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EFFECT OF REFLEX ROLLING ON OXYGEN SATURATION AND INCUBATION PERIOD IN PRETERM NEONATES WITH RESPIRATORY DISTRESS SYNDROME

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Abbreviations:

ABG : Arterial Blood Gases.
cCPT : Conventional chest physiotherapy.
DMNI: Damanhour Medical National Institute.
GA : Gestational age.
NICU : Neonatal intensive care unit.
RDS : Respiratory distress syndrome.
RR : Respiratory rate.
SaO2 : Oxygen saturation.
SD : Standard deviation.

ABSTRACT

Objective: The present study aimed at investigating the effectiveness of reflex rolling on incubation period and oxygen saturation in preterm neonates with respiratory distress syndrome.
Background: Respiratory distress syndrome in premature neonates is one of the leading causes of neonatal morbidity and mortality in developing countries. Reflex rolling is tactile stimulation technique used to improve respiration.
Methods: Thirty-seven preterm neonates with respiratory distress syndrome with gestational age of 30 to 36 weeks under oxygen therapy participated in this study. They were allocated into two groups. Control group (A) received conventional chest physical therapy and study group (B) received in addition to the previous program a reflex rolling technique. Respiratory rate and oxygen saturation were measured on the first day and last day of incubation. Oxygen therapy period and incubation period were also recorded.
Results: The results (before versus after intervention) revealed a significant difference in each group regarding respiratory rate as well as oxygen saturation. There was insignificant difference between the two groups before and after intervention. The results showed a statistical significant difference between the two groups regarding oxygen therapy period as well as incubation period with less period for group (B).
Conclusion: Reflex rolling technique is safe and effective in minimizing incubation period in preterm neonates with respiratory distress syndrome.

INTRODUCTION

Prematurity is a term for the broad category of neonates born at less than 37 weeks' gestation. Preterm birth is the leading cause of neonatal mortality and the most common reason for antenatal hospitalization (Furdon, 2016). Respiratory distress syndrome (RDS) is seen in premature neonates requiring ventilatory assistance or oxygen support. Population, who suffer from respiratory disorders have distinct physiological characteristics, which make them vulnerable to nutritional deficits with detrimental short and long-term effects (Dassios and Hayes, 2013).

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Respiratory distress in the neonate is responsible for 30-40% of admissions in the neonatal period (Kumar and Bhatnagar, 2005 and Mathai *et al*., 2007). Prolonged incubation and neonatal intensive care units (NICU) stay is associated with complications such as chronic lung disease, respiratory infections, subglottic stenosis, feeding problems, weight loss and long-term neurodevelopmental problems (Hawdon *et al*., 2000, Petrini *et al*., 2009 and Cho *et al*., 2012). On average, newborns stayed in the hospital for 3.4 days and incurred average hospital costs of $3,200. Newborns that were preterm or had low birth weight or RDS had higher average lengths of stay and higher average costs compared to all newborns. Preterm newborns had hospital stays averaging 14.3 days with mean costs of $21,500. Newborns with RDS had hospital stays averaging 31.3 days and average costs of $55,000 (HCUP,

2013). Decreased production of mature levels of surfactant may result in atelectasis, ventilation-perfusion inequality, hypoventilation, reduced lung volume and decreased lung compliance (Moor, 2000 and Rudolph *et al*., 2000), and requires a massive increase in work of breathing required to ventilate the lung (Tecklin, 1999 and Beck *et al*., 2010) leading to decreased oxygenation, asphyxia, metabolic acidosis, and acute respiratory failure. It may also lead to production of excess bronchial secretions thus causing an increase in airway resistance. Oxygen supplementation and arterial blood gas (ABG) monitoring being an essential part of treatment, but its prolonged use can lead to accumulation of excess bronchial secretions, which need to be removed using chest physiotherapy (CPT) (Unoki *et al*., 2005). Reflex rolling is one of few newer techniques that has been introduced, that employs isometric strengthening techniques through tactile stimulation, to encourage the development of normal movement patterns and therefore to improve respiration (Giannantonio *et al*., 2010 and Vojta, 2011). To the best of our knowledge, there has been little research to support claims for the benefits of reflex rolling in the treatment of preterm neonates with respiratory distress. Therefore; the aim of this study was to investigate the effectiveness of reflex rolling on incubation period and oxygen saturation (SaO2) in preterm neonates with RDS.

