

EFFECTS OF HANDS-ON CONTAINMENT ON THE FREQUENCY OF APNEA EPISODES ON THE PREMATAURE INFANTS WITH RESPIRATORY DISTRESS SYNDROME

Martha V. Whetsell, RN, ARNP, PhD

Profesor Asociado de Enfermería
Departamento de Enfermería. Lehman College
Profesor Asociado, Programa de
Doctor en Ciencias de la Enfermería
marwhet@hotmail.com

Dra. Yolanda González W.

Profesora titular
Departamento de salud de Adultos
Facultad de Enfermería
Universidad de Panamá
meriam.caboral@downstate.edu

Fecha de Recibido	22 de noviembre 2011
Fecha de Arbitraje	30 de noviembre 2011
Fecha de Aceptación	5 de diciembre 2011
Fecha de Corrección del Lenguaje	10 de diciembre 2011

RESUMEN

Guiado por el Modelo de Adaptación, el objetivo de este estudio cuasi experimental, es determinar la incidencia de episodios de apnea en niños prematuros con Síndrome de Distres Respiratorio, a los cuales se trató un grupo experimental aplicando la terapia de contención y un grupo de control no lo recibió. Las manos de la enfermera fueron utilizadas como la terapia de contención en este estudio. El nivel de significancia para el estudio fue $p < 0.05$.

Los datos preliminares de este estudio, fueron analizados; la muestra fue de 44 neonatos que presentaban Síndrome de Distres respiratorio, cada neonato fue asignado al tratamiento de contención y al no tratamiento de forma alternada, cada uno fue su propio control. La cohorte consistió en $n= 44$ prematuros; 59% varones con una media gestacional de edad ± 1.3 semanas, con una media en el peso al momento de reclutamiento para el estudio fue de 92 ± 16 horas; 86% nacidos por parto natural con Hemoglobina 15 ± 1.3 . El estudio demostró pocos episodios de apnea en aquellos neonatos que recibieron el tratamiento de contención.

Palabras claves: Contención del Recién Nacido, Apnea, Síndrome Disneico Respiratorio del Recién Nacido (DeCS- Bireme).

ABSTRACT

Guided by Roy's Adaptation Model, the aim of this quasi-experimental, cross-over research was to determine the incidence of apnea episodes on premature infants with Respiratory Distress Syndrome (RDS) on containment (experimental group) versus non-containment (control group) treatment. The nurses' hands were used as containment for the purpose of this study. The significance level was set at $p < 0.05$.

Data from an earlier containment study was reanalyzed for the purpose of this study. Forty-four neonates with respiratory distress syndrome were in the study. Each neonates were alternately assigned to containment and no containment, and each served as their own control. The cohorts consisted $n = 44$ prematures, 59% boys, mean gestational age of 28 ± 1.3 weeks, mean weight at time of enrollment was 92 ± 16 hrs; 86% born by natural delivery, and with Hgb of 15 ± 1.3 . The study showed that significantly less episode of apnea was noted on those neonates who received containment.

Keywords: *Containment Newborn, Apnea, Respiratory Distress Syndrome, Newborn (DeCS- Bireme).*

INTRODUCTION

Infants born prematurely suffer from Respiratory Distress Syndrome (RDS) due to surfactant deficiency that requires mechanical ventilation and frequent suctioning (Bennet, 2002). Infants with low birth weight (LBW) on mechanical ventilation are susceptible physiological instability when responding to endotracheal suctioning (ETS). Although an effective intervention, one of the known consequences of suctioning is hypoxia (Kohlhauser et al., 2000). Hypoxemia and oxygen (O_2) desaturation due to inadequate gas exchange are commonly seen complications from these interventions. Few studies have been done to examine the causes of desaturation episodes and to identify neonatal responses to interventions that can give us an understanding of the nature of how to use these interventions

without causing apnea on neonates (Porter et al., 1999).

Premature babies present frequent episodes of hypoxemia and the risk of O_2 desaturation which may increase in relation to posture (Zanardo, 2008). Containment may play an important role in O_2 recuperation time and neonate's sense of adaptation. Containment is a flexed position that simulates the position of the infant in utero that facilitates neuromuscular development, which is important in respiratory function development. It is a technique for restraining an infant's movements that include lightly grasping the infant's feet with one hand and flexing his legs slightly upward to the level of the hips while simultaneous gently cupping the infants head with the other hand. This limits the infant's movements, which seems to induce relaxation and provide a feeling of security (A1s, 1983;

Brazelton, 1983; Velasco-Whetsell, Evans, & Wang, 1992; Ward Larson et al. 2004). Containment, a handling technique that simulates therapeutic milieu in utero is one intervention which can minimize the neonate's response to pain and/or ETS (Taquino & Blackburn, 1994; Whetsell-Velasco, Evans & Wang, 1992). Kangaroo care, swaddling, positioning and facilitated tucking are selected non-pharmacological forms of posturing or containment. Most of the studies looking at these interventions were focused on pain-alleviating effect to neonates. Very limited studies have looked at the effect of these containment interventions on apnea episodes.

