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SEVERE BRONCHOSPASM DURING GENERAL ANESTHESIA IN LAPROSCOPIC CHOLECYSTECTOMY A CASE REPORT

Anaesthesiology

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ABSTRACT

Objective: Bronchospasm is the clinical component of exacerbated underlying airway hyper-reactivity or as part of a more severe underlying pathology such as anaphylaxis. Bronchospasm is a joint sequel during the intubation period, especially in patients with respiratory disease and in most cases resolves without further complications.This case report reviews the literature and the algorithm taken to manage bronchospasm and will be helpful in patient care and successful outcome. **Case Report:** The patient was a 42-year-old female, 70 kg, American Society of Anesthesiologists (ASA) I admitted for laparoscopic cholecystectomy.The patient had no other past medical or surgical history, and all preoperative investigations, cardiac and pulmonary physical exams were within normal limits. when general anesthesia was induced and pneumoperitoneum was created, patient had sudden episode of bronchospam. At this point, surgery stopped immediately and treated accordingly.Then surgery aborted and patient shifted to ICU.The pulmonary team evaluated and assessed the patient,a diagnosis of asthma/reactive airway was made. **Conclusion:** Bronchospasm can become a life-threatening situation during general anesthesia. It is important for anesthesiologist to be prepared to make decisions focused on patient's safety. That is why we trust that any anesthesia provider must understand what is Bronchospasm, its pathophysiology, differential diagnosis, and treatments to provide the best patient care and successful outcome.

KEYWORDS

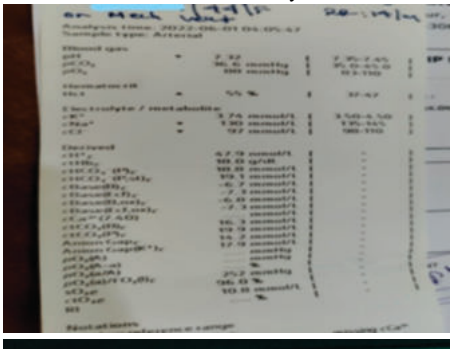
intubation, airway hyper reactivity, general anesthesia, bronchospasm.

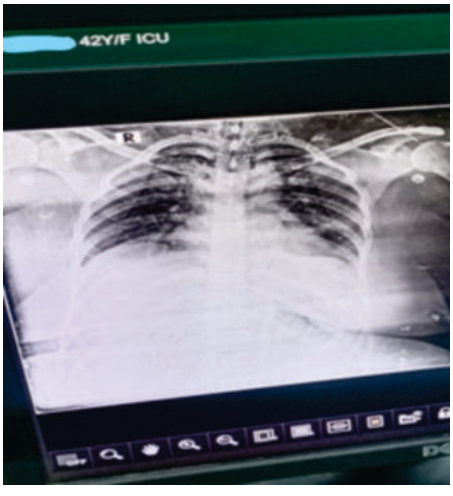
INTRODUCTION

Bronchospasm is a type of airway hyper-reactivity can be triggered by an underlying respiratory disorder. This case was observed in a patient with American Society of Anesthesiologists (ASA) grade I who underwent general anesthesia. If bronchospasm not treated, it may lead to hypoxia, hypotension, and increased morbidity and mortality [1]. An uneventful procedure is critical to a patient's well-being. The treatment of bronchoconstriction should be continuous and focused on the underlying causes. Monitoring for clinical signs and symptoms of bronchoconstriction should remain during the procedure. This case report aims to discuss the critical aspects and management of intraoperative bronchospasm.

CASE PRESENTATION

The patient was a 42-year-old female, 70 kg, American Society of Anesthesiologists (ASA) I and was admitted with right upper quadrant pain for laparoscopic cholecystectomy. The patient had no other past medical or surgical history, and all preoperative investigations were within normal limits, no recent upper respiratory tract infectionsor smoking. No abnormalities were found on cardiac and pulmonary physical exams. Our patient was taken to the operating room; ASA monitors were placed, and general anesthesia was induced by IV injections of midazolam 2 mg, fentanyl 100 mcg, propofol 100 mg, and vecuronium 4mg. An endotracheal tube (ETT) was placed on the first attempt, and placement was confirmed by auscultation and capnography readings. The patient was ventilated with volume-controlled ventilation, a tidal volume (TV) of 400 mL, a respiration rate of 12, FiO2 0.4, and isoflurane was used for anesthesia maintenance. The patient received a slow push of ceftriaxone 1 g intravenously, and pneumoperitoneum was created. Subsequently, the pulse oximetry started trending down, and the 'shark-fin' capnography pattern was observed. The FiO2 was increased from 0.4 to 1, and manual ventilation was started. However, pulse oximetry rapidly continued to decrease to 60%. At this point, surgery stopped immediately, pneumoperitoneum was released and the anesthesia provider requested help. Two other anesthesia providers present as SpO2 continued to decline to 54%.and blood pressure declined upto 80/40mmhg and heart rate increased upto 160/min. Severe bilateral wheezes were auscultated, no signs of allergic reactions were noticed. On monitors, minute ventilation (MV) dropped from 4.8 L/min to 0.4 L/min, TV from 400 mL to 33.3 mL, and mean airway pressure (Pmean) increased from 12 cm H2O to 38 cm H2O. infusion of nor-epinephrine 20 mcg/min was started, along with three puffs of salbutamol inhaler via ETT because the patient still had the same wheezes pattern on physical exam and increased Pmean with low TV and MV. Dexamethasone 08 mg IV and hydrocortisone 100 mg IV were also administered. Right after these interventions, there was an immediate improvement of Sp02 to 100%,blood pressure 110/72mmhg,heart rate 90/min, bilateral airway entry equally, MV 3.8 L/min, TV 398 mL, and Pmean 14 cm H2O. After a discussion with the surgical team, it was decided to abort the surgery and patient shifted to ICU because of severe bronchospasm and patient safety. A blood sample was obtained and sent to a laboratory.





