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RESEARCH ARTICLE

IMMEDIATE EFFECT OF CHEST PHYSIOTHERAPY ON LEVEL OF OXYGEN SATURATION (%SPO_2), RESPIRATORY RATE AND SILVERMAN SCORING SYSTEM IN NEONATES WITH RESPIRATORY PROBLEMS

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ABSTRACT

Objective: This article aims at making Chest physiotherapy (CPT) simple, so that it could be incorporated as a routine intensive care procedure in neonates with respiratory problem for managing respiratory ailments.

Introduction: Respiratory problems occur in 4 to 6% of neonates. CPT in the neonatal intensive care unit is associated with taking care of the neonatal lungs. CPT such as percussion, tapping or vibrating on the chest has been used to clear the secretions from the baby's lungs. Respiratory distress is one of the commonest disorders encountered within first 42-78 hours of life.

Study design: Experimental study

Sampling Method: Randomized sampling

Methodology: Single session study was done on 50 neonates with respiratory problems like Infant Respiratory Distress Syndrome (IRDS), Severe Birth Asphyxia (SBA), Meconium Aspiration Syndrome (MAS), congenital pneumonia. The contra indications to active CPT were ruled out before starting the intervention. The outcome measures were SPO2, RR, and Silverman score. Pre intervention outcome measures were taken after that intervention in form of active CPT was given and then suction was done. Immediately after the intervention again the outcome measures were recorded. The data was collected and analyzed.

Results: Z test was done to compare the values of SPO2, RR, and Silverman score pre and post CPT in 50 neonates. It signifies that the p value of pre and post physiotherapy Spo2 is significant and it suggests that there is improvement in oxygen saturation after giving chest physiotherapy, and the p value of pre and post physiotherapy RR and Silverman score is significant which suggests that there is decrease in the respiratory distress after giving chest physiotherapy.

Conclusion: This study suggests that introduction of CPT as an adjunct with ongoing medical treatment improves the oxygen saturation and reduces the signs of distress in neonates suffering from respiratory problems.

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INTRODUCTION

A neonate is an infant in the first 28 days of life (Neonate, 2007). Over the last decade physiotherapy has become an acknowledged and often integral part of the management of newborn infants in Neonatal Intensive Care units (NICU) around the world (Dulock, 1991). Respiratory problems occur in 4 to 6% of neonates and account for significant mortality in the neonatal period (Banerjee *et al.,* 1971). Chest physiotherapy (CPT) (tapping or vibrating on the chest) has been used to clear the secretions from the baby's lungs. CPT is thought to facilitate the drainage and clearance of these secretions (Finer *et al.,* 1998). Respiratory distress is one of the commonest disorders encountered within first 42-78 hours of life. It occurs in about 0.96to 12% of live births and is responsible for about 20% of neonatal mortality (Khatua *et al.,* 1979). The role of chest physiotherapy in NICU has historically been mainly associated with the care of the neonate's lungs (Raval *et al.,* 1987). Postural drainage, coupled with percussion, vibrations and suction are all used in the physiotherapy management of neonatal respiratory disorders (Nicolina Bertone, 1988). Current study was done to find out the immediate effect of chest physiotherapy on level of oxygen saturation, respiratory rate and Silverman scoring system of

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neonates with respiratory problems. The common respiratory problems encountered in neonates are Meconium aspiration syndrome (MAS), Birth asphyxia (BA), Infant respiratory distress syndrome (IRDS), congenital pneumonia. Newborns are obligate nose breathers who can almost simultaneously breathe and swallow until two to three months of age (Littman, 1980). A newborn infant's ribs are positioned horizontally, and the intercostals muscles are weak, resulting in a predominantly abdominal (diaphragmatic) pattern of breathing. This difference can lead to an increase in both airway resistance and obstruction (Gerhardt and Bancalari, 1980). The principal of chest physiotherapy is to not adversely impact on the cardio respiratory status. The aims of chest physiotherapy in the newborn infant is to increase the clearance of lung secretions and maintain lung expansion with the potential benefits of

- Reducing need for ventilatory support,
- Improving oxygenation,
- Prevention of endo tracheal tube obstruction, need for endotracheal tube changes and resultant hypoxia, and
- Prevention of extubation failure (Bloomfield *et al.,* 1998).

