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Preoperative Preparation

Carmen R. Green and Sujit K. Pandit

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Use of current medications
The day before the operation
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Summary

Preoperative Instructions
Once outpatient surgery has been scheduled, it is important to give the patient clear instructions about what to do during the perioperative period. A health professional, usually a registered nurse, certified nurse anesthetist, or another trained person, may give instructions in person or over the telephone. In addition, a written copy of the instructions (or a booklet) is also given to the patient. Many hospitals and facilities have produced short video presentations about what to expect on the day of operation, which they show the patients (and the parents if the patient is a child) during a visit with the surgeon. Box 6-1 contains some instructions that must be given to the patient before an operation.

Fasting Instructions
It is known that aspiration of acidic gastric contents is an important cause of perioperative morbidity and mortality; as a result, overnight fasting has become a standard anesthetic practice. However, a number of recent studies show that the gastric emptying time for clear liquids is very different than that for solid foods. Although after ingestion, solid food takes as long as 6 to 8 hours to leave the stomach, clear liquids leave the stomach within 2 hours. Ingestion of food or drink immediately stimulates stomach activity; solid foods must be broken down to semisolid chyme (2 μm particle size) to pass through the pylorus, while liquids can pass almost immediately. Furthermore, it has been shown that patients who are allowed clear liquids up until 2 to 3 hours before induction are more cheerful, less hungry and thirsty, have lower incidence of perioperative headaches, need less intravenous fluids during and after the operation, and have less residual intragastric volume and acidity. In fact, there is evidence that ingestion of clear liquids 2 to 3 hours before induction increases gastric peristalsis and helps empty the stomach of residual acid secretions faster.

A recent survey of U.S. anesthesiologists shows that almost 70% of pediatric anesthesiologists and about 40% of adult anesthesiologists have liberalized their fasting requirements for clear fluids. Most anesthesiologists allow patients in ASA class 1 or 2 to ingest an unlimited amount of clear liquids until up to 3 hours before elective surgery. Box 6-2 shows the current NPO (nulla per os, nothing by mouth) guidelines at the University of Michigan Medical Center. In patients at increased risk for pulmonary aspiration (e.g., those with morbid obesity, diabetes, pregnancy, hiatal hernia, or other gastroesophageal lesions), use of these guidelines is still controversial. Types of common clear liquids allowed are listed in Box 6-3. It should be noted that cow’s milk is not a clear liquid and should not be allowed. Although breast milk is not technically a clear liquid, it is functionally a clear liquid because it is rapidly emptied from the stomach. Therefore, most of the surveyed pediatric anesthesiologists allow breastfeeding until 2 to 4 hours before induction; however, this remains controversial.

Use of Current Medications
Most of the patient’s current prescribed medications are needed to maintain homeostasis of the patient’s physiological condition.
Box 6-2 Fasting Guidelines Before Elective Operations in ASA Class 1 or Class 2 Patients

Solid Food
No solid food on the day of operation (8 hours fasting)

Clear Liquid
Adults and children greater than 3 months of age: unlimited amounts of clear liquid up to 3 hours before the operation
Infants (less than 3 months of age): clear liquids up to 2 hours before operation

Oral Medication
For both adult and children, required oral medications may be taken up to 1 hour before the induction, with one-half cup of water

Box 6-3 Common Clear Liquids Allowed Before Operation

<table>
<thead>
<tr>
<th>Children</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Water</td>
</tr>
<tr>
<td>Apple juice</td>
<td>Apple juice</td>
</tr>
<tr>
<td>Carbonated beverage</td>
<td>Black tea or coffee</td>
</tr>
<tr>
<td>Jell-O</td>
<td>Carbonated beverage</td>
</tr>
<tr>
<td>Broth</td>
<td>(Breast milk)</td>
</tr>
</tbody>
</table>

Box 6-4 Disposition of Current Medications Before Outpatient Operation

Continue
- Antihypertensive
- Beta adrenergic blockers
- Calcium channel blockers
- ACE inhibitors
- Vasodilators
- Bronchodilators
- Antiseizure medications
- Tricyclic antidepressants
- MAO inhibitors (controversial)
- Corticosteroids
- Thyroid preparations
- Anxiolytics

