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Original Article

Is the Perioperative Period No Longer a Problem for Adult Asthmatics under Control?-OPERA Study

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Abstract

OBJECTIVES: Asthma is a global problem and chronic condition that persists through patient's entire life, during which the possibility of a surgical procedure is common. An accurate clinical and functional evaluation of respiratory functions and asthma control is needed in patients undergoing surgical procedures and requiring general anesthesia. The aim of this study was to disclose any possible relation between postoperative complications and some pre- and postoperative factors.

MATERIALS AND METHODS: In this prospective cross-sectional study, randomly selected 111 asthmatic patients who presented to 10 different tertiary centers were included. The patients were evaluated at three different periods; any day between 1-7 days before surgery, and postoperative third and seventh to tenth days.

RESULTS: Among the patients included in the study, 86 (77.5%) were women and mean age was 52.2±13.8 years. General anesthesia was the most common anesthesia type (89.2%), and 33.3% of patients had had a thoracoabdominal surgery. There was a statistically significant difference between pre- and postoperative third-day values, including ACT scores (22.2±3.16 and 21.59±3.84, respectively; p<0.001); forced expiratory volume during the first second (84.92±19.12 and 78.26±18.47, respectively; p<0.001); peak flow rate (79.51±21.12 and 70.01±19.72, respectively; p<0.001); and SaO2 (96.95±1.82 and 95.8±3.32, respectively; p<0.001). Bronchospasm and pain were the most common complications during the postoperative period.

CONCLUSION: Controlled asthma under treatment steps 1-2-3 does not cause any serious postoperative pulmonary complications (PPCs). Therefore, achieving an optimal control level of asthma during the preoperative period must be considered the "gold standard" to reduce the risk of PPCs in asthmatic patients.

KEYWORDS: Asthma, postoperative complications, preoperative care, pulmonary disease.

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INTRODUCTION

Asthma affects patients of all ages and persists through a patient's entire life, during which the possibility of a surgical procedure is common [1]. The prevalence of postoperative pulmonary complications (PPCs) in non-cardiothoracic surgical procedures was reported to be 2% to 19%, and in cardiothoracic surgical procedures, the incidence range was reported to be 8% to 39% [2, 3]. It is clinically important to reduce PPCs in patients with asthma, and proper perioperative management strategies are necessary to predict PPC risk in patients with asthma. There are two types of risk factors for PPCs. One type is patient-related risk factors, such as aging and pulmonary function, and the other is procedure-related risk factors such as anesthetic techniques and operating time [4]. The most common PPCs include atelectasis, pneumonia, bronchitis, bronchospasm, hypoxemia, respiratory failure, and prolonged mechanical ventilation [5].

Owing to airway hyperreactivity, bronchospasm may be precipitated by instrumentation, a variety of drugs, and perioperative complications, such as aspiration, infection, or trauma in patients with asthma [6, 7]. The type of anesthesia has not been demonstrated to be a risk factor for PPCs in asthmatics [5].

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An accurate clinical and functional evaluation of respiratory functions and asthma control is needed in patients undergoing surgical procedures and requiring general anesthesia. In the Global Initiative for asthma (GINA) guidelines, for an elective surgery, achieving good asthma control is recommended for patients with more severe asthma, uncontrolled symptoms, exacerbation history, or fixed airflow limitation.

Patients with asthma are routinely evaluated by a chest medicine specialist during the preoperative period. However, preoperative risk factors are less well known in patients with asthma with a proper preoperative evaluation. The aim of this study was to disclose any possible relation between perior postoperative complications and some preoperative factors, including clinical complaints and findings, asthma control test (ACT), pulmonary functions, oxygen saturation (SaO_2), the location of surgery, and the type of anesthesia.

