Harsukh Educational Charitable Society
International Journal of Community Health and Medical Research
Journal home page:www.ijchmr.com doi: 10.21276/ijchmr

ISSN E: 2457-0117 **ISSN P:** 2581-5040 **Index Copernicus** ICV =62.61

Original ARTICLE

Assessment of effect of anaesthetic technique in pulmonary function

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ABSTRACT
Background: Respiratory complications in the postanesthesia period are an important area of concern because they are a major cause of morbidity and mortality. A critical respiratory event in the postanesthesia care unit (PACU) is the complex of major unanticipated ventilation problems, including hypoxemia. GA causes relaxation of jaw and pharyngeal muscles and leads to posterior displacement of tongue. Loss of cough reflex along with increased secretions results in airway obstruction, laryngospasm and bronchospasm. GA abolishes the sigh reflex with rapid onset of atelectasis in the majority of the patients. Irrespective of mode of ventilation (spontaneous or mechanical), there is loss of muscle tone and dose-dependent decrease in minute ventilation (MV) as a result of decrease in respiratory rate or tidal volume (VT) or both. **Aim of the study:** To assess effect of anaesthetic technique in pulmonary function. **Materials and methods:** The present study was conducted in the Department of Anesthesiology of the Medical institutions. A total of 50 patients who were scheduled for ambulatory surgery were included in the study. The patients were divided into four groups according to BMI as healthy (18.5-24.9 kg/m2), overweight (25-29.9 kg/m2), obese (30-39.9 kg/m2), morbidly obese (over 40 kg/m2). Respiratory function tests of the patients in standing postures were performed 24 hours before the operation and on the 1st and 6th day after the operation. Blood gas values and anaesthesia periods were recorded. Forced expiratory volume in 1st second (FEV1), forced vital capacity (FVC) and FEV1/FVC values were included in this study. The same person tested every patient with a mobile hand spirometer (one flow spirometre; Clent Clarke 2002, made in UK) for respiratory function test. **Results:** We observed that 28 participants were males and 22 were females. Mean age of the patients was 54.65 years, mean weight was 72.33 and mean height was 1.69 m. We observed that FEV1, FVC and FEV1/FVC values in all cases were statistically low compared to preoperative values on 1st day after the operation. Percentage changes of respiratory function test were calculated preoperatively and postoperative 1st day. The changes were compared and there was a significant decrease in FEV1, FVC and FEVI/FVC in subjects. **Conclusion**: Within the limitations of the present study, it can be concluded that anesthesia does not have significant effect on the pulmonary functions of the patient after the surgery.
Keywords: Pulmonary functions, surgery, postoperatively, PFT

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This article may be cited as: Charak G, Sharma S. Assessment of effect of anaesthetic technique in pulmonary function. HECS Int J Comm Health Med Res 2020; 6(1): 13- 16.

INTRODUCTION

Respiratory complications in the postanesthesia period are an important area of concern because they are a major cause of morbidity and mortality. A critical respiratory event in the postanesthesia care unit (PACU) is the complex of major unanticipated ventilation problems, including hypoxemia (hemoglobin oxygen saturation <90%), hypoventilation (respiratory rate <8 breaths/min or arterial carbon dioxide [CO2] tension >50 mmHg) or upper-airway obstruction (laryngospasm or stridor), that require a physical or pharmacological intervention (eg, insertion of an oral/nasal airway, ventilation, tracheal intubation, opioid antagonism, muscle relaxant reversal).[1] GA causes relaxation of jaw and pharyngeal muscles and leads to posterior displacement of tongue. Loss of cough reflex along with increased secretions results in airway obstruction, laryngospasm and bronchospasm. Patients with hyperreactive airways are more prone to complications.[2] Tracheal intubation protects airway but increases the dead space, and delivery of dry gases may affect pulmonary function, especially in younger patients. Anaesthesia causes respiratory impairment by mismatch in alveolar ventilation (Va) and perfusion (Q). GA abolishes the sigh reflex with rapid onset of atelectasis in the majority of the patients. Irrespective of mode of ventilation (spontaneous or mechanical), there is loss of muscle tone and dose-dependent decrease in minute ventilation (MV) as a result of decrease in respiratory rate or tidal volume (VT) or both.[3, 4] Simultaneously, there is fall in functional residual capacity (FRC) and forced expiratory volume in 1 s (FEV1)

leading to alveolar collapse and increase in shunts. Alveolar recruitment manoeuvres, followed by positive end-expiratory pressure (PEEP) which limits the shunts, may reduce post-operative pulmonary complications and improve patient outcomes.[5, 6] Hence, the present study was conducted to assess assess effect of anaesthetic technique in pulmonary function.

