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# Comparison of incentive spirometry and active cycle of breathing techniques for prevention of postoperative pulmonary complication in patients with upper abdominal surgery

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**Abstract**
**Introduction:** Surgeries alter postoperative pulmonary function, as observed by impairment of lungs volume such as total lung capacity, vital capacity and tidal volume. It also reduces the efficiency of efforts to cough for as long as one week and also fall in a oxygen arterial pressure and in oxygen-hemoglobin saturation.
**Aim:** To compare effectiveness of Incentive Spirometry and ACBT in prevention of postoperative pulmonary complications in upper abdominal surgeries.
**Objective:** To study effect of Incentive spirometry and ACBT in prevention of postoperative pulmonary complications in upper abdominal surgeries.
**Procedure:** Ethical clearance was taken from ethical committee. Two groups were made. 30 patients were taken in each group by convenient sampling method. The details of research were explained to subjects and written consent form was charted out. Pre - assessment of both the groups was done using PFT post – operative on day 2.Subjects in group A received ACBT and subjects in group B received incentive Spirometry for duration of 15 mins for 5days. Post assessment was done on the 5th day of the treatment session.The readings was noted and further considered.Further data analysis was be done.
**Results:** After 5 days of training program post values of spirometry showed extremely significant improvement.
**Conclusion:** This study concludes that the effect of incentive spirometery is more significant than ACBT to prevent post surgery pulmonary complication after upper abdominal surgery.

**Keywords:** Incentive spirometry, ACBT, upper abdominal surgeries

## Introduction
Abdominal surgeries are Worldwide 56 (29%) of 192 who member states undergoes abdominal surgeries every year. Because of this epidemiological transition, surgery will assume an increasing role in public health. Surgery has become an integral part of global health care, with an estimated 234 million operations performed yearly. Surgical removal of a mass or masses from the abdomen through an abdominal incision-either up and down is called laparotomy. Diseases affecting the abdominal cavity are generally treated under their own name (e.g. Appendicitis). Surgeries of the abdominal organs are performed according to the description of that organ (stomach, kidney, liver, etc.)
Most commonly performed abdominal surgeries are: appendectomy, it is a surgical procedure for removal of appendix through the abdominal cavity. Exploratory laparotomy refers to the opening of the abdominal cavity and for the direct examination of its contents, for example, to locate a source of bleeding or trauma etc. Laparoscopy is a minimally invasive procedure of the abdominal cavity where rigid tubes are passed through small incisions into the abdominal cavity despite of the improvement in the surgical technology and preoperative care, complication rates are still high ranging from 30% to 50%.surgery and general anesthesia directly affects the respiratory system.
Surgeries alter postoperative pulmonary function, as observed by impairment of lungs volume such as total lung capacity, vital capacity and tidal volume. It also reduces the efficiency of efforts to cough for as long as one week and also fall in a oxygen arterial pressure and in

oxygen-hemoglobin saturation. Following major operations, the vital capacity diminishes by 50% - 60% and functional residual capacity by 30% for few days to weeks. Postoperative pulmonary complications have been reported to occur in 5-10 % of the general patient population and in 4-22 % of patient's undergone abdominal surgery.

The basic mechanism of postoperative pulmonary complications is a lack of lung inflation that occurs because of a change in breathing to a shallow, monotonous breathing pattern without periodic sighs, prolonged recumbent positioning and temporary diaphragmatic dysfunction. Mucociliary clearance which is impaired postoperatively along with the decreased cough effectiveness, increases risks associated with retained pulmonary secretions, anesthesia, opioid analgesia and postoperative pain which also seem to contribute to this ventilation pattern which contributes to the postoperative pulmonary complications. According to some authors, surgery lasting for more than 210 minutes is a risk factor for postoperative pulmonary complications. Pulmonary complications following atelectasis, pneumonia, respiratory failure, and tracheobronchial infection. The most common complications are: atelectasis, respiratory infections bronchoconstriction and respiratory failure.

