Journal homepage: www.ijcbr.com

INTERNATIONAL JOURNAL OF CLINICAL AND BIOMEDICAL RESEARCH

Case series

EFFECTIVENESS OF CHEST PHYSIOTHERAPY IN PRONE POSITION ON RESPIRATORY FUNCTIONS IN VENTILATED NEONATES: A CASE SERIES

DR. ABHIJIT DIWATE[1], DR. SUBHASH KHATRI[2]

ARTICLE INFO

Received: 4th Sep 2016
Revised: 20th Sep 2016
Accepted: 29th Sep 2016

AUTHOR DETAILS

[1]Ph.D. Scholar, [2]Principal & PhD supervisor, APJAK College of Physiotherapy, Pravara Institute of Medical Sciences (DU) , Loni, Maharashtra, India

*Corresponding author: **Dr. Abhijit Diwate,** Ph.D. Scholar, APJAK College of Physiotherapy, Pravara Institute of Medical Sciences, Loni, Maharashtra, India
Email:abhijitdiwate@gmail.com

ABSTRACT

Background: A child's risk of dying is highest in the first 28 days of life (the neonatal period). The central function of Chest physiotherapy in ventilated neonates is to assist in the removal of tracheobronchial secretions, remove airway obstruction, reduce airway resistance, enhance gas exchange, and reduce the work of breathing. Positioning is used with the aim to improve of ventilation/perfusion (V/Q) matching, lung volumes and mucociliary clearance and to reduce the work of breathing (WOB). **Objective:** To find out effectiveness of Chest Physiotherapy in prone Position on Respiratory Functions in Ventilated Neonates. **Method**: 6 ventilated Neonates (n=6) between day 1 – day 28 fitting the inclusion criteria were selected. They received chest physiotherapy in prone position which was given to each participant in for 240 minutes/day in two divided sessions of 120 minutes each with a gap of 6 hours (10am -12 pm & 6pm – 8pm) for consecutive three days. (i.e. six intervention sessions). Primary outcomes were Oxygen saturation (SpO_2), Partial pressure of arterial oxygen (PaO_2) & Peak Inspiratory Pressure (P.I.P.). Outcomes were recorded Pre & Post of Last (6^{th}) 120 minutes session (0 Min & 120 Mins). **Results**: On comparison of three parameters in two groups using paired t test we found that there was significant difference ($p < 0.05$) in SpO_2, PaO_2 and P.I.P at baseline and post intervention. **Conclusion**: The study concluded that chest Physiotherapy combined with prone positioning is a cost effective, non-invasive and affordable intervention which has a significant impact on improvement of SpO_2, PaO_2 and PIP in ventilated neonates. A randomized clinical trial evaluating the efficacy of this intervention seems warranted.

KEYWORDS: Chest Physiotherapy, Positioning, Ventilated neonates, prone position

INTRODUCTION

The term neonatal came from *neo*, "new", and *natal*, "pertaining to birth or origin". The neonatal mortality rate (NMR) is defined as the probability of dying before 28 days per 1,000 live births. A child's risk of dying is highest in the first 28 days of life (the neonatal period). Improving the quality of antenatal care, care at the time of childbirth, and postnatal care for mothers and their newborns are all essential to prevent these deaths. Globally 2.6 million children died in the first month of life in 2016 [1]. There are approximately 7000 newborn deaths every day, amounting to **46%** of all child deaths under the age of 5-years. The largest number of newborn deaths occurred in Southern Asia (39 per cent), followed by sub-Saharan Africa (38 per cent). Five countries accounted for half of all newborn deaths: India, Pakistan, Nigeria, the Democratic Republic of the Congo and Ethiopia [1].

2.6 million Babies die every year in their first month of life and a similar number are stillborn. Within the first month, up to half of all deaths occur within the first 24 hours of life, and 75% occur in the first week. The 48 hours immediately following birth is the most crucial period for newborn survival. This is when the mother and child should receive quality follow up care to prevent and treat illness [2].