MATERIALS AND METHODS

This prospective cross-sectional study included 111 adult patients with asthma who presented to 10 different adult chest disease departments for a preoperative consultation between January and December 2012. Patients were evaluated preoperatively, postoperative third and seventh to tenth day. Demographic data; type of operation; type of anesthesia; site of operation; type of anesthetic agents; all kinds of other medications; comorbid diseases; symptom scores on a visual analog scale of cough, sputum, dyspnea, wheezing, dyspnea on exertion, and nocturnal asthma; pulmonary function tests (forced expired volume in one second (FEV_1%) and peak expiratory flow (PEF%)), SaO_2, and ACT scores at stated days; postoperative complications; preoperative bronchodilator usage status; difficulty on intubation; and postoperative narcotic analgesic usage were recorded using a questionnaire administered by a trained physician. Patients who volunteered for the study were included in the study, and those who did not want to participate in the study were excluded. The study protocol was approved by the local ethics committee. Verbal voluntary informed consent was received from patients.

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences version 18.0 (SPSS Inc.; Chicago, IL, USA). The usual statistical tests were performed for a univariate analysis. A chi-square test for categorical variables and a t-test for continuous variables were used. The level of statistical significance was set at $p<0.05$.

RESULTS

Among the patients included in the study, 86 (77.5%) were women, and the mean age was 52.2±13.8 years (Table 1). Among the patients, 80.2% of patients were nonsmokers but 6.3% of patients were current smokers. A total of 11.7% of patients were receiving step 1-2 treatment (ie, low-dose inhaled corticosteroids, only montelukast, or short-acting beta-agonists), 36.9% of patients were receiving step 3 treatment, and 31.4% of patients were receiving step 4-5 treatment as medications.

General anesthesia was the most common anesthesia type (89.2%), and only 4.5% of the surgical procedures were emergent. Only 7.2% of the surgical procedures were laparoscopic. A total of 33.3% of patients had had a thoracoabdominal surgical procedure, and 18.9% of patients had had a nasal polyposis surgical procedure (Table 2).

ACT scores and FEV_1, PEF, and SaO_2 values were statistically significantly lower on the third-day visit but returned to normal on the seventh to tenth day (preoperatively and on the third and seventh to tenth days: ACT: 22.2±3.16, 21.59±3.84, 22.28±3.2, $p<0.001$; FEV_1 (percent of the predicted): 84.92±19.12, 78.26±18.47, 83.94±19.31, $p<0.001$; PEF (percent of the predicted): 79.51±21.12, 70.01±19.72, 76.95±19.69, $p<0.001$; SaO_2: 96.95±1.82, 95.8±3.32, 96.97±2.08, $p<0.001$, respectively) (Table 3). There were no statistically significant differences among symptom scores of the mentioned days for thoracoabdominal surgery patients (Table 4).

Table 1. Demographic characteristics of patients (n=111)

Demographics	Values
Gender, n (%)	
Female	86 (77.5)
Male	25 (22.5)
Age (years, mean±SD, range)	52.2±13.8 (20-87)
Smoking, n (%)	
Nonsmoker	89 (80.2)
Ex-smoker	12 (10.8)
Current smoker	6.3 (7)
Body mass index (kg/m^2, mean±SD, range)	29.3±5.8 (20-44.8)
Asthma treatment (n=89), n (%)	
ICS	7 (6.3)
ICS and LABA	38 (34.2)
ICS and MONT	3 (2.7)
ICS, LABA, and MONT	34 (30.6)
Oral CS	1 (0.9)
SABA as needed	4 (3.6)
Only MONT	2 (1.8)

CS: corticosteroid; ICS: inhaled corticosteroid; LABA: long-acting β^2 agonist; MONT: montelukast; SABA: short-acting β^2 agonist

MAIN POINTS

- The preoperative evaluation is an important opportunity to improve patient outcomes during the perioperative period.
- Routine preoperative testing (pulmonary function test and arterial blood gas analysis) is unnecessary. Preoperative testing should be triggered by findings on examination, patient history, and review of systems.
- Ensuring optimized and stable asthma control is essential. These patients benefit from standard risk reduction strategies as well.

