 to 33 weeks' gestation. The outcome measure was the NIPS score. HR and oxygen saturation were recorded. Parents completed a questionnaire about their perception of the procedure. The median NIPS was 3 during facilitated tucking by parents and 5 without facilitated tucking during suctioning with a 2-point difference, which was statistically significant ($P < .001$). The infants calmed down more quickly after "facilitated tucking by parents" ($P = .024$). Nineteen of 20 parents preferred facilitated tucking during suctioning when compared with control care. The researchers concluded that facilitated tucking by parents is an effective and safe pain management method during suctioning of preterm infants. This study shows that parents can be given an active role in the pain care of their preterm infants.

Huang et al⁷ used a crossover design to compare the effects of facilitated tucking with swaddling on HR, SaO_2 after heel stick. The 30 preterm infants (25–36 weeks' gestation) were assigned to facilitated tucking or swaddling while undergoing 2 heel sticks. Mean HR was higher and mean SaO_2 was lower than their baseline values for the facilitated tucking intervention. Little difference between the facilitated tucking and swaddling was seen on attenuating physiological and behavioral stress caused by acute pain among preterm infants. Both facilitated tucking and swaddling attenuated preterm infants' responses to pain and stress. In conclusion, the literature reviewed related to facilitated tucking was limited to only 5 studies conducted to test the effectiveness of facilitated tucking. None of the studies meet the CONSORT guidelines. Most of the studies conducted had methodological constraints such as small sample size, sample sizes not based on effect size calculation or power analysis, and part of the studies utilizing a nonvalid reliable tool as an outcome measure. The issues of carry over effect and washout period were not addressed. This will result in limited generalizability of the studies.

Pain assessment instruments

The efficacy of facilitated tucking was measured by the PIPP scale in 3 of the studies reviewed.^{4,7,13} The PIPP scale assesses acute pain in preterm and term infants in both research and clinical practice.¹⁵ The PIPP was derived from multiple data sets and has been shown to have face and content validity. Construct validity had

been tested by multiple test data sets including infants of a variety of gestational ages and level of illness acuity. Interrater reliability was established when analysis for painful event scores yielded reliability coefficient of 0.93 to 0.96. According to Ward-Larson et al.,⁴ intrarater reliability coefficient analyses for individual event score were also high at 0.94 to 0.98. The PIPP scale is a 7-indicator pain measure that includes behavioral, physiological, and contextual indicators. Behavioral variables (time of brow bulge, eye squeeze, and nasolabial furrow), 2 physiological variables (changes in HR and oxygen saturation), and 2 contextual variables (gestational age and overall behavioral state). The second outcome measure was the NIPS score. This instrument was used in the study conducted by Axelin et al.¹⁴ The NIPS quantifies the level of pain on a scale from 0 to 7 based on 5 behavioral characteristics—state of arousal, crying, movements of arms and legs, facial expressions, and the breathing pattern—and is used as a physiological parameter. The instrument has a good face, content and constructs validity, interrater reliability (0.92–0.97), and internal consistency (Cronbach α .87).¹⁴

DISCUSSION

Of the 5 studies that evaluated the effectiveness of facilitated tucking in preterm infants by utilizing a crossover design, most had methodological concerns resulting in limitations in the generalizability of the studies. These concerns included small sample sizes and/or tools without established validity. By using a crossover design, the importance of the “washout period” and whether there was a carry over effect was not addressed. As the crossover designs are those in which study participants receive all treatments under investigation, each in a different study period. A washout period is used to allow the effects of the previous treatment to disappear, because the treatment effect is estimated within rather than between patients.¹² Ancillary measurements, such as baseline covariates at the beginning of each treatment period, can improve the performance of crossover designs. The treatment periods must be separated by a sufficient length of time for the

effects of the earlier treatment to subside. In the studies reviewed, none of them did consider “the washout period.”

Nevertheless, this review yielded several important findings relevant to nursing. The following outcomes were statistically significant: HR in 4 of 4 studies; increase in SaO_2 in 3 of 4; sleep-wake state in 4 of 5; PIPP scores in 2 of 3; and a difference in median NIPS scores in 1 of 1.