Discontinue or Withhold
- Diuretics
- Insulin
- Digitalis
- Anticoagulants (may change to a short-acting agent like heparin)

for hypokalemia, which may precipitate digitalis toxicity and dangerous intraoperative arrhythmias. Because of their long half lives (digoxin half life is 36 to 40 hours, digitoxin half life is 5 to 9 days) and narrow therapeutic range, digitalis glycosides should be withheld on the day of surgery. Whether it is necessary to stop some antidepressant medications (e.g., monoamine oxidase [MAO] inhibitors) is controversial. Several recent studies and surveys suggest that MAO inhibitors may be continued as long as the anesthesiologist is fully aware of their possible disastrous interactions with some vasoressors and with some narcotics (e.g., meperidine). There is also controversy regarding continuation of aspirin therapy for patients with coronary artery disease. Chronic use of aspirin products can cause a bleeding tendency and can prolong the bleeding time. A thorough preoperative history and assessment about bleeding tendency will reveal the extent of the problem. Box 6-4 lists recommended preoperative disposition of chronic medications.
Box 6-5 Purposes of the Nurse’s Phone Call the Day Before the Operation

- Provide reassurance
- Confirm the time of the scheduled operation and time of arrival at the facility
- Instruct what to bring (medications, eye glass case, insurance card) and what not to bring (unnecessary money, jewelry, etc.)
- Restate the fasting instructions
- Ask about any recent changes in the health status (e.g., upper respiratory tract infection)
- Instruct about the use of prescribed and current medications
- Emphasize the need to bring a responsible adult escort (old enough to have a valid driving license) to take the patient back home
- Emphasize the importance of having a responsible adult at home during the 24 hours following surgery
- Note the telephone number where the patient can be reached that night in case of any changes in schedule

The Day Before the Operation

Whenever possible, a health care professional, usually a registered nurse or a CRNA should call the patient to give any last-minute instructions, get up-to-date information about the patient’s condition, answer any questions, repeat and reinforce previous instructions, and provide reassurance (Box 6-5).

Preamnesthetic Evaluation on the Day of the Operation

Regardless of the method of screening or preanesthetic evaluation done earlier, the anesthesiologist must perform a final assessment on the day of the operation. At this time, after reviewing the screening and preoperative records, the anesthesiologist must take a quick history, perform a final focused physical examination, and go over the anesthetic and postanesthetic care plans with the patient (Box 6-6).

Box 6-6 Purposes of Final Evaluation by the Anesthesiologist

- Reassure patient
- Establish or re-establish patient-doctor relationship and rapport
- Review health questionnaire
- Review other screening or preanesthetic records and laboratory findings
- Note the current and any recent changes in health status
- Obtain and review previous anesthetic history
- Review family history of anesthetic complications
- Note history of drug allergy
- Ask about last meal, drink, and medications taken
- Take history of current and prescribed medications
- Note history of any other chemical use
- Perform a short physical examination including examination of the heart, lung, blood pressure, and airway
- Note the relevant available laboratory findings
- Perform necessary laboratory tests (e.g., blood sugar for diabetics, serum potassium for patients receiving diuretics)
- Explain the anesthetic and postanesthetic care plans
- Answer any questions and obtain informed consent
- Provide pharmacologic premedication, if necessary

The holding room nurse also should take a pertinent history that includes the patient’s allergies; the last time the patient ate or drank anything; the patient’s current health status; whether the patient wears dentures, eyeglasses, or contact lenses; the name of the patient’s escort; and telephone numbers where the patient can be reached. The clinician should also note the patient’s heart rate, blood pressure, respiratory rate, temperature, and, if available, room air oxygen saturation (SaO₂).

Preoperative Medication

Preoperative medications are given for many reasons (Box 6-7). This discussion focuses on adults, while specific pediatric
Box 6-7 Purposes of Preoperative Medication

**Primary Purposes**
- Allay anxiety
- Reduce gastric acidity and residual volume
- Decrease histamine activity
- Reduce oral and airway secretions
- Minimize nausea and vomiting
- Control infection

**Secondary Purposes**
- Produce amnesia
- Produce sedation
- Provide analgesia
- Reduce anesthetic requirement
- Reduce vagal activity
- Reduce anesthetic requirement
- Provide hemodynamic stability

Premedicants are addressed in Chapter 5. Several things must be considered before ordering preoperative medications (Box 6-8).