MATERIALS AND METHODS

The present study was conducted in the Department of Anesthesiology of the Medical institutions. The ethical clearance for the study was approved from the ethical committee of the hospital. A total of 50 patients who were scheduled for ambulatory surgery were included in the study. An informed written consent was obtained form each subject after explaining them the protocol of the study. The patients were divided into four groups according to BMI as healthy (18.5-24.9 kg/m2), overweight (25-29.9 kg/m2), obese (30-39.9 kg/m2), morbidly obese (over 40 kg/m2). Prior to the surgery, patients with any pulmonary problems were given antibiotics, expectorant and bronchodilatator treatment for 1 week. Surgery was performed after recovery. Respiratory function tests of the patients in standing postures were performed 24 hours before the operation and on the 1st and 6th day after the operation. Blood gas values and anaesthesia periods were recorded. Forced expiratory volume in 1st second (FEV1), forced vital capacity (FVC) and FEV1/FVC values were included in this study. The same person tested every patient with a mobile hand spirometer (one flow spirometre; Clent Clarke 2002, made in UK) for respiratory function test. The best test results of patients were recorded for every parameter. All the patients were operated under general anaesthesia with endotracheal intubation by the same team. Postoperative analgesia (paracetamol 1gr/d) was given according to the need of every patient.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

RESULTS

Table 1 shows demographic and clinic features of patients. We observed that 28 participants were males and 22 were females. Mean age of the patients was 54.65 years, mean weight was 72.33 and mean height was 1.69 m (**Fig 1**). **Table 2** shows pulmonary function tests preoperatively and postoperatively. We observed that FEV1, FVC and FEV1/FVC values in all cases were statistically low compared to preoperative values on 1st day after the operation. Percentage changes of respiratory function test was calculated preoperatively and postoperative 1st day. The changes were compared and there was a significant decrease in FEV1, FVC and FEVI/FVC in subjects. There was no significant difference in respiratory function tests evaluated on the 6th postoperative day and they had returned to normal values (**Fig 2**).

DISCUSSION

In the present study, we observed that there was a significant decrease in FEV1, FVC and FEVI/FVC in subjects on 1st day postoperatively. There was no significant difference in respiratory function tests evaluated on the 6th postoperative day and they had returned to normal values. The studies were compared to previous studies in literature.

Table 1: Demographic and clinic features of patients

Characters	Values
Sex (M/F)	28/22
Mean age (years)	54.65
Mean weight (kg)	72.33
Mean height (m)	1.69

Fig 1: Demographic data

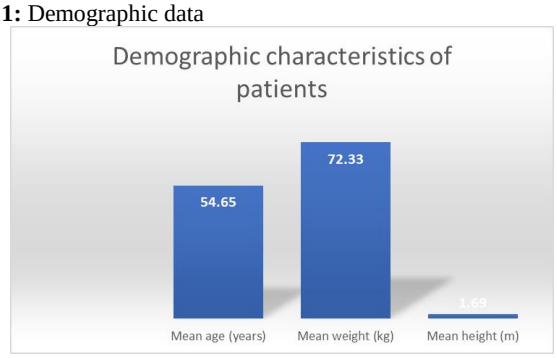
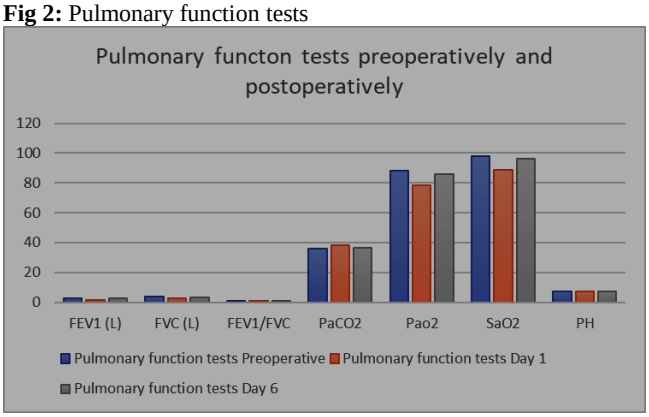


Table 2: Pulmonary function tests preoperatively and postoperatively

Parameters	Pulmonary function tests			p-value
	Preoperative	Day 1	Day 6	
FEV1 (L)	2.88	1.69	2.68	0.21
FVC (L)	3.68	2.49	3.42	0.22
FEV1/FVC	0.80	0.69	0.78	0.09
PaCO2	35.7	37.98	36.25	0.01
Pao2	88.2	78.65	85.65	0.21
SaO2	98	89	96	0.65
PH	7.4	7.32	7.38	0.5

Fig 2: Pulmonary function tests



Cihan Doger et al investigated the effects of low-flow sevoflurane anesthesia on the pulmonary functions in patients undergoing laparoscopic cholecystectomy. Methods. Sixty American Society of Anesthesiologists (ASA) physical status classes I and II patients scheduled for elective laparoscopic cholecystectomy were included in the study. Patients were randomly allocated to two study groups: high-flow sevoflurane anesthesia group (Group H,) and low-flow sevoflurane anesthesia group (Group L,). The fresh gas flow rate was of 4 L/min in high-flow sevoflurane anesthesia group and 1 L/min in low-flow sevoflurane anesthesia group. Heart rate (HR), mean arterial blood pressure (MABP), peripheral oxygen saturation (SpO2), and end-tidal carbon dioxide concentration (ETCO2) were recorded. Pulmonary function tests were performed before and 2, 8, and 24 hours after surgery.