The studies reviewed here provide important preliminary findings that suggest facilitated tucking may be beneficial to preterm infants in attenuating their responses to painful procedures. Definitive studies are needed before facilitated tucking can be adopted systems wide focusing on evidence-based nursing practice. Many of the pertinent aspects of the CONSORT guides are also relevant to crossover designs and need to be followed to eliminate some of the common limitations that were noted in the above studies. For example, the intended sample size used in the studies needed to be determined by using a statistical power calculation. The sample size should be adequate to provide a high probability of detecting as significant an effect size of a given magnitude if such an effect of facilitated tucking actually exists.

NURSING IMPLICATIONS

This review suggests that facilitated tucking may be useful for nonpharmacological pain reduction in preterm infants. While none of the studies addressed if there is any harm from facilitated tucking, it is likely that facilitated tucking provides comfort to the preterm infants and can be included as an adjunct to current evidence-based pain management until such time when the results of facilitated tucking provide sufficient evidence of the efficacy of this nursing intervention. Numerous methodological limitations restrict the generalizability to the findings, and until more definitive studies are available may serve as an adjunct to evidence-based practice as a nonpharmacological alternative. However, systematic adoption of this practice warrants a stronger evidence base.

REFERENCES

1. American Academy of Pediatrics, Committee on Fetus and Newborn and Section on Surgery. Canadian Pediatrics Society and Fetus and Newborn Committee. Prevention and management of pain in the neonate: an update. *Pediatrics*. 2006;118:2231–2241.
2. Stevens B, Johnston C, Franck L, Petryshen P, Jack A, Foster G. The efficacy of developmentally sensitive interventions and sucrose for relieving procedural pain in very low birth weight neonates. *Nurs Res*. 1999;48:35–43.
3. Cignacco E, Hamers J, Stoffel L, et al. The efficacy of non-pharmacological interventions in the management of procedural pain in preterm and term neonates: a

- systematic literature review. *Eur J Pain*. 2007;11:139-153.
4. Ward-Larson C, Horn R, Gosnell F. The efficacy of facilitated tucking for relieving procedural pain of endotracheal suctioning in very low birthweight infants. *Am J Matern Child Nurs*. 2004;29:151-156.
 5. Corff KE, Seideman R, Venkataraman PS, Lutes L, Yates B. Facilitated tucking: a nonpharmacologic comfort measure for pain in preterm neonates. *J Obstet Gynecol Neonatal Nurs*. 1995;24:143-147.
 6. Graden M, Schollin J. The role of endogenous opioids in mediating pain reduction by orally administered glucose among newborns. *Pediatrics*. 2005;105:1004-1007.
 7. Huang CM, Tung WS LL, Chang YJ. Comparison of pain responses of premature infants to the heel stick between containment and swaddling. *Nurs Res*. 2004;12:31-40.
 8. Mathew PJ, Mathew JL. Assessment and management of pain in infants. *Postgrad Med J*. 2003;79:438-443.
 9. Anand K, Hall R, Desai N, et al. Effects of morphine analgesia in ventilated preterm neonates: primary outcome comes from the NEOPAIN randomized trial. *Lancet*. 2004;363:1673-1682.
 10. Altman DG, Schulz KF, Moher D, et al. The revised CONSORT statement for reporting randomized trials: explanation and elaboration. *Ann Intern Med*. 2001;134:663-694.
 11. Moher D, Schulz KF, Altman DG. The CONSORT statement: revised recommendations for improving the quality of reports of parallel-group randomized trials. *Ann Intern Med*. 2001;134(8):657-662.
 12. Hulley SB, Cummings SR, Browner WS, Grady D, Hearst N, Newman TB. *Designing Clinical Research*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2001.
 13. Hill S, Engle S, Jorgensen J, Kralik A, Whitman K. Effects of facilitated tucking during routine care of infants born preterm. *Pediatr Phys Ther*. 2005;17:158-163.
 14. Axelin A, Salantero S, Lehtonen L. Facilitated tucking by parents in pain management of PTI: a randomized crossover trial. *Early Hum Dev*. 2006;82:241-247.
 15. Stevens BJ, Johnston C, Petryshen P, Taddio A. Premature Infant Pain Profile: development and initial validation. *Clin J Pain*. 1996;12:13-22.