Parental Sedation

6

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Introduction

For the correct patient, office anesthesia provides relief from anxiety related to surgical procedures. Many oral and maxillofacial surgeons practice as operator-anesthetists, meaning, they perform anesthesia and surgery simultaneously. This unique practice requires an abundance of knowledge regarding airway physiology in order to maintain airway patency while also depressing consciousness. By the end of this chapter, the reader should appreciate the level of complexity involved in the operator-anesthetist model and understand basic anesthetic techniques.

The Initial Consultation

Medical History

Chapter 1 highlighted the medical and surgical history as a foundation for risk assessment prior to surgery. This chapter focuses specifically on conditions that affect the airway and delivery of anesthesia. A risk assessment should be conducted for each patient that will help guide the expected morbidity and mortality on an individual basis. A commonly utilized scoring system is the American Society of Anesthesiologists (ASA) physical status, which sets clear parameters as demonstrated in Table 6.1. Although this is a highly subjective system with moderate inter-rater variability, it can be helpful when deciding if a patient can handle the stress of a procedure and anesthesia [2]. Patients with an ASA physical status of I or II tend to have a large reserve and tolerate anesthesia, whereas a physical status of III or above are at risk for perianesthesia cardiac or respiratory events [3].

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Table 6.1 Excerpted from ASA Physical Status Classification System, 2014 of the American Society of Anesthesiologists

ASA Physical Status Classification System
I—A normal healthy patient
II—A patient with mild systemic disease
III—A patient with severe systemic disease
IV—A patient with severe systemic disease that is a constant threat to life
V—A moribund patient that is not expected to survive without the operation
VI—A declared brain-dead patient whose organs are being removed for donor purposes

A copy of the full text can be obtained from ASA, 1061 American Lane Schaumburg, IL 60173-4973 or online at www.asahq.org [1]

Table 6.2 Adapted from Chung F, Yegneswaran B, Liao P, et al. STOP questionnaire: a tool to screen patients for obstructive sleep apnea, *Anesthesiology*, 2008, vol. 108 (pg. 812–21) [6]

STOP-bang obstructive sleep apnea screening tool
S: Snoring: Do you snore loudly (loud enough to be heard through closed doors)?
T: Tired during the day: Do you often feel tired, fatigued, or sleepy during daytime?
O: Observed: Has anyone observed you stop breathing during your sleep?
P: Blood pressure: Do you have or are you being treated for high blood pressure?
B: BMI: BMI >35?
A: Age: Age over 50 years old?
N: Neck circumference: Neck circumference >40 cm?
G: Gender: Male?

Obstructive Sleep Apnea

Patients with obstructive sleep apnea (OSA) likely have multiple comorbidities including hypertension, cardiovascular disease, or metabolic disorders [4]. According to a study by Chung et al., 82% of men and 92% of women with moderate-severe OSA are undiagnosed [5]. Undiagnosed moderate-severe OSA can be identified by answering “yes” to at least five of the risk factors in the screening mnemonic “STOP-Bang,” as described in Table 6.2 [4, 5]. Patients with high probability of OSA should be referred for further workup usually via polysomnography and optimization prior to elective anesthesia [7]. Patients with OSA often have increased opioid sensitivity resulting in worsening respiratory depression, as well as upper airway obstruction from relaxation and collapse of pharyngeal tissues. Well-managed OSA with continuous positive airway pressure (CPAP) and optimized comorbidities may actually be candidates for office anesthesia. CPAP compliant patients should be instructed to bring their device to the office and use for several days postoperatively [7]. If postoperative pain cannot be adequately treated with nonopioid pain medications or they are not compliant with CPAP, anesthesia with a secured airway should be considered [7].

Obesity

Obesity is divided into three classes: Class I (BMI 30–34.9), Class II (BMI 35–39.9), and Class III (BMI ≥ 40) [8]. The obese patient population presents with many similar office anesthesia difficulties as OSA discussed above. Other comorbidities resulting from obesity include hypertension, diabetes, and cardiovascular disease [8]. Morbidly obese patients generally are more sensitive to anesthetics and opioids, therefore, may lose airway reflexes and cause respiratory depression at an alarming rate [3]. Obese patients may be more difficult to ventilate due to excess soft tissues in the neck and pharynx [3, 9]. Evaluation prior to administering anesthesia can be assessed by weight or BMI, Mallampati score (Fig. 6.1), or neck circumference [9]. Obese patients, especially morbidly obese patients, may be safer to treat in a setting that provides a secured airway with help nearby in case of emergency [3]. Use caution in prescribing of opioids postoperatively due to risk of respiratory compromise [8].

Cardiorespiratory

Cardiac diseases most commonly encountered in the office include congestive heart failure, myocardial ischemia, and valvular heart disease [11]. Cardiac consultation may be indicated to assess severity of disease based on EKG, chest X-ray, echocardiogram, stress test, or physician recommendations prior to anesthesia. Respiratory diseases often encountered are asthma and chronic obstructive pulmonary disease (COPD). Consultation with physician may be indicated to determine disease severity based on prior hospitalizations and exacerbation, pulmonary function tests or chest X-ray. The functional capacity of a patient should be estimated at the consultation appointment to predict risk for cardiac and respiratory events in the perianesthesia period. A simple screening tool that can be used is metabolic equivalent of task (METs), which estimate energy expenditure based on activity level (Table 6.3). If the patient can exert 4–5 METs without symptoms, likely they will be able to tolerate surgery and

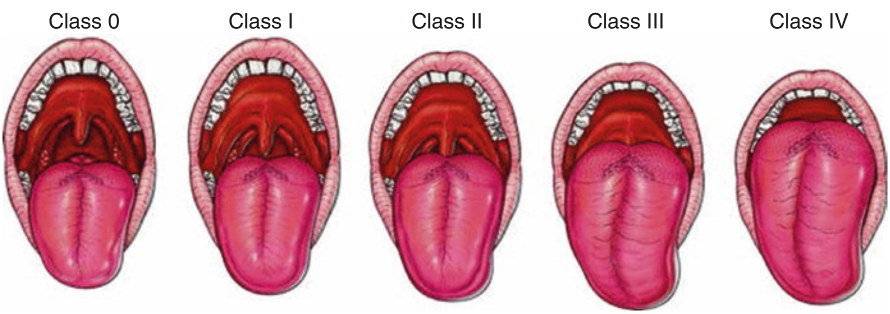

Fig. 6.1 Modified Mallampati Classification. Adapted from Finucane B, Tsui B, Santora A. Principles of airway management, 4th ed., New York, Springer, 2010 [10]