Therefore, the purpose of this study was to determine if there is a difference in the frequency of apnea episodes on premature infants with RDS while on containment versus no containment treatment.

Conceptual framework

The Roy Adaptation Model (RAM) was the theoretical underpinning that guided this study (Galbreath, 2002). The effects of manipulating one or all three classes of stimuli in order to enhance adaptation through the introduction of a nursing intervention, containment, was what guided this study and its hypotheses. Theoretically, an intervention can be first viewed as focal stimuli on an adaptive system. The intervention becomes contextual stimuli with repeated exposures, and over time becomes part of the environment and can be seen to modify an organism's responses to a focal stimuli. Later, learnt responses becomes incorporated into the

organism's behavioral responses (a constraint to input and to the transformation of inputs into outputs), thus an intervention could even be associated with residual stimuli. This view of stimuli was a modification of Roy's original Adaptation Model; contextual and residual stimuli are seen within this study to constrain an adaptive system's inputs and its transactions into outputs, and that the adaptive organism not only reacts to stimuli but can be proactive toward such stimuli (i.e., able to learn, change, and, therefore, able to modify the effects of stimuli) (Galbreath, 2002). This modification, in effect, changes the focus from solely on stimuli to include the self-regulatory nature of an adaptive organism in relation to stimuli.

Literature Review

Premature neonates have immature respiratory control, which makes them susceptible to apnea, bradycardia, hypoxemia, and mucosal trauma while undergoing suctioning (Ludington-Hoe, et al., 2004; Abu-Shaweesh & Martin, 2008; Sale, 2010). The very vulnerable premature neonates are at high risk for developing transient apnea, and bradycardia, which commonly affects up to 90% of these infants, reflects physiologic rather than pathologic immaturity (Ludington-Hoe, et al., 2004; Abu-Shaweesh & Martin, 2008). Experimental studies have focused on changing the conventional methods to partially ventilated (PVS) method, which incorporates mechanical ventilation to continue during the insertion of the suction catheter (Mosca

et al., 1997). None of these studies, however, have been substantiated by rigorous clinical research to include examination of body positioning as a mean of fostering respiratory stability.

Some studies on the use of a nursing intervention called kangaroo care (K care) looking at apnea episodes were promising. A quasi-experimental study was performed by Messmer and colleagues (1997) on twenty parent/infant dyad to determine if K care, a nursing intervention that limits an infant's movement, would result in changes in the infants' physiologic parameters. The researchers performed a pre-test and post-test with neonates serving as their own control for 4 episodes of 1 hour each. The study showed that during K care, the neonates exhibited less apnea and bradycardia. Similarly, Ludington-Hoe (2004) conducted a randomized control trial on twenty four healthy infants to compare the effect of continuous K care versus standard neonatal intensive care unit (NICU) care on cardiorespiratory and thermal responses. Apnea, bradycardia were noted to be absent in the K care group.

Another nursing intervention on body positioning on neonates is called facilitated tucking. A randomized, cross-over study was performed by Ward-Larson et al. (2004) on forty very low birth weight (VLBW) infants that compared the efficacy of facilitated tucking with the standard NICU care on decreasing pain caused by suctioning. The study showed a significant difference

in the Premature Infant Pain Profile (PIPP) scores between tucking and non-tucking ($p = 0.001$) was noted. The implication of this study was that facilitated tucking is a developmentally sensitive non-pharmacologic comfort measure that can be used to reduce pain in VLBW infants.

Keene and colleagues (2000) studied 22 premature infants to determine the effect of prone versus supine positioning on cardiopulmonary stability of preterm infants with apnea and bradycardia. Their study showed that there was no significant differences apnea, bradycardia and oxygen desaturation between supine and prone positions. Therefore, preterm infants cardiopulmonary stability were compromised by positioning.

