



RESEARCH ARTICLE

Factors Associated with the Peak Flow Variation Generated during Forced Manual Hyperinflation Technique

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Abstract

Background: Manual hyperinflation is one of the most used respiratory physiotherapy techniques in critically ill patients and consists of administering a higher volume of gaseous fluid than the patient performed using a self-inflating balloon (AMBU). This technique was developed with the objective of removing bronchial secretion and re-expansion of atelectasis lung areas, thus improving pulmonary compliance and oxygenation in mechanically ventilated patients.

Objectives: To demonstrate the peak flow variation generated during the physiotherapeutic technique of abrupt manual hyperinflation in an experimental model according to gender and classification among physiotherapists and physiotherapists.

Methods: The analytical and exploratory study included 115 participants, who were instructed to carry out the technique of abrupt manual hyperinflation with the AMBU connected to the device of measuring the peak of three times. Data were analyzed descriptively, according to gender and educational level, Shapiro-Wilk test, t-test and Pearson's correlation coefficient between the mean PEF, height and age variables.

Results: The sample consisted of women (74%) and physiotherapists (75%), with a mean of 22.71 ± 5.75 years of age, 116.74 ± 8.36 cm of height and 322.03 ± 45.78 l/min peak flow. There was a significant difference between the genders for mean PEF ($P = 0.000$), for age ($P = 0.002$) and for height ($P = 0.000$) and between the average PEF ($P = 0.001$) and for the age ($P = 0.000$).

Conclusions: Factors such as male gender, educational level and age were positively influenced by the mean peak expiratory flow generated by the manual hyperinflation technique.

Keywords

Manual hyperinflation, Manual resuscitation, Peak flow

Introduction

Manual hyperinflation is one of the most used chest physiotherapy techniques in critically ill patients and consists of administering a gaseous volume greater than that performed by the patient [1]. It was developed for the possible removal of secretions and re-expansion of areas with atelectasis, thus improving lung compliance and oxygenation in mechanically ventilated patients. Despite being a technique with a lack of scientific evidence confirming its benefit on clinical outcomes, Manual Hyperinflation is widely used in Intensive Care Units (ICU) as a respiratory physiotherapy technique. This technique is widely accepted as effective and it is also widely used to remove retained secretions [2]. It is indicated for patients with accumulation of tracheobronchial secretions, and to increase the pulmonary elastic recoil forces, promoting an improvement in peak expiratory flow and favoring the displacement of accumulated secretion in the airways [3]. It is frequently used by intensive care physicians and physiotherapists when assisting patients in the ICU with the aim of performing passive lung insufflation and increasing the peak expiratory flow and, consequently, improving compliance, increasing the volume of mobilized secretions and preventing pneumonia associated with mechanical ventilation [4].

The sudden manual hyperinflation technique can be performed in several ways, such as: Application of six rhythmic compressions (fragmentation into two brief and quick steps of manual compression) of the manual resuscitator followed by release. The second form consists of manual hyperinflation at times with occlusion of the expiratory valve. It involves manual occlusion of the AMBU exhalation valve, three maximum and slow manual compressions of the resuscitator followed by releasing the exhalation valve. The third form is associated with bronchial hygiene maneuvers such as chest compressions or expiratory vibro-compressions. Regardless of the way in which the technique is performed, what causes the effects is the air flow generated both to expand the lungs and to displace pulmonary secretions, that is, a Peak Flow [5].

The Expiratory Peak Flow (EPF) consists of the maximum flow achieved during an expiration performed with maximum force and starting from a maximum level of pulmonary insufflation. In healthy subjects, EPF depends on the height and anthropometric conditions of the patient, elastic properties of the lung, expiratory muscles, type of resuscitator used and experience of the professional who performs the technique [6]. It can be measured using a peak flow meter. There are specific commercial devices that measure the maximum airflow generated in a spontaneous ventilation cycle. Peak exhaled air flow values depend on the anthropometric conditions of the individuals and basically depend on the condition of the lung parenchyma, height and age [5]. The main objective of measuring the Expiratory Peak Flow serves to assess the degree of bronchial obstruction in various lung diseases, as well as the reversibility of bronchospasm after the use of bronchodilator drugs by systemic pathway [7].

One of the difficulties is to guarantee the flow peak generated during the execution of the techniques due to the anthropometric variation of the professionals who use this therapeutic resource [2]. It is known that the performance/execution of the Manual hyperinflation technique is influenced by several factors, such as the type of manual resuscitator used and the professional experience that performs the technique.

The objective of this study was to investigate the variation in peak flow generated during the physiotherapeutic technique of sudden manual hyperinflation, as well as to write the socio-demographic and anthropometric profile of the study participants and to verify how the socio-demographic and anthropometric conditions of those who perform the Manual hyperinflation technique interferes in Expiratory Peak Flow.