**Antianxiety Premedicants**

Explanation of the procedure and reassurance by the anesthesiologist during the preoperative period goes a long way in relieving patient anxiety. Nevertheless, most patients remain anxious before an operation. Controversy has long existed about whether a preoperative antianxiety agent should be administered to anxious patients undergoing outpatient surgery. The older anxiolytic agents were associated with delayed discharge and recovery. However, when midazolam, a rapid-onset short-acting, watersoluble benzodiazepine, was introduced, these problems were solved. An ideal outpatient premedicant should have rapid onset of action and a short elimination half-life. Midazolam, with an elimination half-life of 2.5 hours, is the most common premedicant used in the United States. Instead of using a fixed dosing regimen, it is best to titrate the drug to effect, by increments of 0.5 mg to 1 mg. Since the onset of action is rapid (1 to 2 minutes), titration is easy. Rarely does an average adult need more than 2 mg; elderly patients need even less, often only 0.5 mg. Midazolam can also be administered intramuscularly (0.07 to 0.1 mg/kg), orally (0.5 to 0.75 mg/kg), or intranasally (0.2 mg/kg) in pediatric and adult patients. Oral midazolam has a very bitter taste that can be masked by mixing it with a sweetened clear liquid, like cola, or grape or apple juice. When the midazolam dose is in the upper limits of the dose range, the discharge time may be delayed because of long anterograde amnesia and diminished psychomotor function, which may be undesirable in the adult ambulatory patient.

Oral diazepam (5 to 10 mg) may be given 1 hour preoperatively; patients may take this dose at home before leaving for the facility, as long as they are not driving. Although diazepam has a long elimination half-life (about 20 hours), this dose is well tolerated by healthy, young adults. Long-acting agents (e.g., lorazepam) are not recommended, mainly because of their extremely long sedative and amnesic effects. Triazolam and the formulation of temazepam currently available in the United States are not recommended for outpatient premedication because of unpredictable duration. Short-acting narcotics (e.g., fentanyl 0.5 to 1.0 μg/kg, sufentanil 0.15 to 0.2 μg/kg) are occasionally used as antianxiety premedicants when benzodiazepines are

Box 6-8 Questions to Ask Before Any Preoperative Medication Is Ordered

- Does this patient need a pharmacological premedicant in addition to the psychological preparation and suggestions?
- Is this patient at a high risk for acid aspiration?
- Is this patient at a high risk for postoperative nausea and vomiting?
- Does this patient need a drying agent?
- Does this patient need any histamine receptor blockers (H₁ and H₂) to prevent allergic reactions?
- Does this patient need antibiotic prophylaxis?
Box 6-9 Ideal Anxiolytic Premedicant for Outpatient Surgery

- Rapid onset of action
- Nonirritating to tissue when given intravenously or intramuscularly
- Short elimination half life
- Nonactive metabolites
- Brief, if any, amnesic effect
- Effective orally (in children)
- Devoid of side effects (e.g., nausea, vomiting, dizziness, and sedation)

inappropriate.\textsuperscript{11} Innovative ideas like transdermal or transmucosal administration systems (e.g., fentanyl) for outpatients are now available; however, these are not desirable because of the high incidence of nausea, vomiting, pruritus, long latency, and high cost.

Box 6-9 lists the characteristics of an ideal antianxiety premedicant. Box 6-10 lists the common antianxiety premedicants for outpatient surgery in adults.

Sedative, Amnesic, and Analgesic Premedicants

Except in a very small number of extremely anxious patients, neither sedation nor amnesia is a desirable feature of a premedicant. In fact, prolonged sedation and anterograde amnesia in the immediate postoperative period is certainly unwarranted because the patient must remember the postoperative instructions given to them. However, the pediatric patient differs from the adult patient: Amnesia may actually be desirable in children, since it is the parents who are responsible for understanding the postoperative instruction.\textsuperscript{10} Midazolam in small doses causes anterograde amnesia, but fortunately, the duration of this amnesia is fairly short, about 30 minutes. Analgesic premedicants (e.g., fentanyl 1 to 2 µg/kg, sufentanil 0.15 to 0.2 µg/kg) are indicated when a painful procedure is contemplated before the induction of anesthesia (e.g., regional anesthetic blocks).\textsuperscript{11}

Box 6-10 Preoperative Medicants for Anxiolysis in Adult Outpatient Surgery

Most Common Premedicant
Midazolam intravenously (titrate to effect in increments of 0.5 to 1 mg; total dose is usually no more than 2 to 3 mg)

Other Premedicants
Midazolam: intramuscularly (0.08 to 0.1 mg/kg)
intranasal (0.2 mg/kg)
Fentanyl intravenously (0.5 to 1.0 µg/kg)
Sufentanil intravenously (0.15 to 0.2 µg/kg)
Ketamine intramuscularly (2 to 4 mg/kg) in belligerent patients
Diazepam orally (5 to 10 mg) 1 hour before operation

