Practice patterns of physiotherapists in neonatal intensive care units: A national survey

Tejas Chokshi, Gopala Krishna Alaparthi, Shyam Krishnan, K. Vaishali, C.P. Zulfeequer

Abstract

Objective: To determine practice pattern of physiotherapists in the neonatal intensive care units (ICUs) in India with regards to cardiopulmonary and neuromuscular physiotherapy. Materials and Methods: A cross-sectional survey was conducted across India, in which 285 questionnaires were sent via e-mail to physiotherapists working in neonatal intensive care units. Results: A total of 139 completed questionnaires were returned with a response rate of 48.7%, with a majority of responses from Karnataka, Maharashtra and Gujarat. More than 90% of physiotherapists performed chest physiotherapy in neonatal ICUs. Chest physiotherapy assessment predominantly focused on vital parameter assessment (86%) and in treatment predominantly focused on percussion (74.1%), vibration (75.5%), chest manipulation (73.3%), postural drainage (67.6%) and suction (65.4%). In neuromuscular physiotherapy more than 60% of physiotherapists used positioning, and parent education, whereas more than 45% focused on passive range of motion exercise and therapeutic handling. Conclusion: The practice pattern of physiotherapists for neonates in neonatal intensive care units involves both chest physiotherapy as well neuromuscular physiotherapy. Chest physiotherapy assessment focused mainly on vital parameter assessment (heart rate, respiratory rate and partial pressure of oxygen saturation SpO2). Treatment focused on airway clearance techniques including percussion, vibration, postural drainage and airway suction. In neuromuscular physiotherapy most physiotherapists focused on parent education and passive range of motion exercise, therapeutic handling, as well as positioning.

Keywords: Chest physiotherapy, early intervention, neonatal intensive care unit, neuromuscular physiotherapy, survey

Introduction

A Neonatal Intensive Care Unit (NICU) is a specially equipped nursery where critically ill and unstable infants receive diagnostic, therapeutic and life support care for a wide range of illnesses and conditions. A NICU is for those infants who are preterm, have low birth weight, or perinatal problems, or congenital abnormalities, respiratory disorders, neuromuscular disorders and for those who have undergone thoraco-abdominal surgery.

Physiotherapy is a part of the services delivered by the interdisciplinary team in the NICU. Chest physiotherapy commonly includes techniques like percussion, vibration, positioning for postural drainage and airway suctioning. It may be useful for the maintenance of a clear airway, as also to re-expand collapsed segments of the lungs, maintain adequate levels of oxygenation, facilitate early weaning, and reduce the probabilities of re-intubation.

For neuromuscular dysfunction, common therapeutic strategies for neuromuscular physiotherapy include positioning, skin to skin holding (kangaroo care), therapeutic handling, orofacial stimulation, taping, range of motion exercise, soft tissue mobilization (surgical scar release), hydrotherapy and parent education (feeding, dressing, positioning of infants for sleep, interaction/
These developmental strategies are beneficial for the promotion of posture and movement appropriate to gestational age and medical stability, to modulate sensory stimulation in the infant’s NICU environment, to promote behavioral organization and physiological stability, to foster infant-parent attachment, and to provide direct intervention for neonatal feeding dysfunction and oral motor deficits.\textsuperscript{[9,10,12]}

Previous studies carried out in ICUs did not explore the practice pattern of physiotherapists in neonatal ICUs.\textsuperscript{[13-17]} A study done in India to identify the role of the physiotherapists in ICUs demonstrated that physiotherapists were involved in chest physiotherapy and mobilization, but the role of the physiotherapist specific to a NICU was not clear.\textsuperscript{[14]} There is a scarcity of literature regarding physiotherapy practice patterns in NICUs in India. Therefore, there was a need to identify the current practice patterns of physiotherapists in NICUs. The aim of the study is to determine the practice patterns of physiotherapists in NICUs in India with regard to cardiopulmonary and neuromuscular physiotherapy.

**Material and Methods**

**Content validation**

A total of 10 physiotherapists working in NICUs, experts in the field of neonatal physiotherapy were given the “Practice patterns of physiotherapists in neonatal intensive care units” questionnaire for content validation and accordingly the final questionnaire was prepared [Appendix 1].

