Respiratory Anesthetic Emergencies in Oral and Maxillofacial Surgery

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KEYWORDS

• Anesthesia • Airway emergencies • Laryngospasm • Bronchospasm • Airway obstruction

KEY POINTS

- Respiratory anesthetic emergencies are the most common complications encountered during anesthesia administration.
- Asthma is the most common chronic inflammatory respiratory disease and affects 6% of the US population.
- Laryngospasm is a protective mechanism preventing irritants from entering the lower airway.
- The most common airway anesthesia emergencies include laryngospasm, bronchospasm, airway obstruction, and emesis and aspiration.

INTRODUCTION

Respiratory anesthetic emergencies are the most common complications encountered during the administration of anesthesia in both the adult and pediatric populations.[1–26] Regardless of the depth of anesthesia, a thorough review of the patients' health history, including the past medical history, medication list, prior anesthesia history, and complex physical examination, is critical in the promotion of safety in the oral and maxillofacial surgery office. The effective management of respiratory anesthetic emergencies includes both strong didactic and clinical skills.

There are multiple disease states that affect the pulmonary system. These states include asthma, chronic obstructive pulmonary disease (COPD), and respiratory infections. Patients with these types of respiratory diseases present many challenges during the perioperative period in the office-based setting. It is with a thorough knowledge, excellent training, and clinical skills that the oral and maxillofacial surgeon is uniquely qualified to perform both surgical and anesthetic procedures in the outpatient setting.

RESPIRATORY PHYSIOLOGY

The primary function of the lungs is to oxygenate the blood perfusing through the pulmonary vasculature and remove the byproduct of metabolism carbon dioxide. This gas exchange occurs between the alveoli of the lungs and the blood in the pulmonary capillary system. Oxygen diffuses through the capillary walls into the plasma and binds to hemoglobin molecules. To establish gas exchange in the pulmonary system, there must be ventilation of the alveoli, diffusion through the capillary membranes, and circulation or perfusion of the pulmonary capillary bed.

A very important aspect of the use of oxygen during anesthesia is preoxygenation. Preoxygenating patients with 100% oxygen before the induction of anesthesia will maintain higher levels of tissue oxygenation during periods of apnea. The use of preoxygenation will greatly aid the

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surgeon during anesthetic induction, when there may be periods of apnea, ventilatory difficulty, and airway control issues.

The respiratory system, as noted earlier, functions by delivering oxygen to the arterial blood supply, which is then delivered to the body's tissues. The oxygen found in the arterial blood is 98% bound to hemoglobin molecules located in the red blood cells. The remaining 2% is diffused in the plasma. This ratio produces a pressure called the *arterial oxygen tension* (Pa_{O_2}). This pressure gradient is how the unbound oxygen enters the plasma and is delivered to the tissues of the body. There is a commonly known relationship between the hemoglobin saturated with oxygen (Sa_{O_2}) and the pressure gradient by dissolved oxygen (Pa_{O_2}). This relationship is classically illustrated by the oxygen-hemoglobin dissociation curve (**Fig. 1**). It is this curve that we use to assess a patient's oxygenation status.

COMMON RESPIRATORY DISEASES

There are many diseases of the respiratory tract that can alter the physiology of gas exchange and, thus, the administration of an anesthetic. A thorough history and physical examination are critical in the decision-making process of an anesthesia plan and before the induction of that anesthetic. A few of the major disease processes that affect the respiratory system include asthma, COPD, and upper respiratory infections (URI). URIs can adversely affect the airway. For example, in children a URI can cause hyperreactivity of the airway for up to 6 weeks after the infection. For this reason, the recommendation for postponing any anesthetic for 2 weeks after any clinical signs or symptoms is commonplace and recommended by the American Society of Anesthesiologist (ASA).

Chronic pulmonary diseases are characterized as obstructive or restrictive. Obstructive airway disease is the most frequent cause of pulmonary dysfunction. Two of the most common obstructive airway diseases are asthma and COPD. Changes in airway resistance will lead to ventilation-perfusion mismatches. These mismatches result in arterial hypoxemia while on room air. Carbon dioxide is chronically retained, leading to respiratory acidosis. All obstructed airway diseases will manifest dyspnea, coughing, wheezing, and sputum production.

Restrictive pulmonary diseases have decreased lung compliance resulting in decreased lung volumes. This decrease translates to a decreased in vital capacity or forced expiratory volume in the first second of expiration (FEV_1), which is the classic sign of restrictive diseases. The main complaints of patients with restrictive diseases include dyspnea and rapid, shallow breathing. Acute episodes of restrictive pulmonary diseases are caused by leakage of intravascular fluid into the interstitium of the lungs and alveoli manifesting as pulmonary edema. Acute diseases include adult respiratory distress syndrome, aspiration pneumonia, and pulmonary edema. Chronic restrictive diseases are caused by pulmonary fibrosis. Sarcoidosis is the main chronic restrictive disease. Other causes include the interference of lung expansion, which includes pulmonary effusions, obesity, pregnancy, and ascites.

Asthma

Asthma is the most common chronic inflammatory respiratory disease, and it affects upwards of 6%

Extrapolations	
Hb Saturation (Sa_{O_2})	Arterial Tension (Pa_{O_2})
95	80
90	60
80	50
70	40

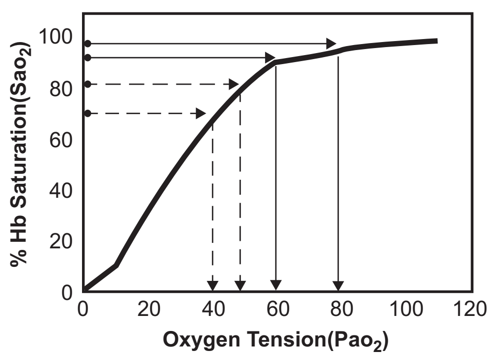

Fig. 1. The oxygen-hemoglobin dissociation curve. There is a nonlinear relationship between the percentage of total Sa_{O_2} and Pa_{O_2}, as demonstrated by the oxygen-hemoglobin dissociation curve. Hemoglobin saturations of 95% and more sustain Pa_{O_2} at or more than 80 mm Hg, preventing hypoxemia. At 90% saturation, the curve becomes steep; within a relatively narrow period, the percent hemoglobin saturation and Pa_{O_2} decline dramatically. Hb, hemoglobin. (*Data from* Guyton AC. Textbook of medical physiology. 8th edition. Fort Worth (TX): Harcourt College Publishers; 1991. p. 436.)