Effectiveness of Manual Hyperinflation Therapy plus Postural Drainage and Suctioning To Prevent Ventilator Associated Complications

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Abstract:

Objectives: Aim of this study is to provide evidence based effectiveness of manual hyperinflation therapy plus postural drainage techniques followed by suctioning to prevent respiratory complications in intubated patients and gives much better prognosis than other techniques used during chest physical therapy.

Methods: It’s an experimental study conducted on 30 patients for 6 months. Two Groups were selected, 15 patients in each group were compared. Group A received manual hyperinflation therapy plus postural drainage followed by suctioning per day 30 min session for 2 weeks, while group B received postural drainage followed by suctioning technique per day 30 min session for 2 weeks. The test was proved statistically by SPSS, applying t – test. (p=.001) With α = 0.05 and degree of freedom= 2.

Results: Fraction of inspired oxygen (FIO2) and oxygen saturation (SPO2) were two variables that studied in this research in both groups showed improvement.

Group A who received manual hyperinflation therapy plus postural drainage and suctioning shows 100% improvement in FIO2, while in group B 6 % of patients shows complete improvement in FIO2 .Improvement in SPO2 was calculated by pulse oximeter in which group A shows that 93 % of patients maintain SPO2 between the 97 %– 100% .SOP2 of group B shows that 60% of patients maintain oxygen saturation between 90%-%96%.

Conclusions: It is concluded that manual hyperinflation therapy along with postural drainage and suctioning is more effective than postural drainage and suctioning alone. Emphasize of this therapy is to maintain oxygen saturation , re-expand collapsed alveoli and initiate cough reflex in intubated patients, and decrease number of days in ICU due to respiratory complications

Keywords: Fraction of inspired oxygen (FIO2), Oxygen Saturation (FIO2), Manual Hyper inflation Therapy (MH)

Introduction:

Pulmonary Physical Therapy was first introduced in Chicago by the combined efforts of a few Oxygen tank technicians and pulmonologists later on their efforts were recognized by Inhalation Therapy Association in 1946. One of the first methods of Pulmonary Physical Therapy was recognized with the name of Deep Breathing Exercises¹. A series of techniques were later on added to the list. Percussion, clapping and vibration were used to help patients in sputum clearance. With the advent of time mechanical breathing devices were introduced like continuous Airway pressure breathing, intermittent positive Airway pressure breathing, Incentive Spirometry and hyperinflation Therapy.

Manual Hyperinflation Therapy came into practice in 1960 .MH Therapy was found effective in Heart rhythm abnormalities, segmental collapsed and Chest
expansion inabilities. The procedure of MH involves the discontinuation of the patient from the ventilator and inflating the lung with Manual Resuscitating Bag followed by mechanical suctioning of sputum using normal saline through tracheostomy tube.

Postural drainage is position that assist gravity to allow secretions to move from more periphery lung’s segments to segmental bronchus and superior airways. 19 lung segments are drained by eleven postural drainage positions but in ventilated patient’s position depend upon the individual patient condition. Transient decrease in oxygen is noticed during postural drainage for few minutes but it returns to base line after some time, FIO2 demand increases with postural drainage so ventilator adjustment is required to meet the increasing demand of FIO2 prior to postural drainage. Duration of postural drainage varies from 15 to 60 min depending on patient tolerance and amount of sputum production, per segment duration is three to fifteen min.

**Methods & Material:**

Experimental (RCT) Study Design was utilized. Study took place in Intensive Care Unit of Fauji Foundation Hospital Rawalpindi. The study took Six Months for completion. The Sample Size of 30 patients was chosen using Simple Random Sampling technique. Based on inclusion criteria, admitted patients in Fauji Foundation Hospital were included in the study between the ages of 15 to 60 years irrespective of gender difference. 15 patients were selected for experimental and 15 for control group missing rate is 0% and control group rate of turnover is also 100% with 0% missing rate. Independent variables of the study were Manual hyperinflation therapy technique and Postural drainage Dependent variables of the study were Oxygen saturation (SPO2) and Fraction of inspired oxygen (FIO2)

**Results:**

Fraction of inspired oxygen for weaning is 0.30L or 30%. For normal healthy person FIO2 is 22% of atmospheric pressure. For normal healthy person SPO2 range from 97% to 100% but oxygen saturation above 90% is also satisfactory without external support and SPO2 below 90% and in some studies below 88% is not considered normal. Normal SPO2 should be around 95-100%. SPO2 is the measure of the percentage of hemoglobin that has already bound with oxygen. A healthy person who does not smoke normally has a 98% SPO2. Devices that are used to detect oxygen ions the blood are called pulse oximeter. After Treatment of 2 Weeks Session on Each Patients Statistics

Comparison of FIO2 of Group A and Group B

All patients treated by manual hyperinflation therapy plus postural drainage and suctioning maintain their level of FIO2 between 30%-35% after 2 weeks session, of each patient daily and these patients are ready for weaning and this will prevent their ventilator induced complications.

