

Effectiveness of Manually Assisted Cough Technique on Peak Cough Flow in Patients with Spinal Cord Injury

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ABSTRACT

Background: In patients with 'Spinal Cord Injury' there is weakness in the respiratory and abdominal muscles which results in difficulty in clearing the secretions from chest. Chronic accumulation of Secretions in the lungs, which is seen in patients with higher level injury, increases the possibility of respiratory complications such as pneumonia, atelectasis, and respiratory failure. Manually cough assisted technique is used to improve patients cough strength of clearance of secretions.

Objective: To assess the effect of Manually Assisted Cough Technique on peak cough flow in spinal cord injury patients

Methodology: The study design was Pretest-Posttest experimental study which consist of 10 participants with spinal cord injury were selected by convenient sampling. Manually cough assisted techniques was given for 4 weeks.

Outcome Measure: Peak Cough Flow

Result: Pre-and post-intervention peak cough flow was 214 ± 58.72 L/min and 270 ± 62 L/min. The mean difference of pre and post intervention peak cough flow was 56.00 L/min. Paired t test was used to compare the pre intervention and post intervention peak cough flow values which showed statistically extremely significant difference (<0.0001) in peak cough flow values after four weeks of manually assisted cough techniques

Conclusion: The study concluded that Manually Assisted Cough Technique improves peak cough flow in spinal cord injury patients

Keywords: Spinal Cord Injury, Peak Cough Flow, Manually Assisted Cough Technique.

INTRODUCTION

A spinal cord injury (SCI) is impairment to any part of the spinal cord or nerves extending from the spinal cord that often leads in permanent changes in motor and/or sensory abilities and other body functions below the point of the injury.

The majority of spinal cord injuries are due to preventable causes such as road traffic crashes, falls or violence. Males are most at risk in young adulthood (20-29 years) and older age (70+). Females are most at risk in adolescence (15-19) and older age (60+). Studies report male-to-female ratios of at least 2:1 among adults, sometimes much higher. Spinal cord injury is associated with a risk of developing secondary conditions that can be debilitating and even life-threatening- e.g. deep vein thrombosis, urinary tract infections, muscle spasms, osteoporosis, pressure ulcers, chronic pain, and respiratory complications. Acute care, rehabilitation services and ongoing health maintenance are essential for prevention and management of these conditions. [1,2]

The physical impairments from SCI vary as a function of the level and extensiveness of the injury. Types of Spinal Cord Injuries. These classifications are based on the location of the injury, cause of injury, level of motor impairment, degree of sensory impairment, and muscle strength. Traumatic vs. Non-traumatic SCI A traumatic injury occurs when an outside

force impacts the spinal cord. Traumatic injuries are results of events like motor vehicle accidents, sports accidents, acts of violence, falls, etc. and can cause a contusion or a laceration in the spinal cord.

Non-traumatic injury results from an illness or disease such as Multiple Sclerosis, arthritis, cancer, osteoporosis, etc., as well as from degeneration, inflammation, or abnormal development of the spinal cord. Causes of spinal cord injury Paraplegia and quadriplegia (or Tetraplegia) differ in where the spinal cord is injured and the extremities affected. [3,4]

A spinal cord injury above the first thoracic nerve results in quadriplegia. It means the injury affects the legs and arms and there is some degree of sensory and/or motor loss in all four limbs. This will range from mild loss to a complete loss of sensory and motor function. [5]

The abdomen and chest muscles are affected. If the injury is very high up in the neck it also affects person's ability to breathe on their own, rendering them dependent on a ventilator. Quadriplegia weakens the abdominal muscles and diaphragm making it difficult to cough and clear the chest.

Chronic accumulation of Secretions in the lungs, as it is typically seen in patients with higher level injury, increases the chances of respiratory complications such as pneumonia, atelectasis, and respiratory failure. The air passages can be cleaned by artificial means, such as positioning, suction or manually assisted cough. However, because these methods require assistance, the lungs may not be cleared frequently enough. The inability to cough freely and effectively severely compromises a patient's health. It has been shown that pulmonary complications are related to the level of injury. This suggests that partial control of the muscles necessary for cough, which varies with motor level, proportionately improves a patient's ability to cough volitionally. [6]

Spinal cord injury affects the ability to cough and the effectiveness of mucus

clearance. Peak flow meter is used to assess the ability of coughing is the measurement of Peak Cough Flow (PFC). [7]

Airway clearance technique used are incentive spirometry, balloon blowing exercise, manually assisted cough technique, active cycle of breathing exercise, postural drainage, autogenic drainage, positive expiratory pressure.

Manual cough assisted technique is used to enhance the cough strength, to help with clearance of secretions it can be carried out in a lying, side-lying or sitting positions. Spinal cord injury leads to weakness in the respiratory & abdominal muscles which usually help people to cough. This results in difficulty in clearing secretions from chest.