Alpha\textsubscript{2} adrenergic agonists (e.g., clonidine, dexmedetomidine) have been utilized preoperatively as premedicants and as adjuncts during the intraoperative period.\textsuperscript{12} These drugs reduce anesthetic requirements by virtue of their analgesic effects. Oral clonidine (200 to 300 µg, approximately 3 µg/kg) has been used to provide sedation and anxiolysis while maintaining hemodynamic stability. Clonidine in larger doses and as transdermal patch may be associated with prolonged postoperative sedation. The optimal dose of dexmedetomidine for premedication of the ambulatory patients is 0.3 to 0.6 µg/kg intravenously or 1.0 µg/kg intramuscularly. The incidence of side effects (e.g., sedation, dry mouth, and hypotension) increase when higher doses of clonidine and dexmedetomidine are used.

Medications to Prevent Acid Aspiration

The incidence of serious pulmonary aspiration is rare in healthy adults undergoing elective outpatient surgery: less than 1:25,000.\textsuperscript{13} Over the last decade, studies and anesthesiologists' experience have disproved earlier reports that outpatient surgery patients were at higher risk for acid aspiration than were inpatient surgery patients. These reports stemmed from an erroneous assumption that a residual gastric volume of 25 ml or greater, along
Box 6-11 Patients at Higher Risk for Pulmonary Acid Aspiration

- Morbidly obese patients
- Insulin dependent and non-insulin-dependent diabetic patients
- Pregnant patients
- Patients with a history of hiatal hernia or other gastrointestinal dysfunction
- Patients at the extremes of age
- Patients who smoke
- Patients with high anxiety
- Patients with an anticipated difficult airway

with a pH of 2.5 or less, automatically places a patient at a higher risk for acid aspiration. According to this false assumption, the majority of the patients scheduled for any surgery (inpatient or outpatient) are at high risk for pulmonary aspiration. Actually, the incidence of pulmonary aspiration in ASA class 1 or 2 patients undergoing elective surgery is extremely rare. Thus, routine aspiration prophylaxis for all outpatient surgical candidates is neither cost-effective nor appropriate. However, some patients are perceived to be at a higher risk for pulmonary acid aspiration (Box 6-11). These patients and other high-risk patients should be pretreated (Box 6-12). A dose of an oral H₂ antagonist the night before surgery and another dose the morning of surgery gives the best result. A prescription for this drug should be given to patients during the preoperative visit so that they can take it at home. An intravenous H₂ antagonist may be administered within 1 hour before surgery. However, rapid intravenous infusion of cimetidine may result in cardiac arrhythmias (e.g., bradycardia). The H₂ blocker may be combined with metoclopramide, which has antiemetic properties, increases the lower esophageal sphincter pressure, and may prevent gastric regurgitation. A clear antacid is best given just before the operation in patients who are at risk (see Box 6-12) but were not prepared appropriately with a H₂ blocker and/or metoclopramide.

Box 6-12 Drugs for Acid Aspiration Prophylaxis

**H₂ Antagonists**
- Ranitidine
  - 150 mg orally about 2 hours before operation
  - 50 mg intravenously about 1 hour before operation
- Cimetidine
  - 300 to 400 mg orally about 2 hours before operation
  - 300 mg intravenously about 1 hour before operation
  (Dosage may need to be reduced for patients with renal insufficiency.)
- Famotidine
  - 20 to 40 mg orally 2 hours before operation
  - 20 mg intravenously about 1 hour before operation

**Gastrokinetic Agents**
- Metoclopramide
  - 10 mg intravenously about 30 minutes before operation
  - 10 mg orally about 1 hour before operation

**Clear Antacids**
- Sodium citrate (or Bicitra)
  - 15 to 30 ml orally about 15 minutes before operation
  (Allow thorough intragastric mixing by rolling the patient from side to side.)

**Antiemetic Premedicants and Prophylaxis**

Nausea and vomiting is still a significant problem following outpatient surgery. Box 6-13 lists the conditions that predispose to postoperative nausea and vomiting (PONV).

