

Chest physiotherapy techniques in neurological intensive care units of India: A survey

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Abstract

Context: Neurological intensive care units (ICUs) are a rapidly developing sub-specialty of neurosciences. Chest physiotherapy techniques are of great value in neurological ICUs in preventing, halting, or reversing the impairments caused due to neurological disorder and ICU stay. However, chest physiotherapy techniques should be modified to a greater extent in the neurological ICU as compared with general ICUs.

Aim: The aim of this study is to obtain data on current chest physiotherapy practices in neurological ICUs of India. **Settings and Design:** A tertiary care hospital in Karnataka, India, and cross-sectional survey. **Subjects and Methods:** A questionnaire was formulated and content validated to assess the current chest physiotherapy practices in neurological ICUs of India. The questionnaire was constructed online and a link was distributed via E-mail to 185 physiotherapists working in neurological ICUs across India. **Statistical Analysis Used:** Descriptive statistics. **Results:** The response rate was 44.3% (n = 82); 31% of the physiotherapists were specialized in cardiorespiratory physiotherapy and 30% were specialized in neurological physiotherapy. Clapping, vibration, postural drainage, aerosol therapy, humidification, and suctioning were used commonly used airway clearance (AC) techniques by the majority of physiotherapists. However, devices for AC techniques such as Flutter; Acapella, and standard positive expiratory pressure devices were used less frequently for AC. Techniques such as autogenic drainage and active cycle of breathing technique are also frequently used when appropriate for the patients. Lung expansion therapy techniques such as breathing exercises, incentive spirometry exercises, and positioning, proprioceptive neuromuscular facilitation of breathing are used by majority of physiotherapists. **Conclusions:** Physiotherapists in this study were using conventional chest physiotherapy techniques more frequently in comparison to the devices available for AC.

Keywords: Cardiorespiratory physiotherapy, critical care units, cross-sectional survey, India, neurological intensive care unit, online survey

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Introduction

Neurological intensive care unit (ICU) is a rapidly developing sub-specialty of neurosciences. Intensive care management includes vigilant nursing care, medical care and physiotherapy, irrespective of their specialty such as neurological ICU, cardiac ICU, or trauma ICU.^[1]

Various cardiorespiratory complications may be encountered in severely head injured patients due to inability to maintain airway, hypoventilation and direct injuries to the chest. Pneumonia can occur in about 60% of the patients with severe head injuries due to prolonged intubations, mechanical ventilation and inability to maintain airway.^[2]

The physiotherapist has an important and a diverse role within the ICU as a member of the multidisciplinary team in managing the cardiorespiratory complications and to maintain the functional abilities.^[3] Chest physiotherapy has conflicting data about its effect on intracranial pressure (ICP) in neurological patients with

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head injury.^[4,5] Mean arterial blood pressure (BP) and central venous pressure should be monitored in order to prevent adverse events such as autonomic dysreflexia or bradycardia in the patients admitted to the neurological ICU. Coughing can further increase the risk of re-bleed in patients with cerebral bleed.^[6] Since there is a risk of ICP elevation and autonomic disturbances, the physiotherapy treatment methods need to be modified in neurological ICU patients.^[4] Furthermore, as the majority of patients admitted in neurological ICUs are unconscious, the routine treatment strategies, which requires patients' volitional effort may fail and alternative therapy strategies need to be adopted for patients in these ICUs.^[1]

There are theoretical reasons for routine physiotherapy in neurological ICU. Routine physiotherapy may help in maintaining the airway, improve ventilation and maintain bronchial hygiene. It is found that during day time; almost 90% of the ICUs had physiotherapists available, whereas during weekends only 66% of the ICUs had physiotherapists in Australian ICUs. It is evident that physiotherapists are employed in the ICUs for routine chest physiotherapy and early mobilization.^[7]

Various factors may influence physiotherapy practices in Indian ICUs, when compared with the ICUs in developed countries such as: (1) Awareness about the technique, (2) availability of the equipment, (3) training or education of the physiotherapist, (4) physiotherapist: Patient ratio, (5) presence of respiratory therapists, (6) cultural differences, (7) attitude of other professionals toward physiotherapy, (8) evidence-based practice considerations, (9) medical management of the patient (such as sedation practices, modes of ventilation favored, inclination for early tracheostomy), (10) open versus closed ICUs, and (11) case-mix of unit.