One of the first studies on containment was conducted by Velasco-Whetsell et al. (1992) who examined the effect of containment on post-suctioning transcutaneous PO₂ values on premature infants less than 72 hours. They found that infants receiving containment had a significantly different transcutaneous PO₂ post suctioning during containment compared to those who were not contained. The effect was significant ($F, 6.26; p < 0.0001$), and also the treatment (containment) effect was significant ($F, 5.47; p < 0.0001$) (Velasco-Whetsell, et al., 1992). A subsequent study by Becker et al. in 1993 examined the effect of developmental care in the VLBW infants, which included containment. They reported that using containment as a nursing care practice showed a significant

difference, suggesting that its use could be very beneficial. After over a decade, Salazar & Velasco-Whetsell (2007) performed a follow-up study to determine the effectiveness of containment using pre-suctioning with oxygen bag versus non-presuctioning oxygen bag on 30 premature infants 26-36 gestational age. The ANOVA test ($F(3,87) = 7,77, p < 0.001$) showed that the means were significantly lower when they received containment. The recovery time indicated that containment helped with recovery time of percutaneous hypoxia value after suctioning of premature infants with RDS.

MATERIAL AND METHOD

Subjects and Recruitment

A random sample of 44 premature neonates (less than 36 weeks gestational age) between 12 and 168 hours of age diagnosed with RDS were included in the study. All neonates were admitted to the Neonatal Intensive Care Unit (NICU) of a large medical center. The contacts with the mothers were made no earlier than 8 hours after delivery to ensure that the mother did not have any residual effects from anesthesia. Both parents were asked to give consent when possible. The inclusion criteria for the study were: (1) diagnosis of RDS; (2) gestational age of 24 to 36 weeks; (3) intubated; (4) umbilical artery catheters; (5) recorded hemoglobin higher than 40%; (6) FiO_2 equal or less than 40%; (7) a documented O_2 plateau O_2 saturation between 88% - 95% as measured by the pulse oxymeter; (8) chest X-ray negative for pneumonia;

and (9) signed informed consent from either one of the parents. Infants who have congenital anomalies, heart defects or those who were receiving aminophylline, epinephrine, or/and dopamine were excluded from the study because the side effects of hyperglycemia, diuresis, dehydration, hyperreflexia, jitteriness, and irritability along with tachycardia have been reported.

Protocol

Each LBW neonates were alternately assigned to be exposed to both the hands-based containment (experimental group) and non-containment (control group). Each premature infant served as his/her own control to minimize variability for individual differences within subjects. The neonates first underwent containment during the ETS and at the next ETS, which is 4-6 hour later, the neonates did not have containment. The procedure was repeated 24-48 hours apart until three pairs of readings were collected. The 3-day protocol consisted of either containment performed in the morning follow by a non-containment period in the afternoon or vice versa. The $TcPO_2$ recuperation time, apnea episodes, heart rate (HR), respiratory rate (RR), and blood pressure (BP) were measured during each procedure.

Established hospital protocol included ETS performed every 4 hours, and assessment of chest wall movement and subsequent increase in the FiO_2 every four hours. The babies were observed and baseline physiologic measures (HR, RR,

BP, and O₂ saturation) were obtained one hour prior to starting the research protocol. An intensive care electrocardiogram monitored the HR, RR, and BP, while a NelcorOxisensor attached to the foot or the hand of the infant to measure O₂ saturation. During containment, at the end of the hour, the first research assistant performed the ETS then the second research assistant administered the containment and remains with the infant until the O₂ saturation returned to baseline and maintained for one minute prior to discontinuing the containment. The vital signs, O₂ levels and apnea episodes were observed for 5 minutes post containment. Apnea was defined as cessation of breathing for 5 seconds.

Statistical Analysis

Statistical analysis will be performed using SPSS Version 18. Baseline and clinical information were measured using descriptive statistics (frequencies, and means \pm Standard Deviations). Paired t-test was used to examine differences in variables between neonates during containment and non-containment. Repeated measures design was used to assess change over time within the participants. The statistical significance was set at 0.05.

RESULTS

Table 1. Baseline demographic and clinical characteristics of neonates with RDS.

Characteristics	N=44
Age	
- Gestational Age	28 \pm 1.3 weeks
- Age at time of enrollment	92 \pm 16 hrs
Weight (Gms)	
- At birth	1089 \pm 198 grms
- At time of enrollment	962 \pm 177 grms
Gender	
- Boys	26 (59 %)
- Girls	18 (41 %)
Apgar score	
- 1 minute	2.6 \pm .63
- 5 minutes	5.8 \pm .8
Hemoglobin (mean)	15g/dl \pm 1.3
Type of delivery	
- Natural	38 (86 %)
- Caesarian	6 (14 %)