Chest physiotherapy should be ordered by the attending neonatologist in consultation with the unit physiotherapist and nurse. Usual active physiotherapy includes gentle active vibrations and Suctioning. The duration of CPT as well as number of positions employed will be dependent upon infant's condition and tolerance. This will also depend upon the judgment of the practitioner. Suctioning is performed after the use of active gentle vibrations (Lewis *et al.,* 1992) CPT should be used when secretions are not cleared by suction alone (Oberwaldner, 2000). The side lying position is indicated when coarse crepitations are greatest on one side, or unilateral disease is indicated on Chest X-ray. Only perform side lying if the infant can tolerate it and avoid excessive neck flexion/ extension (Oberwaldner, 2000).

Contra lateral head support should be used. For upper lobe collapse/consolidation, the crib may be tilted to 15-25 degrees head elevation (Frownfelter, 1978). Vibrations are given by the fingers of one hand molded to the shape of the baby's chest wall, with contra-lateral thumb support. Vibrations are at a rapid rate (approximately 120 / minute, with minimal compression pressure), and within the baby's tolerance (Linda, 1981). The physiotherapist's other hand is cupped and supports the baby's head for the duration of treatment. During unilateral vibrations the head should be supported in the physiotherapist palm. Drain only one area per treatment. Suctioning is usually performed after the use of active gentle vibrations or in middle of tapping as required. Chest physiotherapy is used to prevent or reduce the mechanical consequences of obstructing secretions such as hyperinflation, atelectasis, misdistributions of ventilation, ventilation perfusion mismatch and increased work of breathing (Raval *et al.,* 1987). The application of CPT in airway management of adults with various respiratory problems has been shown to improve lung thoracic compliance and cardio respiratory function. However little is known about its effect on neonates (Khatua *et al.,* 1979; Oberwaldner, 2000).

Hypothesis

- H0: There is no statistical significant effect of chest physiotherapy in neonates with respiratory problems.
- H1: There is statistical significant effect of chest physiotherapy in neonates with respiratory problems.

MATERIALS AND METHODS

An experimental single session study was done on randomly selected 50 neonates, both males and females from the NICU of SSG Hospital, Vadodara from December 2012 to February 2013.

Selection criteria were as below:

Inclusion Criteria: Both pre and full term neonates, receiving oxygen at the rate of 3lit/min

Exclusion criteria: Neonates on ventilator, VLBW (<1300gms) and those in whom CPT was contraindicated

Variables

Active chest physiotherapy in form of positioning, percussion, gentle vibrations were given with single hand or fingers according to the area, pre physiotherapy nebulisation (using nebuliser with normal saline) was given and suction (using IFT, Suction apparatus) was done during and after CPT as needed.

Outcome measures

Oxygen saturation SPO_2 (measured using pulse oxymeter), Respiratory rate RR (readings on monitor), Silverman Scoring system (Silverman *et al.,* 1956) (breath sounds/expiratory grunt were heard using stethoscope) were taken after the session.

Study protocol

Study was approved by departmental research committee. Appropriate permission was taken from the hospital authorities. After taking consent from the parent/guardian of the baby the procedure was started. NICU medical management was given to all subjects as per the institutional NICU protocol and additional physiotherapy management was given. Physiotherapy intervention was given in the following order:

Basic details of the baby were taken in the assessment form. The vitals of the patient were taken priorly. There after the child was given nebulisation. Then chest physiotherapy was given which included proper positioning for easy drainage, followed by gentle percussion on the chest, gentle vibrations were given in the expiratory phase usually at every third or fifth expiration because neonates have a higher respiratory rate as compared to adults so vibration at every expiration is not recommended. There after suction was done at last using the suction apparatus suction in between chest PT was also done if needed. At the end of the treatment again the outcome measures were noted. The intervention was stopped if any complications arise. The frequency and rate of CPT was modified according to the condition and tolerance of the neonate.

