# Anesthesia for Cosmetic Surgery

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**Learning Objectives:** After studying this article, the participant should be able to: 1. Recognize the anesthetic choices available to patients undergoing outpatient cosmetic surgery. 2. Identify the various medications selected for use in outpatient cosmetic surgery. 3. Understand the complexities of providing safe anesthesia to patients undergoing outpatient cosmetic surgery.

**Summary:** Increasing numbers of plastic surgery procedures are performed in diverse environments, including traditional hospital operating rooms, outpatient surgery centers, and private offices. Just as plastic surgeons develop areas of specialization to better care for their patients, anesthesiologists have specialized in outpatient plastic surgery, both cosmetic and reconstructive. The methods they utilize are similar to those for other procedures but incorporate specific techniques that aim to better relieve preoperative anxiety, induce and awaken patients more smoothly, and minimize postoperative sequelae of anesthesia such as nausea and vomiting. It is important for plastic surgeons to understand these techniques since they are the ones who are ultimately responsible for their patients' care and are frequently called on to employ anesthesiologists for their practices, surgery centers, and hospitals. The following is a review of the specific considerations that should be given to ambulatory plastic surgery patients and the techniques used to safely administer agreeable and effective anesthesia. (*Plast. Reconstr. Surg.* 125: 1e, 2010.)

The American Society of Plastic Surgeons recently reported that more than 11 million cosmetic procedures were performed last year in the United States.[1] Many expect this number to rise as plastic surgery procedures become more advanced and less invasive. With the continued increase in the number and variety of cosmetic procedures performed each year, careful clinical decision making for the safe and effective administration of anesthesia for patients undergoing cosmetic surgery is imperative. Furthermore, many cosmetic procedures are performed in an office-based setting, in addition to hospitals or surgery centers, reinforcing the need to consider all factors that ensure patient safety.

Today, patients are discharged home soon after the completion of their procedure without an overnight or extended stay.[2] It is for this reason that the anesthetic technique is considered as vital as the surgery itself. The technique in which the various anesthetic agents are administered may impact both the quality and the quantity of recovery time. Moreover, the anesthetic technique may contribute not only to patient safety but also to the overall success of nearly every cosmetic procedure. It is imperative that not only the anesthesiologist but also the surgeon understand the benefits and risks of the various anesthetic options for cosmetic surgery. The following considerations were developed to highlight some of the basic principles involved in providing general anesthesia to patients undergoing cosmetic surgery in the outpatient setting.

The plastic surgeon is ultimately responsible for managing the patient's expectations of the perioperative period (i.e., "Will I have pain?" "Will I be nauseated?" and so on). Therefore, it is imperative that the surgeon understand and appreciate some of the anesthetic methods, drugs, and/or possible sequelae. In addition, neither the surgical procedure nor the anesthetic delivery occurs in a vacuum. Thus, both physicians must understand and appreciate what the other will need

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to perform the procedure safely. Just as the anesthesiologist must understand all aspects of the surgical procedure to choose the correct anesthetic technique, the surgeon must comprehend the choices and possible sequelae of different anesthetic techniques for any given procedure.

## PREOPERATIVE DISCUSSION AND PATIENT EXPECTATIONS

An anesthetic complication during cosmetic surgery is rare in part because of the rigorous screening process a patient should undergo before any elective procedure. The patient should be medically optimized before receiving any type of anesthetic ranging from general anesthesia through monitored anesthesia care. In preparing a patient for surgery, it is useful to classify him or her by the American Society of Anesthesiologists' Physical Status Score. On this continuum, a patient's physical condition is classified into one of six categories:

Class I: completely healthy
Class II: mild controlled illness or disease with no interference in the patient's daily life
Class III: illness or disease of greater than two organ systems
Class IV: uncontrolled illness or disease, which is a constant threat to life
Class V: expected to die within 24 hours with or without surgery
Class VI: organ donor

Most anesthesiologists would agree that a class I or II patient is a suitable candidate for a cosmetic procedure, whereas a class III patient would most likely need additional assessment before being considered suitable for such procedures. In addition to a thorough history and physical examination, laboratory screenings are often required. Commonly ordered tests include hemoglobin and hematocrit, electrolytes, blood glucose, urinalysis, an electrocardiogram, and a pregnancy test for women within child-bearing age. In fact, any patient who is menstruating must have a negative beta-human chorionic gonadotropin blood test within a few days of the surgical procedure. Urine tests are not acceptable. The choice of which test to order should be directed by the history and physical examination. A specific preoperative visit to the anesthesiologist is not required because the primary care physician is able to furnish all of the above information.