**Active cycle of breathing techniques (ACBT):** ACBT was introduced by Webber & Pryor it consists of three distinct phases performed in sequence breathing control, thoracic expansion and forced expiratory technique. ACBT has shown to be effective in mobilizing and clearing the excess bronchial secretion and it will help to improve pulmonary function. ACBT is a flexible method of treatment which can be adapted for use in the surgical cases. The method can be used with or without assistant. Thoracic expansion exercises re-expand the lung tissue and helps in mobilizing and clearing excess bronchial secretions which is explained by the phenomenon of interdependence; it neither causes nor increases hypoxemia or increase airflow obstruction. ACBT consists of repeated cycles of the Breathing control, thoracic expansion, and forced expiratory training and breathing control which involves gentle diaphragmatic breathing at normal tidal volumes for 5 to 10 seconds with relaxation of the upper chest and shoulders. The thoracic expansion phase is designed to help loosen secretions, improve the distribution of ventilation, and provide the volume needed for frt. The subsequent forced expiratory training moves secretions into the central airways. Postoperative patients may require splinting at the thoracic or abdominal incision site.

**Incentive Spirometry:** To prevent above complications different physiotherapy interventions are given. One of the most commonly used is incentive spirometer (IS). The purpose of incentive spirometry is to guide the patient to take a sustained maximal inspiratory effort resulting in a decrease in ppl and maintain the patency of airways at risk for closure. Because of its simplicity, is has been the mainstay of lung expansion therapy for many years. Is devices are designed to mimic natural sighing by encouraging patients to take slow, deep breaths. Is can be performed using devices that provide visual cues to patients when the desired inspiratory flow or volume has been achieved. Is has been shown to be an efficient and effective prophylaxis against postoperative atelectasis in high-risk patients.

**Materials**

- PFT by Spirotech
- Spirometry
- Mouth piece
- Assessment sheet
- Pen
- Consent form

**Methodology**

- **Study Type:** Comparative Experimental study
- **Study Area:** PCMC
- **Sampling Technique:** Convenient Sampling.
- **Sampling Method:** Purposive sampling
- **Population:** Patients undergone upper abdominal surgery
- **Sample Size:** 60
- **Study Duration:** 5 days

**Procedure**

Ethical clearance was taken from ethical committee. Two groups were made, Group A and Group B. 30 patients were taken in each group by convenient sampling method. The details of research were explained to subjects and written consent form was charted out. Pre - assessment of both the groups was done using PFT post – operative on day 2. Subjects in group A received ACBT and subjects in group B received incentive Spirometry for duration of 15 mins for 5days. Post assessment was done on the 5th day of the treatment session.The readings was noted and further considered.Further data analysis was be done.

**Outcome Measures**

**PFT**

1. FEV 1
2. FVC
3. FEV1/FVC
4. PEFR
5. FEF25-75

**Result and Analysis**

**Table 1:** Pre and Post PFT for ACBT

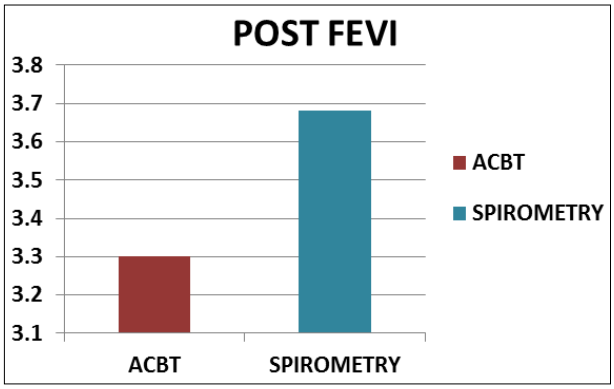
| | P PAIRED | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FEV1 | | FVC | | FEV1/FVC | | PEFR | | FEF25-75 | |
| | PRE/ POST | | PRE | POST | PRE | POST | PRE | POST | PRE | POST |
| Mean | 3.09± 1.11 | 3.30± 1.13 | 3.53± 0.93 | 3.75± 0.94 | 82.41± 16.02 | 83.92± 16.42 | 5.43± 2.019 | 5.76± 2.015 | 3.88± 0.3431 | 4.07± 0.3456 |