Variations in the chest physiotherapy practices may also be related to the hospital referral policies and autonomy provided for a physiotherapist. In order to assimilate the current chest physiotherapy practices in neurological ICU, questionnaires and surveys are regarded as better method when the population to be reached is large. Questionnaires can be sent to distant places by E-mailing them to the respondents.

To the best of our knowledge, there are presently no studies that examine the chest physiotherapy practices in neurological ICUs of India. Therefore, we conducted a national level survey of physiotherapists to assess the current chest physiotherapy practices for patients in the neurological ICU and to identify most frequently used chest physiotherapy techniques used in this setting.

The aim of this survey was to assess the current chest physiotherapy practices in neurological ICUs of India.

Subjects and Methods

The cross-sectional study was conducted using a mail survey through a validated questionnaire. The questionnaire was developed following extensive literature review pertaining to the neurological ICU and physiotherapy. Following this, the qualitative content validation of the questionnaire was undertaken. Ten physiotherapists who had completed Masters of Physiotherapy in either neurological physiotherapy or cardiorespiratory physiotherapy were invited to form the panel for qualitative content validation of the questionnaire. Instructions to assess and organize the questionnaire were given along with the drafted questionnaire. Comments and suggestions from all the panelists were reviewed and appropriate modifications were made to improve the quality of the questionnaire draft. The questionnaire contained both multiple choice questions and open-ended questions. Physiotherapists working in neurological ICUs of India were selected by short-listing the hospitals providing super-specialty courses of neurology and neurosurgery (i.e. Doctorate of Medicine neurology and Magister Chirurgiae Neurosurgery under Medical Council of India [MCI] website [www.mciindia.org]) and the hospitals, which have neurological ICU under National Accreditation Board for Hospitals and Healthcare Providers (NABH) website (www.nabh.co/). From the MCI website, 61 hospitals were short-listed after excluding the duplicates; from the NABH website, 91 hospitals were short-listed after excluding the hospitals which do not have neurology or neurosurgery super-specialty. Institutional Ethical Committee Clearance was obtained. Hospital officials were contacted either through E-mail or by telephone to request the E-mail addresses of the physiotherapists working in the neurological ICUs at their facility. Physiotherapists with the following criteria were included in the study: (1) Physiotherapy staff irrespective of qualification working in neurological ICU, and/or (2) postgraduate students who have working experience in the neurological ICU for at least 2 months in a year. The following were excluded: (1) Students of postgraduation with the posting in neurological ICU for a period of <2 months in a year; (2) interns and undergraduate students; and (3) physiotherapists of the hospitals which denied providing the E-mail address of the physiotherapists. After the content validation of the questionnaire, an online questionnaire was constructed. Physiotherapists were requested through E-mail to answer the online questionnaire. Two reminders were sent with an interval of 1 month, and physiotherapists

who did not respond within 1 month after the second reminder were excluded from the survey. The data were entered in SPSS version 16 (SPSS Inc., Released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc.) and descriptive statistics was used to summarize the data.

Results

A total of 152 hospitals were requested to provide E-mail addresses of the physiotherapists working in neurological ICUs of their hospitals, of which 27 hospitals (18%) agreed and replied to the request. In total 185 E-mail addresses were obtained from the hospital officials. Only 82 physiotherapists responded to the questionnaire resulting in a response rate of 44.3%.

Table 1 provides details of the gender, educational qualifications and physiotherapy specialization of the respondents in the study. Respondents median work experience as physiotherapists was 3 years (interquartile range [IQR] 1½ years, 5 years) and median work experience in neurological ICU was 6 months (IQR 3 months, 2 years). Most of the physiotherapists treat about 3-7 patients/day in the neurological ICU. All the respondents were full-time physiotherapists, with 96.3% working in multi-specialty hospitals. The majority of the respondents (65.9%) had their clinical postings in neurological ICU on rotational basis, 12.2% were permanently posted in neurological ICU, and 22% of them visited neurological ICU only upon patient referral. Some of the respondents (40.2%) reported that they work on over-night shifts in neurological ICUs, and 75.6% of them work during weekends and festival holidays. The majority of physiotherapists (73.2%) required neurologists/neurosurgeon's referral to treat the neurological ICU patients, whereas 23.2% treated patients on routine assessment and only 3.7% on anesthetist's/intensivist's referral. Nearly 35% attended routine clinical discussion with medical professionals in neurological ICU, whereas 20% never attend the clinical discussion. The remainder of respondents reported that they attend clinical discussions when they have to discuss a patient (16%), when the patient is referred for physiotherapy (23%), and few attend the clinical discussion if it begins while they are treating the patient in the ward (6%). Team decision was most apparent among physiotherapists (67%) for deciding their treatment plan; however, 20% of them decide on their own and 13% follow physician's instruction.