## PREOPERATIVE CARE FOR ELECTIVE SURGERY

All patients should be instructed to abstain from solid food 8 hours before surgery and clear liquids 2 hours before surgery. The history of this recommendation likely comes from a report published in 1946 by Mendelson, who noted a high incidence of pulmonary aspiration in obstetric patients undergoing general anesthesia. A more concrete recommendation was published by the American Society of Anesthesiologists Task Force on Preoperative Fasting in 1999.[3] They recommend a minimum fasting period for clear liquids of 2 hours and a minimum of 6 hours for milk or a light meal. They further recommend a fasting period of 8 hours for patients who have ingested any meal containing fried or fatty foods. Since it is easiest and safest to adopt a single *non per os* rule before elective surgery, 8 hours is the most appropriate, since it covers all foods and liquids. In most healthy adults undergoing elective cosmetic surgery the following morning, there is minimal inconvenience from an overnight fast.

In addition to urging a patient to get plenty of rest the night before the procedure, the surgeon should consider prescribing a medication that provides somnolence. It is common for patients to feel anxiety and apprehension before surgery. A preoperative benzodiazepine is a suitable choice because in addition to inducing somnolence, this class of drug is also associated with anxiolysis. In fact, many plastic surgeons treat preoperative anxiety prophylactically. Anxiolytic medications such as Xanax (alprazolam; Pfizer, New York, N.Y.) or Ativan (lorazepam; Biovail, Bridgewater, N.J.) can be prescribed to patients 1 to 3 days before the procedure in doses of 0.25 to 0.50 mg three times daily and 2 to 4 mg twice per day, respectively.[4] In addition, clonidine, an alpha-2 agonist given in doses of 0.1 to 0.2 mg orally the morning of surgery, has been shown to be dually beneficial by both decreasing blood pressure and providing a degree of sedation.[5] Informed consent for the surgical procedure should be obtained in advance of the surgery, and many anesthesiologists do not feel that a small dose of a preoperative anxiolytic will interfere with the patient's ability to sign consent for anesthesia. Ultimately, procedures performed on a well-relaxed patient will more than likely be much smoother than those performed on an irritable and anxious patient.[6]

## INTRAOPERATIVE CARE

Upon the patient's arrival to the hospital, surgery center, or office, both the anesthesiologist

and cosmetic surgeon should confirm that no interval changes have occurred in the patient's medical condition. If a significant change in the patient's health status occurs immediately before the operation, the entire procedure may need to be delayed. Ostensibly, the paramount concern is patient safety.

After ensuring that all the required paperwork and consent forms are in order, the patient may be brought into the operating room. Before the induction of anesthesia, an intravenous line is inserted for administration of medications. Monitors are placed as outlined by standards set forth from the American Society of Anesthesiology and include a continuous electrocardiogram, a cycling blood pressure cuff, a pulse oximeter for oxygen saturation, an end-tidal carbon dioxide monitor, and a temperature probe. Compression boots should be placed on the calves before the induction of general anesthesia, as they have been shown to prevent the incidence of deep vein thrombosis in patients.[7] A bladder catheter is generally advisable for cases longer than 4 hours to safely manage fluid resuscitation, or to keep the bladder decompressed for abdominal procedures. For procedures that go beyond the expected time, a catheter can be placed temporarily in the operating room or postoperative care unit.

