

## Observational Assessment of Postoperative Pulmonary Changes After Laparoscopic Cholecystectomy as Measured by Spirometry

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### Abstract

**Aim:** To study the changes in spirometric parameters of the patients following laparoscopic cholecystectomy to evaluate post-operative pulmonary changes.

**Methods:** This observational study including 40 patients admitted to the Department of General Surgery, Shaheed Nirmal Mahto Medical College and Hospital, Dhanbad, Jharkhand, India for 6 months. Patients undergoing laparoscopic cholecystectomy were included in this study. Patients were subjected to preoperative spirometry a day before surgery followed by postoperative spirometry on day two and day seven after laparoscopic cholecystectomy to evaluate the pattern of postoperative pulmonary changes. All the patients were subjected to detailed history taking and physical examination along with all baseline investigations, including CBC, KFT, LFT, X-ray chest and ECG. A fresh USG abdomen was done.

**Results:** The total of 40 patients were included in the study with a mean age of  $38.75 \pm 15.24$  years. Eleven (26.8%) of the subjects were male, and 29 (73.2%) were female. Out of the 40 patients, 34(85%) patients had normal lung function preoperatively, 2(5%) had a restrictive pattern of lung function and 4 (10%) had an obstructive pattern of lung function. On the second postoperative day of laparoscopic cholecystectomy, 13 patients (32.5%) had normal lung function, 22(55%) had the restrictive pattern, and 5 (12.5%) had an obstructive pattern of lung function on spirometry. On the seventh postoperative day of laparoscopic cholecystectomy, 31 patients (77.5%) had normal lung function, 7(17.5%) had restrictive pattern while 2(5%) had an obstructive pattern.

**Conclusion:** From this study, it can be concluded that there is more restrictive pattern of pulmonary dysfunction after laparoscopic cholecystectomy. Further, more studies should be done on a large scale to get proper results.

**Keywords:** Spirometry, Laparoscopic Cholecystectomy, Pulmonary Changes.

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### Introduction

A cholecystectomy is a surgical procedure to remove your gallbladder a pear-shaped

organ that sits just below the liver on the upper right side of abdomen. Laparoscopic

cholecystectomy is a surgical technique which is associated with a shorter hospital stay (mean 1-3 days), an early return to full activity, and low morbidity when compared with conventional cholecystectomy [1,2]. In an attempt to reduce the morbidity and cost of the surgical treatment of gallbladder disease, a minimally invasive approach to the surgical removal of the gallbladder was developed [3].

Laparoscopic cholecystectomy (LC) was first reported in Germany (1985) and France (1987) more than 2 decades ago [4,5]. By 1992, a National Institutes of Health Consensus Statement [6] endorsed laparoscopic cholecystectomy as a legitimate tool in the surgeon's armamentarium for the treatment of symptomatic cholelithiasis, and by 1995, 10 years after the introduction of LC, the number of cholecystectomies performed (both open and laparoscopic) had increased by 25% to 30% [7, 8], of which close to 80% were done laparoscopically. Laparoscopy has become the new gold standard for the treatment of symptomatic cholelithiasis and an increasing number of procedures are done for acute cholecystitis (AC) [9,10].

Laparotomy performed through upper abdomen incision is associated with changes in various postoperative respiratory functions which include a reduced vital capacity (VC), reduced functional residual capacity (FRC), hypoxemia, a shift from abdominal to rib cage breathing and increased work of breathing [11, 12]. Laparoscopic cholecystectomy causes an inhibitory reflex of phrenic nerve and dysfunction of the diaphragm [13]. Ford et al., [14] observed disturbances in the respiratory muscle activity after surgical removal of the gallbladder. The location and size of the incision, presence of postoperative pain, and diaphragmatic dysfunction are the main factors which contribute to the changes in

the postoperative respiratory functions [14,15].

The suspension of pulmonary function is a well-known sequela of upper abdominal surgery and has been characterized as a restrictive pattern dysfunction, faster recovery of preoperative pulmonary function, and less atelectasis [1,2,15,16]. Many authors have demonstrated that postoperative pulmonary function is better after laparoscopic cholecystectomy than after open cholecystectomy [15, 16]. Several studies have examined the effects of laparoscopy on postoperative respiratory function [2, 15-18]. Schauer et al. [1] and Frazee et. al. [15] showed a significant decrease in FEV1 and FVC after laparoscopic cholecystectomy, reflecting a restrictive pulmonary dysfunction.

### Materials and Methodology

This observational study including 40 patients admitted to the Department of General Surgery, Shaheed Nirmal Mahto Medical College and Hospital, Dhanbad, Jharkhand, India for 6 months. Patients undergoing laparoscopic cholecystectomy were included in this study. Smokers and patients with known respiratory diseases were excluded from the study. All the patients were subjected to detailed history taking and physical examination along with all baseline investigations, including CBC, KFT, LFT, X-ray chest and ECG. A fresh USG abdomen was done. Post-operatively, patients were monitored for pulse rate, blood pressure, temperature and respiratory rate, the appearance of bowel sounds, any Jaundice and colour and quantity of discharge from the drain. The drain was removed on the second postoperative day.

Pulmonary function studies were performed in the pulmonary function laboratory by the same professional technician and same equipments. A portable spirometer Spiro Pro ®version 2.0, which can measure pulmonary flow and volume parameters and is validated by the

American Thoracic Society (ATS) was used in all the patients. The device, in addition to generating flow-volume and volume-time curves, discriminated 12 spirometric variables and the results were printed out automatically.