Results. There was no significant difference between the two groups in terms of HR, MABP, SpO2, and ETCO2. Pulmonary function test results were similar in both groups at all measurement times. Conclusions. The effects of low-flow sevoflurane anesthesia on pulmonary functions are comparable to high-flow sevoflurane anesthesia in patients undergoing laparoscopic cholecystectomy. Akhiwu BI et al determined the variations in pulmonary functions readings between cases treated under general anesthesia (GA) and those treated under local anesthesia (LA). A descriptive hospital-based study of 106 patients was carried out from January 2011- December 2012. Information was obtained using a questionnaire and all study subjects had their baseline lung functions and their post-operative daily lung function parameters measured for the first week and then weekly for the next five weeks. The data obtained were analyzed using SPSS version 16 and a P-value of ≤0.05 was considered significant. A total of 85 males and 21 females participated in the study. The means for age was 30.62±8.06, weight 63.92± 9.96 and BMI 23.21± 3.14 while the means for the pre-operative FVC, FEV1, and PEFR were 3.71 ± 0.70, 3.14± 0.51 and 8.18± 1.61 respectively. There was a statistically significant drop (p< 0.05) in the FVC, FEV1 and PEFR in the first post operative week. The drop in the lung function parameters were similar between the GA group and the LA group. Maxillo-mandibular fixation causes a significant fall in pulmonary function parameters especially in the first 48 hours post-operatively irrespective of whether general or local anaesthesia was used at surgery. The pulmonary functions should be further monitored for more than 48 hours after surgery.[7, 8]

Rademakerm D et al compared the efficacy of 0.9% NaCI 20 ml (n = 15), 0.25% bupivacaine 20ml (n = 15) and 0.5% lignocaine 20 ml (n = 15), administered i.p., in reducing postoperative pain and opioid requirements, and modifying the metabolic response to surgery and postoperative lung function after laparoscopic cholecystectomy. There were no differences in postoperative pain scores (visual analogue scale and verbal rating scale) between the three groups in the first 4 h after operation and in analgesic requirements during the first 24 h. In all groups, forced vital capacity, peak expiratory flow and forced expiratory volume in 1 s decreased 2h after surgery. Ventilatory values recovered only partially in the first 2 days after operation, with no significant differences between groups. Plasma concentrations of glucose and cortisol increased after surgery. Cortisol concentrations returned to baseline 48 h after operation. There were no significant differences between the groups in any measured variable. These data suggest that the administration of 20 ml of local anaesthetics i.p. is not effective in reducing postoperative pain, improving lung function, or attenuating the metabolic endocrine response after laparoscopic cholecystectomy. Frazee RC et al studied that upper abdominal surgery is associated with characteristic changes in pulmonary function which increase the risk of lower lobe atelectasis. Sixteen patients undergoing open cholecystectomy and 20 patients undergoing laparoscopic cholecystectomy were prospectively evaluated by pulmonary function tests (forced vital capacity [FVC], forced expiratory volume [FEV-1], and forced expiratory flow [FEF] 25% to 75%) before operation and on the morning after surgery to determine if the laparoscopic technique lessens the pulmonary risk. Fraction of the baseline pulmonary function was calculated by dividing the postoperative pulmonary function by the preoperative pulmonary function and multiplying by 100%. Postoperative FVC measured 52% of preoperative function for open cholecystectomy and 73% for laparoscopic cholecystectomy (p = 0.002). Postoperative FEV-1 measured 53% of baseline function for open cholecystectomy and 72% for laparoscopic cholecystectomy (p = 0.006). Postoperative FEF 25% to 75% measured 53% for open cholecystectomy and 81% for laparoscopic cholecystectomy (p = 0.07). It is concluded that laparoscopic cholecystectomy offers improved pulmonary function compared to the open technique. Hasukić S et al evaluated the pulmonary function during and after laparoscopic cholecystectomy (LC). Thirty patients were evaluated with preoperative and postoperative spirometry, arterial blood gas determinations and chast radiographs to quantitate the magnitude of postoperative pulmonary changes after LC. Spirometry and chast radiographs were made before and 24 h after operation. Blood gas analye were performed preoperative, and 24 h after operation. Forced expiratory volume in 1 s (FEV: mean +/- SD values; preoperative: 3.12 +/- 0.78; postoperative: 2.33 +/- 0.80; P < 0.05), forced vital capacity (FVC; preoperative: 3.58 +/- 0.95; postoperative: 2.93 +/- 1.05; P < 0.05), peak expiratory flow (PEF; preoperative: 5.59 +/- 1.97; postoperative: 4.27 +/- 1.60; P < 0.05) and the midexpiratory phase of forced expiratory flow (FEF25-75; preoperative: 1.98 +/- 0.93; postoperative: 1.60 +/- 0.73; P < 0.05), were reduced 20-25% on average compared with preoperative values. Clinically important changes in arterial blodd gas values did not occur. Of 30 postoperative chest films, 9 showed the development of microatetelctasis. They concluded that improved pulmonary function after laparoscopic cholecystectomy may account for the observed reduced rate of pulmonary[9-11]

CONCLUSION

Within the limitations of the present study, it can be concluded that anesthesia does not have significant effect on the pulmonary functions of the patient after the surgery.

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