Neonatology and NICUs have greatly increased the survival of very low birth-weight and extremely premature infants. Today, because of advanced NICUs

infants of 500 grams at 26 weeks have a fair chance of survival.

The introduction of Mechanical Ventilation in the 1960s was one of the major new interventions in neonatology, which provided lifesaving support for infants with respiratory failure but endotracheal intubation and mechanical ventilation cause trauma and inflammation to the airways and increase secretions in the lungs. These effects may contribute to respiratory complications following cessation of mechanical ventilation and extubation. Postextubation complications range from problematic secretion build up causing discomfort, agitation and distress (necessitating frequent suctioning) to obstruction of major airways with resultant lung collapse [3].

The central function of Chest physiotherapy in paediatric respiratory disease is to assist in the removal of tracheobronchial secretions. The intention is to remove airway obstruction, reduce airway resistance, enhance gas exchange, and reduce the work of breathing. Chest Physiotherapy (CPT) in the preterm infant consists of a variety of techniques that include positioning, active techniques such as percussion and vibration, and suction [4]. Positioning describes the use of body position as a specific treatment technique. Positioning is used with the aim to improve of ventilation/perfusion (V/Q) matching, lung volumes and mucociliary clearance, to reduce the work of breathing (WOB) and the work of the heart [5]. Though there are various studies mentioning effects of positioning on respiratory outcomes in neonates, there was variation in parameters, time duration, sample size, geographical location and intervention technique. Hence, the purpose of this case series study was to exclusively find out the effectiveness of chest physiotherapy along with positioning in ventilated neonates.

MATERIAL AND METHODOLOGY

This Randomized Control Trial (pilot) study tests the effectiveness of chest physiotherapy with prone positioning in ventilated neonates. Ethical approval for the present study was obtained from PIMS (DU), IEC, Loni. Written & recorded informed consent was obtained from the parent or legal guardian of each participant. The study was conducted at APJAK College of Physiotherapy, Pravara Institute of Medical Sciences (DU), Loni and duration was one year. In the present study sample size six neonate.

Inclusion criteria: Six ventilated Neonates (n=6) between day 1 – day 28 and with history of any recent respiratory tract infection, cardio respiratory or disabling musculoskeletal or neurological condition affecting Ventilation & Perfusion were included.

Methodology

The selected patients received chest physiotherapy in prone position. Prone positioning was given to each participant in for 240 minutes/day in two divided sessions of 120 minutes each with a gap of 6 hours (10am -12 pm & 6pm – 8pm) for consecutive three days. (i.e. six intervention sessions). For prone positioning, two small towels were rolled and placed under infants' knees and abdomen to prevent from pressure to knees and chest. In this position, elbows were flexed and arms were placed along sides of the body, while hands were placed at the two sides of the head which was rotated/placed towards ventilator tubes [6]. A conventional chest physiotherapy session included percussion (including cupping with face mask, contact heel percussion and finger percussion) & vibration (with fingers). Only 5 participants completed the study protocol.

Outcome Measures: Primary outcomes were Oxygen saturation (SpO_2), Partial pressure of arterial oxygen (PaO_2) & Peak Inspiratory Pressure (P.I.P.).Final outcomes were recorded Pre & Post 120 minutes Intervention session of 3rd Day.(Pre & Post 6th Session) (0 Min & 120 Mins).

Statistical analysis: Current case series study was done by using SPSS version 23 (IBM). The SpO_2, PaO_2 and P.I.P. values measured Pre & Post Intervention on the 3rd day (at the end of 6th Session) were shown as Mean ± SD and the changes at 0 Min (Pre Intervention) were compared with 120 Mins (Post Intervention) by paired t test. 'p' value less than 0.05 was considered as significant.

RESULT

Table 1: Pre & Post Intervention Comparison of SpO2, PaO2 and PIP levels at the end of 3rd day.