Table 6.3 Adapted from Freeman WK, Gibbons RJ (2009) Perioperative Cardiovascular Assessment of Patients Undergoing Noncardiac Surgery. Mayo Clinic Proceedings 84:79–90

Metabolic equivalent of task (MET)
1 MET: eat, dress, toilet, walk inside house
<4 MET: light work such as dusting or washing dishes
≥4 MET: climb flight of stairs, run short distance
>10 MET: strenuous sports such as football, basketball, skiing

anesthesia [4, 12]. Patients identified as high risk for adverse events may be referred for further workup and optimization or anesthesia may be completed in a hospital setting with an anesthesiologist.

Endocrine Disorders

The most common endocrine disorder that will be observed in the office is diabetes mellitus. Proper history should be obtained including compliance with medications and monitoring, most recent hemoglobin A1c, fasting glucose levels, or glucose tolerance test [11]. Gastroparesis is a common comorbidity; therefore, the surgeon should consider an extended NPO period and prophylactic H2 blockers to prevent acid reflux and aspiration [11]. Diabetic patients are known to have "silent" cardiovascular events due to neuropathy and cardiac consultation may be indicated [11]. Discuss insulin and oral hypoglycemic agent therapy with prescribing physician as doses may be adjusted to prevent hypoglycemia on the day of anesthesia [11].

Special Populations

Opioid Abuse

In the late 1990s, pain became known as "the fifth vital sign," and quality of patient care began to revolve around adequate pain control [13]. Increasing pressure on physicians to prescribe opioids for aggressive pain control led to a steady rise in misuse of the unnecessarily prescribed narcotics [13]. According to the U.S. Department of Health and Human Services, the opioid epidemic in the U.S. was declared a public emergency in 2017 [14]. This special population will be encountered frequently in the office, and it is the responsibility of the surgeon to formulate a safe and effective anesthetic plan. Opioid-sparing anesthetic techniques should be implemented rather than withholding opioids [15]. Opioids in the postoperative setting may be appropriate as inadequate pain control may act as a trigger to relapse into drug use [15]. The surgeon must not mistake drug-seeking behavior with inadequate pain control, a term referred to as pseudoaddiction [15, 16]. Increased doses of opioids may be required with chronic opioid use due to increased tolerance or opioid induced hyperalgesia [13, 17, 18]. A thorough history and physical must be obtained as chronic opioid users may have underlying cardiopulmonary disease, renal impairment, anemia, and adrenal hypertrophy [18]. Physical exam findings of acute opioid use include lethargy, pinpoint pupils, and slow respiratory rate [19].

Smoking

Cigarette smoking has many deleterious effects on the airway and cardiovascular system that negatively impacts office-based anesthesia [20]. The nicotine in cigarettes causes an endogenous release of catecholamines leading to increased blood pressure, heart rate, and peripheral vascular resistance [20]. Levels of carboxyhemoglobin are drastically increased in smokers, which prevent tissues from extracting the oxygen leading to chronic tissue hypoxia [20, 21]. Pulse oximeters are unable to detect the difference between oxyhemoglobin and carboxyhemoglobin; therefore, oxygen saturation will be overestimated [20]. Other negative respiratory effects include increased secretions, impaired mucociliary clearance, and increased reactivity of airways [20, 21]. Perianesthesia risk decreases if the patient quits smoking around 8 weeks prior to anesthesia and may actually be at higher risk if quitting less than 8 weeks prior to anesthesia [20]. For this reason, it is recommended that patients quit smoking at least 8 weeks prior to anesthesia [20].

Breastfeeding

There are few clinical trials that have been completed demonstrating clear recommendations regarding breastfeeding after receiving parenteral sedation; most information is based on expert opinion [22]. The consensus is that most commonly used sedation drugs are relatively safe while breastfeeding when used judiciously. Sedation should be scheduled early in the day and the mother is encouraged to breastfeed or pump before anesthesia to prevent breast engorgement [22]. Profound local anesthesia should be administered to decrease amount of systemic parenteral medications required [23]. Mothers undergoing office anesthesia with short-acting anesthetics and analgesics are encouraged to continue breastfeeding when alert and recovered from anesthesia [23]. Caution should be used with mothers of neonates at risk for apnea, hypotension, or hypotonia, as small amounts of drug in the breast milk can be harmful [22]. Codeine is not recommended in the breastfeeding mother as it is easily secreted into breast milk and is metabolized into morphine by the liver and may lead to sedating levels if the patient or child are rapid metabolizers [23].

Pregnant

In rare cases, such as emergencies, the pregnant patient may require sedation if pain and anxiety cannot otherwise be controlled [8]. The risk of medication teratogenicity must be weighed against harm to the patient if presenting issue is not dealt with. Local anesthesia with epinephrine has been shown to be safe during pregnancy and should be used in sufficient quantity to prevent endogenous release of epinephrine [8]. Little is known about the teratogenicity of opioids and benzodiazepines on the human fetus [8]. Risks involved with sedation include hypotension and decreased perfusion of the fetus, risk of aspiration from decreased gastric emptying and decreased lower esophageal sphincter tone, and airway edema leading to hypoxia, and preterm labor [8]. Consultation with the practitioner primarily caring for the pregnant patient should be obtained prior to administering anesthesia [8].

Table 6.4 Examples of pertinent findings within the anesthesia history

Anesthesia history
Difficult intubation or ventilation
Postoperative nausea and vomiting (PONV)
Anxiety
Delayed emergence
Delirium (emergence agitation)
Respiratory or cardiac events
Malignant hyperthermia
Pseudocholinesterase deficiency
Family history of adverse effects

Anesthesia History

The surgeon should inquire about prior anesthesia experiences including regional (local), minimal, moderate, deep, or general anesthesia. Many adverse events can be prevented or at least anticipated if identified at the consultation appointment. Genetic conditions such as malignant hyperthermia, although rare, can be life threatening if not diagnosed and treated early. Examples of pertinent findings within the anesthesia history can be found in Table 6.4.

