Airway clearance techniques: examining the effectiveness of a physiotherapy-led training programme

Neonatal chest physiotherapy, a highly specialised area of respiratory care, can be used to improve ventilation by removing excess tracheobronchial secretions. Nursing staff must be trained and deemed competent before carrying out chest physiotherapy on neonates. The aim of this audit was to evaluate the effectiveness of a newly implemented physiotherapy-led training programme on airway clearance techniques for nursing staff on the neonatal unit.

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Key points

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1. The efficacy of a physiotherapy-led training programme aimed at enhancing knowledge of airway clearance techniques was examined.
2. Results indicated improved knowledge immediately post-training, although knowledge of contraindications to treatment was not maintained at six months.
3. Modifications to the teaching programme will address areas of poor knowledge, both immediately post-teaching and at follow-up.

Introduction

Chest physiotherapy can be used to improve ventilation by removing excess tracheobronchial secretions.[1] In preterm infants, this involves a range of techniques including postural drainage and positioning, and active techniques such as percussion, vibrations and suction.[2]

Neonatal chest physiotherapy is a highly specialised area of respiratory care and is given due importance in a number of national guidelines published over the last five years.[3-5] Detailed understanding of the practice is required in order to apply treatment techniques judiciously and safely to preterm infants, who differ in vulnerability and physiology from their term counterparts,[6] particularly given the potential for chest physiotherapy to be associated with major neurological sequelae.[7,8] Knowledge of potentially unfavourable outcomes is crucial to minimise the risks during treatment. The Cull enquiry,[9] investigating the link between chest physiotherapy and the devastating brain lesion encephaloclastic porencephaly (ECPE), found that staff carrying out airway clearance techniques (ACTs) had received little or no formal training. The report recommended that nursing staff must be trained and deemed competent by qualified experienced physiotherapists before applying respiratory physiotherapy techniques to neonates.

As there is a paucity of high quality evidence for neonatal chest physiotherapy, best practice is based on the applicable body of evidence currently available and peer consensus, with a formal framework document published earlier this year aimed at standardising practice.[6]

Currently there is limited evidence regarding multidisciplinary training within an intensive care environment. The articles found[10-12] related to pharmacological or simulation training.

Background

While the St Thomas' Hospital neonatal unit (NNU) has access to specialist respiratory neonatal physiotherapy input during normal working hours, the unit does not currently have a funded weekend or out of hours service. Patients requiring respiratory physiotherapy during these hours rely on the nursing staff to deliver this specialist treatment.

A high turnover of nursing staff and changes in physiotherapy personnel on the NNU led to difficulties maintaining nursing staff respiratory physiotherapy competencies. It was recognised by both physiotherapy and senior nursing staff that a wide variety of respiratory 'physiotherapy' techniques were being performed by nursing staff, and that practice was not always safe, appropriate or well documented. To address this issue, a physiotherapy-led teaching package for the nursing staff was established. However, the teaching was delivered on an *ad-hoc* basis and, although questionnaires were used in an attempt to capture changes in nursing staff knowledge as a result of training, it was difficult to monitor its effectiveness.

It was recognised that a more formalised training programme was needed, along with formal written guidelines to ensure standardisation of practice for 'airway clearance techniques' applied by nursing staff. Given the potential for high-risk practice associated with poor education to result in patient harm, audit was recognised as essential to the project.[9]

Methodology and data collection

An audit was designed to assess the short- and long-term knowledge retention of the physiotherapy teaching programme. A formalised audit plan was submitted and approved by the local therapies audit committee. Senior medical and nursing staff on the unit approved the plans for training implementation and review of its results.

The audit questionnaire (**FIGURE 1**) was designed by senior nursing and physiotherapy staff based on the NNU. It was piloted on a number of nursing staff and no significant changes were required. The questionnaire sought information about the participants' level of experience, including nursing 'agenda for change (AfC)' banding and number of years of NNU experience, and evaluated knowledge across seven areas of the training session. These included:

- Indications for ACTs
- Techniques for airway clearance
- Identifying patients who would not benefit from ACTs
- Identifying contraindications for ACTs
- Equipment required to perform ACTs safely
- How to assess if ACTs have been effective
- What should be documented following ACTs.

