



# ABDOMINAL SURGERY AND RESPIRATORY COMPLICATIONS

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## Abstract

Patients undergoing abdominal (visceral) surgery are at increased risk for pulmonary complications postoperatively. Pulmonary complications in the postoperative period increase hospital morbidity, prolong hospital stay, and contribute to additional health-care costs. In the beginning of the 20th century postoperative chest physiotherapy was practiced; deep breathing exercise was one of the first methods. A variety of manual treatments including percussion, clapping, vibration, or shaking were developed to improve bronchial drainage

Evidence for postoperative physiotherapy in ERAS pathways is limited but suggests that preoperative characterization of patients may in the future facilitate optimal, individualized care, which can accelerate the return to normal function and physical activity.

## Key words: pulmonary complication

Abdominal surgery is the surgical procedures done in a person's abdominal region to diagnose or treat a medical condition. Abdominal surgery can reduce the symptoms of abdominal conditions like injury, trauma, or pain caused by a ruptured appendix or to control internal bleeding.

The impact of surgery leads to homeostatic disturbance. The surgical stress response is characterized by catabolism and increased oxygen demand. The risk of developing postoperative complications is proportionate to the duration and extent of the stress response and magnitude of surgery .

Decreased survival rate is seen among patients who experience postoperative complications within 30 days of surgery. There is a 20-40% reduction in postoperative physical function and a significant deterioration in quality of life after major surgery even in the absence of complications.

The respiratory system is primarily and directly affected by surgery and general anesthesia. Impairment of lung volumes such as total lung capacity, vital capacity and tidal volume are observed to be the postoperative pulmonary functions altered by upper abdominal surgery. The efficiency of efforts to cough is diminished for as long as one week after the surgery. Falls are also seen in oxygen arterial pressure and in oxygen-hemoglobin saturation. About 6 to 70% of patients, depending on the criteria for defining them, develop postoperative pulmonary complications after upper abdominal surgery. These include atelectasis, pneumonia or hypoxemia, among others which can be prevented by breathing and chest wall physiotherapy.

Postoperative pulmonary complications (PPCs) amount to one of the most important causes of postoperative morbidity and mortality after abdominal surgery."It is an umbrella term of adverse changes to the respiratory system occurring immediately after surgery—An altered function of respiratory muscles, reduced lung volume, respiratory failure and atelectasis are the common presentations."

### **Risk Factors**

The development of PPCs can be predicted by the risk factors which are divided into modifiable and non-modifiable factors

#### **Non-Modifiable factors**

**Age** > 60 or 65 years & **Surgery type** i.e Abdominal aortic aneurysm repair, thoracic, upper abdominal, neck, neurosurgery and major vascular surgery are found to have a higher risk than other types of surgery.

#### **Modifiable factors**

- Smoking
- Preoperative anemia
- General anesthesia
- Low tidal volume
- Neuromuscular blocking drugs
- Co-morbidity. Chronic obstructive pulmonary disease, congestive heart failure, chronic liver disease.

Result of an RCT at a hospital in Brazil, revealed that chest physiotherapy during the immediate postoperative period following upper abdominal surgery was effective for improving oxygen-hemoglobin saturation without increased abdominal pain. Thirty-one adults were randomly assigned to control (n = 16) and chest physiotherapy (n = 15) groups. Spirometry, pulse oximetry and anamneses were performed preoperatively and on the second postoperative day. Before and after

chest physiotherapy a visual pain scale was applied on the second postoperative day,. Surgery duration, length of hospital stays and postoperative pulmonary complications were gathered from patients' medical records. The control and chest physiotherapy groups presented decreased spirometry values after surgery but without any difference between them. In contrast, the chest physiotherapy group presented improved oxygen-hemoglobin saturation after chest physiotherapy during the immediate postoperative period ( $p < 0.03$ ) that did not last until the second postoperative day. The medical record data were similar between groups The study concluded that breathing exercises could be adopted at post-anesthesia care units with benefits for patients.

Prehabilitation prior to major surgery has increased in popularity over recent years and aims to improve pre-operative conditioning of patients to improve post-operative outcomes. EMBASE, Medline, PubMed and the Cochrane database were searched for trials comparing outcomes of patients undergoing prehabilitation involving prescribed respiratory and exercise interventions prior to abdominal surgery. Study characteristics, overall and pulmonary morbidity, length of stay (LOS), maximum inspiratory pressure and change in six-minute walking test (6MWT) distance were obtained. The primary outcome was post-operative overall morbidity within 30 days. The study concluded that prehabilitation can reduce overall and pulmonary morbidity following surgery and could be utilized routinely.