It is important to clear secretions in order to maintain clear and healthy lungs. By using manually assisted cough technique the risk of repeated chest infections and complications, can be reduced which can improve one's quality of life. [8]

To maximize airway clearance, several techniques can be used to stimulate a stronger cough, make coughing more comfortable or improve the clearance of secretions. Manually Assisted Cough technique can be performed if a patient has abdominal muscle weakness (e.g., as the result of a mid-thoracic or cervical spinal cord injury), manual pressure on the abdominal area assists in developing greater intra-abdominal pressure for a more forceful cough.

Manual pressure for cough assistance can be applied by the therapist or the patient. Therapist-Assisted Techniques with the patient in a supine or semi-reclining position, the therapist places the heel of one hand on the patient's abdomen at the epigastric area just distal to the xiphoid process. The other hand is placed on top of the first, keeping the fingers open or interlocking them. After the patient inhales as deeply as possible, the therapist manually assists the patient as he or she attempts to cough. The abdomen is compressed with an inward and upward force, which pushes the

diaphragm upward to cause a more forceful and effective cough.

Manually assisted cough is a technique using strong arms to assist cough. This may be helpful in a neuromuscular disease or spinal cord injury with weak respiratory and abdominal muscles. [9]

In patients with spinal cord injury as there is weakness in the respiratory and abdominal muscles. Patient is not able to cough effectively and patient is having difficulty in clearing the secretions from lungs. So due to this the peak cough flow is reduced moderately. There is chronic accumulation of cough in spinal cord injury patients which increases the risk for pulmonary complications. The inability to cough voluntarily and effectively severely compromises a patient's health affects the ability to cough and the effectiveness of mucus clearance. Few research suggested that this technique improves the peak cough flow and cough strength in patients with neuromuscular disorders, as there are less literature available on this study, the purpose of the study was to find out effectiveness of manually assisted cough technique.

MATERIALS AND METHODS

The pre-post experimental study was conducted at the Pravara Spinal Cord Injury Rehabilitation Centre & Pravara Rural Hospital, Loni. The study was approved by the institutional ethical committee of Dr.APJ Abdul Kalam College Of Physiotherapy with Ref no. IEC/2019/465, Pravara Institute Of Medical Sciences Loni. Convenient sampling method was used, 10 patients who fulfilled inclusion criteria were included in the study, written informed consent was obtained from the participants for the study, assessment of peak cough was

done with peak flow meter, manually assisted cough technique was performed for all the participants for the duration of 4 weeks. Reassessment of peak cough flow.

INTERVENTION PROTOCOL:

Manually cough assisted techniques:

Patient was in supine or semi reclining position, therapist placed heel of one hand on the patients abdomen at the epigastric area just below the xiphoid process, other hand was placed on top of the first keeping the fingers open or interlocking them, after the patient inhaled as deeply as possible the therapist manually assisted the patient as he /she attempted to cough the abdomen was compressed and an inward and upward force applied which pushed the diaphragm upward to cause a more forceful and effective cough, manually assisted cough technique using strong arms to assist your cough.

PROTOCOL OF INTERVENTION:

10 to 12 repetitions of manually assisted cough technique with rest of 1 minute after 3 to 4 repetitions in a 1 set.

3 sets in one session

2 sessions per day.

STATISTICAL ANALYSIS

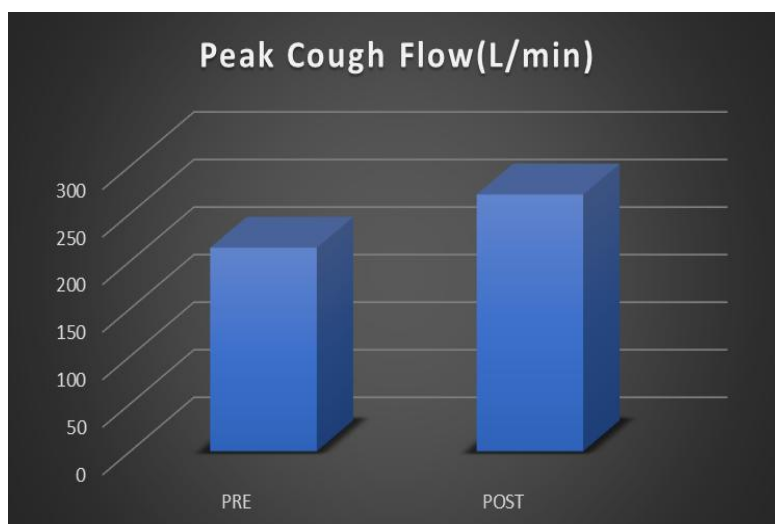
Data analysis was done by using INSTAT statistical software. pre and post intervention values were compared with paired T test.

RESULT

The Pre intervention Mean of Peak Cough Flow was 214 ± 58.72 L/min & Post intervention Mean of peak cough flow was 270 ± 62 L/min. The mean difference of pre and post intervention peak cough flow was 56.00 L/min. It shows extremely significant improvement in peak cough flow values after 4 weeks of Manually cough assisted techniques.