MATERIALS AND METHODS

This was a quasi-experimental trial with one control group (A) and one study group (B). A total of 37 preterm neonates of both sexes between 30 and 37 weeks of gestational age (GA) were included in the study based on the following criteria: (1) Ranging from 30-37 weeks of gestation admitted to NICU with diagnosis of RDS, (2) On oxygen therapy, (3) Respiratory rate (RR) of more than 60 breaths per minute and (4) Medically free from any other diseases except RDS. They were excluded if they had one or more of the following: (1) Musculoskeletal disorders, (2) Micro encephalopathy, and/or (3) Recent surgery. The study was conducted in NICU of Damanhour Medical National Institute (DMNI) since December 2015 till June 2016, after it was approved by the ethical committee of faculty of physical therapy, Cairo University. Participants diagnosed by the neonatologist as having RDS were screened to find their suitability as per the inclusion and exclusion criteria and were requested to participate in the study. Those willing to participate were briefed about the nature of the study and the intervention and a written consent was obtained from the parents or caregivers of each participant. Demographic data were collected along with details of GA, birth weight, RR, SaO2, and mode of delivery.
Hewlett Packard pulse oximeter (Hewlett Packard Neonatal Viridia 24C, System no. M1205 A, manufactured in 71034 Boeblingen, Germany) was used to quantify the amount of SaO2 in participants. A band like sensor was placed across neonate's foot which was connected to monitor that displayed SaO2. Participants were allocated into two groups. Group (A) received conventional chest physiotherapy (cCPT) in a form of chest percussion, modified postural drainage and vibration techniques and Group (B) received reflex rolling in addition to cCPT.

Conventional Chest Physiotherapy

Chest percussion was administered using a size zero neonatal facemask, with motion primarily from the wrist, with firm support applied to the side of the thorax opposite that being percussed. Postural drainage was done by placing the patient in a position that employs gravity to move mucus centrally from the targeted lung unit. Vibration of the chest were done manually by placing the fingers on the chest wall over the segment being drained and isometrically contracting the muscles of the forearm and hand to cause a vibratory motion.

Reflex rolling

In this maneuver, neonates head was rotated towards the side from which stimulus was delivered. A slight digito-pressure (dorsal, medial and cranial direction, diagonally to spine) was exerted on the chest area at the level of the 6th rib, or between 5th and 6th, or between 6th and 7th. Each treatment consisted of delivering four stimuli, two to the left and two to the right according to Giannantonio *et al*., 2010. Neonates were placed in asymmetrical supine position during the intervention. Treatment was given for 2 sessions /day, of 20 min duration till discharge. Suctioning was done if needed. SaO2 was recorded at day one of incubation and at the last day of incubation by the nurse who was blinded to groups and nature of intervention given.

Statistical analysis

Statistical analyses were conducted using statistical package for the social sciences (SPSS) version 19 for Windows. Independent *t*-test or Mann Whitney test (whenever it was appropriate) was used to find the significance of study parameters between groups pre- as well as post-intervention. Paired *t*-test or Wilcoxon Signed Ranks test (whenever it was appropriate) was used to find the significance of study parameters in each group. Chi-square test was used to find the significance of study parameters on categorical scale between groups. All statistical analyses were significant at 0.05 level of probability.

RESULTS

Subjects participating in this study had a mean gestational age of 33.74±1.88 in group (A), and 34.22±1.63 weeks in group (B). About 68.4% of group A and 72.2% of group B were delivered by cesarean section while about 31.6% of group A and 27.8% of group B were normally delivered. The mean admission weight (kg) of neonates in group A was 2.02±0.50 and 2.14±0.51 in group B. The demographic data of both groups did not show any significant difference thus demonstrated the homogeneity in the groups as shown in Table (1).

Table 1. Demographic data of the participants in both groups

		Groups		*P* value
		A (19)	B (18)	
Gestational age (weeks)		33.74±1.88	34.22±1.63	0.408
Mode of Delivery (%)	Cesarean	13 (68.4)	13 (72.2)	0.800
	Normal	6 (31.6)	5 (27.8)	
Admission Weight (kg)		2.02±0.50	2.14±0.51	0.453

Data are expressed as mean ± SD or number (%).
NS= p> 0.05= not significant.

The results showed insignificant difference between groups regarding weight at the time of discharge (p=0.540). The results also showed in significant difference between groups regarding SaO2 level at admission (p=0.982) as well as the time of discharge (p=0.377). For the RR, there is non-

significant difference between groups at admission (p=0.162) as well as the time of discharge (p=0.863). However, there was a statistical significant increase in the mean values of SaO2 and a statistical significant decrease in the mean value of RR measured at discharge when compared with its corresponding value at admission in both groups (p=0.001) as shown in Table (2).