Physical Examination

Cardiorespiratory Examination

Vital signs are obtained at the consultation appointment to provide a baseline for the patient, uncover potentially undiagnosed conditions, and allow for optimization prior to anesthesia. Vitals include blood pressure, heart rate, respiratory rate, and oxygen saturation. The heart should be auscultated to listen for arrhythmias or valvular disturbances. The lungs are auscultated to identify severity of chronic lung conditions or acute infections. Measurement of height and weight is important for drug dosing [4].

Airway Assessment

If the patient is low risk for anesthesia from a medical standpoint, the next step is the airway assessment. The surgeon must understand airway anatomy and identify key landmarks prior to administration of anesthesia. Relevant airway exam techniques can be found in Table 6.5 and further demonstrated in Fig. 6.1. The surgeon must be competent in mask ventilating a patient that has slipped into a deeper plane of anesthesia than intended or is experiencing desaturation for another reason as it can be lifesaving. Approximately 0.9–7.8% of the population is considered a difficult mask ventilation, which can be predicted based on the risk factors listed in Table 6.6 [24, 25]. Inadequate mask ventilation can lead to hypoxic brain damage or death due to poor oxygenation and ventilation, and aspiration of gastric contents. Although most surgeons will not be intubating patients in the office, roughly 7% of patients are considered a difficult intubation, which can be relevant in emergency settings [25].

Table 6.5 Adapted from Klinger K, Infosino A (2018) Airway Management. In: Basics of Anesthesia, 7th ed. Elsevier, Philadelphia, PA, pp 239–272

Airway examination component	Nonreassuring findings
Length of upper incisors	Relatively long
Relationship of maxillary and mandibular incisors during normal jaw closure	Prominent "overbite" (maxillary incisors anterior to mandibular incisors)
Relationship of maxillary and mandibular incisors during voluntary protrusion of mandible	Patient cannot bring mandibular incisors anterior to (in front of) maxillary incisors
Interincisor distance	Less than 3 cm
Visibility of uvula (Mallampati score)	Not visible when tongue is protruded with patient in sitting position (e.g., Mallampati class ≥2)
Shape of palate	Highly arched or very narrow
Compliance of mandibular space	Stiff, indurated, occupied by mass, or nonresilient
Thyromental distance	Less than three ordinary finger breadths
Length of neck	Short
Thickness of neck	Thick
Range of motion of head and neck	Patient cannot touch tip of chin to chest or cannot extend neck

Table 6.6 Adapted from El-Orbany M, Woehlck HJ (2009) Difficult Mask Ventilation. Anesthesia & Analgesia 109:1870–1880

Predicted difficult mask ventilation
Increased body mass index
History of snoring or sleep apnea
Presence of beard
Lack of teeth
Age >55 years
Mallampati III or IV
Limited mandibular protrusion
Male gender
Airway mass or tumor

Venous Access

Assess peripheral venous anatomy and document likely access points for the day of anesthesia. Inquire about history of failed intravenous cannulation or need for advanced techniques such as ultrasound guidance or other technologies such as vein finders. Examples of patients that may have difficult access are IV drug users, advanced age, obese, dehydrated, or diabetic patients. If intravenous access is predicted to be difficult based on physical examination, but the patient is otherwise a candidate for office anesthesia, ultrasound guidance may be indicated.

Preanesthesia Counseling

Patient Education

Patient expectations for anesthesia should be set at the initial appointment to prevent confusion and frustration on the day of surgery. Patients may fear not knowing what to expect with the sedation and feel that they do not have control. The anticipated anesthetic plan should be reviewed with the patient from start to finish. As most oral and maxillofacial surgeons will use moderate to deep sedation in the office, the patient should be instructed that they will not have memory of the procedure, but they likely will remain conscious enough to respond to simple commands or tactile stimulation. Psychological readiness for office sedation should be assessed and anesthetic plans adjusted accordingly.

Preanesthesia Instructions

At the consultation appointment, the patient should receive both verbal and written instructions on how to prepare for the day of anesthesia. The patient should be counseled on the most up-to-date fasting recommendations to decrease incidence of pulmonary aspiration of gastric contents as depicted in Table 6.7 [26]. The patient is expected to arrive on the day of anesthesia with a responsible escort that will be spending the day caring for the patient. The escort should be instructed to remain in the office for the duration of anesthesia and recovery. The patient should be instructed to dress comfortably, wear shoes that will not easily fall off while walking, and to not wear nail polish as this affects the pulse oximeter.

Medications

Medications that should be stopped or continued should be reviewed and adjusted on a case-by-case basis. Beta-blockers should generally be continued in the perianesthesia period as they have been shown to be cardioprotective [27]. Although widely debated, for the purposes of the oral and maxillofacial surgeon, ACE inhibitors (ACE-I) and angiotensin receptor blockers (ARBs) should be continued as the risk of rebound hypertension with discontinuing likely outweighs the hypotension observed with continuing [27]. Diuretics, with the exception of thiazide diuretics for hypertension, should be discontinued [19]. Insulin-dependent diabetic patients should discontinue short-acting insulin on morning of surgery and use 1/2 to 1/3 of basal dose of insulin. Generally, oral hypoglycemic medications are held on the morning of surgery to prevent hypoglycemia [19]. Generally, antidepressants, antipsychotics, and anxiolytics are continued on the day of anesthesia [19].

Table 6.7 ASA fasting recommendations (2016)

Ingested food or liquid	Minimum fasting time before surgery (h)
Clear liquids	2
Breast Milk	4
Infant formula	6
Nonhuman milk	6
Light meal	6
Fried or fatty foods, meat	8

Adapted from (2017) Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. Anesthesiology 126:376–393

Preparation: Day of Anesthesia

Preanesthesia Checklist

Table 6.8 is a checklist that reviews common causes of delayed or postponed anesthetics. Review this list with the patient early on the day of anesthesia to ensure compliance with preanesthesia instructions and identify other obstacles to a safe anesthesia experience.

