Effectiveness Of Incentive Spirometry In Improving Peak Expiratory Flow Rate In Post Abdominal Surgery : An Experimental Study

Biplab Nandi, Sucheta Mishra, Ujwal Yeole, Pravin Gawali, Roshan Adkitte

Tilak Maharashtra Vidyapeeth, Department of Physiotherapy, Pune, Maharashtra, India.
Institute at which research was conducted: Tilak Maharashtra Vidyapeeth, Department of Physiotherapy, Pune, Maharashtra, India.
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Address of Correspondence
Dr. Biplab Nandi
5th floor, Department of Physiotherapy
Tilak Maharashtra Vidyapeeth
Mukundnagar, Pune, 37.
Email: bips1303@gmail.com

Abstract
Background: Incentive Spirometry is widely used in prevention and treatment of postoperative pulmonary complications after major surgeries. This study was aimed to evaluate the efficacy of incentive spirometer in improving the Peak Expiratory Flow Rate in abdominal surgery patients.

Methodology: A total of 40 patients were selected between 25-55 age group and put in two groups through random sampling. Patients in group B were given IS for 5 days and patients in group A were taught Diaphragmatic Breathing Exercise and both groups were encouraged to perform this every waking hour. PEFR measurements of day 1 and day 5 of both groups were taken.

Conclusion: The PEFR measurement exhibited significantly higher values in IS group. There was a major difference in the improvement among the two groups. The difference in the mean value for Group A and Group B on day 1 and day 5 was 24.00 and 41.25 respectively using statistical test (Two independent t-test) showing p value of 0.021.

Keywords: IS- Incentive Spirometer, PEFR- Peak Expiratory Flow Rate, Abdominal surgery, Diaphragmatic Breathing Exercise.

Thesis Question: Is Incentive Spirometry effective in improving peak expiratory flow rate in abdominal surgery patients?
Thesis Answer: Incentive Spirometry is effective in improving peak expiratory flow rate in abdominal surgery patients.

Introduction

Upper abdominal surgical procedures are associated with a high risk of postoperative pulmonary complications. These are defined as pulmonary abnormalities occurring in the postoperative period which produce clinically significant identifiable diseases or dysfunction that adversely affect the patient's clinical course. Pulmonary complications include atelectasis, pneumonia, respiratory failure and tracheobronchial infection. Pulmonary complications are the most frequently occurring complications following upper abdominal surgeries with reported frequency of up to 7.5% of all patients. Upper abdominal surgeries are associated with decreased lung volumes, adoption of rapid shallow pattern of breathing. Rapid shallow breathing causes uneven ventilation of lungs and this may lead to development of microatelectasis and if sustained for long enough it may be the starting mechanism for pulmonary inefficiency. It is particularly important to identify patients at risk of postoperative pulmonary complication as this is the most frequently reported cause of morbidity and mortality in the postoperative period. The risk and severity of complication can be reduced by the use of therapeutic maneuvers that increase lung volume. Physiotherapy is designed to enhance inspiration and is aimed at increasing the abnormally low postoperative functional residual capacity.

Incentive spirometry has been routinely considered a part of the perioperative respiratory therapy strategies to prevent or treat these complications. The spirometer is designed to imitate maximum deep inspirations and encourages the patient to take long, deep, slow breathes that increases lung inflation. This promotes increased lung expansion and better gas exchange. When this procedure is repeated on a regular basis, pulmonary complications may be prevented.

Objective: To assess the effect of incentive spirometry in improving peak expiratory flow rate in abdominal surgery patients.
There are limited studies that have been done on clinical efficacy of incentive spirometry after abdominal surgery in Indian set up. With this objective in mind this study is planned to evaluate the efficacy of Incentive Spirometry in abdominal surgery patients[3].

**Material and Methodology**

This is an experimental study. The study was approved by the ethical committee and faculty of physiotherapy department of Tilak Maharashtra Vidyapeeth, Pune. Forty patients were selected through convenient sampling based on inclusion and exclusion criteria and put into one of the two groups through randomisation. The study was conducted in Pune city, Maharashtra. Patients having any type of abdominal surgery both male and female between the ages of 25-55 were included in this study. Neurological patients or patients below the age 25 or above 55 were not included in the study.