Fever, pain, immobilization, abdominal distension, and bronchospasm were recorded as postoperative complications. Bronchospasm and pain were statistically significantly more common on the third-day visit than seventh- to tenth-day visits (p=0.002 and p≤0.001, respectively). Among the 12 bronchospasm patients, only 3 had had a thoracoabdominal surgical procedure. Narcotic analgesic usage was statistically significantly higher on the third day (p≤0.001), but there was no relation with complications (Table 5).

Table 2. Characteristics of operations

Characteristics	Values n (%)
Operation type	
Emergency	5 (4.5)
Laparoscopic	8 (7.2)
Type of anesthesia	
Local-spinal	12 (10.8)
General	99 (89.2)
Site of operation	
Thorax	4 (3.6)
Upper abdomen	11 (9.9)
Lower abdomen	22 (19.8)
Cranial	6 (5.4)
Orthopedic	21 (18.9)
Nasal polyposis	21 (18.9)
Others	26 (23.4)

DISCUSSION

In this study, there was no possible relation between peri- or postoperative complications and some preoperative factors (clinical complaints and findings, ACT, pulmonary functions, SaO_2, the location of surgery, and the type of anesthesia) in adult patients with asthma.

PPCs are a significant source of mortality and morbidity. Practically and ethically, it is impossible to determine a dominant contribution from surgical procedures or from anesthesia. Bronchospasm is one of the most significant respiratory events during anesthesia [8]. The risk of bronchospasm in the perioperative period is low in stable patients with asthma, and when it occurs, it is usually not associated with serious morbidity. The occurrence of potentially life-threating bronchospasm in anesthesia practice varies from 0.17% to 4.2% [9]. In this study, bronchospasm prevalence

Table 3. Symptom scores of all patients

Symptoms	Preoperative (n=111; mean±SD)	Third day (n=73; mean±SD)	Seventh to tenth day (n=96; mean±SD)	p
Cough	1.24±1.96	1.7±1.99	1.2±1.55	<0.001
Sputum	0.74±1.54	0.77±1.29	0.62±1.25	0.037
Wheezing	0.77±1.68	0.99±1.61	0.67±1.29	0.001
Dyspnea on exertion	2.55±2.47	2.48±2.5	2.19±2.23	0.001
Nocturnal asthma	0.41±1.19	0.51±1.14	0.35±1.08	0.031
FEV_1	84.92±19.12	78.26±18.47	83.94±19.31	<0.001
PEF	79.51±21.12	70.01±19.72	76.95±19.69	<0.001
Saturation	96.95±1.82	95.8±3.32	96.97±2.08	<0.001
ACT	22.2±3.16	21.59±3.84	22.28±3.2	<0.001

FEV_1: forced expired volume in one second; PEF: peak expiratory flow; ACT: asthma control test

Table 4. Symptom scores of thoracoabdominal surgery patients

Symptoms	Preoperative (n=111; mean±SD)	Third day (n=73; mean±SD)	Seventh to tenth day (n=96; mean±SD)	p
Cough	0.95±1.58	1.74±2.15	1±1.16	0.006
Sputum	0.76±1.59	0.74±1.16	0.53±1	0.073
Wheezing	0.59±1.26	0.88±1.53	0.61±1.15	0.099
Dyspnea on exertion	2.57±2.3	2.88±2.45	2.39±2.26	0.037
Nocturnal asthma	0.3±1.22	0.26±0.71	0.31±1.06	0.331
FEV_1	80.97±19.81	71.44±17.31	78.65±22.54	0.081
PEF	75.91±21.33	66.89±17.18	73.71±22.08	0.007
Saturation	96.85±1.52	95.93±2	96.84±1.95	0.007
ACT	22.46±3.02	21.31±4.18	22.15±3.31	<0.001

FEV_1: forced expired volume in one second; PEF: peak expiratory flow; ACT: asthma control test