Positioning the patient on the operating room table should take into consideration the risk of permanent nerve injury from continuous pressure. The patient's position must allow the anesthesiologist to have adequate access to the airway in case there is a problem with ventilation. If the patient's face is in the operative field and a problem arises, the airway should be addressed expeditiously at the temporary expense of sterility before continuing with the procedure. Finally, the length of all cords of electrical surveillance and patient monitoring systems must be taken into account so that they do not cause distractions during the surgery.

It is important to note that the temperature of the operating room is a vital consideration when planning a surgical procedure. Due to the vasodilatory nature and the direct inhibition of the hypothalamus caused by many anesthetic agents, all patients are susceptible to hypothermia or loss of body heat during surgery. This may result in platelet dysfunction and bleeding, enzymatic inactivity, cardiac dysfunction, or postoperative shivering. Hence, the ambient temperature of the operating room should be kept at a temperature that minimizes body heat loss and a warming blanket be used for longer procedures. While hypothermia is probably not a likely occurrence in short cases, a warming blanket is relatively inexpensive compared with other adjunctive devices.

After the induction of general anesthesia, every effort should be made to protect the patient's eyes from inadvertent injury. Closed eyes should always remain closed during surgery, especially in procedures on the face. With the various surgical instruments being passed between the nurse and surgeon, accidents may occur. To minimize the risk of corneal abrasion, a gentle ophthalmologic lubricant, with or without antibiotic, should be placed in the lower fornix of each eye at the start of the procedure. Sterile tapes are also recommended to keep the eyelids closed if possible.[8] Ointment is not easily washed from the eye, so that unlike tape that may come loose during the procedure, ointment tends to remain for the duration.

Both patients and surgeons are interested to know what role music has in the operating arena. In fact, much has been documented about the use of music before, during, and after surgical procedures. Numerous studies have found that patients who listen to music preoperatively and during operations requiring regional anesthesia are calmer and less preoccupied with the surgery than their counterparts.[9] Furthermore, a similar study reported a measurable difference in heart and respiratory rates as well as blood pressures between patients undergoing ambulatory surgery who listened to music compared with those who did not.[10] Additional studies sought to determine the effect of music not just on patients but on the entire operating room, including the staff and the surgeons. Not surprisingly, the studies showed that listening to music allayed preoperative anxiety in patients and neither improved nor hindered the concentration of the surgeons performing the procedures.[11] Thus, while helping patients moderate their anxiety, the use of music in the operating suite seems to simply be a matter of personal preference and precedent.

## GENERAL ANESTHESIA

"General anesthesia is defined as a controlled state of unconsciousness accompanied by a loss of protective airway reflexes. [In addition to] the inability to maintain a patent airway, the patient will be unresponsive to verbal commands."[12] With this type of anesthesia, the patient may require respiratory or cardiovascular support. The insertion of an endotracheal tube after induction will allow control of ventilation. Throughout the surgical procedure, the patient is closely monitored to note any changes in physiologic status (e.g.,

oxygen saturation, blood pressure, heart rate and rhythm, breathing rate and rhythm, and temperature). General anesthesia can be divided into three phases: induction (when the patient loses consciousness), maintenance (when unconsciousness is maintained during the procedure), and emergence (when the patient regains consciousness).

It is believed that a patient's state on induction mirrors that of emergence. Accordingly, a smooth induction with minimal hypertension and tachycardia is desirable for cosmetic anesthesia. Before induction, the anesthesiologist should consider a number of premedications. Midazolam, a short-acting benzodiazepine, can produce sedative-hypnotic effects or can even induce anesthesia at very high doses. It is also characterized by its ability to cause amnesia, hypnosis, and the relaxation of muscles with relative celerity. In fact, the onset of sedation following intravenous administration of midazolam is usually within 3 to 6 minutes, though there is some degree of patient variability. Intravenous midazolam will depress the ventilatory response to carbon dioxide stimulation, which may already be impaired in patients with chronic obstructive pulmonary disease. In young, healthy patients, intravenous sedation with midazolam in small doses does not appear to adversely affect respiration. As far as cardiac sensitivity is concerned, the use of midazolam is associated with decreases in mean arterial pressure, cardiac output, stroke volume, and systemic vascular resistance. Consequently, *midazolam is contraindicated in patients with acute pulmonary insufficiency or severe chronic obstructive pulmonary disease.* Nevertheless, studies have reported that the administration of certain barbiturate and benzodiazepam drugs by an anesthesiologist preoperatively may "reduce the overall anesthetic requirements [of the procedure itself], thereby improving recovery time [later]."[6]