**Strategy to control postoperative nausea and vomiting**

Nausea and vomiting is the most disliked postoperative sequelae by both patients and PACU nurses. Specific postoperative treatment modalities are discussed in Chapter 11. It has been shown by many authors that PONV, even when treated, significantly prolongs recovery room stay and discharge time. This delay in discharge from PACU impacts the smooth operation of the facility, thus increasing the cost of health care. As a result, prevention of
Box 6-13 Factors That Predispose to PONV

- Female gender
- Infants and small children
- Certain operations:
  - Eye surgery, especially strabismus surgery
  - Laparoscopy
  - Middle ear surgery
  - Tonsillectomy/adenoidectomy
  - Abortion
- Inappropriate mask and bag ventilation
- Intraoperative narcotic use
- Nitrous oxide and narcotic combination
- Operation during the days of menstruation and ovulation
- History of motion sickness
- History of previous PONV or chemotherapy
- Obesity
- Oral intake attempted too early in the postoperative period
- Postoperative ambulation attempted too early, especially after narcotic use
- Postoperative hypotension

PONV is certainly a better strategy than treating after it occurs. However, routine PONV prophylaxis for all outpatients is neither cost-effective nor desirable, as most currently used antiemetics are not always effective, and they do have undesirable side effects. Box 6-14 lists strategies to prevent PONV.

A prophylactic antiemetic should be considered for any patient who appears to be at high risk for PONV when other strategies may not be adequate. The incidence of nausea and vomiting for similar situations vary tremendously among various facilities and even among anesthesiologists practicing in the same facility. Thus, each anesthesiologist’s plan must be based on his or her own experience and track record. Box 6-15 gives a list of common antiemetics that are used for prophylaxis.

Box 6-14 Strategies to Prevent PONV

- Provide smooth, elegant anesthesia (by an experienced and caring anesthesiologist)
- Use propofol anesthesia
- Prevent gastric distention
- Ensure adequate preoperative and intraoperative intravenous hydration
- Limit usage of intraoperative narcotic; instead use regional blocks
- Provide prompt treatment of pain during recovery
- Avoid sudden movements in the PACU
- Avoid attempting oral intake and ambulation too early
- Avoid orthostatic hypotension in PACU
- Provide prophylactic antiemetic for high-risk patients

Box 6-15 Prophylactic Antiemetic Drugs

- Droperidol
  - 10 to 20 μg/kg intravenously at the time of induction
- Metoclopramide
  - 10 mg intravenously at the end of operation
- Ondansetron
  - 4 to 8 mg intravenously during the operation
- Hydroxyzine
  - 1.0 to 1.5 mg/kg intramuscularly in preoperative period
- Ephedrine
  - 25 to 50 mg intramuscularly during the operation or in the postoperative period

Droperidol, a butyrophenone, a dopaminergic antagonist, is by far the most common and probably the most effective prophylactic antiemetic used in the United States. While a dosage of 10 to 20 μg/kg is usually effective, in certain situations such as strabismus surgery, a dose of 50 to 75 μg/kg has been recommended. Droperidol has a long latency and a long duration of action. Thus, it should be given toward the beginning of the operation rather than
near the end. Nevertheless, it is unwise to give droperidol during the preoperative period, since it can cause extreme anxiety and restlessness in the patient waiting for surgery. Droperidol is also associated with extrapyramidal side effects, agitation, and dysphoria.

Metoclopramide, also a dopaminergic antagonist, is a proven antiemetic when used in large doses in patients receiving cancer chemotherapy. However, the effectiveness of smaller doses in the outpatient surgery setting is rather controversial. It appears to be most effective when given at the end of surgery, or on arrival to the PACU in an intravenous dose of 10 mg. Rapid administration of metoclopramide, like that of droperidol, may also result in extrapyramidal side effects, flushing, intestinal cramps, and agitation. There is some indication that metoclopramide hastens recovery from anesthesia.\(^{16}\)

Ondansetron, a serotonin 5-HT\(_3\) receptor antagonist, has been recently approved as an antiemetic for PONV. Like metoclopramide, it has been used successfully for antiemetic prophylaxis before cancer chemotherapy. Available results indicate that it is an effective intravenous antiemetic in a dose of 4 to 8 mg, but that it is probably no more effective than droperidol.\(^{17}\) However, ondansetron has no cardiovascular and psychological side effects. At this time, ondansetron is very expensive (a 4.0 mg dose costs about $17.00), making it a poor choice for routine antiemetic prophylaxis. Many anesthesiologists reserve its use as a last-resort rescue medication to treat PONV when other methods have failed.

Hydroxyzine is an effective antiemetic that also provides sedation, especially when combined with a small amount of narcotic. However, prolonged sedation may be a disadvantage in the outpatient setting. In addition, intramuscular injection of hydroxyzine is painful and may cause tissue irritation. Intramuscular ephedrine has also been a useful antiemetic agent during the intraoperative and postoperative period, especially when symptoms of low blood pressure accompany nausea and emesis.

