

Hospital-Based Comparative Assessment of Postoperative Pulmonary Functions in Patients Undergoing Laparoscopic and Open Cholecystectomy

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Abstract

Aim: The study was planned to compare changes in respiratory function after laparoscopic and conventional open cholecystectomy.

Methods: The study was analytical, carried out in the department of surgery Jawahar Lal Nehru Medical College and Hospital, Bhagalpur, Bihar, India On a total of 100 patients admitted in hospital for symptomatic were included.

Results: There was no significant difference between the groups in age, gender, height and weight. Preoperative respiratory functions and capillary blood gas analysis were normal. There was a decrease in respiratory functions in the postoperative period in both groups. Postoperative change in all parameters when compared to preoperative values was highly significant ($p < 0.001$). Difference in all parameters between the groups was significant ($p < 0.05$).

Conclusion: It was concluded that laparoscopic cholecystectomy offers improved pulmonary function compared to the open technique.

Keywords: laparoscopic cholecystectomy, open cholecystectomy Lungs, Spirometry, Blood gas.

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Introduction

Respiration is carried out by movements of thorax and abdominal wall. Abdominal surgery involves division of abdominal muscles which results in pain and restriction of movements. This also associated with changes in diaphragmatic function and atelectasis of the lung. [1,2] A fall in oxygen tension without

significant change in carbon dioxide tension has been reported by recent studies. [3,4] These changes are common in open surgeries. Laparoscopic surgeries employ smaller incisions, inflation of gas and are now replacing some procedures which were done with open surgeries. As the incisions are small, there is less pain and early recovery of respiratory functions.

The site and size of the surgical incision, severity of postoperative pain and impaired diaphragmatic function are the most important factors known to impair pulmonary function after conventional open cholecystectomy. [5-9] Laparoscopic cholecystectomy is a new technique that has become the treatment of choice for symptomatic cholelithiasis. The procedure is associated with the absence of skin incision, less pain, shorter hospitalization and faster recovery compared with open cholecystectomy. [10-12] Minimal pulmonary dysfunction after laparoscopic cholecystectomy in healthy patients has been reported by several authors. [13-16] However, in most studies only expiratory lung volumes were evaluated and postoperative respiratory complications were not studied. In addition, these were observational or nonrandomized studies, limited to a small number of patients, and could have exaggerated the advantages of laparoscopic cholecystectomy.

The study was planned to compare changes in respiratory function after laparoscopic and conventional open cholecystectomy.

Materials and Methods

The study was analytical, carried out in the department of surgery Jawahar Lal Nehru Medical College and Hospital, Bhagalpur, Bihar, India. On a total of 100 patients admitted in hospital for symptomatic cholelithiasis were included.

Ethics Committee approved the proposed study consent was obtained from the participants

Grouping: The subjects consisted of two groups. Group I laparoscopic cholecystectomy consisted of 50 patients scheduled for and Group II open cholecystectomy consisted of 50 patients.

Inclusion criteria: Inclusion criteria were subjects of both genders with age between 20 to 60 years, negative history of respiratory illness, negative history of smoking habits, and negative history of occupational exposure to irritants, normal preoperative respiratory function and elective surgery.

Exclusion criteria: Exclusion criteria were emergency surgery, history of pulmonary disease and smoking habits.

Methodology

Both groups were tested for respiratory functions using MEDSPIROR® with the subject lying in the supine posture as postoperative pain prevented the patients in assuming the erect posture. The patients were instructed to breathe out forcibly into the spirometer after taking a deep breath. A demonstration was given by the examiner before recording the readings. Values were noted down after taking three readings.¹⁷ Blood gas analysis was carried out using capillary blood obtained from the fingers or toes after warming the area to approximately 45 degrees Celsius.¹⁸ The tests were performed preoperatively and after 48 hours of surgery. All measurements on the subjects were done after taking informed consent.

Statistical analysis: Mean and standard deviation values of all parameters were calculated. Student's t test was used to compare Group I with Group II.

Results

Table 1: Anthropometric data

| Parameter | Group 1 (Laparoscopic cholecystectomy) | Group 2 (Open cholecystectomy) |
|-------------|--|--------------------------------|
| Number | 50 | 50 |
| Sex (M, F) | 28, 22 | 19, 31 |
| Age (years) | 33.86±9.25 | 34.04±8.73 |
| Height | 159.42±9.15 | 156.22±6.71 |

| | | |
|-------------|------------|------------|
| (cms) | | |
| Weight (kg) | 54.92±8.62 | 53.98±6.25 |

There was no significant difference between the groups in age, gender, height and weight.