Venipuncture

One of the first interactions with the patient on the day of anesthesia is the placement of the peripheral intravenous catheter, an area of intense anxiety in many patients. Providing efficient placement with minimal discomfort is a chance to earn the patient's trust.

Venipuncture Anatomy

Choice of vein for elective anesthesia in the maxillofacial surgery office typically is in the dorsum of hand, ventral forearm, or antecubital fossa [28]. Dorsal hand veins are superficial, distant from other anatomically important structures, but tend to be smaller than proximal veins and mobile due to superficial location [28]. The ventral forearm includes larger caliber veins, less mobility, but can be challenging due to deeper location [28]. The antecubital fossa has several large caliber veins that are readily accessible and minimally mobile, but caution should be taken on the medial aspect to avoid nearby important anatomic structures [28].

Venipuncture Technique

Basic setup for placement of the peripheral IV should be simple and done the same way each time, an example is depicted in Fig. 6.2.

Prior to starting the IV, the tubing should be run entirely with fluids to eliminate all air bubbles, which have potential to be hazardous to the patient. The drip chamber should be filled about halfway with fluids to reduce the risk of turbulence

Table 6.8 Day of anesthesia checklist

Day of anesthesia checklist
The patient is NPO according to current ASA guidelines
The patient is present with responsible adult escort
The patient has a responsible adult to care for the patient until fully recovered from anesthesia
The patient has taken home medications as recommended at previous appointment
Informed consent obtained with written confirmation
Vital signs obtained and within normal limits for the patient
Recent illness with focused reevaluation for respiratory tract sensitivity including upper respiratory infection, bronchitis, pneumonia, asthma exacerbation, etc.

Fig. 6.2 Basic peripheral IV setup

and air bubble formation. The patient is positioned comfortably and the tourniquet is applied to the upper arm tight enough to prevent venous flow but still allows for arterial flow (radial pulse maintained). The tourniquet should be applied in such a way that it can be simply removed with one hand after the catheter is inserted. The arm is allowed to hang below the level of the heart while venous blood pools and the patient can be asked to open and close a fist, which redistributes blood from the musculature into the veins [29]. Venodilation can be encouraged by light tapping of tissue overlying vein or application of warm towel [29]. Nitrous oxide-oxygen can be used to promote venodilation and provide analgesia during venipuncture. Skin is cleaned with 70% isopropyl alcohol or other equivalent solution over IV insertion site and allowed time to dry completely. If desired, injection of local anesthetic (Lidocaine 1% or 2%) with 27-gauge needle to form a wheal may be used to minimize discomfort at the time of intravenous cannulation as depicted in Fig. 6.3. A cream such as EMLA® (Eutectic mixture of local anesthetic) can be applied over IV insertion site for the indicated time period to achieve similar effect [29]. This technique is generally reserved for larger gauge catheters (at least 18 gauge), but this is based on surgeon preference. A 20 or 22 gauge catheter is generally sufficient for use in the office [29].

Traction is applied with nondominant hand distal to injection site to pin the vein in place and prevent movement during venipuncture. Hold the nondominant hand in such a way that the proper angulation of the angiocatheter can be maintained. The needle is advanced with bevel up at 15–30° angle from the skin until through the skin layer and into the vein as shown in Fig. 6.4 [29]. After the vein is penetrated, the angulation of the needle is decreased to parallel that of the vein.

When the needle enters the vein, blood will appear in the clear chamber, known as "flash." When the flash appears, advance the needle another 2–3 mm while remaining parallel to vein to ensure that the plastic catheter is also within the vein as seen in Fig. 6.5.

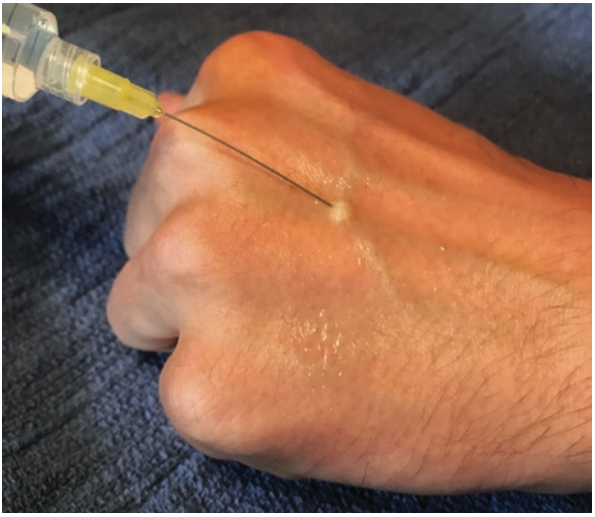

Fig. 6.3 Injection of local anesthetic into subcutaneous tissue to alleviate pain during peripheral IV insertion

Fig. 6.4 Angulation of angiocatheter as it passes through skin

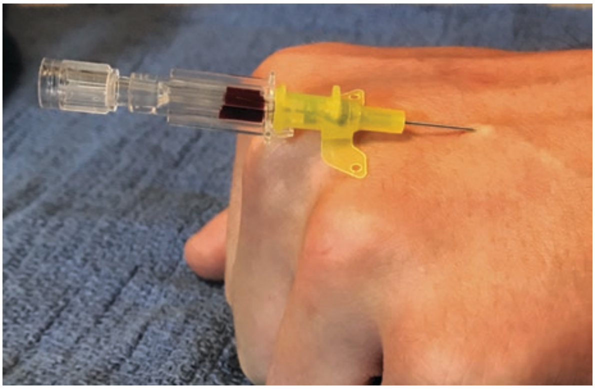

Fig. 6.5 Blood return into chamber as needle enters the vein, known as "flash"

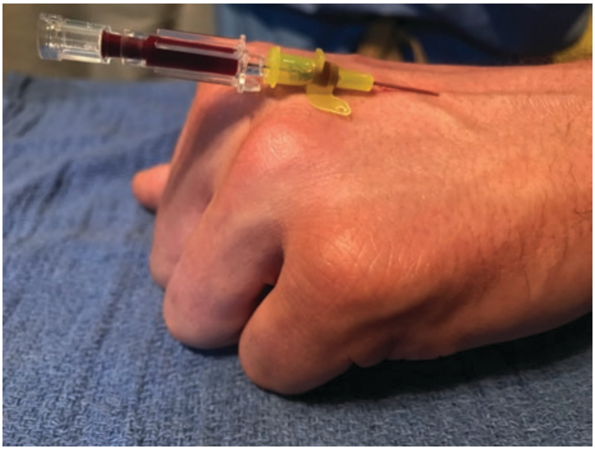

Fig. 6.6 Blood return into the plastic catheter is observed when needle is withdrawn and the catheter is within the lumen of the vein

While holding the plastic catheter stationary, the needle is then withdrawn 2–3 mm. If the catheter is indeed within the vein, blood will be seen entering the catheter as the needle is withdrawn as shown in Fig. 6.6.