**Table 2:** Pre and Post PFT for Incentive Spirometry

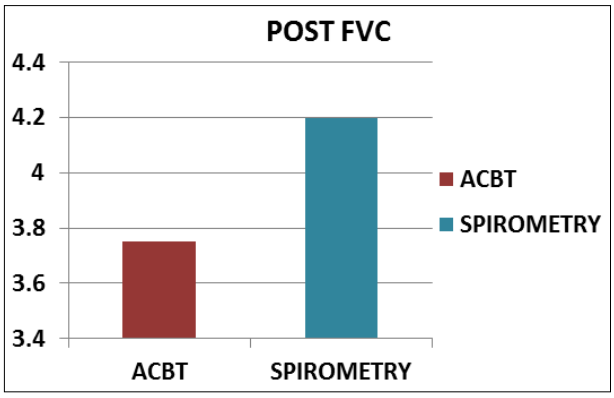
| | P PAIRED | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FEV1 | | FVC | | FEV1/FVC | | PEFR | | FEF25-75 | |
| | PRE POST | | PRE | POST | PRE | POST | PRE | POST | PRE | POST |
| Mean± | 3.32± 0.97 | 3.68± 0.96 | 3.87±0.87 | 4.20± 0.87 | 87.71 ±9.13 | 85.66± 11.68 | 5.88± 1.77 | 6.81± 1.89 | 4.23± 1.43 | 4.89± 1.47 |

**Table 3:** P-Paired test for Post PFT values for ACBT and Incentive Spirometry

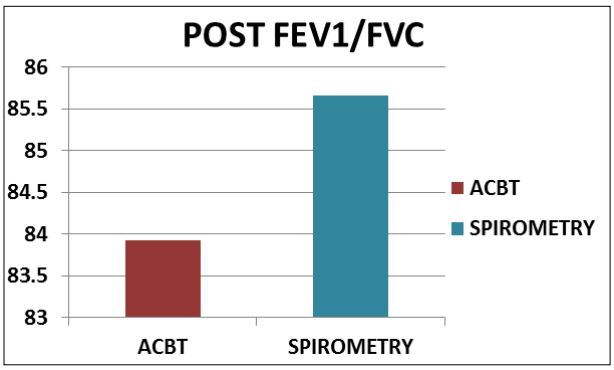
| | POST COMPARISON A: ACBT B :SPIROMETRY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FEV1 | | FVC | | FEV1/FVC | | PEFR | | FEF25-75 | |
| | A | B | A | B | A | B | A | B | A | B |
| Mean± | 3.30± 1.13 | 3.68± 0.96 | 3.75± 0.94 | 4.20± 0.87 | 83.92± 16.42 | 85.66± 11.68 | 5.76± 2.02 | 6.81± 1.89 | 4.07± 0.34 | 4.89± 1.47 |