Table 1 described the overall baseline clinical characteristics of the neonates. All the neonates were on assisted ventilation. Paired t-test performed with the three day protocol showed that episodes of apnea with containment were statistically significantly less during days 1 and 3 compared to no containment. Repeated measures revealed a statistically significant difference in apnea episodes between the containment and non-containment treatment ($F = 96$, $Df = 1$, $p < 0.0001$). However, the recuperation time from apnea episode post-intervention did not differ between the two groups. The oxygen recuperation

time post-suctioning was significantly shorter with containment throughout the three day protocol period (Day 1: $t = 2.9$, $p = 0.005$; Day 2: $t = 6.9$, $p < 0.0001$; Day 3: $t = 4.4$, $p < 0.0001$). Additionally, the difference in the desaturation level post-suctioning between containment and no containment was noted to be significant, with those receiving containment with lower desaturation levels (Day 1 difference -1.7 , $p < 0.0001$; Day 2 difference 2.2 , $p < 0.0001$; Day 3 difference 1 , $p = 0.002$).

Table 2. Comparison between containment and non-containment

	Containment	Non-containment	P value
Apnea episodes			
1 st reading (Day 1)	1.3 ± .9	1.4 ± .9	0.02
2 nd reading (Day 2)	1.3 ± .9	1.4 ± 1	NS
3 rd reading (Day 3)	1.1 ± .9	1.3 ± .9	0.05
Apnea recuperation time (post-intervention)			
1 st reading	.95 ± .9	1.1 ± .9	NS
2 nd reading	.93 ± .9	1 ± .9	.08
3 rd reading	.93 ± .9	.91 ± .9	NS
Hypoxia level			
1 st reading	90% ± 2	89% ± 2	<0.0001
2 nd reading	90% ± 2	88% ± 2	<0.0001
3 rd reading	90% ± 2	89 ± 2	0.002
O₂ recuperation time			
1 st reading	2.9 ± .7	3.3 ± 1	0.005
2 nd reading	2.9 ± .6	3.7 ± 1	<0.0001
3 rd reading	3 ± .8	3.6 ± 1	<0.0001

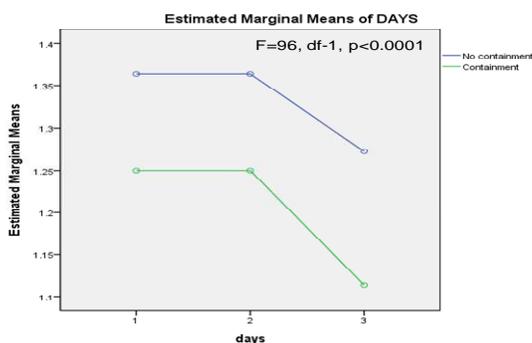


Fig. 1. The frequency of apnea between containment and no containment during the three days period using repeated measures.

DISCUSSION

The present study is one of the few studies that examined the effect of containment on apnea episodes on premature infants. Our result demonstrates significantly less apnea episodes on containment. This is consistent with earlier studies conducted by this author on containment (Whetsell et al., 1992; Salazar & Whetsell, 2007). Likewise, studies by Messner et al. (1997) and Ludington-Hoe (2004) showed similar results that apnea is decreased when the infant's movement is limited or restricted. However, our result is in contrast with Keene and colleagues study which showed no difference in apnea episodes with positioning (2000).

Infants desaturate transiently to <85% as a result of procedures such as suctioning. This episode is self-limiting and no added intervention is needed. Our study presents that those premature

neonates who received containment have a shorter oxygen recuperation time post-suctioning during the three day protocol. The decrease in the recuperation time after suctioning suggests beneficial effects on lungs mechanics when performed in the presence of containment. Salazar & Whetsell (2007) further elucidated this in an earlier study that the infant's thoracic stability during expiration is provided by the stability delivered by containment. Additionally, premature neonates with RDS may have difficulty maintaining their expiratory effort to prevent airway collapse during expiration due to pliable rib cage may explain the difference in the level of desaturation between those in containment versus no containment (Mammey & Bing, 1996). Further, Greenberg and Robertson (1999) explains that the smaller the neonates, the smaller their functional residual capacity that can be reflected in the degree of hypoxemia.

CONCLUSION

It is apparent from review of literatures and this study that strategies to prevent apnea are needed to be developed and researched in order to reduce this complication among premature neonates. Most preventive medical interventions should focus on minimizing the complications of prematurity. More specific nursing interventions worthy additional research. Nursing interventions such as containment to prevent apnea in premature infants or to minimize the O₂ recuperation time after painful procedures most be included. Further studies will be required to establish the clinical significance of these interventions.