Many other medications, especially antihistaminics, phenothiazines, anticholinergics, and transdermal scopolamine, are also used for antiemetic prophylaxis before outpatient surgery. Their effectiveness is variable, and all seem to have undesirable side effects. Nonpharmacological methods such as acupuncture and acupressure have been advocated for PONV, but their effectiveness has not been established in any large study.

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### Box 6-16 Anticholinergic Premedics

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine</td>
<td>0.4 to 0.6 mg intramuscularly or intravenously</td>
<td>Causes tachycardia, crosses blood-brain barrier, possible central cholinergic syndrome</td>
</tr>
<tr>
<td>Scopolamine</td>
<td>0.4 to 0.6 mg intramuscularly or intravenously</td>
<td>Prolonged sedative and amnesic effect; postoperative agitation is common in older adults because of its central effect; should not be used for outpatient surgery</td>
</tr>
<tr>
<td>Glycopyrrolate</td>
<td>0.2 to 0.3 mg intravenously or intramuscularly</td>
<td>Does not cross the blood-brain barrier; causes less tachycardia than atropine</td>
</tr>
</tbody>
</table>

### Anticholinergic Premedics

Anticholinergics (e.g., atropine, scopolamine, and glycopyrrolate) are sometimes used to dry oral and airway secretions, especially when difficult airway intubation is anticipated (Box 6-16). Scopolamine should be avoided in outpatient surgery because of its long onset of action and prolonged sedative and anterograde amnesic effect. When drying of oral secretions is desired, glycopyrrolate, a quaternary amine compound, is a better choice because it does not cross the blood-brain barrier, and because it has no central nervous system effect. It also causes less tachycardia than does atropine. Drying agents must be given about 30 minutes before the intended time of effect, usually in the holding room. In the pediatric population, atropine may be used as prophylaxis against bradycardia, which is particularly common after administration of succinylcholine. When atropine (10 to 20 μg/kg) is utilized preoperatively for this purpose, it has been shown to be efficacious only when given intravenously immediately before induction. Intravenous atropine has a duration of action of approximately 30 minutes.

### Miscellaneous Premedics

- **Reduction of anesthetic requirements and provision for intraoperative hemodynamic stability**

  The secondary goals of premedication are to reduce anesthetic requirements and provide for intraoperative hemodynamic...
stability. The medications most commonly employed for these purposes are alpha₂ adrenergic agonists (e.g., clonidine 5 to 15 µg/kg orally, intramuscularly, or intravenously; dexmedetomidine 0.3 to 0.6 mg/kg).

**Histamine receptor blocking agents**

A patient with a history of multiple allergies may benefit from pretreatment with a combination of H₁ blockers (e.g., diphenhydramine 25 to 50 mg orally, intramuscularly, or intravenously; hydroxyzine 1.0 to 1.5 mg/kg intramuscularly) and H₂ blocking agents (ranitidine or famotidine, dosage described previously).

**Corticosteroids**

The use of small doses of steroids for a short period of time (e.g., dose pack) can suppress the hypothalamic pituitary axis for up to 12 months. It is clear that a patient who requires exogenous corticosteroids for health maintenance may not be able to respond to major stressors (e.g., surgery) and thus replacement steroid therapy may be necessary to prevent intravascular collapse due to adrenal insufficiency. However, it is controversial whether patients undergoing minor surgery need steroid replacement, and what the dosage should be if they do. We believe that patients who have received corticosteroids during the immediate perioperative period and patients on steroid therapy for longer than 1 month within the last 6 months should be considered for preoperative corticosteroid replacement administration. Chapter 3 discusses the relative potencies of the exogenously administered corticosteroids (see Table 3-4). In general, a 70 kg patient should receive an intravenous 100 mg dose of hydrocortisone phosphate before minor procedures. Patients on long-term cortisone or hydrocortisone replacement therapy should either double the dose or increase it by 20 mg the night before surgery, and resume the normal dose on the first postoperative day. For minor operations, this regimen should obviate the need for perioperative intravenous hydrocortisone, although it is highly recommended that hydrocortisone 100 mg be available in the operating room and in the PACU in case of acute adrenal insufficiency.

**Selective beta₂ agonists**

Beta₂ agonist nebulizers (e.g., albuterol) are commonly utilized for the management of asthma, chronic bronchitis, exercise-induced bronchospasm, and other medical problems associated with hyperreactive airways. Patients who have respiratory diseases will often report that stressful situations (e.g., surgery), environmental allergens, and temperature changes may exacerbate their symptoms. Even patients who report that they are well controlled with minimal use of nebulizers may become symptomatic during stressful perioperative episodes that predispose them to bronchospasm and laryngospasm. In light of this, these patients should be instructed to continue using their inhalers through the morning of operation and to bring their inhalers to surgery since they may need to self-administer their medication (2 puffs) before induction.