Intracranial pressure monitoring, when available, was utilized by 34.1% of the respondents; 65.9% of respondents had reported that ICP monitoring was not

available. Jugular bulb oxygen saturation monitoring was appreciated by 26.8% of the respondents. Table 2 provides description about the usage of others parameters that are monitored and investigations looked for in planning the chest physiotherapy.

Chest physiotherapy techniques

Both conventional and adjunct airway clearance (AC) techniques usage are reported by the physiotherapists. Table 3 provides the details of the usage of various chest physiotherapy techniques and their frequency of usage.

Table 1: Gender, educational qualification and physiotherapy specialization of physiotherapists working in neurological ICU

Demographics	%
Gender	
Male	54.9
Educational qualification	
Postgraduate students	51.2
MPT	34.1
BPT	12.2
PhD	2.4
Physiotherapy specialization	
Cardiorespiratory physiotherapy	31.7
Neurological physiotherapy	30.5
Others	25.6
BPT	12.2

MPT: Master of Physiotherapy; BPT: Bachelor of Physiotherapy; PhD: Doctor of Philosophy; ICU: Intensive care unit

Table 2: Monitoring and clinical investigations used by physiotherapists in the neurological ICU as part of their assessment

Monitoring and investigations	Percentage of respondents
Monitoring in neurological ICU	
BP	99
Oxygen saturation	96
Mechanical ventilator parameters	94
Continuous ECG	73
Central venous pressure	57
Clinical investigations in neurological ICU	
Chest X-ray	91.5
Arterial blood gases	91.5
Blood investigations	78
Snapshot 12 lead ECG	68.3

ECG: Electrocardiograph; ICU: Intensive care unit; BP: Blood pressure

Table 3: Airway clearance techniques utilized by physiotherapists in the neurological ICU (%)

Treatment techniques	Always	Most of the times	Sometimes	Never
Clapping	43.9	40.2	15.9	0
Vibration	51.2	35.4	13.4	0
Mechanical vibrator	4.9	19.5	45.1	30.5
Postural drainage	17.1	47.6	32.9	2.4
Humidification	24.4	47.6	17.1	11.0
Aerosol/nebulization therapy	23.2	37.8	28.0	11.0
Suctioning	65.9	26.8	6.1	1.2

ICU: Intensive care unit. Values in percentages

Saline instillation during suctioning is reported by 76.8% of the respondents, whereas 61% have reported to be using distilled water and 78% have reported to be using sodium bicarbonate solution for instillations during suctioning.

Active cycle of breathing technique (ACBT) (92%), forced expiratory technique (90%) and autogenic drainage (80%) are being used more by the physiotherapists compared to standard positive expiratory pressure (PEP) device (45%) and Flutter/Acapella device (35%). Though some techniques are used less frequently and only when appropriate to the patients, the values above mentioned depict the total usage of the techniques by the physiotherapists.

Table 4 provides the insight into the frequency of usage of lung expansion therapy used by physiotherapists. Positioning technique and breathing exercises are frequently used in patients admitted in neurological ICU as reported by the respondents.

Inspiratory muscle training (IMT) was used by nearly 73% of the physiotherapists on patients with respiratory muscle weakness. However, only 12% of the physiotherapists used it more frequently.

Only 25.6% of the physiotherapists were always involved in tracheostomy care and 8.5% of the physiotherapists never provide tracheostomy care. Nearly 61% of the physiotherapists were involved in setting up the initial mechanical ventilator mode and parameters, and 72% of them adjusted mechanical ventilator when appropriate. About 36.6% of the physiotherapists engaged in the extubation procedure through decision-making, performing, or assisting with the procedure.

Discussion

In this cross-sectional survey, it was found that there are diversities in physiotherapy practices within neurological ICUs across different hospitals of India.