Table 2. Inter-group comparison for discharge weight as well as inter- and intra-group comparison for oxygen saturation level and respiratory rate

		Groups		*P* value
		A (19)	B (18)	
Weight (kg)		2.12±0.40	2.22±0.58	0.540
Oxygen Saturation	Admission	92.36±3.33	92.39±3.66	0.982
	Discharge	97.26±2.23	96.61±2.20	0.377
	P value	0.001*	0.001*	
Respiratory Rate	Admission	68.21±2.15	66.89±3.38	0.162
	Discharge	47.63±7.24	47.28±4.85	0.863
	P value	0.001*	0.001*	

*Significant (P<0.05)

Table 3. Correlation between gestational age and both oxygen days and days in neonatal intensive care unit in both groups

	Group A		Group B	
	r_s	*P value*	r_s	*P value*
Oxygen Days	-0.252	0.297	-0.298	0.230
Days in NICU	-0.520	0.022*	-0.477	0.045*

r_s: Spearman's Correlation.
NICU: Neonatal intensive care unit.
*Significant (P<0.05)

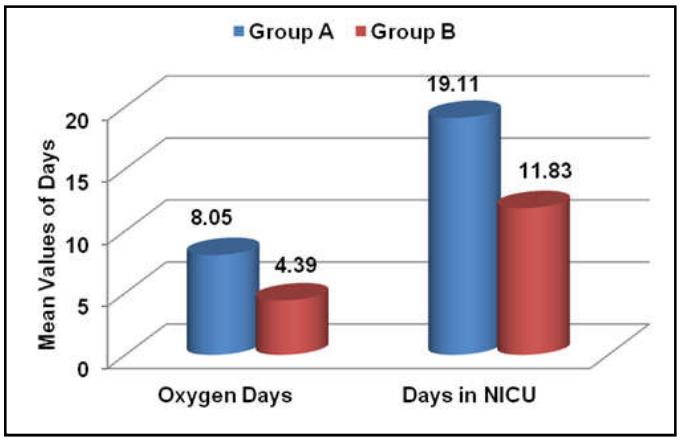

Figure 1. Comparison between mean values of oxygen days as well as days in neonatal intensive care unit (NICU) between groups

The results revealed a statistical significant decrease in the mean value of oxygen days in group B (4.39±2.20] when compared with its corresponding value in group A (8.05±4.43) with p= 0.005.

The results also revealed a statistical significant decrease in the mean value of days in NICU group B (11.83±6.17] when compared with its corresponding value in group A (19.11 ± 9.72) with p= 0.021 as shown in Figure (1). The results revealed non-significant correlation between GA and oxygen days in groups A and B (r_s=-0.252 and -0.298 respectively). On the other hand, there was a negative correlation between GA and days in NICU in groups A and B (r_s=-0.520 and -0.477 respectively) as shown in Table (3).

DISCUSSION

The results of this study revealed a significant improvement on oxygen saturation in both groups with less incubation period for group B who received reflex rolling in addition to cCPT. These results are consistent with previous studies, which indicate that cCPT and reflex rolling significantly improves oxygenation in preterm neonates (Etches and Scott, 1978; Finer and Boyd, 1978; Curran and Kachoyeanos, 1979; Wong and Fok, 2003; Giannantonio *et al*., 2010 and de Abreu *et al*., 2011). In this study, we used percussion with postural drainage and vibration as cCPT intervention. Chest percussions help unstick mucus from the lungs so that it can be coughed out, which improve chest sound (Hill and Webber, 1999). The effects are based on shear thinning of secretions, "squeezing" secretions from distal airways with changes the intrathoracic pressures, formation of central mucus globules that are easier to expectorate, freeing the adhesive secretions from the airway walls (Van der Schans *et al*., 1999). With effective percussion, breath sound improved as secretions move into the larger airways. In a study conducted in preterm neonates with RDS, chest vibrations were administered prior to endotracheal suctioning.