The patient extubated after 24hrs with stable vital signs, no signs of respiratory distress were noted, bilateral air entry without wheezes. While in the ICU, a chest X-ray was ordered and showed mildly diffusely prominent vascular and interstitial markings, mild peribranchial cuffing, and no focal infiltrates. diagnosis of asthma/reactive airway was made by pulmonary team and budesonide and formoterol inhaler and pulmonary function tests recommended. Forty-eight hours later, the patient was discharged from the hospital with pulmonary, allergy, and immunology follow-ups. The patient has followed up primary care physician, presently being treated with budesonide and formoterol inhaler.

DISCUSSION

Bronchospasm is a condition characterized by increased airway hyper-reactivity. It can cause frequent coughing and wheezing and severe respiratory distress. The sudden onset of bronchospasm after anesthetic induction is linked to various physiological changes, with cardiovascular changes and skin signs clinically suggesting a drug-induced anaphylactic response [1]. Bronchospasm commonly occurs during the perioperative period following an anesthesia induction or intubation. They can be triggered by various factors, such as an immediate hypersensitivity reaction including IgE-mediated anaphylaxis, a nonpharmacological mechanism, or pharmacologic-induced by histamine-releasing drugs in patients with uncontrolled airway hyper-reactivity [1-7]. The complex mechanism that causes bronchoconstriction is caused by various factors, such as the airway nerves responsiveness, smooth muscle, epithelial tissue, and inflammatory cells surrounding the respiratory tract triggering an afferent signal to the brainstem, and from there an efferent signal through the vagus nerve leading to acetylcholine release in the airway. Moreover, that is why antimuscarinic drugs can help prevent or treat this condition because they will counteract the acetylcholine on M3-muscarinic receptors that cause bronchoconstriction. Also, noncholinergic neurotransducers are capable of releasing tachykinins and vasoactive intestinal polypeptides. They can also stimulate the release of procontractile neuropeptides. Studies show that propofol reduces tachykinin-caused airway constriction in patients with respiratory distress. It has been known that deep anesthesia can modulate and attenuate tachykinin-caused bronchoconstriction in patients. Despite these protective effects of IV propofol and the adequate induction dose used in the current case, reflex-induced bronchoconstriction may still be triggered in patients who had previously unrecognized and untreated asthma. Prior to surgery, a comprehensive evaluation of pulmonary risk factors can be performed to identify the potential complications of an asymptomatic or poorly controlled airway hyper-reactivity. Perioperative and postoperative complications depend on the severity of asthma at the time of surgery, type of surgery, and anesthesia techniques. Patients with uncontrolled asthma have a history of use of inhaled corticosteroids and/or beta2-agonists, recent use of systemic corticosteroids, recent exacerbations, emergency department, recent hospital visits, and intubations. Same as wheezing, cough, increased sputum production, shortness of breath, and diurnal variability in peak expiratory flow rate indicate further assessment [7]. These guidelines mainly focus on the management of asthma before surgery. It is considered a leading cause of bronchoconstriction during surgery and should be suspended until the patient is optimized, and their medication should be continued until the time of surgery. If the patient has an upper respiratory tract infection postpone surgery uptill the complete resolution of symptoms is not achieved. Pretreatment with β2- agonist, 30 min prior to surgery, propofol for induction of anesthesia, and adequate depth of anesthesia before airway manipulation reduce the risk of bronchospasm [7]. Understanding the physiological mechanism of a hypersensitivity reaction's clinical signs and symptoms timeline is crucial. Perioperative anaphylaxis caused by neuromuscular blockers has initially cardiovascular signs that befall within minutes after the drug injection and may be associated with or followed by bronchospasm [1]. Cardiovascular disturbance is the hallmark of severe IgE-mediated anaphylaxis. Latex induced anaphylaxis usually occurs in patients with prior latex exposure, a cross-reaction food allergy. Latex is slowly absorbed so the event usually takes about 60 min after surgery to develop. The cause of the hyper-responsiveness may due to an ETT or the suction catheter, without antigen exposure. It is essential to keep in mind that positive end-expiratory pressure with bronchospasm can reduce venous return and cardiac output, plus the association of hypoxia and respiratory failure from inadequate ventilation may lead to cardiovascular collapse [1].