Table 4: Lung expansion techniques utilized by physiotherapists in the neurological ICU (%)

Treatment techniques	Always	Most of the times	Sometimes	Never
PNF of respiration	13.4	25.6	47.6	13.4
Breathing exercises	56.1	34.1	8.5	1.2
IS	28.0	46.3	24.4	1.2
Positioning	65.9	29.3	4.9	0
Alveolar recruitment strategies	3.7	14.6	42.7	39.0

ICU: Intensive care unit; PNF: Proprioceptive neuromuscular facilitation; IS: Incentive spirometry. Values in percentage

Diversity in practices has been found in comparison to practices in other countries as reported in previous studies.^[8,9] This diversity can be attributed to differences in physiotherapists' qualification, specialized training, referral system, autonomy, work load, availability of physiotherapists during night and holidays, cooperation of other professionals and availability of the equipment. This study aimed to identify these variations using a cost-effective and easily accessible online survey method. All the physiotherapists have reported to be working as full-time physiotherapists in this study. The surveys conducted by Kumar *et al.*,^[8] and Chaboyer *et al.*,^[7] have reported 79% and 41% physiotherapists delivering on-call physiotherapy services, respectively; but, none of the physiotherapists responded in this study work part-time or on-call. According to this current survey, only 12% of the physiotherapists were permanently working only in the neurological ICU, whereas 66% were posted on a rotational basis from the wards. The results of this survey were consistent with the survey conducted in Indian ICUs, which reported that 78% of the physiotherapists had their postings on a rotational basis rather than on permanent basis.^[8] The survey conducted by Norrenberg and Vincent in European ICUs also reported that one in four ICUs did not have full-time physiotherapists.^[10]

It was found that workload of each physiotherapist in neurological ICU is around 3-7 patients/day. However, Indian guidelines on ICU design only specifies the need for physiotherapists in ICU, but does not specify the number of physiotherapists required per ICU, or recommended ratio of beds covered per therapist. If specifications had been given, it would have been possible to assess if physiotherapists can work efficiently with this workload.

Although there may be theoretical reasons for the provision of routine physiotherapy, not all the patients in the neurological ICU are routinely assessed and managed by physiotherapists.^[9] Most of the physiotherapists (73%) required a formal reference by neurologist or neurosurgeon for the management of patients in neurological ICU. This observation is consistent with the studies, typical of those conducted in the area of ICU.^[8,11] The majority of physiotherapists (67%) decided the treatment as a team. Although, it is not studied as to which type of decision-making is superior to other, the process of decision-making varies according to the autonomy of the physiotherapists and hospital policies.^[10] Discussion with the medical professional during clinical rounds is an essential part in the holistic management of the patient. It also helps to plan

treatment and take precautionary measures if required. Surprisingly, only 35% of respondents attended routine clinical rounds.

Cardiopulmonary resuscitation (CPR) training is essential for all the personnel working in ICU environment, but only 60% of the respondents are trained to provide CPR. Only 15% of the physiotherapists were certified as CPR provider. Interestingly 30% of the physiotherapists were involved in the process of intubation either by performing the procedure or by assisting during intubation. According to the results of the survey, irrespective of CPR certification, most of the physiotherapists in Indian neurological ICUs provide valuable assistance at the time of crisis such as cardiac and respiratory arrest.

Intracranial pressure monitoring is one of the important monitoring elements in neurological critical care during physiotherapy. Only 34% all the respondents have reported to utilize ICP monitoring in planning the treatment. Jugular venous oxygen saturation (SjO_2) can provide valuable information about the metabolic needs of the brain and can aid as a valuable measure when ICP monitoring is not available.^[12] However, only 27% of the respondents were aware of SjO_2 monitoring. The poor awareness can be attributed to lesser usage of SjO_2 monitoring due to risks associated with it and its invasive nature.^[12]

From this survey, it was evident that majority of the physiotherapists monitor BP, oxygen saturation, mechanical ventilator parameters, and continuous electrocardiograph (ECG) during physiotherapy. However, these monitored parameters are not universally utilized by the physiotherapists all of the time. This possibly can be attributed increased workload, unavailability of the equipment or lack of training. Although physiotherapy is safe in ICU, due to unstable hemodynamics and increased metabolic demands during multimodal physiotherapy (exercise like response), it is safe to monitor the patient continuously in order to prevent adverse events. BP should be carefully monitored in these patients because change in BP can alter the cerebral perfusion pressure.^[5]