![Figure 1: FIO2](image-url)
In figure 1 group B receives only postural drainage and suctioning it shows that only 6% of patients in this group have maintained their FIO2 level of 30% to 35% during 24 hours and ready for trial wean off session and prevent development in pulmonary complications. While 60% of patients shows fluctuation in levels of FIO2 between 40%-50% and FIO2 of 33% patients is not up to the level of trial wean off because they shows variation in the FIO2 reading between 60% to 80% they did not maintaining their level of FIO2 up to 30% for 24 hour and not considered for normal weaning.

In figure 3 group B oxygen saturation is measured by pulse oximeter shows that 60% of patients show improvement in oxygen saturation but not up to 100% while in 40% of patients oxygen saturation is below 90% after 2 weeks therapy session in each patient they still need ventilatory support and respiratory therapy to achieve required level of oxygen saturation.

**Figure 2: SPO2(A)**
In figure 2 group A 93.3% patients maintain their maximum oxygen saturation after 2 weeks session of MH plus postural drainage and suctioning, while 6% patients required external oxygen support to maintain their oxygen saturation level above 90% and up to 96%.

**Figure 3: SPO2(B)**
According to SPO2 group A shows 93% patients maintain their oxygen saturation near to normal after
2 weeks session while in group B 9 patients show improvement in oxygen saturation of up to 90% - 96% oxygen, while 6 patients does not show any improvement at all as their SPO2 range is below than 90% which is non-satisfactory and give poor prognosis about patients improvement

Discussion:
According to the study Ntoumenopoulos G it is explained that two groups received on mechanical ventilator received physical therapy treatment is conducted to decrease incidence of nasocomial pneumonia. After this study it’s proved that frequency of pneumonia is reduced in control group⁶. Berney S and Denehy L study helps to enhance the effect of hyperinflation therapy treatment by improving static pulmonary compliance and clearing pulmonary secretion ⁷
Study of Blattner C proves that Use of hyperinflation therapy with manual resuscitation bag, PEEP and suctioning in experimental group is more effective to maintain lung compliance as compare to control group that received suctioning only. It reduce hospital stay and while post-operative complication are same in both groups.⁸
Lemes DA study proves that in experimental group secretions clearance is more than control group because technique used in experimental group is ventilator induced hyperinflation performed in side lying as compare to position of side lying alone⁹
Choi JS study proves that manual hyperinflation therapy in combination with suctioning draw better results as compare to suctioning alone because value that is calculated from data shows MH with suctioning reduces the incidence of aspiratory pneumonia ¹⁰

According the study of Patman S When MH performed in stable patients it decrease the FIO2 but how much it is effective it’s not clear ¹¹
Nancy D Ciesla proves that Respiratory therapy in intensive care unit detention decrease the pulmonary secretions by increasing the mobility of secretions from bronchi towards trachea this will improve concentration of FIO2 and resolved or prevent atelectasis ¹²
Manzano RM study is basically to assess the effectiveness of manual hyperinflation therapy in reducing development of pneumonia and reduce time of stay in intensive care unit ¹³

Conclusion & Recommendations:
Clinically it is determined that chest physical therapy interventions helped in removing the secretion from the lung , improve the chest expansion, oxygen saturation and reduced the ICU stay of the experimental group. It is indicated that manual hyperinflation therapy has great role to improve SPO2, FIO2 and helps to prevent the development of respiratory complications associated with long term ventilator support. It is expected that this study will have significant role in the field of physical therapy. This study provides evidence based facts about the effectiveness of manual hyperinflation therapy, MH is helpful not only for the respiratory complications but it also maintain heart rate and respiratory rate up to normal level.
This study shows that benefit of manual hyperinflation therapy augment the patient recovery ,but still awareness about the respiratory therapy in Pakistan is not at the satisfactory level, other health professionals have some misconceptions about the respiratory therapy that should be settled by
physiotherapists and other health professional and work in collaboration with each other. A team of pulmonologist, anesthesiologist and physiotherapist is best combination for those patients who are on ventilator support. Nursing staff of intensive care unit have at least basic knowledge of respiratory therapy so they can maintain patient’s vitals between the therapy sessions by regular postural change, suctioning and positioning. There is a need for further well designed clinical trials; more research is needed to establish a uniform method of defining respiratory problems associated with ventilator and developing outcome measures which are valid, reliable, and responsive in affected people.

References:


7. Berney S, Denehy L. 2002; A comparison of the effects of manual and ventilator hyperinflation on static lung compliance and sputum production in intubated and ventilated intensive care patients, Physiotherapy Research International; 7(2):100-108