Patients were subjected to preoperative spirometry a day before surgery followed by postoperative spirometry on day two and day seven after laparoscopic cholecystectomy to evaluate the pattern of postoperative pulmonary changes. FEV1 less than 80% of predicted was taken as an obstructive defect, FVC less than 80% of predicted was taken as a restrictive defect and FEV/FVC less than 70 % was taken as

suggestive of obstruction as per revised GOLD guidelines. Further FEF 25%-75% less than 70% of predicted was considered as suggestive of small airway obstruction [19].

### Results

The total of 40 patients were included in the study with a mean age of  $38.75 \pm 15.24$  years. Eleven (26.8%) of the subjects were male, and 29 (73.2%) were female. In patients who underwent laparoscopic cholecystectomy, the BMI of <18.5 in 2.5%, 18.5-24.9 in 45%, 25-29.9 in 37.5%, 30-34.9 in 10%,  $\geq 35$  in 5% was observed. Preoperative chest X-ray was normal in all the patients.

**Table 1: Gender and Body mass index (BMI) of the study group**

Variable		Number	%
Gender	Male	11	27.5
	Female	29	72.5
BMI	<18.5	1	2.5
	18.5-24.9	18	45
	25-29.9	15	37.5
	30-34.9	4	10
	$\geq 35$	2	5

Out of the 40 patients, 34(85%) patients had normal lung function preoperatively, 2(5%) had a restrictive pattern of lung function and 4 (10%) had an obstructive pattern of lung function. On the second postoperative day of laparoscopic cholecystectomy, 13 patients (32.5%) had normal lung function, 22(55%) had the restrictive pattern, and 5

(12.5%) had an obstructive pattern of lung function on spirometry. On the seventh postoperative day of laparoscopic cholecystectomy, 31 patients (77.5%) had normal lung function, 7(17.5%) had restrictive pattern while 2(5%) had an obstructive pattern.

**Table 2: Spirometric parameters of patients**

Spirometry	Preoperatively	2 <sup>nd</sup> day postoperatively	7 <sup>th</sup> day postoperatively
Number of patients with Normal pattern	34(85%)	13 (32.5%)	31 (77.5%)
Number of patients with restrictive pattern	2 (5%)	22 (55%)	7 (17.5%)
Number of patients with obstructive pattern	4 (10%)	5 (12.5%)	2 (5%)
Total	40 (100%)	40 (100%)	40 (100%)

Preoperatively 37(92.5%) had normal SpO<sub>2</sub>, while 3 (7.5%) had low SpO<sub>2</sub>. Postoperatively 32(80%) had normal SpO<sub>2</sub>, and 8(20%) had low SpO<sub>2</sub>.

**Table 3: Preoperative and postoperative SpO<sub>2</sub> levels.**

Variable		Number	%
Preoperatively	Normal SpO <sub>2</sub> levels	37	92.5
	Low SpO <sub>2</sub> levels	3	7.5
Postoperatively	Normal SpO <sub>2</sub> levels	32	80
	Low SpO <sub>2</sub> levels	8	20

## Discussion

The gallbladder is a small organ underneath the liver that concentrates and stores bile. Bile is fluid made by the liver and released into the small intestine to help digestion. Changes in bile concentration and composition caused by changes in diet, hormones, medications, or rapid weight loss or weight gain can result in formation of solid pieces of bile called gallstones. Gallstones can sometimes migrate out of the gallbladder, block the normal flow of bile, and lead to inflammation and infection of the gallbladder, which is called cholecystitis. Patients who have cholecystitis or are bothered by symptoms of gallstones are treated with surgical removal of the gallbladder, known as cholecystectomy. Laparoscopic cholecystectomy, also known as minimally invasive cholecystectomy, is performed through 4 small incisions with use of a camera to visualize the inside of the abdomen and long tools to remove the gallbladder.

Several studies have examined the impact of laparoscopic cholecystectomy on spirometric parameters of patients. In almost all these studies, there is a common finding of a restrictive pattern of pulmonary dysfunction [20,21]. The aetiology of such postoperative dysfunction involves multiple factors including inhibitory reflex of phrenic nerve and dysfunction of the diaphragm, abdominal wall trauma and postoperative pain [22].

Laparoscopic cholecystectomy is an established surgical technique which is associated with a reduction in post-operative analgesic requirements, a shorter

hospital stay (mean 1 to 3 days), and an early return to full activity (mean 6.5 to 12.8 days) when compared with conventional chole- cystectomy [23,24]

Of the 56 patients, 11 (26.8%) of the subjects were male, and 29 (73.2%) were female. Our results are consistent with the study carried out by S Hasukic [25]. In his study, there was a total of 30 patients which included 23 (76.66%) females and 7(23.33%) males. Similar studies were done by Peters JH et al. [26], Torrington KG et al. [27], Milheiro A et al., [28] and Poulin EC et al. [29]. The results from all these studies also confirmed a restrictive pattern of pulmonary dysfunction after laparoscopic cholecystectomy.

## Conclusion

From this study, it can be concluded that there is more restrictive pattern of pulmonary dysfunction after laparoscopic cholecystectomy. Further, more studies should be done on a large scale to get proper results.

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