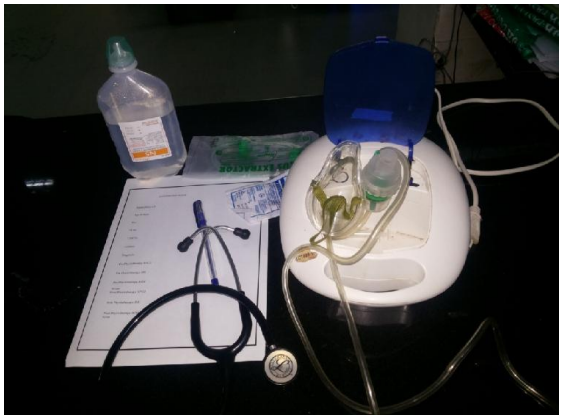

Figure 1. Materials used

Figure 2. NICU Apparatus

Figure 3. Chest PT

Figure 4. Suctioning

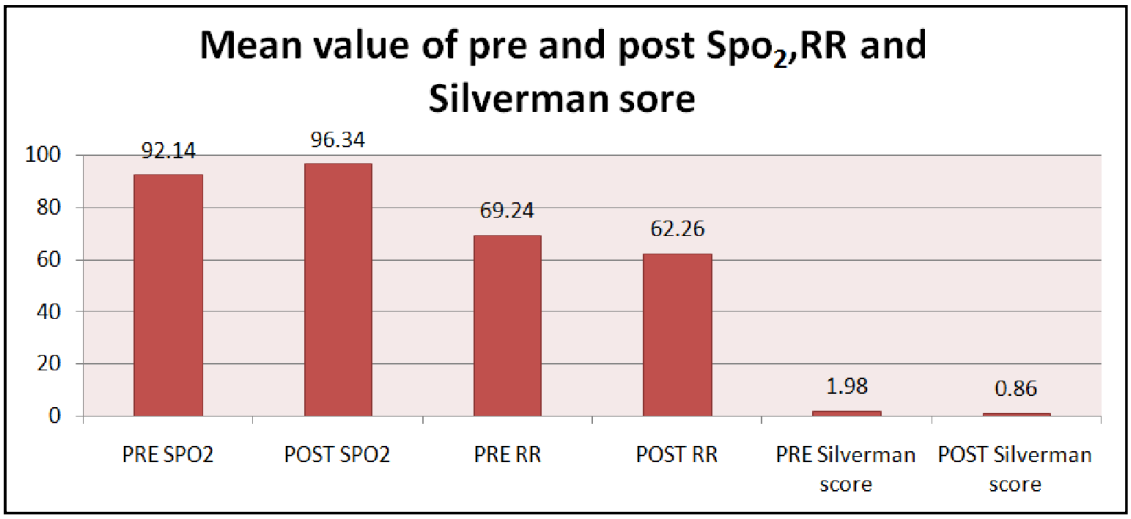

Figure 5. Graph showing mean value of pre and post Spo2, RR and Silverman score

RESULTS

The total numbers of subjects available for study were 50. Before initiating the intervention, subjects were assessed for outcome measures. Data was analyzed by Z test. Observations taken are described in the table and graph below. The table shows mean value of pre SPO2, which is less than the normal mean for SPO2 which is 95-100 (Molteni, 1992). Mean value of RR in my subjects is 69.24 which are more than the normal value of RR which is 40-60 (Molteni, 1992).

Mean Silverman score is 1.98 which is in normal limits (Silverman *et al.,* 1956). The above graph and below table shows that p value of pre and post physiotherapy SPo_2 is 0.00 <0.05, which is significant and it suggests that there is improvement in oxygen saturation after giving chest physiotherapy. The p value of pre and post physiotherapy RR and Silverman score is 0.00 <0.05, which is significant and it suggests that there is decrease in the respiratory rate and Silverman score after giving chest physiotherapy and thus reduction in respiratory distress.