Nursing staff anonymously completed the questionnaire prior to, immediately after, and six to eight months following the physiotherapy teaching programme. The questionnaire took less than ten minutes to complete. Results were anonymised as the purpose of the audit was to evaluate the effectiveness of the teaching, not individual staff performance. Results for each of the seven knowledge-related question sets were analysed in terms of group averages for percentage of correct responses.

The ACT training programme involved a 90-minute training session delivered by two NNU specialist physiotherapists based permanently on the unit and well known to the nursing team. The teaching was part of an established training day for all unit nursing staff and was carried out on the NNU.

1. How long have you been a neonatal nurse?
2. How long have you worked on the neonatal unit at St Thomas' Hospital?
3. What AfC band are you?
4. Day and month of birthday?
5. What is the main area you work in (SCBU/HDU/NICU)?
6. Have you ever used ACTs before? If yes, was it in the neonatal population?
7. List all of the indications for using ACTs?
8. What techniques could you/do you use?
9. What babies might not benefit from ACTs?
10. List the contraindications and precautions that would make it potentially unsafe to carry out ACTs?
11. What equipment do you need to have available or check before carrying out ACTs to ensure safety?
12. How do you know if your ACTs are effective?
13. What do you document about completion of ACTs?
14. If you were asked to carry out ACTs for a baby you are looking after but you did not feel competent to do it, what would you do?

FIGURE 1 Airway clearance techniques (ACTs) questionnaire for nursing staff.

The programme consisted of theory teaching and practical training within a single session. The practical element was influenced by the success of simulation training researched within an intensive care environment.[12] The number, banding and experience of nurses in each training group varied, although all were based on either the neonatal intensive care unit or high dependency unit. The theory teaching on ACTs included a review of research, indications, contraindications, common conditions requiring ACTs, respiratory assessment, treatment techniques and documentation guidelines. The practical teaching session involved three stages:

1. Discussing a clinical scenario.
2. Analysing assessment findings and identifying appropriate treatment techniques.
3. Practising positioning and percussion on a doll and practising the technique of percussion on an air-filled bag with attached manometer to give visual feedback about the levels of pressure being used.

Results

Questionnaire data were available from 39 nurses (**TABLE 1**). Respondents ranged in banding and experience, most (72%) were band 6 staff. Follow-up data were available for 32 (82%) participants. **FIGURE 2** shows the group results.

An improvement was seen in knowledge across all seven categories immediately post-training. The largest improvement was seen in identification of techniques for airway clearance, while the smallest gains related to contraindications and documentation. At six to eight months post-training nursing staff had retained enhanced knowledge across all categories, although scores suggested a relative reduction in knowledge in two categories (including contraindications to treatment). Three areas demonstrated continued gains in knowledge over six to eight months, as assessed by the repeat questionnaire, including identification of appropriate equipment required for ACT treatment, reassessing the patient after treatment and documentation following ACTs.

All but one nurse demonstrated an improvement in knowledge immediately post-training. The results demonstrated a relationship between the number of years respondents had nursed on the NNU and their level of knowledge pre-teaching (ie more experience correlates with a higher score). Interestingly, the data showed that less experienced nurses retained more knowledge immediately post-training than their more experienced counterparts, and this differentiation continued at the six-month reassessment.

Total number of participants	39	
AfC Band 5	5 (13%)	
AfC Band 6	28 (72%)	
AfC Band 7	4 (10%)	
AfC Band 8	2 (5%)	
Years of neonatal nursing experience	Mean: 10 years, range: 0-38 years	
Lost to six month follow-up	7 (18%)	**Reason** Left the hospital: 2 (5%) Maternity leave: 4 (10%) Extended leave: 1 (3%)

TABLE 1 Participants in the ACTs audit questionnaire. Key: AfC = agenda for change.

Discussion

The results from this audit highlight a number of outcomes. A physiotherapy-led training programme improved nursing staff knowledge of ACTs on both a short- and longer-term basis.