Chest X-ray resolution and improvements in arterial blood gas analysis (ABG) are the mainstay clinical methods to assess the effectiveness of multimodal chest physiotherapy.^[13] From current survey results, it was found that the majority of the physiotherapists (91%) interpreted X-ray and ABG results in planning and assessing the improvements

following treatment. Blood investigations such as coagulation status, total leukocyte count, erythrocyte sedimentation rate, and hemoglobin levels provide valuable information for the physiotherapist in planning the treatment, and help in implementing precautionary measures. In the present survey, many physiotherapists planned the treatment of their patients by examining the blood investigations (78%) and Snapshot 12 lead ECG reports (68%).

Conventional chest physiotherapy techniques are routinely practiced in ICU,^[7] a finding affirmed with the results of this current survey. Nearly 98% of the respondents reported that they provide postural drainage to the patients in the neurological ICU. However, this survey did not assess the details of modifications made in the postural drainage positions for neurological patients. Although the provision of chest physiotherapy and suctioning is often shared with other professionals such as nursing staff;^[7] from this study, it is evident that nearly 99% of the physiotherapists were involved in suctioning procedure. Tracheostomy care is crucial part of bronchial hygiene therapy.^[14] This study revealed that the majority of the physiotherapists provided tracheostomy care for the patients in the neurological ICU. This survey revealed that most of the physiotherapists practiced ACBT and autogenic drainage technique. However, the results should be interpreted with caution as these techniques cannot be easily administered in head injured or in patients with altered sensorium.

According to a survey conducted in the United States of America, the frequency of the delivery of physiotherapy varied according to the hospitals and the specific clinical scenario.^[11] From current survey results, chest physiotherapy was provided either every 2-4 h or 4-6 h by most of the physiotherapists.

All physiotherapy techniques may not be appropriate for all the patients in the neurological ICU due to altered sensorium. However, few patients who are conscious may benefit from the adjunctive physiotherapy techniques which require cooperation. From this survey, use of devices for AC such as Acapella/Flutter device and PEP were reported by about 35-45% of the physiotherapists for suitable patients.

Although the mechanism of therapeutic positioning is different for various conditions, a goal may be to improve oxygenation.^[15] In this study, most of the physiotherapists had reported using therapeutic positioning as a part of lung expansion therapy. In patients who are unable to obey commands,

proprioceptive neuromuscular facilitation (PNF) techniques may be of value in increasing air entry and help propel the secretions toward trachea.^[4] According to this survey, nearly 85% of physiotherapists practiced PNF techniques in neurological ICU patients for lung expansion therapy when appropriate.

Adjuncts like IMT may have a beneficial role in patients with neuromuscular diseases, muscular dystrophy and tetraplegics. Improving the muscle strength and endurance by IMT may be beneficial in weaning the patient from prolonged mechanical ventilation.^[16] By the results of this survey, 14% of the physiotherapists used IMT always when indicated.

As there were poor responses from the hospitals when physiotherapists E-mail identities were requested, the results of the survey cannot be generalized. The technical problems such as E-mail delivering into the spam folder may have added to poor response rate. The target of this project was to establish direct contact with the physiotherapists working in the neurological ICU. As there was no database of physiotherapists working in the neurological ICU available, it was necessary to contact the administrative officials of the hospitals. This might have been the cause for lesser response rate and less number of E-mail address of physiotherapists obtained during the Phase 2 of the survey. The usage of online questionnaire always carries risk of respondent bias. The majority of the questions in the survey were closed-ended. Usage of open-ended questions might have provided additional information about the physiotherapy practices in the neurological ICU.

Future studies can focus on developing the evidences for the present practices in neurological ICU. The questionnaire used in the current survey did not aim at assessing the knowledge of the participant, which can be studied in future.

Conclusion

Physiotherapists in the present survey were using conventional chest physiotherapy techniques compared to the devices for AC.

Appendix

E-appendix of the questionnaire used in the survey can be retrieved from the following link : http://issuu.com/anup_251/docs/questionnaire_manuscript

Apart from physiotherapy techniques, physiotherapists in the present survey were also involved in assisting physicians in intubation, ventilatory management, extubation, and during CPR.

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