Outcome measures	Mean ± S.D.		't' Value	'p' Value
	Pre Intervention (0 Mins)	Post Intervention (120 Mins)		
SpO_2 (%)	84.20 ± 2.59	96.20 ± 0.84	10.95	0.0004
PaO_2(%)	46.80 ± 4.60	59 ± 4.69	15.25	0.0001
P.I.P (cmH_20)	19.40 ± 1.16	14.60 ± 1.14	8.232	0.0012

On analysis using paired't' test there was significant difference (p <0.05) in SpO2, PaO2 and P.I.P. when baseline values compared with post intervention values.

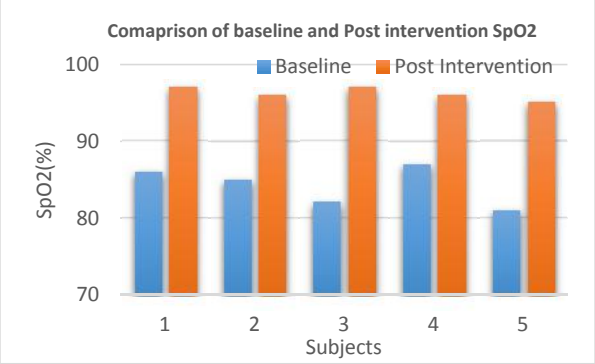

Fig 1: Comparison of Spo2 (%) at Baseline and post intervention

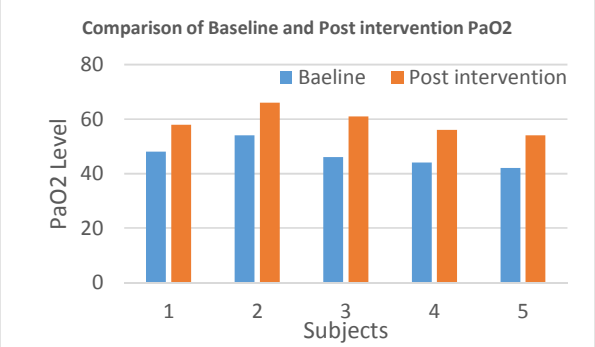

Fig 2: Comparison of PaO2 (%) at Baseline and post intervention

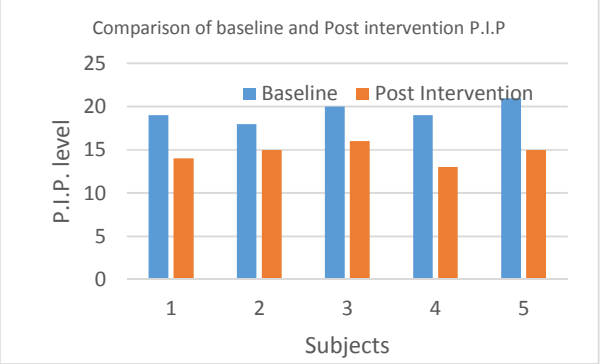

Fig 3: Comparison of P.I.P. at Baseline and post intervention

DISCUSSION

The purpose of this case series study was to exclusively find out the effectiveness of chest physiotherapy along with positioning in ventilated neonates. Although a cause-and- effect relationship cannot be inferred from a case series, our results suggest that this particular treatment approach may be beneficial in improving the outcomes in ventilated neonates.

On analysis we found that there was significant improvement in SpO2, PaO2 and P.I.P. when baseline values compared with post intervention values.

Balaguer et al in an systematic review study regarding the effect of positioning on amount of SpO_2, showed that prone position increased SpO_2level in the range between 1.18 to 4.36% during the intervention (prone position) [7].

The reason of increasing SpO_2 in prone position can be due to, the connection of hand-mouth and semi-embryonic flexion occur better than any other position and this can lead to good sleep as well as less consumption of oxygen compared to any other position. The study by Chang showed that positioning infants in prone position reduces their activities and led to better oxygenation and decreased the number of SpO_2 attacks reduced as compared to supine position [8, 9].