All domains of knowledge demonstrated an improvement, with retention or further gains in knowledge seen in five of seven areas. In two areas, there was a relative reduction in the level of retained knowledge, though scores remained above baseline. The subject most commonly recalled was the range of appropriate techniques available to assist in removal of secretions in the neonatal population. This will hopefully increase the successful recognition and treatment of those patients that would benefit from ACTs, who might otherwise have been under-treated. A number of areas demonstrated poorer recall, including knowledge of contraindications for treatment and recognition of patients that would not benefit from treatment. This presents a significant safety concern, as lack of such knowledge may result in patients being inappropriately treated. Further investigation into alternative and effective ways of reinforcing this educational message is necessary.

The audit results demonstrate a substantial improvement in the nurses' knowledge of documentation of ACTs six months after the training session. Prior to initiation of the teaching package there was some discussion as to whether streaming the nurse groups by banding would improve the quality of teaching. The results from this audit suggest universal improvement in knowledge across the bands, indicating the education package was effective in equalising the knowledge base of nursing staff regardless of their experience. The data show that less experienced nurses retained more knowledge than their more experienced counterparts, both immediately and at six months post training. This may be due to less experienced nurses engaging more effectively with training as their baseline knowledge levels were lower.

This audit has shown the importance of evaluating teaching provision. Had the short- and long-term knowledge of nursing staff not been assessed it may have been presumed that the teaching was fully effective. The audit process has highlighted those areas that are sufficiently covered in the current teaching package, and identified areas where knowledge acquisition and recall are less satisfactory, with potential safety implications. This will guide changes to the teaching programme to target these areas with the aim of improving unit quality standards.

Currently there is no published precedent for multidisciplinary training within the neonatal environment and the methods used within this study could be a useful basis to enhance training within this clinical field.

Limitations

It is not possible to ascertain if the data are a true representation of staff knowledge of the training programme undertaken. Anonymous questionnaire submission could reduce respondents' incentive to achieve their full potential. The questionnaires were often not returned at the end of the session but up to two weeks later, which presents the possibility that responses may be influenced by other staff or access to learning resources beyond the training being evaluated. It was also apparent that nursing staff commonly misinterpreted some questions and therefore the answers given may not be a true indicator of their knowledge in that area; some questions may not have been fully answered despite the respondent having the knowledge.

Comparisons with other centres are difficult to make at this stage due to the wide variety of practices of ACTs within UK neonatal units and the differing availability and role of physiotherapy. Fewer than 50% of level 3 units have access to respiratory physiotherapy[13] and even fewer units provide any formal training for nursing staff in carrying out ACTs. Such issues of clinical governance need to be considered by physiotherapists working in these units, although the challenges in providing such educational interventions are acknowledged given the demands on clinical time for both physiotherapists and nursing staff.

Future recommendations

The current training programme involves the nurses attending a scheduled training session annually. By formalising the training as part of the NNU's mandatory training study day, it is hoped that all nursing staff will attend annual respiratory competency training. The teaching programme should be modified to address the areas in which nurses demonstrated poor knowledge, both immediately post teaching and after six months. Formal feedback from nursing staff regarding the training package was not collected, however, in the future collecting this data may provide useful additional information to improve the training programme. It is recognised that more emphasis should be placed on understanding the contra-indications to treatment within the training package, as this was an area with reduced knowledge retention over time. To ensure quality of care, posters are to be put up in each intensive care room as a