This study suggested that vibrations facilitates to loosen lung secretion and to move them to larger airways, these findings related to improvement in oxygenation (Susan and Hintz, 2004). We used vibration in addition to percussion, which caused thinning and loosening of secretions with further movement of these secretions to the larger airways. A review conducted in order to report different therapeutic techniques used in cCPT (which included active and non-active physiotherapy techniques) in preterm neonates reports similar finding (Ahn, 1988). In our study, we used active cCPT, which included percussion and vibration, which caused bronchial clearance and thus increased SaO2 thereby increasing oxygenation. In this study, we introduced cCPT in addition to reflex rolling thus the improvement seen in RR, may attributed to lung clearance that improved ventilation. This was thereby demonstrated by the positive effect on SaO2 values which were significant and the reduction of duration of both ventilation and hospitalization periods. Improvement in the study group may be explained by the work of Vojta who noticed a global reaction, consisting of rotation of the head with flexion of the lower limbs and rotation of the pelvis, opening of the hands and an increase in depth of costal respiration, with an expansion of the ribcage, initiation of swallowing and increase in the depth of breathing.

These stimulations, especially if repeated, lies in the fact that the afferences due to induced physiologic muscle activity are imprinted in the central nervous system and memorized (Giannantonio *et al*., 2010). These results come in agreement with Mohamed (2014) who stated that the duration of ventilation was less in those who subjected to cCPT. The results also agree with Kole and Metgud (2014) who concluded that reflex rolling is a safe and effective method in improving oxygenation in preterm neonates with respiratory problems and can be applied in clinical settings. They stated that physiotherapy techniques like lung squeezing and reflex rolling are equally effective in improving oxygenation in preterm neonates with respiratory problems. On the other hand, the results of the current study disagree with that mentioned in Royal College of Pediatrics and Child Health (2008) who stated that routine CPT is not recommended in

neonatal RDS. Prolonged mechanical ventilation induces pulmonary inflammation in preterm infants. Lung inflammation plays an important role in pathogenesis of chronic lung disease in preterm infants. Results show a strong correlation between duration of mechanical ventilation and the amount of pro inflammatory mediators, so it is achievement to reduce the duration of exposure to mechanical ventilation (Schultz *et al*., 2005). The incubation period for group B who received reflex rolling in addition to the cCPT was significantly less than that for group A which indicates an additional effect of reflex rolling in improving respiration in patients with RDS. This result comes in agreement with El-Tohamy *et al*., (2015) who reported reduction of hospitalization after cCPT in patients with RDS.

Conclusion

The present study concludes that conventional chest physiotherapy and reflex rolling are safe and effective methods in minimizing days of oxygenation and incubation and in improving oxygenation in preterm neonates with respiratory distress syndrome and can be applied in clinical settings. Reflex rolling is an effective technique in decreasing incubation period in preterm neonates with respiratory distress syndrome.

Future scope

Future clinical research should investigate lung mechanics during application of reflex rolling. Studies should be conducted on preterm neonates with postoperative conditions. Sample size should be larger to gain more accurate results statistically.

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REFERENCES

Ahn, Y. 1988. The effect of chest vibration prior to endotracheal suctioning on oxygenation and the amount of lung secretions in premature infants with respiratory distress syndrome. Korean J Child Health Nurs; 4:245-54.

Beck, S., Wojdyla, D., Say, L., Betran, A.P., Merialdi, M., Requejo, J.H., Rubens, C., Menon, R. and Look, P.V. 2010. The world-wide incidence of preterm birth: a systematic review of maternal mortality and morbidity. Bull World Health Organ; 88: 31-38.

Cho, J.Y., Lee, J., Youn, Y.A., Kim, S.J., Kim, S.Y., and Sung, I.K. 2012. Parental concerns about their premature infants' health after discharge from the neonatal intensive care unit: a questionnaire survey for anticipated guidance in a neonatal follow-up clinic. *Korean J Pediatr;* 55: 272-279.

Curran, C.L. and Kachoyeanos, M.K. 1979. The effects on neonates of two methods of chest physical therapy. MCN *Am J Matern Child Nurs*; 4: 309-313.

Dassios, T. and Hayes, K. 2013. Nutrition in neonates with respiratory disorders. *Curr Nutr Food Sci*; 9:3-9.

de Abreu, L.C., Valenti, V.E., de Oliveira, A.G., Leone, C., Siqueira, A.A.F., Herreiro, D., Wajnsztejn, R., Manhabusque, K.V., Júnior, H.M., Monteiro C.B., Fernandes, L.L., and Saldiva, P.H.N. 2011. Chest associated to motor physiotherapy improves cardiovascular variables in newborns with respiratory distress syndrome. Int Arch Med; 4:37.