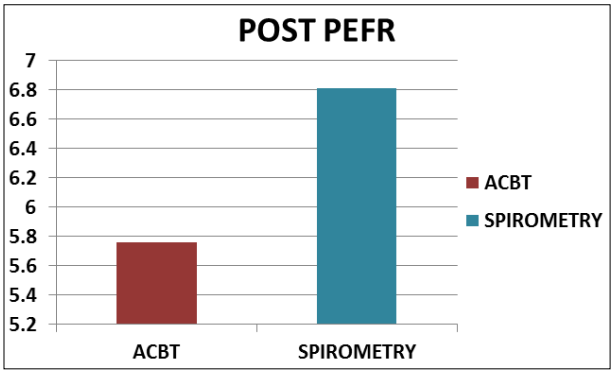

**Graph 1:** Post FEV1 for ACBT & Spirometry



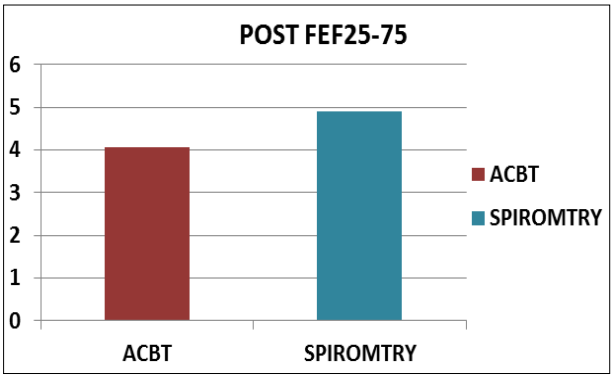

**Graph 2:** Post FVC for ACBT & Spirometry




**Graph 3:** Post FEV1/FVC for ACBT & Spirometry




**Graph 4:** Post PEFR for ACBT & Spirometry




**Graph 5:** Post FEF25-75 for ACBT & Spirometry

## Discussion

Post operative patients of upper abdominal surgery were divided into 2 groups; group A (30 subjects) and group B (30 subjects). As per procedure Group A was given ACBT and Group B was given incentive spirometery. Physiological changes that occur after Laparotomy, including alterations in lung volume, Ventilatory gas exchange and respiratory defense Mechanisms, impose an increased risk of pulmonary complications for susceptible patients. The result obtained in this study indicated that, there was highly significant difference in FVC, FEV1, PEFR, FEF25-75 AND FEV1/FVC after 5 DAYS of intervention. Both groups showed significant improvement after intervention, but there was a highly significant difference in all spirometery parameters more increased in group B as compared to group A. Group B (IC) as compare to ACBT (group A).

This significant change is because an Sustained Maximal Inspiration (SMI) is functionally equivalent to performing an inspiratory capacity (IC) maneuver, followed by a breath hold. Compares the alveolar and Pleural pressure changes occurring during a normal spontaneous breath and an SMI during IS. During the inspiratory phase of spontaneous breathing, the decrease in Pleural pressure caused by expansion of the thorax is transmitted to the alveoli. With alveolar pressure now negative, a pressure gradient is created between the airway opening and the alveoli. This trans respiratory pressure gradient causes gas to flow from the airway into the alveoli. Within certain limits, the greater the trans respiratory pressure gradient, the more that lung expansion occurs. The primary indication for IS is to treat existing atelectasis. IS may also be used as a preventive measure when conditions exist that make the development of atelectasis likely.

IS Breathing exercises produce a large and sustained increase in trans pulmonary pressure which distends the lungs and reinflates the collapsed lung units, TEE re-expands the lung tissue and in mobilizing and clearing excess bronchial secretions is explained by the phenomenon of interdependence, which states that expanding forces exerted between adjacent alveoli. At high lung volumes the expanding forces between alveoli are greater than at tidal volume and assist in re-expansion of lung tissue. Both physiotherapy methods had similar effects on the rate of atelectasis,

pulmonary function. FEV1/FVC Ratio: There was very significant difference within the group and there was significant difference between the group.

Whereas in group A significant improvement was because of ACBT consists of repeated cycles of breathing control, thoracic expansion, and FET. Breathing control involves gentle diaphragmatic breathing at normal tidal volumes for 5 to 10 seconds with relaxation of the upper chest and shoulders. This phase is intended to help prevent bronchospasm. The thoracic expansion exercises involve deep inhalation, approaching Vital capacity, with relaxed exhalation, which may be accompanied by percussion, vibration, or compression. It has been shown to be effective in the clearance of bronchial secretions (Pryor *et al.* 1979, Wilson *et al.* 1995) and to improve lung function (Webber *et al.* 1986). It neither causes nor increases hypoxemia (Pryor *et al.* 1990), nor increases airflow obstruction (Thompson & Thompson 1968, Pryor & Webber 1979, Pryor *et al.* 1994).