Table 1. Showing Pre SPO2, Pre Respiratory Rate, Pre Silverman Score

N=50

	PRE SPO2	PRE RR	PRE Silverman score
MEAN	92.14	69.24	1.98
SD	2.52	6.76	0.76

Table 2. Showing Mean value of Pre and Post Spo2, RR, Silverman Score and p values

N=50

	Pre SPO_2	Post SPO_2	Pre RR	Post RR	PRE Silverman score	Post Silverman score
MEAN	92.14	96.34	69.24	62.26	1.98	0.86
SD	2.52	2.08	6.76	5.39	0.76	0.53
p- value	0.000		0.000		0.000	

DISCUSSION

The study was an experimental study to find out the immediate effect of chest physiotherapy on level of oxygen saturation (%SPO_2), Respiratory rate and Silverman Scoring system in neonates with respiratory problems. The results show that there is an immediate significant change in the respiratory rate, oxygen saturation, and signs of distress after CPT. The mean of Silverman score pre CPT was 1.98 and post CPT came down to 0.86 which constitutes a clinically significant change indicating that chest physiotherapy is beneficial in reducing respiratory distress. The p value of pre and post physiotherapy Silverman score is 0.00 ($p<0.05$), which is significant and it suggests that there is decrease in the Silverman score after giving chest physiotherapy and thus reduction in respiratory distress. No literature is available showing effects of CPT on the clinical severity of respiratory distress, whereas the current study reveals the effect of chest physiotherapy on Silverman scoring system which has a therapeutic as well as diagnostic significance (Silverman *et al.,* 1956). The mean of SPO_2 pre CPT was 92.14 and post CPT came to 96.34 which is constitutes a clinically significant change. This indicates that chest physiotherapy is effective in improving the level of oxygen saturation. The p value of pre and post physiotherapy SPO_2 is 0.00 ($p<0.05$), which is significant and it suggests that there is improvement in oxygen saturation after giving chest physiotherapy. In other study physiotherapy in the form of postural drainage position alone given, but in current study physiotherapy in the form of position as well as percussion and vibrations was given and their effects were monitored (Kirilloff *et al.,* 1985).

The mean of RR pre CPT was 69.24 and post CPT came down to 62.26 which constitute a clinically significant change. This indicates that chest physiotherapy is beneficial in reducing the rate of respiration. The p value of pre and post physiotherapy RR is 0.00 ($p<0.05$), which is significant and it suggests that there is decrease in the rate of respiration after giving chest physiotherapy. In other study of chest physiotherapy in neonates concluded that CPT can be used to clear the secretions from the baby's lungs and to facilitate the drainage. In present study the effect of CPT in form of vibrations percussions along with suction was done which showed an easy removal of secretions, decrease in need of frequent suction alone as well as reduction in rate of respiration (Finer, 1998). There are documented adverse outcomes of CPT such as hypoxemia, bruising, rib fractures and intracranial lesions such as intra ventricular haemorrhage and porencephalic cysts (Beeby *et al.,* 1998).

In the current study not a single subject experienced any of these adverse effects. CPT can be introduced as treatment part with the ongoing treatment protocol in neonates with respiratory problems in the NICU. The result of this study supports the alternative hypothesis which states that there is statistical significant effect of chest physiotherapy in neonates with respiratory problems.

Conclusion

This study suggests that introduction of CPT as an adjunct with ongoing medical treatment improves the oxygen saturation and reduces the signs of distress in neonates suffering from respiratory problems.

Future Recommendations

Further research can be done monitoring the change in duration of NICU stay along with physiological signs due to regular chest PT. Study can be done on a single respiratory condition in neonates with more number of subjects. Effect of regular 2-4 hourly given chest physiotherapy and its effect on overall outcome of the neonate can be recorded.

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