The catheter can now be advanced to the hub, the tourniquet is immediately released, and the catheter is secured with adhesive tape. The catheter is then flushed with saline or connected to IV tubing and observed to ensure surrounding tissues are not infiltrating with fluids. Infiltration is a sign that the tip of the catheter is outside of the vein. If infiltrated, the catheter must be removed and a new one started at a more proximal location on the same limb, or any location on opposing limb.

Emergency Drug and Equipment Checklist

A well-organized compilation of emergency drugs and equipment should be stored in an easily accessible location and stocked regularly [30]. Medications are to be arranged in a simplistic fashion to avoid confusion in the case of an office anesthesia emergency [30]. Example contents of each medication compartment should include generic and proprietary name of drug, dosage, and quick instructions for use in emergency setting. Table 6.9 demonstrates recommended drugs and equipment, but only drugs that the practitioner is trained to administer should be stocked [30].

Intraoperative Management

Levels of Sedation

According to the American Society of Anesthesiologists, there is a spectrum of depths of sedation ranging from anxiolysis to general anesthesia as described in Table 6.10 [31]. This model depicts the levels of sedation with clear-cut parameters, but in reality it is a continuum, and a patient may drift between levels [31]. For this reason, it is important that the anesthetist be prepared to “rescue” the patient from a deeper plane of anesthesia than intended, as response to medications is unpredictable [31].

Table 6.9 Recommended equipment and medications for office anesthesia

Basic equipment setup
Oxygen source
Yankauer suction
Intravenous access—tourniquet, alcohol wipe, angiocatheter, adhesive tape, IV tubing, IV fluids
Sterile water—for reconstitution of medications
Intraoperative monitoring
Stethoscope (precordial recommended)
Blood pressure cuff
Pulse oximeter
Capnograph
Electrocardiogram
Temperature probe
Glucometer
Respiratory/cardiac equipment
Nasopharyngeal and oropharyngeal airway adjuncts
Bag-valve-mask or positive pressure ventilation system
Supraglottic laryngeal mask airways (LMA)
Laryngoscope and blades (or video laryngoscope)
Endotracheal tubes
McGill forceps
Instruments for surgical airway (cricothyrotomy)
Automatic external defibrillator (AED)
Medications
Epinephrine
Atropine
Glycopyrrolate
Nitroglycerine
Phenylephrine
Ephedrine
Lidocaine
Verapamil
Magnesium sulfate
Adenosine
Naloxone
Flumazenil
Esmolol
Labetolol
Hydralazine
Succinylcholine
Dantrolene OR Ryanodex

Intramuscular Anesthesia

Intramuscular Sedation Overview

The intramuscular route of anesthesia administration provides opportunities for sedation in special populations that cannot tolerate oral or intravenous sedation. For example, the uncooperative child, special needs child or adult, or the patient where intravenous access is not feasible [32]. This technique is praised for its relatively fast onset of action (10–15 min) by bypassing the gastrointestinal tract, patient cooperation is not required, and reabsorption is more predictable than with oral administration [32]. There are risks more specifically associated with IM technique,

Table 6.10 Excerpted from "Continuum of Depth of Sedation: Definition of General Anesthesia and Levels of Sedation/Analgesia," 2014 of the American Society of Anesthesiologists. A copy of the full text can be obtained from ASA, 1061 American Lane Schaumburg, IL 60173-4973 or online at www.asahq.org [31]

Levels of sedation
Minimal sedation (anxiolysis) is a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and physical coordination may be impaired, airway reflexes and ventilatory and cardiovascular functions are unaffected
Moderate sedation/analgesia (conscious sedation) is a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained
Deep sedation/analgesia is a drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained
General anesthesia is a drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired

including intra-arterial injection, nerve damage, inability to titrate drugs, needle breakage, and possible needle-stick injury [32].

Intramuscular Injection Sites

There are four anatomic locations that are generally utilized for intramuscular injection of drugs, including deltoid area, gluteal area, ventrogluteal area, and vastus lateralis [32]. The deltoid area is a common location in the adult as it is easily accessible, extremely vascular, and can accommodate up to 4 mL of fluid [32]. Injection in the deltoid area should be administered between the upper and lower areas of the muscle to avoid damaging the radial nerve. The vastus lateralis is the lateral aspect of the thigh and can be used in patients of all ages, easily accessible in most cases, moderate vascularity, few nearby anatomic structures, and can accommodate up to 15 mL of fluid [32]. Injections in the gluteal area should be done in the upper outer quadrant to avoid injuring nearby nerves and arteries. Access for gluteal injection requires the patient to lay face down with arm and legs hanging off the table to allow for relaxation of the muscle; therefore this injection is not commonly used [32]. The gluteal area is able to accommodate 4–8 mL of fluid and is minimally vascular [32]

Intramuscular Injection Technique

The site chosen for injection must be adequately exposed and anatomic landmarks identified [32]. Apply antiseptic such as isopropyl alcohol and allow sufficient time to dry. Squeeze the soft tissue with nondominant hand to keep taut while holding the syringe in the dominant hand in a dart-like fashion [32]. Quickly introduce the needle to the depth of the muscle then release the soft tissue with nondominant hand

[32]. Aspirate to ensure that needle is not intra-arterial, turn syringe quarter turn, and re-aspirate to ensure needle tip was not against vessel wall [32]. If conditions permit, inject drug slowly to reduce discomfort. Remove the needle slowly, apply gauze, and hold firm pressure [32]. Gently massage muscle to encourage increased blood flow [32].