Thoracic expansion exercises are deep breathing exercises emphasizing inspiration. Inspiration is active and may be combined with a 3-second hold before the passive relaxed expiration. The postoperative maneuver of a 3-second hold full inspiration has been said to decrease collapse of lung tissue (Ward *et al.* 1966). This 'hold' may also be of value in some patients with medical chest conditions, but it is probably inappropriate in the very breathless patient. In the normal lung the resistance to airflow via the collateral ventilatory system is high, but with increasing lung volume and in the presence of lung pathology the resistance decreases, allowing air to flow via the collateral channels - the pores of Kohn, channels of Lambert and channels of Martin (Menkes & Traystman 1977)

Air behind secretions may assist in mobilizing them. The effectiveness of thoracic expansion exercise (Mead *et al.* 1970). This is the effect of the expanding forces exerted between adjacent alveoli. At high lung volumes the expanding forces between alveoli are greater than at tidal volume and assist in re-expansion of lung tissue. Three or four expansion exercises are usually appropriate before pausing for a few seconds or a period of breathing control. Any more deep breaths could produce the effects of hyperventilation. By above mechanism we got increase in PFT values.

## Conclusion

From the analysis of the data the study concludes that the effect of incentive spirometry is more significant than ACBT to prevent post surgery pulmonary complication after upper abdominal surgery.

## Limitation of study

- Sample size
- Fesibility
- Availability of subjects

## Future scope of study

- This study can be conducted on a larger population along with same outcome measures.
- Other components can also be assessed with the help of different parameters.
- Study duration can be increased in future study

## Acknowledgement

The satisfaction that accompanies the successful completion of any task would be incomplete without mentioning of people whose ceaseless co-operation, guidance and encouragement crown all the efforts with success. I offer my regard to all those who supported me in any respect during the completion of the study. Last, but not the least, I express my sincere thanks to all the subjects who participate and gave their full co-operation for the study.

## Reference

1. Lamuvel M *et al.*. Effect of ACBT and TENS on Pulmonary Function and Pain Perception in Abdominal Surgeries: A Randomized Control Trial. International Journal of Health Sciences and Research (www.ijhsr.org) 2016, 6(6).
2. Laurie *et al.*. Abdominal Surgery.
3. Broek R *et al.*. Burden of adhesions in abdominal and pelvic surgeries systemic review and met analysis. BMJ 2013.
4. Valerie LDR *et al.*. Risk of Pulmonary Complications after Elective Abdominal Surgery 1996.
5. Cheifetz O, Deborah L *et al.*. The Effect of Abdominal Support on Functional Outcomes in Patients Following Major Abdominal Surgery 2010.
6. How to use an incentive spirometer. The Cleveland Clinic Foundation. Retrieved 2013-11-03.
7. Clinical Practice guide line incentive spirometry. Rc journal 1991;36(12):1402-05.
8. Celli {published data only} - Celli BR, Rodriguez K, Snider GL. A controlled trial of intermittent positive pressure breathing incentive spirometry and deep breathing exercises in preventing pulmonary complications after abdominal surgery. The American Review of Respiratory Disease 1984;130:12-5. [Medline: 6377994]
9. Craven {published data only} - Craven JL, Evans GA, Davenport PJ, Williams RH. The evaluation of the incentive spirometer in the management of postoperative pulmonary complications. The British Journal of Surgery 1974;61:793-7. [Medline: 4416262]
10. Dohi {published data only} - Dohi S, Gold MI. Comparison of two methods of postoperative respiratory care. Chest 1978;73(5):592-5.
11. Hall {published data only - Hall JC, Tarala R, Harris J, Tapper J, Christiansen 1991.
12. K. Incentive spirometer versus routine chest physiotherapy for prevention of pulmonary complications after abdominal surgery. Lancet 1991;337:953-5. [Medline: 1678039]
13. Hall {published data only} - Hall JC, Tarala RA, Tapper J, Hall, JL. Prevention of respiratory complications after abdominal surgery: a randomised clinical trial. BMJ 1996;312:148-52. [Medline: 8563533]