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A survey to assess the use of manual hyperinflation by physiotherapists in intensive care units

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Abstract

Objectives: The objectives were to determine whether or not manual hyperinflation (MHT) is used as a treatment technique by physiotherapists on respiratory compromised patients in intensive care units (ICU).

Methods: A questionnaire was developed by according to the available literature on the use of manual hyperinflation by physiotherapists, Physiotherapists who practice cardiopulmonary physiotherapy in ICUs of hospitals in the private sectors in Karachi were identified then targeted for the study. The self-administered questionnaire was then posted and emailed to the physiotherapists identified for inclusion into the study.

Results: A total of 100 questionnaires were distributed among physiotherapists. Of the 100 questionnaires distributed, the response rate for the questionnaires was 80% The results showed 93% physiotherapist use MHT in ICU. Maximum airway pressure used by 78.8% physiotherapist is 20cmH2 O, 80% used manometer, 30% use shaking as combination technique, 76.3% used percussion, 52.5% postural drainage and 48.8% used nebulization, 58.8% give a treatment of MHT for 5 to 10 minutes. An indication of MHT 42.5% physiotherapist gives to increase oxygen saturation, 43% for stimulation of a cough, 63.8% used for secretion dislodge,61.3% used to increase lung compliance and 53.3% used to increase lung volume. There is no physiotherapist who is post graduated in the field of cardiopulmonary rehabilitation.

Conclusion: The survey of 80 physiotherapists, working in ICUs of Karachi, indicated that MHI is a widely used treatment technique. There is a general consensus regarding the benefits, contraindications, and precautions regarding the use of MHI. This has been shown to be in line with current studies conducted in other countries. The survey does show that there is a need for the development of a post-graduation program in cardiopulmonary rehabilitation pertaining to the use of MHT.

Introduction

Manual hyperinflation (MH), which involves lung ventilation using a manual resuscitation bag, is a technique used in mechanically ventilated patients to assist with clearance of pulmonary secretions in addition to endotracheal suction. Although MH is widely used in Australia, the United Kingdom, the Netherland, Brazil and Sri Lanka (and also recommended in reviews by authors from other nationalities, scientific evidence supporting its efficacy on hard clinical outcomes is still lacking. Use of MH has only been associated with short-term improvements in lung compliance, oxygenation and secretion clearance. According to expert recommendation, MH should apply: 1) a larger than normal volume (up to 50% greater than the tidal volume delivered by the ventilator) with a slow inspiratory flow; 2) an inspiratory pause of 1–2 seconds; and 3) high expiratory flow. Effectiveness of MH is usually evaluated by its capacity to generate an expiratory flow bias (i.e., peak expiratory flow [PEF] higher than peak inspiratory flow [PIF]) which is believed to move secretions towards central airways through the two-phase gas liquid transport. The expiratory flow bias is usually described as the ratio (PIF/PEF) or difference between the peak airflows (PEF-PIF). According to experimental studies, a PIF/PEF ratio lower than 0.9 or a PEF-PIF difference higher than 17 L/min is considered critical thresholds for the removal of lung secretions during mechanical ventilation. On the other hand, whenever the PIF exceeds the PEF, above those described thresholds, secretions may migrate deeper into the lungs. More recently, in an experimental study with mechanically ventilated pigs, in the semirecumbent position, a mean PEF-PIF difference of 33.0 ± 7.6 L/min was necessary to promote outward mucus clearance, while a mean PEF-PIF difference of 23.5 ± 8.6 L/min resulted in inward mucus transport. Besides the fact that it was an in vivo experiment, one of the reasons that might explain why the expiratory bias flow threshold was higher than the previous one reported (17 L/min) is that mucus had to be transported against gravity since animals were in the 30-degree head-up position. Clearly the influence of airway flows on mucus movement during mechanical ventilation requires more investigation. The authors explained that MH might have been customized in that way, because the generation of high PIF may stimulate patients' cough, and consequently enhance secretion clearance, or at least enhance physiotherapists' impression that it removes more secretions. However, the consequences might be the application of ineffective maneuvers, with an inspiratory flow bias, especially if the patient has a depressed cough reflex or inability to cough efficiently.

The study comprised two phases in which the displacement of mucus simulant was tracked following the application of MH performed by physiotherapists in order to assist with the removal of pulmonary secretion. Pre-instruction phase was conducted before and post-instruction phase after verbal instructions were given on how to apply MH. In the pre-instruction phase each physiotherapist was asked to perform five sequential MH breaths to assist pulmonary secretion clearance according to his/her usual clinical practice. In the post-instruction phase each physiotherapist was briefly and verbally instructed to perform MH according to expert recommendation. In both study phases before the physiotherapist started the maneuver, 1 mL of mucus simulant was injected into the center of the tubing and was allowed to settle for 3–5 min; thereafter an initial photograph was taken to register the mucus simulant initial position. After five breaths of MH, the maneuver was concluded and another photograph was taken. The photographs were analyzed offline to assess the MH effects on mucus movement. After each MH maneuver, the tube was washed, air-dried, and repositioned on the light box for the next experiment. The lung model was covered to not allow the physiotherapists to visualize mucus simulant displacement.

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