Commonly Used Intravenous Drugs

Opioids

Opioids are often used during office-based anesthesia due to potent and short-acting analgesia by acting on pain pathways. Opioids also induce a euphoric state and provide an antitussive effect, both of which are beneficial during sedation [18]. Opioids act synergistically with propofol and other anesthetics allowing for decreased effective amounts of each and improved hemodynamic stability [18]. The side effect with greatest clinical impact is dose-dependent respiratory depression and decreased responsiveness to carbon dioxide [18]. Respiratory depression can be exacerbated by factors such as older age, use of other CNS depressants, renal impairment, and decreased hepatic blood flow [18]. Another serious but less common side effect is chest wall or glottis rigidity that can be caused by rapid administration of the drug [21]. Gastrointestinal manifestations may occur with opioid use including postoperative nausea and vomiting, decreased gastric emptying, and ileus [18, 33]. Opioids may cause bradycardia due to increased vagal activity or decreased sympathetic tone [18]. The negative effects of opioids can be reversed by naloxone, which is a pure opioid antagonist.

Benzodiazepines

Benzodiazepines are used for office sedation due to the amnestic, anxiolytic, and sedative properties [34]. The patient will have no memory of intraoperative events, even with a lighter plane of anesthesia, due to the anterograde amnestic effects. Caution used when administering to obese patients or patients with OSA as benzodiazepines relax airway musculature, which may cause upper airway obstruction and decrease response to carbon dioxide. Benzodiazepines act synergistically with propofol and opioids and increase risk of upper airway obstruction and apnea when used together. Oversedation may be observed in patients with renal or hepatic impairment due to decreased clearance and active metabolites [3]. The effects of benzodiazepines can be completely reversed using flumazenil, which is a competitive benzodiazepine antagonist [34].

Propofol

Propofol is an induction agent that causes hypnosis and sedation by effects on the GABA receptor and inhibition of NMDA receptor [34]. This drug is often used for its fast on and fast off properties, allowing quick recovery and discharges. Another benefit that propofol provides for office sedations is its antiemetic properties in doses as small as 10 mg [34, 35]. Bronchodilatory effects make propofol a favorable drug to use with patients with asthma or COPD [34]. Propofol causes vasodilation, which results in a decreased mean arterial pressure with minimal change in heart rate [34]. Apnea may result from administration of propofol in a dose-dependent manner. Propofol can cause burning pain on injection, which can be alleviated by first injecting lidocaine. Although propofol contains egg lecithin and soybean oil, its use has not been shown to be contraindicated in patients with egg, soy, or peanut allergy [36].

Ketamine

Ketamine is a sedative and potent analgesic drug that produces a dissociative anesthesia by acting as an antagonist of the NMDA receptor. The analgesic effects allow for pain control during sedation in patients with opioid tolerance or chronic pain [34]. The use of ketamine reduces the required dosage of postoperative opioids [13]. Most protective reflexes are maintained with ketamine unlike other anesthetics, and it even causes bronchodilation. Ketamine is a sympathomimetic drug; therefore, it causes an increase in arterial blood pressure, heart rate, cardiac output, and myocardial oxygen consumption [34]. Despite many desirable properties of ketamine, the anesthetist must be aware of many side effects of the drug. The sympathomimetic side effects may be harmful to a patient with existing ischemic heart disease. Emergence reactions such as vivid dreams, confusion, and fear occur in around 10–30% of patients, and therefore this drug should be avoided in patients with psychiatric disorders and history of delirium [34]. Ketamine increases intraocular pressure and should not be used on patients with open eye injuries or other eye disorders [34]. Patients are routinely pretreated with an anticholinergic such as glycopyrrolate since ketamine causes salivation and lacrimation [34]. The use of benzodiazepines with ketamine can blunt the sympathomimetic and psychomimetic effects [34].

Dexmedetomidine

Dexmedetomidine is an alpha-2-adrenergic agonist that acts on the brain and spinal cord to produce sedative, hypnotic, anxiolytic, and analgesic effects [34]. This drug is similar in structure to the antihypertensive drug Clonidine, but much more specific to the alpha-2 receptor [34]. The difference between Dexmedetomidine and other sedative drugs like propofol and benzodiazepines is that it does not act on the GABA pathway, but instead, sedation is via endogenous sleep promoting pathways [34]. For this reason, patients treated with dexmedetomidine tend to have smooth wake ups and are easily arousable [34, 37]. Dexmedetomidine can be an advantageous drug for office sedation as it has very little effect on the respiratory system and preserved response to CO_2 [34]. Dexmedetomidine acts as a sympatholytic drug resulting in a decrease in mean arterial pressure, heart rate, and cardiac output. Changes in blood pressure appear to be related to drug concentrations in the blood; hypertension with greater concentration and hypotension with lower concentration [37, 38]. Dexmedetomidine is used less frequently for office sedation due to prolonged recovery and discharges. There is currently no reversal drug that is approved for use in humans [37].

IV Fluids

IV fluids can be divided into two distinct categories: crystalloids and colloids. Colloids are principally used to expand the plasma volume in the case of resuscitation and are not routinely utilized in the oral and maxillofacial surgery office. Crystalloids on the other hand are used routinely to compensate for relative fluid deficit from NPO status, decrease PONV, and maintain patency of the peripheral IV [39]. Only a few types of IV fluids are necessary to review, as patients selected for office sedation will likely have stable hemodynamics.

Normal saline (0.9% NaCl) is a slightly hypertonic crystalloid that contains equal parts of sodium and chlorine in sterile water [40]. Balanced salt solutions such as Lactated Ringer and Plasma-Lyte are crystalloids that contain similar physiologic electrolyte profile (Na, K, Mg, Ca) as plasma with added buffers to prevent metabolic disturbances [40]. The isotonic nature of these fluids allows for a longer intravascular time, which can counter the vasodilatory properties of many anesthetics [21]. Dextrose 5% in water (D5W) is a hypotonic crystalloid that is often combined with normal or half normal saline as it is rapidly metabolized into free water that leaves the intravascular space [21, 39].

With few exceptions, any of the mentioned IV fluids will be appropriate for office sedation due to the relatively short durations of surgery and the health of the patients selected.

