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Preoperative Optimization of the Asthmatic Patient

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Abstract

Asthma is a common upper respiratory condition among patients across the developmental spectrum estimated to affect over 300 million people worldwide with prevalence rate and condition severity continually increasing.[1] The purpose of pursuing this topic is to share a case study to educate anesthesia providers about the complications resulting from intraoperative bronchospasm and to provide guidelines for preventing bronchospasm during the perioperative period. A 77-year-old, female, ASA 4, inpatient was undergoing general anesthesia for left percutaneous hip pinning. The patient had significant medical history including asthma and COPD (well-controlled) but still experienced bronchospastic events intraoperatively. This case report reviews current prevention, treatment, and optimization of bronchospasm in at-risk adults.

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Introduction

- Asthma is a common respiratory condition affecting millions of people worldwide
- Bronchospasms are a defining feature of asthma in which the smooth muscle of the airway contracts and narrows (figure 1)[1]
- The high prevalence of asthma means that many patients undergoing surgery are at risk of an intraoperative bronchospasm
- Preventing intraoperative bronchospasm decreases the risk of postoperative respiratory complications
- Preoperative pharmacologic interventions are a well-documented method for reducing intraoperative bronchospasm and postoperative respiratory issues.
- However, the preventative strategies are often omitted preoperatively for some asthmatic surgical patients
- **Purpose statement:** To educate heath care providers about the risks surrounding intraoperative bronchospasm and to encourage the optimization of asthmatic patients prior to surgery.

Case Report

- 77-year-old, physical status 4, female presented for closed reduction of left hip and percutaneous pinning.
- Medical history: COPD, well-controlled asthma per patient
- Due to self-report of well-controlled asthma, no bronchodilator medication were administered. Lung sounds clear bilaterally upon auscultation.
- Preoperative vital signs: BP 154/89 mm Hg, HR 82/min, RR 16/min, SpO_2 98%, oxygen 2 L/min via nasal cannula, temperature 36.5 °C
- Anesthesia induction: preoxygenation FiO_2 1.0, 10 L/min, lidocaine 100 mg, fentanyl 100 mcg, propofol 100 mg IV; succinylcholine 100 mg IV for neuromuscular blockade
- Atraumatic direct laryngoscopy, Macintosh #3 blade, size 7.0 mm endotracheal tube, grade 1 Cormack-Lehane view of vocal cords, positive end-tidal CO_2 ($ETCO_2$), bilateral breath sounds equal.
- Mechanical ventilation, pressure-controlled ventilation with volume guarantee (PCV-VG) mode, RR 12/min, tidal volume (VT) 562mL, FiO_2 0.5, peak inspiratory pressure (PIP) 17 cm H_2O, positive end expiratory pressure (PEEP) 4 cm H_2O.
- Shortly after induction of anesthesia, $ETCO_2$ decreased, prolonged upstroke on capnogram, SpO_2 drop from 98% to 91%, PIP increase to 38 cm H_2O, and breath sounds were absent.
- The bronchospasm was quickly treated with multiple 90 mcg puffs of endotracheal albuterol. $ETCO_2$ returned to 52, SpO_2 increase to 97%, bilateral breath sounds returned.
- The surgical procedure commenced and proceeded without further exacerbation of asthma.
- However, prior to emergence, a second severe bronchospasm occurred requiring endotracheal albuterol and epinephrine 100 mcg IV.
- The bronchospasm resolved with medications.

Postoperative course

- Patient remained intubated, sedated, and was transferred to ICU for postsurgical and pulmonary care. The patient was extubated the following day once stable.

Clinical assessment	Well controlled	Not well controlled	Poorly controlled
Symptoms (wheezing, shortness of breath, chest tightness)	≤2 days/week	>2 days/week	Daily
Night-time awakenings with breathing problems	≤2 x/month	3–4 x/month	>1 x/week
Short-acting beta 2 agonist use for rescue	≤2 days/week	>2 days/week but not daily	Daily
Interference with normal activity	None	Some limitation	Extreme limitation
Exacerbations requiring systemic corticosteroids	≤1 x/year	2–3 x/year	>3 x/year
Patients above 5 years include additionally			
FEV1 predicted	>80%	60–80%	<60%
FEV1/FVC	>0.8	0.75–0.80	<0.75

Table 1. Assessment Of Asthma Severity[1]
Abbreviations. FEV1, forced expiratory volume in 1 sec; FVC, forced vital capacity.

Figure 1. Asthmatic Airway During Bronchospasm[6]

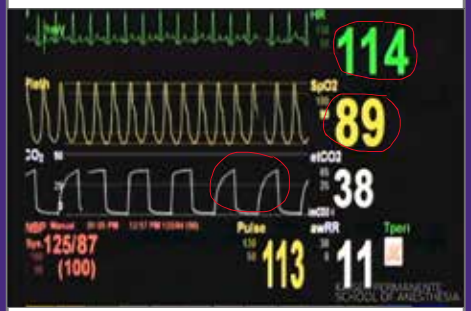

Figure 2. Presentation Of Intraoperative Bronchospasm On Patient Monitor[7] Classic Clinical Signs of Bronchospasm (eg, Tachycardia, Decreased SpO_2, and Prolonged Upstroke on the Capnogram) Circled in Red

