

Effect of Early Chest Physiotherapy Intervention in Neonatal Respiratory Distress Syndrome with Lung Collapse: A Case Study

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Abstract: Respiratory distress syndrome (RDS) is a common respiratory problem in premature infants due to surfactant deficiency and immature lung development. This case study describes a 27-week premature neonate with pneumonia and right lung collapse who required ventilatory support in the Neonatal Intensive Care Unit. Chest physiotherapy, including percussion, vibration, postural drainage, prone positioning, chest PNF, and suctioning, was administered for four weeks under monitoring. Gradual improvement was observed in oxygen saturation, chest expansion, and breath sounds, and oxygen support was reduced step-by-step. Follow-up chest radiography showed lung re-expansion with reduced opacity. This case suggests that early chest physiotherapy helps improve lung function and reduces ventilator dependency in premature infants with respiratory distress syndrome.

Keywords: Respiratory Distress Syndrome, Chest Physiotherapy, Atelectasis

INTRODUCTION

Over the last decade, physiotherapy has become an acknowledged and often integral part of the management of newborn infants in neonatal intensive care units worldwide. It is a well-established practice to refer sick neonatal for chest physiotherapy treatment with respiratory disease like hyaline membrane disease, meconium aspiration, pneumonia, pneumothorax & surgery involving the thorax or abdomen(1)

Respiratory distress syndrome, also known as hyaline membrane disease, occurs almost exclusively in premature infants. The incidence and severity of respiratory distress syndrome are inversely related to the gestational age of newborn infants⁽²⁾. RDS usually occurs when the lungs of a neonate do not produce sufficient surfactant. This substance, composed of proteins and fats, helps keep the lungs inflated and prevents collapse. A fetus normally begins to

produce surfactant between weeks 24 and 28 of pregnancy, and this procedure is completed at approximately 34 weeks. If an infant is born prematurely, they may not have enough surfactant in their lungs.

According to the American Physical Therapy Association, the physiotherapists' roles and responsibilities in the NICU include the following: screening of neonates to determine referral needs, examining neonates, interpreting findings, developing and implementing intervention plans, minimizing the complications of prematurity, and effective collaboration with families and allied professionals to evaluate management plan efficacy (5)

CASE REPORT

A 27-week premature infant with a birth weight of 940 g was born on August 27, 2022, at NMMC Hospital via LSCS. The head circumference at birth was 25 cm. The Apgar scores were 4/10 at 1 min and 7/10 at 5 min, respectively. Owing to extreme prematurity and low birth weight, the neonate was admitted to the NICU for observation and management of the condition. On the 4th day of life, the baby developed severe respiratory distress and was referred for physiotherapy.

The infant was initially placed on a mechanical ventilator in SIMV mode due to severe respiratory distress. The clinical features included marked tachypnea, nasal flaring, grunting, cyanosis, chest retraction, and reduced air entry on the right side. After 72 h of monitoring, respiratory distress increased, and the infant was diagnosed with pneumonia and right lung collapse. Arterial blood gas analysis revealed hypoxemia, respiratory acidosis, and hypercarbia. Chest auscultation revealed crackles throughout the chest and decreased breath sounds on the right side. Chest radiography on the fourth day showed complete opacity on the right side, suggestive of right lung collapse, and mildly prominent bronchovascular markings on the left.

The infant was then referred for chest physiotherapy.

PHYSIOTHERAPY MANAGEMENT

Chest physiotherapy was initiated after obtaining medical clearance. The treatment program included the following steps.

- Nebulization therapy for secretion loosening

- Chest percussion using gentle finger tapping technique
- Chest vibration during expiration
- Postural drainage positioning
- Prone positioning for lung expansion
- Chest PNF
- Suctioning when required
- Position changes every 2 hours
- Monitoring of oxygen saturation and heart rate

Special precautions were taken because of the extremely low birth weight. Treatment was provided once a day for four weeks, under NICU monitoring. Prone positioning was used for posterior lung expansion, side-lying position for drainage of the affected lung, and head-down modified postural drainage position was used sometimes if the patients tolerated it. Nebulization was administered before physiotherapy to mobilize secretions.

Techniques and outcome measures

Chest physiotherapy was performed using gentle and controlled techniques suitable for premature neonates. Chest percussion was performed using three fingers with the middle finger slightly flexed, tapping rhythmically over the affected side (right lower lobe) at a rate of approximately three taps per second. This method creates a small air cushion between the fingers and chest wall, which reduces the impact while still allowing effective transmission of vibrations to the lung tissue. The mechanical force helps to loosen secretions present in the bronchial tree, and with the help of gravity, these secretions move towards the upper airway for removal.

Chest vibration was applied to assist with further mobilization of the secretions. During vibration, rapid oscillatory movements were transmitted through the chest wall. These vibrations help dislodge mucus from the smaller airways and move it towards the larger bronchi and trachea. A mechanical chest vibrator was carefully used with a neonatal AMBU face mask to ensure safe and appropriate vibration intensity for premature infants.

Chest PNF techniques were used to facilitate better chest expansion and improve respiratory muscle activity in neonates. These techniques enhance ventilation, promote secretion clearance, and support lung re-expansion during recovery from pneumonia and lung collapse.