The questionnaire consisted of two sections with a total of 29 questions. These covered two primary roles of physiotherapy in a neonatal ICU: Chest and neuromuscular physiotherapy. Chest physiotherapy mainly focused on assessment and treatment whereas neuromuscular physiotherapy primarily focused on treatment. Answers had to fall into the grades: “Always,” “Frequently,” “Sometimes,” “Rarely” or “Never.”

Written approval was obtained from the Institutional Ethics Committee. A cross-sectional survey was conducted across India, in which 285 questionnaires were emailed to physiotherapists working in NICUs. List of hospitals was obtained from the NABH [National Accreditation Board of Hospital and Healthcare Providers] and MCI [Medical Council of India] websites.

**Data analysis**

Responses were numerically coded to allow for descriptive summaries and frequency analyses of the data. Data were analyzed via SPSS Version 17 (SPSS Inc, Chicago, Illinois, USA). Frequency variables regarding chest and neuromuscular physiotherapy were merged in order to create three responses: “always or frequently,” “sometimes” and “rarely or never.”

**Results**

**Response**

A total of 285 questionnaires were e-mailed to physiotherapists across India, with a total of 139 completed questionnaires returned. This made for a response rate of 48.7%. The responses were received from 12 states including Andhra Pradesh, Delhi, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal. The majority of responders were from Karnataka (\(n = 40\) [28.7%]), Maharashtra (\(n = 32\) [23.0%]) and Gujarat (\(n = 28\) [20.1%]) [Figure 1].

**Chest physiotherapy assessment in neonatal intensive care unit**

The frequency with which different chest physiotherapy assessment measures were used in the Neonatal ICU is given in Table 1 and Figure 2. A total of 94.9% responders performed chest physiotherapy in NICUs; of these more than 30% of the responders marked “always or frequently” for chest physiotherapy assessment. This included pre-treatment vital parameter assessment (heart
rate, respiratory rate, and SpO₂ [n = 120 (86.3%)], ventilator parameter setting [n = 9 (6.4%)], post-treatment vital parameter assessment (heart rate, respiratory rate, and SpO₂) [n = 120 (86.3%)], suction during extubation [n = 16 (11.5%)], opinion for weaning [n = 9 (6.4%)], and decision-making in extubation [n = 10 (7.1%)].

**Chest physiotherapy treatment in neonatal intensive care unit**

The frequency with which chest physiotherapy treatment was used in the NICUs is given in Table 2 and Figure 3. More than 50% of physiotherapists marked “always or frequently” for chest physiotherapy treatment. These included percussion [n = 103 (74.1%)], vibration [n = 105 (75.5%)], chest manipulation (percussion + vibration) [n = 102 (73.3%)], postural drainage [n = 94 (67.6%)], head down position during the use of mechanical ventilator [n = 50 (35.9%)], only suctioning [n = 82 (58.%)], chest manipulation followed by suctioning [n = 91 (65.4%)], prone positioning in ventilated neonates [n = 31 (22.3%)], pre-treatment nebulization [n = 48 (34.5%)], artificial manual breathing unit (AMBU) [n = 64 (46.0%)], saline [n = 32 (23.0%)], post-treatment nebulization [n = 22 (15.8%)], and use of mucolytic agent [n = 12 (8.6%)].

**Neuromuscular physiotherapy treatment in neonatal intensive care unit**

The frequency with which neuromuscular physiotherapy was used in the NICUs is given in Table 3 and Figure 4. A total of 80.5% physiotherapists performed neuromuscular physiotherapy in the NICU. Among them, 30% of physiotherapists marked “always or frequently”. These methods included passive range of motion [n = 69 (49.6%)], therapeutic handling [n = 68 (48.9%)], multimodal sensory stimulation [n = 43 (30.9%)], orofacial stimulation [n = 47 (33.8%)], kangaroo care [n = 43 (30.9%)], neonatal massage [n = 20 (14.3%)], taping [n = 11 (7.9%)], scar tissue mobilization [n = 10 (7.1%)], positioning [n = 101 (72.6%)], and parent education [n = 84 (60.4%)]. Hydrotherapy