Comparison of pre intervention and post intervention peak cough flow

Pre (Mean \pm Sd)	Post (Mean \pm Sd)	Mean Difference	T Value	P Value
214 ± 58.72	270 ± 62	56.00	9.969	<0.0001 Extremely significant



DISCUSSION

The present study conducted on “Effectiveness Of Manually Assisted Cough Technique On Peak Cough Flow In Patients With Spinal Cord Injury”. The result of this study showed that there is extremely significant difference in peak cough flow after 4 weeks of manually assisted cough technique.

The present study showed that Manually Assisted Cough Technique improves peak cough flow in patients with spinal cord injury & the mechanism behind this is when cough assisted technique was performed at that time the patient was in sitting and semi reclining position ,therapists one hand was placed on the patients abdomen at the epigastric area just distal to the xiphoid process ,the other hand placed on top of the first keeping the fingers open or interlocking them, as the patient inhales as deeply as possible the therapist manually assists the patient as he or she tries to cough which pushes the compressed with an inward and upward force, which pushes the diaphragm upward which causes a more forceful and effective cough. It Increases the Intraabdominal and intrathoracic pressure. It indirectly improves the strength of the abdominal muscle and diaphragmatic excursion.

In patients with spinal cord injury as there is weakness in the respiratory and abdominal muscles. Patient is not able to cough effectively and patient is having

difficulty in clearing the secretions from lungs. So due to this the peak cough flow is reduced moderately. There is chronic accumulation of cough in spinal cord injury patients which increases the risk for pulmonary complications. The inability to cough voluntarily and effectively severely compromises a patient's health, affects the ability to cough and the effectiveness of mucus clearance.

Respiratory complications are the main cause of morbidity and mortality in the acute phase of SCI, with an incidence of 36% to 83%. Although pulmonary complications are a common and well-known problem in SCI, there is little information about their management; current practice is mainly based on clinical experience and expert opinion. The pillars of early treatment of respiratory dysfunction in SCI are intensive management of secretions and atelectasis, which has been shown to improve the results in patients with SCI.

The utmost important objective of treatment is the expansion of the lungs and the clearing of secretions. The techniques regularly used to help remove secretions include assisted coughing, percussion, vibrations, aspiration, and assisted postural drainage. To increase ventilation, respiratory exercises can be used for muscle training, non-invasive positive air pressure support and high tidal volumes in patients on mechanical ventilation. Interventions for

mobilizing secretions are essential for preventing mucus plugs, atelectasis, pneumonia, and respiratory failure and should be started early after the injury. For best results when using respiratory therapy techniques, it is essential to have proper pain treatment to facilitate patient cooperation. The goal of Assisted Coughing Technique is to help generate effective cough strength. They are often used with postural drainage, IPPB, and insufflator. [10-13]

Manually Assisted Coughing, this maneuver consists of chest compressions coordinated with the patient's breathing. This attempts to reproduce the normal cough, helping to move secretions from the lowest areas of the lungs.

The therapist performs the technique by placing the palm of the hand below the patient's rib cage, between the xiphoid process and the navel, exerting pressure upwards and inwards in order with the patient's voluntary expiration or cough. The external compression acts in the place of the paralyzed intercostal and abdominal muscles. Its efficiency can be improved with the prior administration of nebulized saline to thin the secretions. The cough can also be improved with prior lung insufflation; it is possible to generate higher expiratory flows by using larger lung volumes.

Magneide Fernandes Brito et al conducted a study on Air stacking and chest compression increase peak cough flow in patients with Duchenne muscular dystrophy of 28 patients with Duchenne muscular dystrophy. Result of the showed that the mean FVC was $29 \pm 12\%$. Mean PCF at baseline, with chest compression, after air stacking and with the use of the combined technique was 171 ± 67 , 231 ± 81 , 225 ± 80 , and 292 ± 86 L/min, respectively. The results of the study shows that with the use of the combined technique were significantly better than were those obtained with the use of either technique alone ($F[3.69] = 67.07$; $p < 0.001$). The study concluded that both chest compression and

air stacking techniques were efficient in increasing PCF. Though, the combination of these two techniques had a significant additional effect ($p < 0.0001$). [14]

Seong-Woong Kanget al conducted a study on the relationships of coughing to the respiratory muscle strength and pulmonary compliance in tetraplegic patients the objective of the study was to analyze the factors influencing the capacity of cough, the relationships between maximal respiratory pressure, lung compliance, capacity of cough, and assisted cough technique were evaluated in tetraplegics, 44 tetraplegic patients were included in the study, unassisted and assisted peak cough flow at two different conditions (a volume assisted method by the mechanical insufflation and the manual assistance by abdominal compression) were evaluated the result of the study showed that both volume and manual assisted method showed significantly higher PCF than unassisted PCF, they concluded that the therapists apply manual pressure only to increase capacity of cough which assist the expulsive phase . The results of the study showed that both inspiratory and expulsive phases should be assisted to enhance the effectiveness of cough. [15]

CONCLUSION

This study concluded that Manually Assisted Cough Technique improved the peak cough flow in patients with spinal cord injury, Manually Assisted Cough Technique should be considered as a Routine physiotherapy treatment protocol in spinal cord injury patients.

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