### **Physiotherapy assessment**

Physiotherapy assessment is done as per the patient condition, the nature and type of the surgery, the ongoing medical plan, the patient's premorbid status and any comorbidities which can affect the post-operative rehabilitation. Level of alertness, ability to follow instruction, hemodynamic and respiratory stability will be assessed before any therapeutic intervention is considered.

**Physiotherapy following abdominal surgery:** Preoperative education, inspiratory muscle training, and exercise training have been shown to significantly impact on PPCs in patients undergoing elective abdominal surgery.

### **Physiotherapy in the immediate post-operative period**

In the routine provision of care to patients undergoing abdominal surgery it is assumed that complications can be prevented by assisted early ambulation and respiratory physiotherapy techniques such as deep breathing and coughing (DB&C) exercises. There is enough evidence to demonstrate that in the immediate post-operative period physiotherapy focusing on early rehabilitation is both safe and effective following elective abdominal surgery, and for patients in intensive care including following emergency surgery. Early assisted mobilization, respiratory physiotherapy, strength and conditioning rehabilitation and education are the therapy which is considered.

## Physiotherapy treatment

### Early ambulation and rehabilitation

Whilst mobilizing critically ill patients in 14 of 15 trials in a recent systematic review reported no serious adverse medical consequences

After elective abdominal surgery and critical illness the effects of early ambulation and rehabilitation have been extensively researched. There is an increasingly strong body of evidence that physical activity 1–2 times per day for up to 15–30 min is both safe and efficacious for critically ill patients. Early mobilization has been shown to decrease ICU and hospital length of stay and improve quality of life. Evidence revealed that adverse events occur in only a small number of patients (1–4%). Enhanced Recovery After Surgery (ERAS) protocols provide information on peri-operative management of specific elective abdominal surgeries. Such protocols contain recommendations regarding, the importance of early ambulation after abdominal surgery, specifying the frequency and duration required to be undertaken. For example, for patients undergoing elective rectal or pelvic surgery the guidelines recommend they are mobilized two hours out of bed on the day of surgery and six hours out of bed each day thereafter.

### Respiratory muscle training

The major determinants of weaning failure in ventilated patients and postsurgical patients were respiratory muscle weakness, imbalance between muscle strength, the load of the respiratory system and cardiovascular impairment. Compared to controls there was a reduction of PPC and hospital stay in patients undergoing respiratory muscle training. Inspiratory muscle training before thoracic surgery may prevent PPC as demonstrated by Nomori et al. A systematic review of studies on ICU ventilator-dependent COPD patients showed that inspiratory muscle strength improved significantly with inspiratory muscle training.

Respiratory exercises has been shown to improve respiratory muscle strength, oxygenation, coughing mechanism, chest wall mobility and lung ventilation, as well as decreasing respiratory work and preventing postoperative pulmonary complications. Preoperative chest physiotherapy reduces the incidence of postoperative pulmonary complications and improved mobilization and oxygen-hemoglobin saturation after major abdominal surgery

Recent research has focused on the effectiveness of providing early ambulation alone in preventing post-operative complications. Some patients may be unable to ambulate due to hemodynamic instability or traumatic injury following abdominal surgery, and thus, the inclusion of DB&C should be considered to be of value after surgery.

A well-designed randomized controlled trial (RCT) has found that an oscillating PEP device reduced days of fever and LOS following elective abdominal and thoracic surgery. Incentive spirometries (ISs) are respiratory devices, which aim to increase inspiratory volumes. The use of Incentive spirometry has been researched extensively; following elective surgery such devices should be considered as a prophylactic respiratory physiotherapy treatment in patients considered high risk for the development of a PPC as the meta-analysis of the available data has found little benefit when administered prophylactically.

## Conclusion

Changes in respiratory mechanics, lung volume and capacity, oxygenation, and pulmonary defense mechanisms are observed after abdominal surgery. The most efficient regimen of prophylaxis against respiratory complications after abdominal surgery is deep breathing exercises for low risk patients and incentive spirometry for high risk patients.

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