### Table 2: Chest physiotherapy treatment in a neonatal intensive care unit

| Treatment                              | Always or frequently n (%) | Sometimes n (%) | Rarely or never n (%) |
|----------------------------------------|----------------------------|----------------|-----------------------|
| Percussion                             | 102 (74.1)                 | 28 (20.1)      | 8 (5.7)               |
| Vibration                              | 105 (75.5)                 | 25 (17.9)      | 9 (6.4)               |
| Percussion + vibration                 | 102 (73.3)                 | 28 (20.1)      | 9 (6.4)               |
| Postural drainage                      | 94 (67.6)                  | 33 (23.7)      | 12 (8.6)              |
| Head down postural drainage            | 50 (35.9)                  | 69 (49.6)      | 20 (14.3)             |
| in ventilated neonates                 |                            |                |                       |
| Suction                                | 82 (58.9)                  | 41 (29.5)      | 16 (11.5)             |
| Chest manipulation + suction           | 91 (65.4)                  | 35 (26.1)      | 13 (9.3)              |
| Pre-treatment nebulization             | 48 (34.5)                  | 78 (56.1)      | 13 (9.3)              |
| AMBU                                   | 64 (46.0)                  | 57 (41.0)      | 18 (12.9)             |
| Saline during suction as lavage        | 32 (23.0)                  | 90 (64.7)      | 17 (12.2)             |
| Mucolytic agent                        | 12 (8.6)                   | 102 (73.3)     | 25 (17.9)             |
| Post-treatment nebulization            | 22 (15.8)                  | 98 (70.5)      | 19 (13.6)             |
| Prone in ventilated neonates           | 31 (22.3)                  | 49 (35.2)      | 59 (42.4)             |

AMBU: Artificial manual breathing unit; N: Number; %: Percentage

### Table 3: Neuromuscular physiotherapy treatment in a neonatal intensive care unit

| Neuromuscular physiotherapy | Always or frequently n (%) | Sometimes n (%) | Rarely or never n (%) |
|-----------------------------|-----------------------------|----------------|----------------------|
| Passive range of motion     | 69 (49.6)                   | 33 (23.7)      | 37 (26.6)            |
| Therapeutic handling        | 68 (48.9)                   | 29 (20.8)      | 42 (30.2)            |
| Multimodal sensory stimulation | 43 (30.9)               | 55 (39.5)      | 41 (29.5)            |
| Oro-facial stimulation      | 47 (33.8)                   | 51 (36.7)      | 41 (29.5)            |
| Kangaroo care               | 43 (30.9)                   | 44 (31.6)      | 52 (37.4)            |
| Neonatal massage            | 20 (14.3)                   | 42 (30.2)      | 77 (55.4)            |
| Taping                      | 11 (7.9)                    | 37 (26.6)      | 91 (65.4)            |
| Hydrotherapy                | 0 (0)                       | 5 (3.6)        | 134 (96.4)           |
| Scar tissue mobilization     | 10 (7.1)                    | 49 (35.2)      | 80 (57.5)            |
| Positioning                 | 101 (72.6)                  | 10 (7.1)       | 28 (20.1)            |
| Parent education            | 84 (60.4)                   | 17 (12.2)      | 38 (27.3)            |

AMBU: Artificial manual breathing unit; N: Number; %: Percentage

*Figure 2: Chest physiotherapy assessment in a neonatal intensive care unit.*

*Figure 3: Chest physiotherapy treatment in a neonatal intensive care unit. AMBU-Artificial manual breathing unit.*
Discussion

To the best of our knowledge, this is the first study reporting practice patterns of Indian physiotherapists working in NICUs. According to the results of our survey, both chest and neuromuscular physiotherapy were used by physiotherapists in the treatment of neonates. The novel findings of our study are as follows:

- Chest physiotherapy assessment predominantly focused on vital parameters which includes heart rate, respiratory rate, and SpO2.
- The most common technique used in chest physiotherapy treatment was chest manipulation which involves percussion, vibration, postural drainage and suction.
- For neuromuscular physiotherapy, positioning, parent education, passive range of motion exercise, and therapeutic handling were predominantly used by physiotherapists.