**Prophylactic Antibiotics**

Preoperative antibiotics are used to prevent infection in the surgical wound and to prevent bacterial endocarditis in patients with certain preexisting cardiac lesions. Antibiotics used to prevent surgical wound infection are usually ordered by the surgical team; however, it is often the anesthesiologist who administers them. Many antibiotics have anesthetic implications, primarily allergic reactions (especially after penicillin), histaminic reactions (e.g., vancomycin), drug interactions (e.g., aminoglycosides with nondepolarizing muscle relaxants).

Prophylaxis against bacterial endocarditis is often the responsibility of the anesthesiologist. Any patient who has an organic cardiac lesion, such as mitral valve prolapse, valvular disease, or rheumatic heart disease, should be considered for antibiotic prophylaxis. According to the recommendations of the American Heart Association, the only patients with mitral valve prolapse who should receive antibiotic prophylaxis are those with valvular regurgitation (Box 6-17). Recommended medications, dosage, and timing are briefly described in Boxes 6-18 to 6-20. With the discharge instructions, a prescription should be given for the remaining antibiotic regimen, and the importance of completing the antibiotic course for preventing endocarditis should be stressed. This is usually done by the surgeon, but the anesthesiologist should make certain that it is done.

**Preparation for Anesthesia**

**General Preparation**

The preparation for anesthesia really begins when the anesthesiologist-patient rapport is established. The patient wants
Box 6-17 Endocarditis Prophylaxis Recommendations\textsuperscript{19}

**Cardiac Conditions That Require Endocarditis Prophylaxis**
- Prosthetic cardiac valves
- Previous bacterial endocarditis
- Most congenital cardiac malformations
- Rheumatic and other acquired valvular dysfunction, even after surgery
- Hypertrophic cardiomyopathy
- Mitral valve prolapse with valvular regurgitation

**Surgical Procedures That Require Endocarditis Prophylaxis**
- Tonsillectomy and/or adenoidectomy
- Surgical operations that involve intestinal or respiratory mucosa
- Rigid bronchoscopy
- Sclerotherapy for esophageal varices
- Esophageal dilation
- Cystoscopy
- Urethral dilation
- Urethral catheterization, if urinary tract infection is present
- Urinary tract surgery, if urinary tract infection is present
- Prostatic surgery
- Incision and drainage of infected tissue
- Dental procedures likely to cause gingival or mucosal bleeding

**Procedures That May Not Require Endocarditis Prophylaxis**
- Injection of local intraoral anesthetic
- Tympanostomy tube insertion
- Endotracheal intubation
- Flexible bronchoscopy
- Endoscopy
- Dental procedures not likely to induce gingival bleeding

Box 6-18 Standard Prophylactic Regimen Recommendations for Dental, Oral, or Upper Airway Procedures in Adult Patients at Risk\textsuperscript{19}

**Standard Regimen**
Amoxicillin 3.0 g orally, 1 hour before procedure; 1.5 g 6 hours after initial dose

**In Amoxicillin/Penicillin-Allergic Patients**
Erythromycin Erythromycin ethyl succinate 800 mg, or erythromycin stearate 1.0 g orally 2 hours before procedure; then half the dose 6 hours after the initial dose 

*or*
Clindamycin 300 mg orally 1 hour before procedure; then 150 mg 6 hours after the initial dose

Box 6-19 Alternate Prophylaxis Regimen for Adult Patients Unable to Take Oral Medications\textsuperscript{19}

**Standard Regimen**
Ampicillin: 2.0 g intravenously or intramuscularly 30 minutes before procedure, then amoxicillin 1.0 g orally, 6 hours after initial dose

**Ampicillin/Amoxicillin/Penicillin-Allergic Patients**
Clindamycin: 300 mg intravenously 30 minutes before the procedure; then 150 mg orally, 6 hours after the initial dose

**Patients Who Are Considered High Risk**
Ampicillin, gentamicin, and amoxicillin: Ampicillin 2.0 g intravenously and gentamicin 1.5 mg/kg (not to exceed 80 mg) 30 minutes prior to procedure; then amoxicillin 1.5 g orally 6 hours after the initial dose (Alternatively, the parenteral dose may be repeated 8 hours later.)