Postoperative nausea and vomiting is a major concern with any anesthetic procedure. Preoperative antiemetics should be used to prevent postoperative nausea and vomiting following the use of numerous anesthetic agents, including narcotics and nitrous oxide. Many anesthesiologists avoid narcotics altogether to minimize the incidence of nausea and vomiting. Alternative analgesics include local anesthetics, ketamine, and ketorolac. Others advocate the use of narcotics for heavy pain cases and use a variety of available antiemetics to minimize postoperative nausea and vomiting. Granisitron (0.2 to 1 mg intravenously) and ondansetron (1 to 4 mg intravenously) are serotonin antagonists that reduce the autonomic neuroactivity in the vomiting center of the brain. Dexamethasone (4 to 10 mg intravenously), a steroid, and scopalamine, a tropane alkaloid, both may be used to resolve dizziness and nausea. In addition, metochlopromide (10 mg intravenously) and Emend (apripetant; Merck, Whitehouse Station, N.J.), a newer antiemetic, are increasingly being used. Combination therapy using with several antiemetics is advisable for patients who have a high risk for postoperative nausea and vomiting, including young women and nonsmokers who have a history of postoperative nausea and vomiting in the past or car-sickness.

Various drugs can be used to induce general anesthesia. One commonly used induction agent is propofol, a short-acting intravenous drug used in adult and pediatric patients. It may also be utilized during the procedure for the maintenance of anesthesia. Side effects include hypotension and apnea following induction, as well as pain on injection, which can be ameliorated by pretreatment with intravenous lidocaine.[13] Propofol is often used for cosmetic procedures because it is associated with reduced postoperative nausea and vomiting and can even be used as an antiemetic. Thiopental is another induction agent. Thiopental is a barbituate that affects fine motor skills and is notorious for producing a heavy "hangover" effect and significant postoperative nausea and vomiting.[6] Midazolam and ketamine can also be used for induction, although they are associated with a longer recovery time postoperatively. Ketamine, a phencyclidine derivative, is an anesthetic agent approved for human and veterinary use whose popularity in the outpatient arena has increased over the past several years. Its effects include analgesia and sedation with minimal to no respiratory depression. However, hallucinations, hypertension, increased intracranial pressure, and salivation have limited its appeal. It has been used successfully with propofol and midazolam for cosmetic procedures, since it may be used without the need for endotracheal intubation, supplemental oxygen, or narcotics.[14,15]

General anesthesia requires control of the patient's airway. The drugs used to induce unconsciousness are associated with muscle weakness, alkalosis, and the loss of many autonomic reflexes, including the ventilatory response to carbon dioxide and hypoxia.[16] Thus, patients under general anesthesia often require mechanical ventilation. Adequate airway control may be achieved either with a traditional endotracheal tube that passes beyond the vocal cords or with a laryngeal mask airway that is inflated above the vocal cords at the laryngeal aperture. As with all considerations in

cosmetic surgery, the means of securing the airway depends on the procedure being performed. For procedures that do not involve frequent head turning, the laryngeal mask airway provides a safe alternative to the endotracheal tube because it does not risk vocal cord injury and has less of an incidence of postoperative laryngeal irritation and "bucking on the tube."[17] However, since the laryngeal mask airway does not occlude the trachea, patients at high risk for aspiration should still use a traditional endotracheal tube.

The device itself may be secured to the face in various ways. For procedures not involving the face, adhesive tape is most often used to secure the tube to the lower jaw. For facial procedures, the tube may be prepped into the field or covered with sterile plastic or stockinet to maintain sterility. Of paramount importance is that the surgeon and anesthesiologist weigh surgical exposure versus sterility and always respect the need for emergent visualization of the numerous connections within the patient's anesthetic circuit should problems with ventilation arise. Because surgical preparation of the face often dislodges the tape holding the tube, it may be advisable to place a suture around the tube and then around the teeth in the midline. Of course, this is impractical in patients with dental restoration, such as a bridge or an implant.