REFERENCES BIBLIOGRAFICS

- Abu-Shaweesh, J. M. & Martin, R. J. (2008). Neonatal apnea: What's new? *Pediatric Pulmonol*, 43:937-944. doi:10.1002/ppul.20832. USA
- Als H., Duffy FH, McAnulty G. (2004). Early experience alters brain function and structure. *Pediatrics*, 113: 846-57. USA
- Becker PT, Grunwald PC, Moorman J, Stuhr S.(1993). Effects of developmental care on behavioral organization in very-low-birth-weight infants. *Nursing Research*, 1993, 42:214–220 Q. USA
- Bennett, F. C. (2002). Low birth weight infants: Accomplishments, risks, and interventions. *Infants and Young Children*, 15: vi-ix. USA
- Brazelton T.B.(1983). Infants and mothers. Revised Edition, Delta/Seymour Lawrence: New York.
- Galbreath, J. G. (2002). Roy Adaptation Model: Sister Callista Roy. In J. B. George. *Nursing theories: the base for professional nursing practice (5th ed)*. pp.295-338. Prentice Hall, New Jersey.
- Gardner, D. L. & Shirland, L. (2009). Evidenced-based guidelines for suctioning the intubated neonates and infant: ETT suctioning in neonates and infants. *Neonatal Network*, 28(5):281-302. USA
- Greenberg A. and Robertson N.C.R. (1999). Acute Respiratory Diseases in the Newborn. In. J.M. Rennie and N.C.R. Robertson (Eds) 1999 . *Textbook of Neonatology*. (3rd ed.), pp 481-607. Churchill Livingstone. London.
- Keene, D. J., Wimmer, J. E., & Matthew, O. (2000). Does supine positioning increase apnea, bradycardia, and desaturation in preterm infants? *Journal of Perinatology*, 20:17-20. USA
- Kohlhauser C., Bernet G., Hermon M., Popow C., Seidi R., and Pollack A. (2000). Effects of endotracheal suctioning in high oscillatory and conventionally ventilated low birth weight neonates on cerebral hemodynamics observed by near

- infrared spectroscopy (NIRS). *Pediatric Pulmonol*, 29: 270-275. DOI: 10.1002/(SICI)1099-0496(200004)29:4<270::AID-PPUL6>3.0.CO;2-Q. USA
- Ludington-Hoe, S. M., Anderson, G. C., Swinth, J. Y., Thompson, C. & Hadeed, A. J. (2004). Randomized controlled trial of kangaroo care: Cardiopulmonary and thermal effects on health preterm infants. *Neonatal Network*, 23(3):39-48. USA
- Mammel, M.C. and Ding D.R. (1996). Mechanical ventilation of the newborn, *Clin, Chest Med.* 17. USA
- Marrow, B.M., & Argent A. C. (2008). A comprehensive review of pediatric suctioning: effects- indications, and clinical practice. *Pediatric Critical Care Medicine*, 9(5): 465-477. USA
- Messmer, P. R., Rodriguez, S., Adams, J., Wells-Gentry, J., Washburn, K., Zabaleta, I., & Abreu, S. (1997). Effects of kangaroo care on sleep time for neonates. *Pediatric Nursing*, 23(4): 408-414. USA
- Mosca. FA., Colnaghi M., Lattanzio M, Bray M., Pugliese S., Fumagalli M. (1997) Closed Versus open endotracheal suctioning in preterm infants: effects on cerebral oxygenation and blood volume. *Biol Neonate*; 72:9-14. doi:10.1159/000244460. USA
- Porter FL., Wolf C., Miller AB. (1999) Procedural pain in newborn infants: the influence of intensity and development. *Pediatrics.* 104. USA
- Salazar, B. & Whetsell, M. (2007). Effects of containment on percutaneous hypoxia after endotracheal suctioning in neonates. *Investigación y Educación en Enfermería*, 25(1), 50-57. Colombia. SA
- Sale, S. M. (2010). Neonatal apnea. *Best practice & research clinical anesthesiology*, 24:323-336. doi:10.1016/j.bpa.21010.04.002. USA
- Velasco-Whetsell, M., Evans, J. C., & Wang, M. (1992). Do post-suctioning transcutaneous PO₂ change when a neonate's movements are restrained? *Journal of Perinatology*, 12: 333- 337. USA
- Ward-Larson, C., Horn, R., & Gosnell, F. (2004). The efficacy of facilitated tucking for relieving procedural pain of endotracheal suctioning in very low birth weight infants. *The American Journal of Maternal/Child Nursing*, 29(3): 151-156. USA
- Zanardo V.; Trevisanuto D.; Dani C.; Bottos M.; Gugliemia A.; Cantarutti F. (1995). *Biology of the Neonate*, Vol. 67, n1, pp54-58. USA