Table 5. Postoperative complications

Complications	Third day (n=107; n, %)	Seventh to tenth day (n=108; n, %)	p
Fever	13 (12.15)	–	–
Pain	28 (26.2)	11 (10.2)	<0.001
Immobilization	2 (1.8)	–	–
Distension	4 (3.7)	1 (0.9)	0.375
Bronchospasm	12 (11.2)	2 (1.9)	0.002
Narcotic analgesic usage	38 (35.5)	3 (2.8)	<0.001

was 11.2% on the third day and 1.9% on the seventh to tenth day, which does not cause any serious problem. The definition of bronchospasm was made clinically, and there was no objective test for this, because of which our bronchospasm rates may be high.

PPCs occur commonly in patients who receive anesthesia and undergo upper-abdominal or thoracic surgical procedures [10]. The risk factors for PPCs in asthmatics include recent asthma symptoms, recent use of antiasthma drugs or therapy in the hospital, and a history of tracheal intubation for asthma [6].

Patients who undergo abdominal (upper and lower) and thoracic surgical procedures have a decreased postoperative vital capacity and functional residual capacity (FRC). This decrease in FRC results in a ventilation-perfusion mismatch and contributes to the development of hypoxemia. Laparoscopic surgical procedures might have advantages in patients with an underlying lung disease. There is improved FEV_1 and forced vital capacity, better arterial oxygenation, and improved ventilation after laparoscopic procedures as compared with open procedures [11]. However, an upper-abdominal laparoscopic surgical procedure is associated with the dysfunction of the diaphragm. The site of surgery rather than the surgical technique is critical in determining whether there will be a diaphragmatic dysfunction. In this study, a thoracoabdominal surgical procedure constituted 33.3% of all operations. Only 3 of 12 patients with bronchospasm have had a thoracoabdominal surgical procedure.

Laboratory testing can predict patients at risk for PPCs, but tests have not been shown to have superior sensitivity or specificity compared with clinical observations. Spirometry does not allow the calibration of a patient's risk but may enhance the diagnosis of a lung disease. Baseline arterial blood gases do not improve risk assessment. In this study, FEV_1%, PEF%, and SaO_2 had decreased statistically significantly on the third day, but this decline was not consistent with clinical symptoms. Mean FEV_1 ratios of the study patients were 85%, so the low complication rate could also be related with better spirometric values of these patients. Only 31.4% of patients were using step 4-5 asthma treatment, and most of our study population was controlled asthma patients under step 1-2-3 treatment, so complication ratios were low.

The type of anesthesia has not been demonstrated to be a risk factor for PPCs in patients with asthma. In the study by Warner et al. [8] including 1500 patients with asthma, the complication rates for general and regional anesthesia were similar, but regional anesthesia was safer for patients with asthma to avoid instrumentation of the airway. As the general anesthesia frequency was very high (89.2%) in this study, it was not possible to make a comparison between the two groups.

It is recommended to avoid drugs that cause histamine release in patients with asthma. Although many narcotic analgesics are notorious in this regard, they have never been shown to have deleterious effects in patients with asthma. In fact, they may be desirable because of their depressant effects on airway reflexes and coughing [12]. In this study, narcotic analgesic usage was statistically significantly higher on the third day ($p \leq 0.001$), but there was no relation with complications.

There are some limitations of this study. First, all of the centers in this study are tertiary health care centers, so most of the patients with asthma were patients with controlled asthma under treatment step 1-2-3 (patient bias). We could not compare these patients with asthma and step 4-5 patients with severe asthma. Second, when we separated patients according to the operation site and complications, the number of patients was too low to make a comparison. Third, in different studies, an operation time longer than 2 hours and 5 hours was a risk factor of PPCs [13, 14]. In this study, the operation time was not recorded. We did not calculate the sample size and power of the study, and these are also limitations of our study.