In our survey 86% of physiotherapists noted their patients’ vital parameters pre- and post treatment, in order to determine the patient’s physiological status. An Indian study on physiotherapy practice patterns in adult ICUs showed that the response rate for vital parameter assessment was 98%. This suggests that regular vital parameter monitoring is a standard practice pattern among physiotherapists working in neonatal and adult ICUs in India.

According to our survey, 11.5% of physiotherapists were involved in suction during extubation. Our survey showed that 6% of physiotherapists were involved in ventilator parameter setting, as against 10% in adult ICUs in India and 12% in Europe. Our survey showed that 7% physiotherapists were involved in decision-making during extubation compared to 25% in European ICUs. The current study showed that 6% physiotherapists were involved in weaning patients off the ventilator, compared to 18% for adult ICU patients in India and 22% in Europe.

Our survey indicated that treatment included chest manipulation, postural drainage, and suction. Percussion is used to augment mobilization of secretions by mechanically dislodging viscous or adherent mucus from the airway. It was shown 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. Vibration is used in conjunction with percussion to help move secretions to the larger airway. According to our survey, 75% of respondents used vibration for neonates. For adult ICU patients it was 96.2%, 98% in Europe, and 87% in Australia.

Postural drainage is an intervention for airway clearance by mobilizing secretions in one or more lung segments to the central airways by placing the patient in various positions so that gravity assists in the drainage process. As per our survey 67.3% of physiotherapists working with neonates in an ICU used postural drainage. For physiotherapists working with adult ICU patients, the response rate was 95% in India, and 98% in Europe.

According to our survey 58.9% of the physiotherapists used airway suction for neonates. For adult ICU patients the response rate for airway suction was 94.2% in India, 70% in Europe and 82% in Australia.
Evidence showed that prone position is used to facilitate extremity flexion toward the midline, limit uncontrolled flailing extremity movement, and encourage more stable vital signs.\cite{11} According to our survey, 22.3% of respondents used the prone position in ventilated neonates. As per our survey the manual resuscitation was made use of by 46% physiotherapists for both mobilizing secretion and hyperinflation of lungs during treatment.\cite{10} The importance of nebulization lies in the humidification of inspired gas, the delivery of a medication like bronchodilator or in aiding bronchial hygiene.\cite{20} Our survey showed that 35% of respondents used pre-treatment nebulization and 16% used post-treatment nebulization. In adult ICUs it was 59.3%.\cite{18} Normal saline (0.9% Nacl) was used for lavage during suction by 23.0% physiotherapists whereas a mucolytic agent was used by 8.6% to reduce the thickness or viscosity of bronchial secretion.

Therapeutic handling improves motor development of infants; 48.9% of physiotherapists used therapeutic handling for neonates. Feeding is a functional activity of the highest priority for infants and caregivers and as such is an integral part of neonatal physiotherapy practice. Evidence suggests that orofacial stimulation hastens feeding progression in neonates and decreases the transition time of oral feeding.\cite{9,21} Our survey showed that 33.8% of respondents used orofacial stimulation.

Evidence for multimodal sensory stimulation suggests that sensory stimuli may enhance state regulation, speed transition to full nipple feedings, mitigate stressful environmental stimuli and shorten length of hospital stay, whereas tactile stimulation alone may improve short-term growth and reduce length of stay.\cite{9,21} According to our survey 30.9% of respondents used multimodal sensory stimulation for neonates.

Adjunct interventions like kangaroo care or skin to skin holding showed improvement in physiological stability, fostered infant-parent attachment, and promoted soft flexion of the infant’s arms, legs, trunk, and neck. The immediate benefits for self-regulation may include temperature regulation, improved oxygen saturation, and decreased respiratory rate.\cite{11,22} Kangaroo care was encouraged by 30.9% of physiotherapists, as showed by our survey. Neonatal massage was shown to produce favorable effects to reduce stress levels and improve infant-parent attachment in neonatal ICU environment.\cite{21} There was a 14.3% response rate for using neonatal massage in our survey.