Assessment

- History of asthma should be screened for and assessed during the preoperative period to determine the level of control the patient has over the disease
- Preoperative assessment of asthma should include:
  1) Severity of disease (table 1)[1]
  2) Triggers (cold air, dust, medications?)
  3) Frequency of exacerbations
  4) Effectiveness of treatment (was hospital admission necessary?)
  5) Steroid use
- Asthma severity can also be screened for with blood eosinophil counts and pulmonary functions tests

Synthesis of Literature

- A structured evidence search was conducted to investigate the topic of perioperative asthma optimization
- Five articles obtained through the search were used as evidence
- The design and methods used to investigate the topic varied from a single case study, to prospective randomized control trials, to systematic reviews.
- Sample sizes used in the studies varied from a small, single participant case study to a large, 484 participant study
- The participants included in each sample consisted of surgical patients with history of asthma undergoing general anesthesia with tracheal intubation
- Measures used in the study focused on the severity of the patients' asthma and the incidence of adverse perioperative respiratory events (ie, bronchospasm, wheezing, oxygen desaturation)
- The results of each study suggest that administration of beta-2 agonists prior to induction of anesthesia greatly reduce the incidence of adverse respiratory events among this patient population
- Based on the results from these studies, prevention of adverse respiratory events among the asthmatic patient population are largely preventable through preoperative pharmacologic optimization
- Some of the studies were limited by either sample size or inclusion criteria (such as age or asthma severity)
- Level of evidence for each of the reviewed studies was assessed using the Joanna Briggs Institute (JBI) levels of evidence
- JBI levels included 1a, 1c, 4b, and 4d
- Future directions for research on prevention of intraoperative bronchospasm should aim at addressing the existing barriers to standardizing the practice of preoperative pharmacologic optimization of the asthmatic patient

Discussion

- Asthmatic patients undergoing general anesthesia with tracheal intubation are at risk for intraoperative bronchospasm caused by the airway irritation inherent in placement of an endotracheal tube.
- Intraoperative bronchospasm increases the risk of postoperative pulmonary complications such as prolonged intubation, oxygen desaturation, severe coughing, and postoperative stridor.[4]
- Comprehensive assessment and preoperative pharmacologic optimization of the asthmatic patient is the most effective way of decreasing the incidence of intraoperative bronchospasm and the complications associated with it.
- Strategies for preventing intraoperative bronchospasm, such as preoperative beta-2 agonist administration, are well documented in the literature
- Despite the evidence, some patients diagnosed with asthma are not receiving preoperative intervention based on the self-report that their asthma is well-controlled.
- If all asthmatic patients, regardless of the severity of their asthma, are pharmacologically optimized during the preoperative period, the overall incidence of intraoperative bronchospasm may be reduced.

Conclusions & Recommendations for Practice

- Every asthmatic patient undergoing surgery with general anesthesia requiring tracheal intubation should be pharmacologically optimized during the preoperative period, regardless of the perceived severity of their asthma.
- Adopting this practice will likely decrease the incidence of intraoperative bronchospasm and the adverse postoperative complications associated with it.
- Providing bronchodilatory medications such as albuterol or ipratroprium via inhaler or nebulizer 10 minutes prior to surgery can potentially reduce the costs associated with lengthier hospital stays and increase patient satisfaction scores.[1]

References

1. Bayable SD, Melesse DY, Lema GF, Ahmed SA. Perioperative management of patients with asthma during elective surgery: a systematic review. *Ann Med Surg.* 2021; 70. doi:10.1016/j.amsu.2021.102874
2. Dewachter P, Mouton-Faivre C, Emala CW, Beloucif S, Riou B. Case scenario: bronchospasm during anesthetic induction. *Anesthesiology*. 2011; 114(5):1200-1210. doi:10.1097/ALN.0b013e3182172cd3
3. Maslow AD, Regan MM, Israel E, Darvish A, Mehrez M, Boughton R, Loring SH. Inhaled albuterol, but not intravenous lidocaine, protects against intubation-induced bronchoconstriction in asthma. *Anesthesiology*. 2000;93(5):1198–1204. doi:10.1097/00000542-200011000-00011
4. Ungern-Sternberg BS, Sommerfield D, Slevin L, Drake-Brockman TFE, Zhang G, Hall GL. Effect of albuterol premedication vs placebo on the occurrence of respiratory adverse events in children undergoing tonsillectomies: the REACT randomized clinical trial. *JAMA Pediatr.* 2019;173(6):527–533. doi:10.1001/jamapediatrics.2019.0788
5. Erdoğan T, Göksel Ö, Kirkıl G, et al. Is the perioperative period no longer a problem for adult asthmatics under control?-OPERA study. *Turk Thorac J.* 2020;21(3):140-144. doi:10.5152/TurkThoracJ.2019.18051
6. Lynn SJ & Kushto-Reese K. Understanding asthma pathophysiology, diagnosis, and management. Myamericannurse.com. Published July 7, 2015. Accessed February 15, 2022. https://www.myamericannurse.com/understanding-asthma-pathophysiology/
7. Bronchospasm 2-Patient Monitor. Kaiser Permanente School of Anesthesia. Youtube.com. Published March 2, 2016. Accessed February 23, 2022. https://www.youtube.com/watch?v=Ty2qb-6Gdk4