Table 2: Pulmonary function tests and blood gas analysis preoperative and on second postoperative day

| Parameter | Group 1 | | Group 2 | |
|---------------------|-----------|-----------|-----------|------------|
| | | D2 | | D2 |
| FVC (L) | 2.38±0.6 | 1.57±0.4 | 2.12±0.41 | 1.75±0.36 |
| FEV1 (L) | 1.9±0.5 | 1.3±0.35 | 1.7±0.35 | 1.42±0.30 |
| FEV3 (L) | 2.27±0.57 | 1.52±0.40 | 2.02±0.39 | 1.69±0.35 |
| PEF (L/s) | 6.36±1.27 | 4.13±0.83 | 5.55±1.11 | 4.58±0.92 |
| FEF25%- 75% (L/s) | 3.10±0.60 | 2.05±0.40 | 2.84±0.35 | 2.44±0.46 |
| FEF 0.2 - 1.2 (L/s) | 5.29±1.29 | 3.50±0.86 | 4.82±0.88 | 4.17± 0.77 |
| FEV1/FVC (%) | 80.1±2.04 | 81.8±2.07 | 79.38±2.9 | 80.44±3.36 |
| FEV3/FVC (%) | 95.3±1.33 | 96.5±1.22 | 95.2±1.44 | 95.3± 1.44 |
| paO2 (mmHg) | 89.68±4.9 | 82.88±4.9 | 88.6±4.25 | 86.34±4.36 |
| paCO2 (mmHg) | 41.2±3.18 | 41.0±3.11 | 40.04±3.2 | 41.02±2.75 |
| Ph | 7.39±0.03 | 7.38±0.03 | 7.4±0.03 | 7.39±0.03 |
| Bicarbonate (mEq/L) | 24.06±2.4 | 24.8±2.11 | 24.08±2.4 | 24.48±2.24 |

Preoperative respiratory functions and capillary blood gas analysis were normal. There was a decrease in respiratory functions in the postoperative period in both groups (Table 2). Postoperative change in all parameters when compared to preoperative values was highly significant ($p < 0.001$). Difference in all parameters between the groups was significant ($p < 0.05$).

Blood gas analysis showed a fall in pO₂ level in the postoperative period that was highly significant ($p < 0.001$) in Group I and significant ($p < 0.05$) in Group II, when compared to preoperative values. Rise in pCO₂ level in the postoperative period was significant ($p < 0.05$) in Group I but was insignificant in Group II. Difference between the groups was not significant.

Discussion

The advantages of the laparoscopic technique include less patient discomfort, shorter hospitalization, and shorter interval to return to full activities after operation. [19] It has been postulated that due to the minimal incisional discomfort,

postoperative pulmonary function following laparoscopic cholecystectomy would be improved as compared to open cholecystectomy. The pulmonary effects of surgery and general anesthesia have been well documented. Impaired gas exchange occurs with the induction of general anesthesia and can be related to the effects of general anesthesia on distribution of ventilation, lung and chest wall mechanics, lung volumes, shunt fraction, and ventilation perfusion relationships. [20,21] Patient position, type of inhaled anesthetic, tidal volume, and airway pressure during general anesthesia can influence gas exchange and lung mechanics. [22,23]

Our study indicates that there is a significant decrease of lung volumes and expiratory flow rates along with a substantial degree of hypoxemia. In patients undergoing laparoscopic surgery the values recorded on the second postoperative day were near normal. All the patients who took part in the study had normal respiratory functions before

surgery according to the norms set for the Indian population. [24-27] Post-operative decrease in FVC in Group I and II was 65.9% and 82.5% respectively. Karayiannakis et al reported a decrease to 67% and 79% from preoperative values in Group I and II respectively. Change in mid expiratory flow rates was similar to the findings of Karayiannakis et al for Group I. [28]

Decrease in respiratory functions after abdominal surgeries is well documented from previous studies. [28-33] With laparoscopic surgery there is less pain and less trauma to the abdominal wall resulting in early recovery of respiratory functions. However gas used for creating pneumoperitoneum can result in increased CO₂ levels in the postoperative period. Gas pockets can also interfere with respiratory movements. [34-36] Changes in lung volumes and flow rates in the open surgery group to about 60%-70% and in the laparoscopy group to about 80%- 90% of the preoperative value is concordant with the previous studies. A fall in arterial oxygen saturation has been noted in many studies, even without pulmonary complications. [37,38] Arterial carbon dioxide, pH and bicarbonate do not show any change in the postoperative period. Changes in blood gases are confirmed with the previous studies. [39,40] Limitations: The limitations were that we could not measure the length of the wound, spirometry had to be done in the supine rather than erect posture due to ethical reasons and capillary blood gas analysis was done instead of arterial blood gas analysis due to ethical constraints. [41]

Conclusion

It was concluded that laparoscopic cholecystectomy offers improved pulmonary function compared to the open technique.

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