Taping is mainly used to stabilize the joints or to prevent abnormal movements. We found that a very small percentage of physiotherapists (7.9%) used taping in India. Scar tissue mobilization is employed to relieve surgical scars.\cite{8} We found that 7.1% physiotherapists provide scar tissue mobilization to relieve surgical scars. Hydrotherapy with a swaddled infant may be a useful adjunct intervention for facilitating self-regulation.\cite{11} Our survey showed that hydrotherapy is rarely used by Indian physiotherapists in the NICU (n = 5).

The limitations of this study include the possibility that participants responded to the survey questionnaire with perceived ideal answers, thereby giving what they considered to be the best or more appropriate answer to each question. This may not reflect the actual practice patterns of physiotherapists. Future research can be focused on more specific assessment and treatment measures used by physiotherapists in the NICUs and to...
identify factors such as inter-professional needs and type of specialized care that may influence practice patterns.

**Conclusions**

Practice patterns of physiotherapists working in NICUs involve both chest physiotherapy as well neuromuscular physiotherapy. Chest physiotherapy assessment has been found to focus mainly on vital parameters which involves an assessment of heart rate, respiratory rate and SpO₂. Treatment is found to predominantly focus on airway clearance techniques like percussion, vibration, postural drainage and airway suction. For neuromuscular physiotherapy strategies preferred by most physiotherapists were parent education, passive range of motion exercise, therapeutic handling and positioning.

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**Appendix 1**

**Practice pattern of physiotherapist in neonatal intensive care unit questionnaire**

(This questionnaire is designed to provide information about current physiotherapy practice pattern in Neonatal Intensive Care Units in India.)

(Please answer all the sections and mark wherever appropriate)

Role of chest physiotherapy in Neonatal ICU

- Are you performing chest physiotherapy for neonates in neonatal ICU?
  
  Yes □ No □
  
  If yes, please answer the following questions.

  Chest Physiotherapy Assessment in Neonatal ICU

- Do you assess vital parameters (Heart rate, Respiratory rate, SPO₂) pre and post treatment?
• Are you involved in setting ventilator parameters?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Is physiotherapist’s opinion taken before weaning a neonate from the mechanical ventilator?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you perform any of the following roles in extubation?
  i. Suctioning during extubation
     □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never
  ii. Decision-making in extubation
     □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• How often do you use the following chest physiotherapy techniques?
  i. Do you prefer percussion only?
     □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never
  ii. Do you prefer vibration only?
     □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never
  iii. Do you prefer to give percussion and vibration (chest manipulation) both together?
     □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you perform postural drainage position?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you perform head down postural drainage position in ventilated neonates?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you perform suctioning?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you prefer chest manipulation and suctioning together?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you perform prone position in ventilated neonates?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you use AMBU while performing chest physiotherapy and/suctioning?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Is mucolytic agent used by you during treatment?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Is saline used by you during treatment?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you apply nebulizer before the treatment?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you apply nebulizer post treatment?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you perform neuromuscular physiotherapy techniques on neonates in the neonatal ICU, whenever it is required?
  Yes  □  No  □

If yes, please answer the following questions.

• Do you apply/advise positioning for infant in neonatal intensive care unit?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you prefer therapeutic handling in neonatal ICU?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Is multimodal sensory stimulation used in your neonatal ICU setup?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never

• Do you give orofacial stimulation in neonates?
  □ Always  □ Frequently  □ Sometimes  □ Seldom  □ Never
• Do you perform joint mobilization (passive range of motion) exercises?
  □ Always □ Frequently □ Sometimes □ Seldom □ Never

• Do you advice skin to skin holding by parents (kangaroo mother care) for infant?
  □ Always □ Frequently □ Sometimes □ Seldom □ Never

• Are any of these adjunct interventions given by you if they are necessary?
  i. Neonatal massage
     □ Always □ Frequently □ Sometimes □ Seldom □ Never
  ii. Taping
      □ Always □ Frequently □ Sometimes □ Seldom □ Never
  iii. Hydrotherapy
       □ Always □ Frequently □ Sometimes □ Seldom □ Never
  iv. Scar tissue mobilization (surgical scar release)
      □ Always □ Frequently □ Sometimes □ Seldom □ Never

• How often do you give education to parents in neonatal intensive care unit?
  □ Always □ Frequently □ Sometimes □ Seldom □ Never

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