DIFFERENTIAL DIAGNOSIS

Bronchospasm usually occurs during anesthesia's induction and maintenance phases. The most common causes of bronchospasm are usually related to endotracheal intubation. When evaluating bronchospasm, we should consider relevant differential diagnoses and contributing factors such as mechanical obstruction, laryngospasm, inadequate depth of anesthesia, and drug induced. Airway soiling due to secretions, regurgitation, or aspiration should be considered in unexplained bronchospasm. For that, using an LMA or an incompletely inflated cuff or uncuffed ETT should be considered to prevent or minimize the accumulation of secretions or continuous stimulus of the airway [7].

TREATMENT

The goals of initial treatment are reverting the bronchospasm and avoiding hypoxemia. If an isolated bronchospasm occurs, increasing the oxygen concentration to 100% should be initiated, and manual bag ventilation promptly started to assess pulmonary compliance and identify high-circuit pressure causes. Deepening anesthesia may be required because an inadequate depth of anesthesia may cause bronchospasm induced by ETT placement or airway manipulation. In addition, increasing the inhalational concentration of an anesthetic is also helpful to avoid or reduce respiratory hyper-reactivity. Mechanical ventilation in acute bronchospasm aims to correct hypoxemia. Reduce tidal volume to avoid high peak airway pressures and barotrauma. Ventilation should include a long expiratory time to allow total exhalation and reduce breath stacking and intrinsic positive end-expiratory pressure (PEEP) because they may increase intrathoracic pressure, decrease venous return, and lead to hypotension [7]. Inhaled β2-agonists are indicated for the quick relief of bronchoconstriction due to the activation of the 2- adrenergic receptors on the airway smooth muscle. Ipratropium has been shown to reduce reflex-induced bronchoconstriction with potency similar to inhaled β2-agonists. Systemic steroids should be used to treat respiratory conditions like asthma, chronic obstructive pulmonary disease (COPD), or even bronchospasm because they decrease airway inflammation. Epinephrine should be considered for patients with severe asthma that has been triggered by IgE-mediated anaphylaxis and is prone to cardiac collapse. Magnesium sulfate is used to treat severe bronchial asthma by relaxing the bronchial smooth muscles.

Ketamine infusions have been reported to treat patients with status asthmaticus successfully. it seems like the catecholamine released by ketamine causes bronchodilation. Beneficial results are reported within 30 min to several hours. Antihistamines compete with histamine for the histamine-receptors in the respiratory tract and causes effects such as the reduction in smooth muscle contraction. Volatile agents - the activity at inhibitory -aminobutyric acid-A chloride channels or modulating calcium sensitivity of the contractile proteins is why deepening anesthesia with volatile agents prevents or relieves reflex-induced bronchoconstriction. Helium-oxygen mixed with oxygen is commonly used for severe asthma exacerbations that are unresponsive to standard therapy. Extracorporeal life support oxygenation can be helpful in patients with severe asthma/ Bronchospasm. However, evidence-based clinical trials are lacking.

POSTOPERATIVE CARE AND FOLLOW-UP

If the symptoms are severe and persistent a chest radiograph should be ordered and chest evaluation to rule out pulmonary edema and pneumothorax. If necessary, pharmacological and chest physiotherapy should also be provided. If the condition worsens or the patient has anaphylactic shock, follow-up examinations should be performed [7]. The patient should be referred to an immunological and allergy center for further investigation.

CONCLUSIONS

For a patient under general anesthesia, bronchospasm can become a life-threatening situation. Although other parts that lead to airway inflammation in asthma are many and still not fully explained, factors triggering perioperative bronchospasm are well known. Prevention and treatment of bronchospasm could be improved by science efforts. In this presented case, the severity of symptoms and dynamic changes on the ventilator were paramount in guiding the intraoperative treatment. Other episodes may happen intraoperatively following an episode of bronchospasm and the anesthesia provider must be prepared to make decisions focused on patient's safety. That is why we trust that any anesthesia provider must understand what is bronchospasm, its pathophysiology, differential diagnosis, and algorithm of treatments to provide the best patient care and successful outcome.

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