Methodology

This research is an analytical and exploratory study carried out in a Brazilian city located in the central region

of the Country, which is composed of active graduated physiotherapists and undergraduate physiotherapy students. Data collection was carried out between the period from May 1, 2015 to May 31, 2015, consisting of a sample of 115 individuals. It was included 116 Physiotherapy professionals and academics with whom contact was obtained during the data collection period, who agreed with its terms.

A questionnaire prepared by the researchers was used as an instrument for data collection, which included sociodemographic data (gender, age, self-reported height, education) and peak flow measurement. The materials used were: A peak flow meter, model Peak Flow Meter, from Philips Respironics®; a plastic mouthpiece, branded Philips Respironics®; a straight connector 22/22 mm in internal diameter, by Impacto Produtos Médicos® and a manual resuscitator, adult size, by Unitec®.

The researcher filled out the questionnaire, set up the instruments and demonstrated the HH technique in which he suggests that the participant remains in the orthostatic position, with extended upper limbs holding the AMBU with both hands. After resetting the peak flow marker, the researcher asked the participants to perform the movement required to measure the technique three times, and in each execution the measured value was reset and all values generated were recorded in the data collection worksheet by the movement of each participant. The three peak flow measurements were recorded and averaged.

Descriptive analyzes of the data were carried out, according to gender (male and female) and education level (academic and professional). Data normality was checked using the Shapiro-Wilk test. To test the differences between gender and classification, the t test was used. Pearson's correlation coefficient between mean PEF, height and age variables was also analyzed.

This work was approved by the UniRV Research Ethics Committee through opinion number 1.033.547, and all participants consented to participate in the study by signing a free and informed consent form, in compliance with resolution 466/2012.

Results

The data obtained refer to the 115 study participants. According to gender, the sample consisted of 85 women (73.9%) and 30 men (26.1%). According to the classification between Physiotherapy professionals and academics, the sample consisted of 29 (25.2%) physiotherapists and 86 (74.8%) academics from the Faculty of Physiotherapy at UniRV.

The individuals in the study were on average 22.71 + 5.75 years-old, 116.74 + 8.36 cm tall and 322.03 + 45.78 l/min of peak expiratory flow. There was a significant difference between genders for mean PEF ($P = 0.000$),

Age ($P = 0.002$) and height ($P = 0.000$). In all variables, males were superior to females. There was a significant difference between education level for mean PEF ($P = 0.001$) and Age ($P = 0.000$). In both variables, females were lower than males. When analyzing height, no significant difference was found between any of the education levels.

Discussion

The Manual Hyperinflation technique performed with Ambu and its consequences on pulmonary variables were evaluated in several preliminary studies. HH promoted an improvement in static lung compliance and in the elimination of a greater amount of secretion [8]. When analyzing the effect of MH associated with positive end-expiratory pressure PEEP, in patients with atelectasis associated with mechanical ventilation, an increase in lung volumes and static lung compliance was observed [9].

The effects of HH associated with the patient's head tilt were increased, since there was an increase in secretion elimination and PEF measurement [10]. Peak Flow can be variable according to the type of technique used by the professional as well as gender, age, height and classification between academic or physiotherapist [11]. Studies have also shown that smoking was considered a factor that was associated with a reduction in mean PEF values [12].

According to the results presented in this study, there are a greater number of young and female participants. This fact is due to the fact that the academic audience is predominantly people in their first graduation, fresh out of high school and, therefore, young, and also because most Physiotherapy students are women.

Men have longer arms, feet and larger hands than women. Perhaps for this reason, the male participants had a higher peak flow when handling the AMBU, as it had a better grip. The larger hand may allow better coupling of the hands to the AMBU and facilitate manual compression. The same author points out that there is a significant difference in the muscle/fat ratio between men and women. Men have proportionately more muscle and fat. It also states that women can possess approximately up to half the strength of men. Thus, men with greater musculature can justify the fact that male subjects obtained a higher peak flow during the experiment [12].

Men and women differ in body composition and that fat accounts for a greater proportion of body weight in women than in men. The percentage that fat contributes to the body is 13.5% for an adult male and 24.2% for an adult female [13]. An adult, in order to make a certain movement, several combinations of muscle contractions can be used containing characteristics of speed, precision and movement. More experienced operators learn to use a combination of more efficient

muscle contractions and still save energy expenditure. Academics without having this practice can make less harmonic, less precise movements, generating sudden accelerations or decelerations, spending more energy and having less efficiency in the procedure.

The same author states that a novice, performing a task for the first time, will experience more difficulty than an experienced person. The novice may make more clumsy moves and make more mistakes. Regarding the studied sample, only one subject was excluded from the study for not being able to develop the sequence of rhythmic movements required by the technique and guided by the researcher [11]. In a study carried out with a population of candidates for bariatric surgery, it was noticed that male individuals had lower values than predicted, while no significant differences were observed in females [7].

Conclusions

From the analyzes carried out in this study, it can be concluded that male gender, education level and age were factors that positively influenced the mean peak expiratory flow generated by the manual hyperinflation technique.

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