Intraoperative Safety

Patient Monitoring

Patient monitoring alerts the anesthetist to changes in physiologic status before it may be clinically apparent. There are minimum requirements for monitoring during office anesthesia that are set by AAOMS parameters of care. Each component, whether measured continuously or intermittently, should be documented in 5-min intervals on the anesthetic record. Requirements for continuous monitoring include continuous pulse-oximetry, capnography, and electrocardiography. Blood pressure should be measured at least every 5 min. Auscultation, visual inspection of ventilation, and level of sedation should be monitored as indicated clinically [8]. Although temperature measurement is not required, it should be immediately available any time a triggering agent for malignant hyperthermia is administered [8].

Anesthesia Team Model

Oral and maxillofacial surgeons have a long track record of safe office-based anesthesia, centered on the anesthesia team model [41]. This model consists of the surgeon as the operator-anesthetist, one trained assistant to observe and monitor patient, and one trained assistant to directly assist the surgeon [41]. The assistants should be trained in recognizing office anesthesia emergencies and assisting the surgeon with management. The anesthesia team is expected to regularly rehearse anesthesia emergencies to ensure that each team member understands their role and can be effective in the case of a real emergency [41].

Airway Protection

Increased levels of sedation may relax the tongue and pharyngeal musculature enough to cause airway obstruction with resulting hypoxia. If a simple chin lift and jaw thrust are unsuccessful, an airway adjunct such as oropharyngeal or nasopharyngeal airway may be inserted. Oral airways should be avoided if the patient is only mildly sedated and has maintained gag reflex as this may trigger vomiting and aspiration or laryngospasm [42]. Nasopharyngeal airways tend to be better tolerated than oral airways especially in lighter sedation but have potential to cause trauma to the mucosa resulting in bleeding in the nasopharynx [42]. If the plane of anesthesia is unintentionally deepened resulting in general anesthesia, airway reflexes and spontaneous breathing may be lost. In this case, the patient may require assistance with breathing that can be accomplished with a supraglottic laryngeal mask airway (LMA) and manual bag ventilation. The appropriate size of airway adjunct or LMA should be determined and pulled prior to initiating anesthesia to allow for rapid insertion if needed.

Intraoperative Emergencies

Laryngospasm

Laryngospasm is a spasm of the vocal cords usually caused by irritation from blood or secretions, light anesthesia, or removal of endotracheal tube during extubation [43]. Signs of laryngospasm include inspiratory stridor, paradoxical chest movement, nasal flaring, diminished or absent breath sounds, and hypoxemia [44]. Although most prevalent in the pediatric population, other risk factors include upper respiratory infection, asthma, smokers, and acid reflux. Treatment consists of stimulus removal, jaw thrust, and 100% oxygen administered via continuous positive airway pressure (CPAP) with facemask [43, 44]. If laryngospasm continues, the level of sedation can be deepened with propofol (0.5–1 mg/kg). Lastly, muscle relaxation with succinylcholine (0.1–1 mg/kg IV or 4 mg/kg IM) can be administered to break the spasm [43]. Studies have demonstrated breaking of laryngospasm by placing firm pressure bilaterally on the "laryngospasm notch," located behind the ear, posterior to the ascending ramus and anterior to mastoid process [44]. This causes a pain-induced autonomic reflex that relaxes the vocal cords [44].

Bronchospasm

Bronchospasm is a constriction of bronchial smooth muscle often in patients with reactive airways such as asthma caused by local irritation and medications [45]. Signs of bronchospasm include wheezing, prolonged expiratory phase, and lack of chest fall [45]. Treatment consists of removal of irritants, administration of medications, and 100% oxygen via facemask [45]. Beta-2 adrenergic agonists (8–10 puffs) via metered-dose inhaler are first line during bronchospasm due to rapid onset [45].

Prevention of bronchospasm occurs by patient selection and an optimal anesthetic plan. Patients with well-controlled asthma with few exacerbations may still be good candidates for office anesthesia [45]. Anticholinergics can be used prophylactically to decrease secretions and airway reactivity [45].

Anaphylaxis

Anaphylaxis is a severe, life-threatening, generalized or systemic hypersensitivity reaction that can be caused by medications or other allergens [46]. Signs include rash, angioedema, hypotension, cough, and airway obstruction [46]. Early recognition of anaphylaxis is critical as shock and airway obstruction may progress quickly. Treatment involves maintaining hemodynamic stability by administering fluids and increasing vascular tone, generally epinephrine in boluses of 50 mcg [46]. Certain patient populations are affected by anaphylaxis differently. Patients with asthma are more likely to have a bronchospasm [46]. Patients with cardiac disease are less likely to tolerate hemodynamic changes and may lead to refractory shock [46]. Patients treated with beta-blockers are not able to mount a tachycardic response, and likely will develop shock at a faster rate [46].

Malignant Hyperthermia

Malignant hyperthermia is a rare, but life-threatening, genetic disorder of hypermetabolism caused by a defect in a skeletal muscle calcium channel [47]. It is important to ask if the patient or any family members have had a history of malignant hyperthermia. This is rarely seen in the oral and maxillofacial surgery office, as the main triggers are inhaled anesthetics (not nitrous oxide) and succinylcholine [47]. Signs include elevated end-tidal CO_2, hyperthermia, muscle rigidity, and tachycardia, among other laboratory findings [47]. The treatment of malignant hyperthermia is dantrolene, a drug that binds to the defective receptor and prevents excess calcium release [44]. The dosage of dantrolene is an initial bolus of 2.5 mg/kg, then again every 10–15 min until signs resolve [47]. A newer medication called Ryanodex is an alternative to dantrolene and is simpler to reconstitute and is more shelf stable [47]. If possible, the patient should be cooled using ice packs or cooled IV fluid [47].

Postanesthesia Management

Recovery From Office Anesthesia

Definition of Recovery

Recovery from anesthesia is a gradual process that comprises three distinct stages [48]. The early stage of recovery occurs from the time administration of anesthesia is completed until all protective reflexes and motor control is reestablished [48, 49]. The intermediate stage of recovery demonstrates readiness for transport out of the surgical facility and to home under the care of a responsible adult [48, 49]. The late stage of recovery occurs at home and may take place several hours to days after receiving anesthesia when the patient is fully recovered from the anesthetic [48, 49].