El-Tohamy, A.M., Darwish, O.S. and Salem, E.S. 2015. Efficacy of selected chest physical therapy on neonates with respiratory distress syndrome. Life Sci; 12: 133- 138.

Etches, P.C. and Scott, B. 1978. Chest physiotherapy in the newborn: Effect on secretions removed. Pediatrics; 62:713-715.

Finer, N.N. and Boyd, J. 1978. Chest physiotherapy in the neonate: A controlled study. Pediatrics; 61: 282-285.

Furdon, S.A. 2016. Prematurity. Medscape. Available at: http://emedicine.medscape.com/article/975909-overview. [Accessed 9 Dec. 2016].

Giannantonio, C., Papacci, P., Ciarniello, R., Tesfagabir, M.G. Purcaro, V., Cota, F., Semeraro, C.M., Romagnoli, C. 2010. Chest physiotherapy in preterm infants with lung diseases. *Ital J Pediatr*, 36:65-69.

Hawdon, J.M., Beauregard, N., Slattery, J. and Kennedy, G. 2000. Identification of neonates at risk of developing feeding problems in infancy. *Dev Med Child Neurol;* 42: 235-239.

HCUP Cost-to-Charge Ratio Files (CCR), 2013. Healthcare Cost and Utilization Project (HCUP).2001–2009.U.S. Agency for Healthcare Research and Quality, Rockville, MD. Available at http://www.hcupus.ahrq.gov/ db/state/costtocharge.jsp. Updated August 2013. Accessed August 16, 2013.

Hill, S. and Webber, B. 1999. Mucus transport and physiotherapy – A new series. Eur Respir J; 13:949-950.

Kole, J. and Metgud, D. 2014. Effect of lung squeeze technique and reflex rolling on oxygenation in preterm neonates with respiratory problems: A randomized controlled trial. *Indian J Health Sci;* 7:15-21.

Kumar, A. and Bhatnagar, V. 2005. Respiratory distress in neonates. *Indian J Pediatr;* 72:425-428.

Mathai, S.C., Raju, C., and Kanitkar, C.M. 2007. Management of respiratory distress in the newborn. MJAFI; 63: 269-272.

Mohamed, R.A. 2014. Is Chest Physiotherapy Effective For Extremely Preterm Newborns With Respiratory Distress Syndrome? : Randomized Controlled Study. *Indian J Appl Res;* 4: 1-6.

Moor, L. 2000. Disorders of transition. In: A Practical Guide to Paediatric Intensive Care. 2nd ed. United States: Mosby Publishing Company; pp. 498-504.

Petrini, J.R., Dias, T., McCormick, M.C., Massolo, M.L., Green, N.S. and Escobar, G.J. 2009. Increased risk of adverse neurological development for late preterm infants. *J Pediatr.,* 154: 169-176.

Royal Collage of Pediatrics and Child Health), 2008. Guidelines for good practice. Management of neonatal respiratory distress. London.

Rudolph, A.M., Kamei, R.K. and Overby, K.J. 2000. Rudolph's Fundamentals of Pediatrics. 3rd ed. New York: McGraw-Hill Medical.

Schultz, C., Tautz, J., Rciss, I. and Mller, J.C. 2005. Prolonged mechanical ventilation induces pulmonary inflammation preterm infants. *Biol Neonate*; 84: 64-66.

Susan, R. and Hintz, M.D. 2004. Therapeutic techniques chest physiotherapy in the neonates. Neoreviews;5: 534-535.

Tecklin, J.S. 1999. Paediatric Physical Therapy. 3rd ed. Lippincott: Williams & Wilkins.

Unoki, T., Kawasaki, Y., Mizutani, T., Fujino, Y., Yanagisawa, Y., Ishimatsu, S., Tamura, F. and Toyooka, H. 2005. Effects of expiratory rib-cage compression on oxygenation, ventilation, and airway-secretion removal in patients receiving mechanical ventilation. Respir Care; 50: 1430-1437.

Van der Schans CP, Postma DS, Koëter GH, Rubin BK. 1999. Physiotherapy and bronchial mucus transport. *Eur Respir J;* 13: 1477-1486.

Vojta, V. 2011. Internationale Vojta Gesellschaft e V, Reflex Locomotion-The fundamentals of Vojta's therapy. Available at: http://www.vojta.com/en/the-vojta-principle/vojta-therapy.

Wong, I. and Fok, F. 2003. Randomized comparison of two physiotherapy regimens for correcting atelectasis in ventilated pre-term neonates. *Hong Kong Physiother J*; 21: 43-50.

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