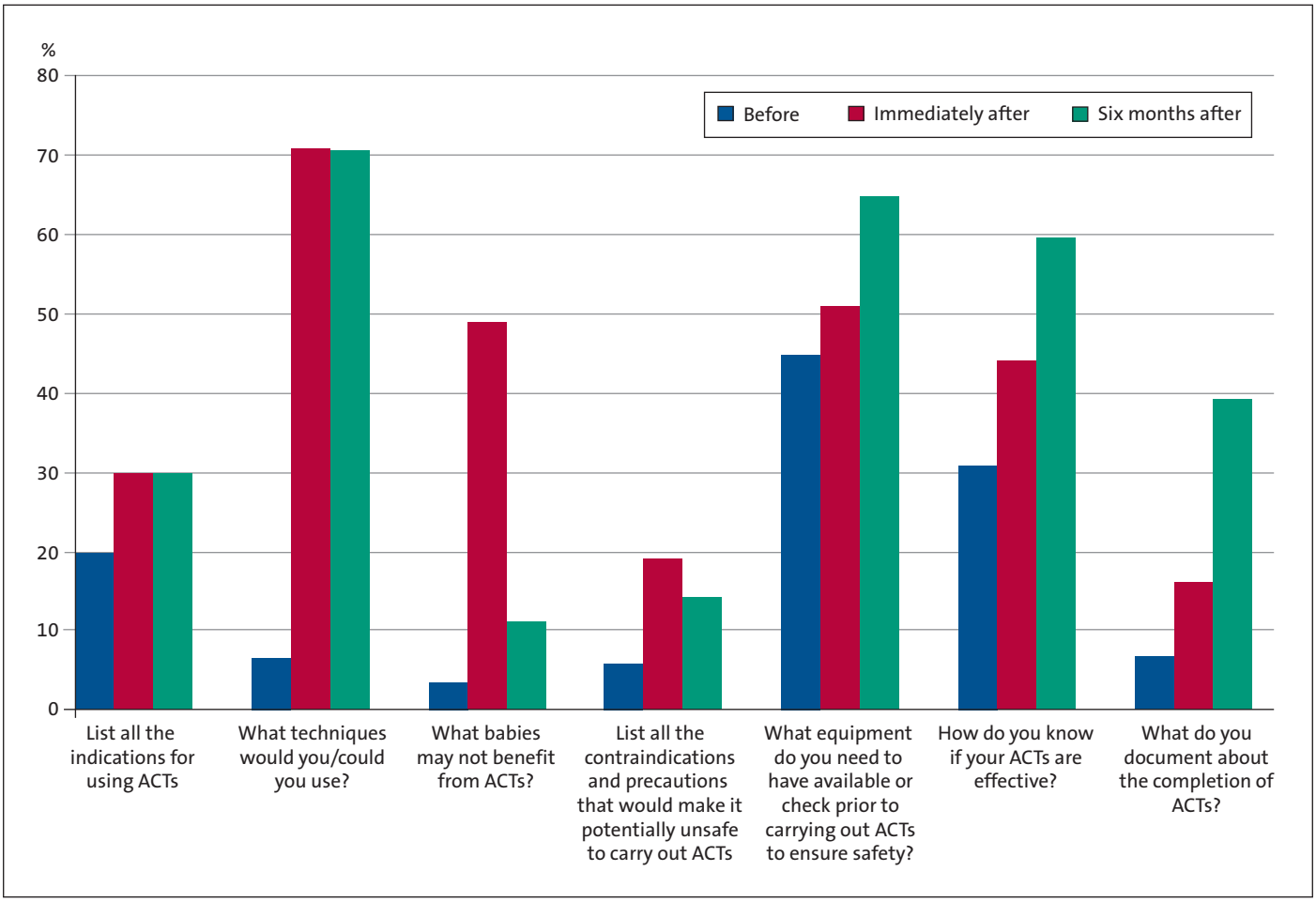

FIGURE 2 The group average percentage of correct answers pre, immediately post and six months after the training session.

reminder of safe practice. The questionnaire format should be changed to ensure the questions are clear to reduce misinterpretation, and with the view to this forming the basis of an individual competency document rather than an anonymous questionnaire. Once all of the above changes are in place, the data collection process will need to be repeated to evaluate the effectiveness of the amended programme.

Conclusion

A physiotherapy-led training programme improved nursing staff knowledge of ACTs on both a short- and longer-term basis. It is recognised that further improvements to this training package could be made through the implementation of an individually completed competency document for each participant.

In view of the potential for adverse effects with inappropriate application of respiratory physiotherapy in the vulnerable neonate, and in the absence of an out of hours respiratory physiotherapy service to the NNU, the authors feel these results show that an educational package such as this is effective and a positive use of time for staff delivering and attending training.

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