After the induction of general anesthesia, the anesthesiologist must vigilantly monitor changes in the patient's cardiovascular status, including alterations in oxygen saturation, blood pressure, heart rate and rhythm, respiratory rate, and temperature, while continuously administering anesthetics for the duration of the operation. To accomplish this, the anesthesiologist carefully administers a combination of drugs while closely assuring that the patient's heart rate and blood pressure are well controlled.

A constant stable blood pressure in the low-normal range for the duration of the cosmetic procedure is desirable to minimize blood loss and bleeding into the tissues, which contributes to prolonged postoperative ecchymosis and edema. More severe consequences of prolonged hypertension include cardiopulmonary-hepatic congestion or anasarca, and possibly even heart or renal failure. If the blood pressure drops too low, the patient will not adequately perfuse vital organs and can develop circulatory collapse. Keeping the blood pressure constant at a level that ensures adequate perfusion without the aforementioned complications cannot be overemphasized.

The choice of drugs used to maintain anesthesia is also important to minimize postoperative nausea and vomiting and to allow for a rapid recovery process. Nitrous oxide is commonly used as an inhalational agent to maintain anesthesia. Its use reduces the need for higher concentrations of the volatile inhalational agents for maintenance of anesthesia. It is, however, associated with postoperative nausea and vomiting and should be limited to concentrations under 50%, especially in patients with evident coronary disease.[18]

Isoflurane is one of a number of volatile inhalation agents commonly used for maintenance of anesthesia. Desflurane is shorter-acting member of this class of drugs and may be more suitable for cosmetic surgery. Its quick recovery time results from a higher vapor pressure. However, desflurane often causes postoperative respiratory irritation and coughing largely due to its pungent smell. Sevoflurane is better tolerated than desflurane because it lacks a characteristic odor. As a result of the lower solubility of these newer volatile agents, cognitive functions return to baseline more rapidly when compared with inhaled isoflurane.

Continuous intravenous anesthetics are commonly employed in cosmetic surgery. Propofol, remifentanil, dexmetatomidine, and ketamine are among the most commonly used. Propofol was discussed earlier as a drug of choice for induction, but it can also be used as a continuous infusion (75 to 150 $\mu$g/kg per minute) to maintain anesthesia. Remifentanil may be used just before induction to suppress the autonomic responses to intubation and during maintenance to suppress other autonomic responses to surgical stimuli. Because it is also a short-acting narcotic, it is ideal for the end of the procedure, since it is a potent cough suppressant. However, as with all narcotics, it can cause postoperative nausea and vomiting.[19] Last, ketamine, like propofol, can be used for both induction and maintenance, though it is often associated with an increase in blood pressure and salivation, as well as bad hallucinations. Fortunately, it is not associated with postoperative nausea and vomiting.

## EMERGENCE

Emergence should be a well-planned event. The ideal emergence from anesthesia following cosmetic surgery has no increases in blood pressure or heart rate, no "bucking" from irritation of the endotracheal tube, and no respiratory complications.[20] While the concentration of inhalational and intravenous anesthetics are lowered to allow the patient to regain consciousness, ad-

ditional medications are administered to restore muscle activity and allow the patient to breathe spontaneously to permit extubation. Maneuvers that are particularly stimulating, such as nasogastric decompression or suctioning, are done while the patient is still deeply sedated to prevent hypertension. Gagging at the conclusion of any procedure is undesirable because it raises blood pressure and may trigger subcutaneous bleeding. The prevention of nausea and vomiting is important to minimize fluctuations in blood pressure. Patients should be reminded as they emerge from anesthesia that they may have blurred vision due to the ointment and should be prevented from attempting to rub their eyes.