Previous studies have reported that chest physiotherapy, including PNF techniques, can be safely used in

NICU infants to improve pulmonary function and reduce the duration of ventilatory support

Table 1: Chest Physiotherapy Treatment for 4 weeks

Physiotherapy treatment duration	1st Week	2nd week	3rd week	4th week
O ₂ therapy	SIMV	CPAP → 5L/min O ₂ (Oxygen Hood)	5 L/min O ₂ (OH) → 2 L/min O ₂ (NC)	2 L/min O ₂ → Off O ₂
Oxygen saturation	87% - 89%	88% - 91%	91% - 94%	94% - 98%
Therapeutic positioning (proneposition)	No	✓	✓	✓
Therapeutic Positioning (bilateral)	✓	✓	✓	✓
Chest PNF	✓	✓	✓	✓

The table shows weekly improvement in respiratory status during physiotherapy. In the first week, the baby was on SIMV mode with low oxygen saturation, and bilateral therapeutic positioning with chest PNF was initiated. From the second week, prone positioning and chest physiotherapy were added, and oxygen support was gradually reduced from CPAP to oxygen hood and then to nasal cannula. Oxygen saturation improved weekly with regular treatment. By the fourth week, the baby was off oxygen support, and lung function improved, indicating an effective response to chest physiotherapy and positioning techniques.

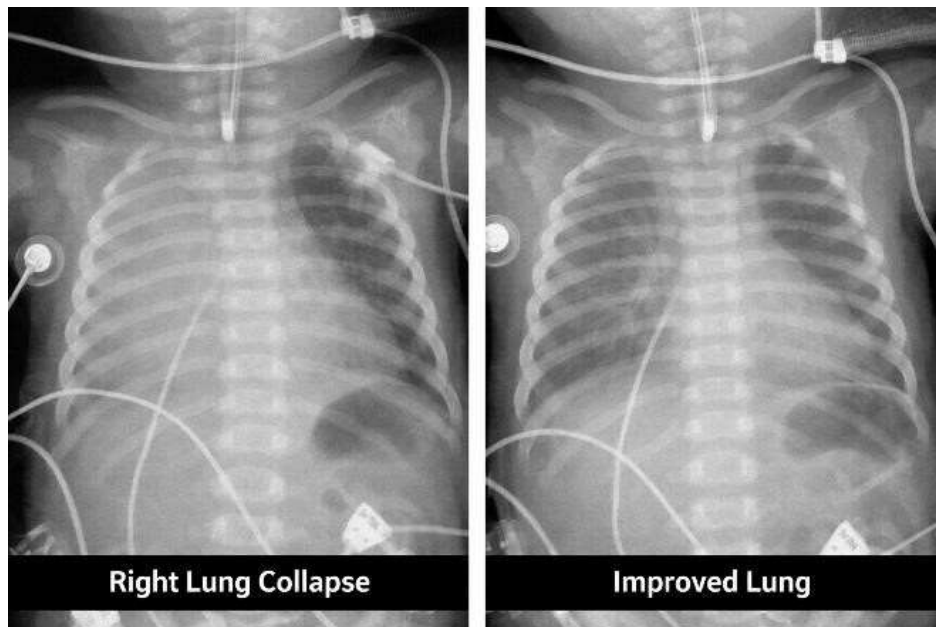


Figure 1: Chest radiograph of 1st day and after four weeks of evidence-based chest physiotherapy demonstrates significant re-expansion of the collapsed right lung with improved aeration and reduction in opacities, indicating marked clinical and radiological improvement.

After one week of regular chest physiotherapy for 1 month, the infant showed gradual clinical improvement. After physiotherapy treatment, respiratory distress was reduced, chest expansion improved, secretions decreased, oxygen saturation improved, and breath sounds on the right side improved. A chest radiograph obtained after one week showed reduced right lobe collapse, no complete opacity, and expansion of the right lung field. The baby-maintained oxygen saturation on room air and showed stable vital signs.

DISCUSSION

Premature infants are at a high risk of respiratory complications due to surfactant deficiency, weak respiratory muscles, and poor airway clearance. Lung collapse and pneumonia further increase the need for ventilatory support in NICU patients. Chest physiotherapy plays an important role in improving ventilation and secretion clearance in neonates with BPD. Techniques such as percussion, vibration, postural drainage, and positioning help in mobilizing secretions and promoting lung re-expansion.⁽⁴⁾

Previous studies in NICU infants have reported that chest physiotherapy combined with proper positioning and suctioning improves oxygenation, reduces duration of mechanical ventilation,

and prevents complications such as atelectasis and pneumonia. In this case, the infant had severe pneumonia with right lung collapse and required ventilatory support. After four weeks of regular physiotherapy including nebulization, prone positioning, percussion, and vibration, there was significant improvement in lung expansion and the infant was successfully weaned off ventilator support. (5)

These findings are consistent with previous research showing that early physiotherapy intervention helps in faster recovery in NICU patients with lung collapse, highlighting the importance of physiotherapy as part of multidisciplinary management in premature infants with respiratory complications. (6)

CONCLUSION

Chest physiotherapy combined with proper positioning, nebulization, and suctioning was effective in improving lung expansion and reducing ventilator dependency in a 27-week premature infant with pneumonia and right-sided lung collapse. Early physiotherapy intervention in the NICU can help achieve faster recovery and better respiratory outcomes in extremely lowbirth-weight infants.

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