Outcome Measure: Peak Expiratory Flow Rate

Procedure:
Patients posted for abdominal surgery were selected and who fulfilled inclusion and exclusion criteria were included in the group. Patients were divided into two groups of Group A – Diaphragmatic Breathing Exercise and Group B – Incentive Spirometry. There were 20 patients in each group. Detailed assessment was done and written consent was taken. The technique and need of this study was explained to every patient. Group A- Diaphragmatic Breathing Exercise Group (control group)

Patients in group A were taught Diaphragmatic Breathing Exercise in crook lying position. Patients were asked to take deep breath through their nose and exhale through their mouth. During this procedure they were asked to relax their shoulders and upper chest and then inhale. This technique was repeated for 10 times. Patients were then asked to repeat the procedure 10 times during each waking hour.

Group B- Incentive Spirometry Group
Patients in group B were given Incentive Spirometry in crook lying position. They were asked to seal their lips around the mouth piece and inhale as deeply as they can and hold the inhalation for 3 seconds. This was repeated for 10 times. Patients were asked to repeat the technique 10 times during each waking hour.

Postoperative day 1 and day 5 three PEFR measurements were taken of both the groups and highest of the three measurements were recorded.

**Result**

Data and statistical analysis were performed by using SPSS Software. The result of this study shows that there is no statistical difference for the values of PEFR on Day 1 after surgery in between Group A and Group B. Whereas, there is significant difference for the values of PEFR on Day 5 between Group A and Group B. The improvement in mean PEFR value for Group A during Day 1 and Day 5 is 26% and improvement in mean PEFR value for Group B during Day 1 and Day 5 is 44%.

**Discussion**

It is well documented that the functions of the respiratory muscles are affected during and after the abdominal surgery. It has been suggested that respiratory muscles dysfunction may be responsible for a number of pulmonary complications including atelectasis and pneumonia. The site of the operation as well as the type of the operation are the most important factors affecting respiratory muscles[5].

There is significant difference in the values of PEFR on Day 1 and Day 5 in between Group A and Group B. The Incentive Spirometer group shows better result.

Table no.1 and figure 1 and 2 describes the Mean PEFR at day 1 of the Group A which is 91.50 and of the Group B which is 94.00 with a p value of 0.644. The mean PEFR at day 5 of the Group A was 115.50 and of Group B was 135.25 with a p value of 0.009. It also shows the Mean difference of the PEFR of both the group at day 1 and day 5 with Group A with a Mean difference of 24.00 and Group B with 41.25 and the p value being 0.021. Two independent t-test used for both the values. The graph describes that there was no significant difference at day 1 in Group A and Group B but as the treatment progressed there is significant difference in the PEFR of both the groups at day 5.

The findings of our study are consistent with various previous studies by Dr. Sanjeev Kumar Khanna in Indian Journal of Basic and Applied Medical Research, December 2013 Vol-3; Paula Agostini et al in Interactive Cardiovascular and Thoracic Surgery 7; Jackie A Thomas in Physical Therapy Journal of the American Physical Therapy Association which confirm the role of Incentive Spirometer in prevention of postoperative pulmonary complications following abdominal surgeries. Hence, the result of this study are supported by previous studies.

Further Scope: This study can be further extended with large sample size and including other major surgeries that affect the pulmonary function of the patients postoperatively. Further study can be done including different age group patients to differentiate the complication and improvement at different age group.

**Limitations:**

i. The sample size is small.
ii. Only one outcome measure ie PEFR
iii. Only abdominal surgery patients included.

We suggest that incentive spirometry should be used widely for abdominal surgery patients under the supervision of the physiotherapist.

**Conclusion**

The conclusion of this study is that there is a significant difference in the PEFR values of both groups and Incentive Spirometer shows better result in improving PEFR for abdominal surgery patients.

**Clinical Importance**

Incentive spirometry is effective in improving peak expiratory flow rate in abdominal surgery patients thus improves pulmonary functions after surgery. It can be used prophylactically to prevent pulmonary complications.

**Keywords**
Peak Expiratory Flow Rate, Abdominal Surgery, Pulmonary Complications, Diaphragmatic Breathing Exercise, Incentive Spirometry.

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