Chest physiotherapy which included techniques like percussion and vibration, were used along with positioning. As per the survey article by Tejas Chokshi et al, percussion is used to augment mobilization of secretions by mechanically dislodging viscous or adherent mucus from the airway [10, 11]. This survey showed that 74% of respondents used percussion as a chest physiotherapy treatment of choice in neonates. A similar study on adult ICUs in India showed that the response rate for percussion was 93.6% whereas it was 98% in Europe and 79% in Australia [12]. Vibration is used in conjunction with percussion to help move secretions to the larger airway.[11] According to this survey, 75% of respondents used vibration for neonates.

These findings could be explained by Hough et al [13] who stated that, Chest Physiotherapy results in lung mechanical effects, further optimizing the respiratory function in order to facilitate effective gas exchange and adjust ventilation-perfusion adequacy of

respiratory support, to prevent and treat pulmonary complications, to provide good maintenance of airways and to facilitate weaning from mechanical ventilation and oxygen therapy.

Limitations of this report are inherent to its case series design. Without a comparison group, we cannot determine if similar improvements would have occurred had these patients received a different treatment approach or no treatment at all. A randomized clinical trial evaluating the efficacy of this intervention seems warranted.

CONCLUSION

The study concluded that chest Physiotherapy combined with prone positioning is a cost effective, non-invasive and affordable intervention which has a significant impact on improvement of SpO_2, PaO_2 and PIP in ventilated neonates.

Acknowledgment

The authors express sincere thanks to the Management of PIMS (DU), Loni

Conflict of Interest: None

Funding: None

REFERENCES

1. Registrar General of India. Sample registration system (SRS) statistical report 2013. New Delhi: 2013.
2. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE et al. Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet 2015;385(9966): 430–440.
3. Avery GB, MacDonald MG, Seshia MK, Mullett MD. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2005. Avery's neonatology: pathophysiology & management of the newborn
4. Principi N, Esposito S. Management of severe community-acquired pneumonia of children in developing and developed countries. Thorax. 2011;66(9):815–822.
5. Fox MD, Molesky MG. The effects of prone and supine positioning on arterial oxygen pressure. Neonatal Network.1990;8(4):25-29.
6. Abdeyazdan, Z., Nematollahi, M., Ghazavi, Z., & Mohhamadizadeh, M. (2010). The effects of supine and prone positions on oxygenation in premature infants undergoing mechanical ventilation. *Iranian Journal of Nursing and Midwifery Research*, *15*(4), 229–233.
7. Balaguer A, Escribano J, Roque M. Infant position in neonates receiving mechanical ventilation. Cochrane Database Syst Rev. 2006;18(4): CD003668.
8. Chang YJ, Anderson GC, Dowling D, Lin CH. Decreased activity and oxygen desaturation in prone ventilated preterm infants during the first postnatal week. Heart Lung. 2002;31(1):34–42.
9. Chang YJ, Anderson GC, Lin CH. Effects of prone and supine positions on sleep state and stress responses in mechanically ventilated preterm infants during the first postnatal week. J Adv Nurs. 2002;40(2):161–9.
10. Chokshi T, Alaparthi GK, Krishnan S, Vaishali K, Zulfeequer CP. Practice patterns of physiotherapists in neonatal intensive care units: A national survey. Indian J Crit Care Med. 2013;17(6):359-66.
11. Kisner C, Colby LA. Management of pulmonary conditions. Therapeutic exercise foundation and techniques. 5th ed. Philadephia: Jaypee Brothers; 2007; 851–82.
12. Jingar A, Alaparthi GK, Vaishali K, Krishnan S, Zulfeequer, Unnikrishnan B. Clinical practices adopted by physiotherapists in India for chronic obstructive pulmonary disease: A national survey. Lung India. 2013;30:131–8.
13. Hough JL, Flenady V, Johnston L, Woodgate PG. Chest physiotherapy for reducing respiratory morbidity in infants requiring ventilatory support. Cochrane Database Syst Rev. 2008;(3):CD006445.