The first thing to do in the preoperative evaluation is to assess whether the patient's asthma is under control or not [15]. Patients with optimally controlled asthma could receive general anesthesia with lower risks, especially in emergency conditions when it is not possible to perform any preoperative evaluation [16].

As a result, for patients with controlled asthma under treatment step 1-2-3, asthma is not a serious risk factor for pulmonary complications. It is not necessary to perform a pulmonary function test or an arterial blood gas analysis in an asymptomatic patient with controlled asthma. Optimal treatment should be arranged to keep FEV_1 or PEF over 80% in patients with asthma who undergo an elective surgery. Further studies are needed to compare risk factors in patients with mild-moderate asthma and severe asthma.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Hacettepe University. (B.30.20HAC.0.20.71.00/1173 /24/11/2011)

Informed Consent: Oral informed consent was obtained from patients participated in this study.

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REFERENCES

1. Virchow JC. What's Asthma. Akdis C, Agache I, editors. Global atlas of asthma-EAACI . EAACI. 2013.p.2-3.
2. Fischer BW, Majumdar SR, McAlister FA. Predicting pulmonary complications after non-thoracic surgery:a systematic review of blinded studies. Am J Med 2002;112:219-25. [Crossref]
3. Gatti G, Cardu G, Lusa AM, et al. Predictors of postoperative complications in high risk octogenarians undergoing cardiac operations. Ann Thoracic Surg 2002;74:671-7. [Crossref]
4. Woods BD, Sladen RN. Perioperative consideraiton for patient with asthma and brochospasm. Br J Anaesth 2009;103:i57-i65. [Crossref]
5. Smetana GW. Preoperative pulmonary evaluation. N Engl J Med 1999;340:937-44. [Crossref]
6. Bapoje S, Whitaker J, Schulz T, et al. Preoperative evaluation of patients with pulmonary disease. Chest 2007;132:1637-45. [Crossref]
7. Tirumalasetty J, Leslie C. Grammer. Asthma, Surgery, and General Anesthesia: A Review. J Asthma 2006;43:251-4. [Crossref]
8. Warner DO, Warner MA, Barnes RD, et al. Perioperative respiratory complications in patients with asthma. Anesthesiology 1996;85:460-7. [Crossref]
9. Rock P, Passannante A. Perioperative assessment:pulmonary. Anesthesiology Clin N Am 2004;22:77-91. [Crossref]
10. Brenerich DH. Anesthesia in bronchial asthma. Anasthesiol İntensicmed Notfallmed Schmerzther 2000;35:545-58. [Crossref]
11. Pederson T, Viby-Mogensen J, Ringsted C. Anaesthetic practice and postoperative pulmonary complications. Acta Anaesthesiol Scand 1992;36:812-8. [Crossref]
12. Putensen-Himmer G, Putensen C, Lammer H, et al. Comparison of postoperative respiartory function after laparascopy or open laparatomy for cholecystectomy. Anesthesiology 1992;77:675-80. [Crossref]
13. Becker DE. Preoperative medical evaluation :part 2: pulmonary, endocrine, renal, and miscellaneous consideration. Anesth Prog 2009;56:135-45. [Crossref]
14. Canet J, Gallart L, Gomar C, ARISCAT group. Prediction of postoperative pulmonary compliactions in population based surgical cohort. Anesthesiology 2010;113:1338-50. [Crossref]
15. Numata T, Nakayama K. Risk factors of postoperative pulmonary complications in patients with asthma and COPD. BMJ 2018;18:4. [Crossref]
16. Özkan M, Kırkıl G, Dilektaşlı AG, et al. Summary of consensus report on preoperative evaluation. Turk Thorac J 2015;16:43-52. [Crossref]
17. Liccardi G, Salzillo A, Piccolo A, et al. The risk of bronchospasm in asthmatics undergoing general anesthesia and/or intravascular administration of radiographic contrast media, physiopathology and clinical/functionla evaluation. Eur Ann Allergy Clin Immunol 2010;42:167-73.