## POSTOPERATIVE CARE

Anesthetic care does not end once the endotracheal tube has been removed and the patient is restored to consciousness. Patients must be closely monitored postoperatively for signs and symptoms of hypoxia, hypertension, pain, nausea and vomiting, and even unconsciousness. This is an important part of the continuum of anesthesia care. A patient may be discharged once an Assessment of Home Readiness test is conducted.[6] In this evaluation, patients are closely observed to ensure that their vital signs are stable, to make sure they are environmentally aware, and to make sure they can walk without falling or becoming excessively dizzy. Patients are also evaluated for pain, nausea and vomiting, and bleeding at the surgical site. Most delays in discharge are due to pain, postoperative nausea and vomiting, hypotension, and dizziness upon ambulating.[6] All patients require analgesia postoperatively and some may require stronger medications than acetaminophen or nonsteroidal anti-inflammatory drugs as part of their postoperative regimen.

## MONITORED ANESTHETIC CARE TECHNIQUES

The choice of anesthetic technique for cosmetic surgery varies based on the discretion of the anesthesiologist, the surgeon, and the procedure. Most patients associate surgery with general anesthesia, but other forms of anesthesia exist along the spectrum of choices for intraoperative sedation/analgesia and are effectively utilized for such procedures. Monitored anesthesia care may be offered to patients undergoing compatible procedures. In this technique, a combination of local anesthetic and intravenous analgesic and sedative drugs produces a "minimally depressed level of consciousness that retains the patient's ability to maintain an airway independently and continuously and to respond to physical stimuli and verbal commands."[6,21] This anesthetic technique is often referred to as "conscious sedation," and the patient will be sedated so as to not feel any pain or have any keen sense of environmental awareness. However, unlike in general anesthesia, where unconsciousness is induced and spontaneous respiration is depressed, patients will continue to breathe on their own.

Monitored anesthetic care has been shown to be effective and safe in large study populations.[22–24] Typically, a combination of two or more medication types is used to achieve the desired level of sedation and analgesia. Commonly used agents include rapid-acting opioids, such as fentanyl, and sedatives, such as midazolam and propofol.[25,26]

In certain patients, the administration of enough medication will cause the patient to lose protective airways reflexes and move into a state of general anesthesia. In some instances, this will require securing the airway, while in others it may require decreasing the dose of the anesthetic agents to allow the patient to regain spontaneous respiration. For this reason, monitored anesthesia care has all of the same requirements as general anesthesia. Patients should be screened preoperatively, vigilantly monitored intraoperatively, and meet the same discharge criteria.

## GENERAL ANESTHESIA COMPARED WITH MONITORED CARE ANESTHESIA

Each of the aforementioned anesthetic techniques has both advantages and disadvantages, thus the selection of one method over the other truly depends on the nature of the surgical procedure and the comfort level of the anesthesiologist and surgeon alike.

For shorter, less complicated procedures, either method may be used. For difficult and time-consuming procedures, general anesthesia is often more appropriate. In the monitored anesthesia care model, the patient drifts in and out of consciousness during the procedure and may become more anxious, irritable, and emotional than patients undergoing general anesthesia.[6] Postoperative nausea and vomiting, however, may be reduced.

It should be noted that the administration of both types of anesthesia in an ambulatory setting is safe. Largely due to the meticulous preoperative screening and technological advancements in anesthesia, morbidity and mortality resulting from outpatient anesthesia are rare.[6] A recent study reported no significant differences between either

form of anesthetic technique employed as it relates to patient recovery time, sensitivity to pain, and safety.[27] A joint study conducted by Yale University and the State University of New York at Stony Brook evaluated the safety of outpatient anesthesia for plastic surgery procedures on the face. The study reported no deaths or severe complications among the 1200 cases retrospectively reviewed.[28]

Patients undergoing cosmetic surgery are generally well informed regarding the nature of the procedure and the reputation of their surgeon, but overlook the importance of the anesthetic technique needed to effectively perform the procedure. A successful cosmetic procedure involves both a skilled plastic surgeon and a knowledgeable anesthesiologist. Cosmetic surgeons realize the importance of this and often choose to work with one or more select anesthesiologists with whom they have developed a rapport and a tacit understanding of what is needed before, during, and after surgery.

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