Monitoring

According to the ASA, signs and systems that should be monitored in the recovery unit include respiratory function, cardiovascular function, neuromuscular function, mental status, temperature, pain, nausea and vomiting, fluid assessment, urine output, and bleeding or drainage [50]. Although encouraged in the recovery room, a requirement to void and take in oral fluids is not a criterion to postpone discharge, unless indicated on a case-by-case basis [50, 51]. Forced oral fluid intake increases the likelihood of PONV, especially in patients that have received opioids [51]. Risk factors for postoperative urinary retention include male sex, older age, increased duration of surgery, and increased IV fluids [51]. Patients with low risk for urinary retention should be given instructions on how to obtain help if they are unable void within 6–8 h after anesthesia [51].

Discharge Planning

Surgeons performing office anesthesia should adopt a scoring system that predicts criteria for safe discharges [49]. There are many systems that have been created and the surgeon should choose one that fits best in their individual practice. The ideal system should be easy to remember and practical for the type of office sedation conducted [51]. One example is the Modified Aldrete's scoring system as depicted in Table 6.11, which measures consciousness, physical activity, circulation, respiration, and oxygen saturation and requires score of ≥9 prior to predicted safe discharge to home [48]. There is no minimum time required prior to discharge, but the surgeon should be confident that the patient is stable from a central nervous system and cardiorespiratory standpoint [50].

Table 6.11 Modified Aldrete's scoring system

Modified Aldrete score	
Level of consciousness	
Fully awake	2
Arousable with verbal cue	1
Nonresponsive	0
Physical activity (voluntary movement)	
Moves four extremities	2
Moves two extremities	1
Moves no extremities	0
Circulation/hemodynamic stability	
Blood pressure within 20 mmHg of preoperative level	2
Blood pressure within 20–50 mmHg of preoperative level	1
Blood pressure greater than 50 mmHg of preoperative level	0
Respiration/respiratory stability	
Able to breathe deeply and cough freely	2
Shortness of breath, shallow or limited breathing	1
Apneic	0
Oxygen saturation status	
SaO_2 maintained above 92% on room air	2
Needs supplemental oxygen to maintain SaO_2 >90%	1
SaO_2 <90% even with oxygen supplementation	0

Postanesthesia Complications

Postoperative Nausea and Vomiting

Postoperative nausea and vomiting (PONV) is an unfortunate adverse effect of anesthesia and surgery affecting up to 20–40% of the general population and up to 80% of high-risk patients [52]. Post-discharge nausea and vomiting (PDNV) occurs after discharge at home and occurs in roughly 33% of the population [48]. Patient-dependent risk factors include female, age less than 50, history of PONV or motion sickness, and nonsmokers [52]. Patient-independent risk factors include increased duration of anesthesia or surgery and use of opioids or nitrous oxide [52]. Two methods exist to overcome this reaction, PONV prophylaxis and treatment. Anti-nausea drugs are not without side effects, so choice to use prophylactically should be on a case-by-case basis for high-risk patients. Although there is no single drug proven to be superior, a multimodal approach is recommended to target different receptor groups [52]. In the office, recommendations to decrease PONV include: prophylactically treat moderate and high-risk groups with multimodal therapy 20–30 min before anticipated end-of-surgery [53], minimize opioids and nitrous oxide, hydrate with IV fluids, and control pain [48, 52]. Small doses of intraoperative propofol have been shown to decrease PONV [54]. If PONV does occur, treatment should be with a different antiemetic than the drug used for prophylaxis [53].

Pain Control

Analgesia in the postoperative setting is important as continued pain can cause PONV, patient dissatisfaction, and delayed discharges [49]. A multimodal approach to pain control should be utilized including long acting local anesthesia, acetaminophen, NSAIDS, and opiates [49]. Targeting multiple receptors will allow for opioid-sparing pain control, which limits the negative effects of opioids [49]. Although a multimodal approach is preferred, severe breakthrough pain may require use of opioids [48]. Adequate pain control will allow the patient to be discharged to home earlier and resume normal daily activities including ambulating and taking PO [54]. NSAIDS may increase postoperative bleeding due to disruption of platelet aggregation and should be used with caution in patients with kidney impairment or gastric ulcers.

Oversedation

Office sedation with opioids and benzodiazepines can lead to oversedation if too much drug is used or if the patient is more sensitive to the drug. Oversedation can cause respiratory depression or delayed recovery from anesthesia [50]. The decision to reverse anesthetic drugs should not be routine practice, but reserved for select cases in which it is for the patient's safety. Naloxone is an opioid antagonist that can reverse the respiratory depression or glottic rigidity that is possible with opioids [50]. Flumazenil is a benzodiazepine antagonist that can reverse the sedation effects of benzodiazepines [50]. Following use of reversal drugs, the patient should be observed for an extended time as the half-life of reversal drugs may be shorter than that of the anesthetics [50].

Discharge and Home Care

Postanesthesia Instructions

As mentioned earlier in this chapter, the discussion about postanesthesia care begins in the preoperative stage [48]. Preferably, this conversation occurs with the patient and the responsible adult that will be caring for the patient during recovery. Postoperative medications including analgesics, antibiotics, and other medications should be reviewed with the patient and escort to ensure safe and proper usage. The patient should be given instructions about who to contact in the case of emergency, whether it is the surgeon's office or local emergency department. Follow-up should be scheduled to ensure proper healing from surgery and full recovery from anesthesia.

Conclusion

Safe and effective office anesthesia begins with careful patient selection and protocols that aim to prevent complications. Patients with OSA, severe cardiorespiratory disease, predicted difficult mask ventilation, or intubation might be better treated in the operating room with a secured airway. A comprehensive knowledge of equipment and drugs is necessary to work efficiently through the inevitable office anesthesia emergency. Drugs utilized during an office sedation should not be cook book, rather, adapted to a specific patient's requirements. Recovery from anesthesia occurs in stages and close observation is required until the patient is deemed stable for discharge based on hemodynamic stability, respiratory stability, and level of consciousness.

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