**Ampicillin/Amoxicillin/Penicillin-Allergic Patients**
Vancomycin 1 g infused intravenously over 1 hour starting 1 hour before procedure; no repeated dose necessary
Box 6-20 Prophylaxis Regimen for Genitourinary and Gastrointestinal Procedures in Adults

**Standard Regimen**

Ampicillin, gentamicin, and amoxicillin
Ampicillin 3 g intravenously plus gentamicin 1.5 mg/kg (not to exceed 80 mg), then amoxicillin 1.5 g orally 6 hours after initial dose (Alternatively, the parenteral regimen can be repeated 8 hours after the initial dose.)

**Ampicillin/Gentamicin/Penicillin-Allergic Patients**

Vancomycin and gentamicin
Vancomycin 1.0 g infused intravenously over 1 hour, plus gentamicin 1.5 mg/kg (not to exceed 80 mg), 1 hour before procedure; may be repeated 8 hours after initial dose

**Alternate Low-Risk Patient Regimen**

Amoxicillin
3 g orally 1 hour before procedure; then 1.5 g 6 hours after initial dose

to feel that he or she is being well cared for and is safe from harm, while the anesthesiologist has the responsibility of providing this care and protecting to the best of his or her abilities. This requires that the anesthesiologist be thorough and vigilant about setting up the work environment (e.g., medication preparation) by confirming the proper functioning of the anesthetic equipment. This attention to detail is critical whether a local, regional, or general anesthetic technique is planned.

**Intravenous Access and EMLA Cream**

Intravenous access should be obtained in all but the rare patient undergoing ambulatory surgery, regardless of the anesthetic technique that is selected. A catheter connected to intravenous fluids should be used to provide hydration to compensate for the preoperative fast. Most adult patients will require at least 6 ml/kg of intravenous fluids during the preinduction period. Acceptable intravenous fluids include Lactated Ringer’s, normal saline, and Normosol. Diabetics may need dextrose-containing salt solutions. Patients receiving a central regional blockade (i.e., spinal or epidural) will require up to 1 liter of intravenous crystalloid fluid before proceeding with the introduction of the local anesthetic. The size of the intravenous catheter in an adult patient should be at minimum a 20-gauge angiocatheter, but optimally, an 18-gauge catheter. In very brief procedures (e.g., breast biopsy) even a butterfly needle may be appropriate for intravenous access. Ideally the catheter should be placed in the nondominant upper extremity away from the elbow joint. Discomfort that commonly accompanies insertion of the catheter can be minimized by prior intradermal infiltration of lidocaine using a tuberculin syringe with a 30-gauge needle.

One of the major advances in the intravenous induction of anesthesia in the pediatric population has been the introduction of EMLA (eutectic mixture of local anesthetic). EMLA has made venous cannulation virtually painless. It has been particularly useful in pediatrics, but it is also being used in the adult population. EMLA cream is applied to the skin surface overlying the anticipated venipuncture site. For EMLA to be effective, it must be applied to the skin under an occlusive dressing for at least 60 minutes.

**The Anesthetic Plan**

The next step is the initiation of the anesthetic plan as discussed previously with the patient. The choice of appropriate technique is determined by anesthesiologist recommendation and patient preference. For instance, some patients may absolutely refuse a regional or MAC (monitored anesthesia care) for a procedure (e.g., breast biopsy) that is easily managed by these techniques, and their wishes for general anesthesia should be respected and accepted if general anesthesia is safe. Likewise some patients will request regional anesthetic techniques for surgical sites that are not usually done under regional blockade (e.g., diagnostic laparoscopy with laser), or the patient may not be a candidate for regional block or MAC because of a coexisting disease process.

The major difference between general anesthesia and regional anesthetic techniques or MAC is the level of consciousness. For regional techniques, peripheral (e.g., ankle block) or conduction blockade (e.g., subarachnoid or epidural block) of the surgical site is provided. Like regional anesthesia techniques, MAC procedures use minimal sedation to keep the patient comfortable while maintaining the level of consciousness. However, MAC procedures depend upon the surgeon infiltrating the surgical site with local
anesthetic. General anesthesia renders the patient unconscious for the intraoperative events. Common anesthetic techniques for outpatient procedures are discussed in Chapter 2. Despite the differences between general, regional, and MAC anesthetic techniques, they all require the anesthesiologist to ensure an adequate airway, so that general anesthesia may be induced if necessary. Therefore, the routine preparation for all anesthetic techniques is the same, i.e., preparation for a possible general anesthetic.

**Equipment and Monitoring**

The current recommendations for anesthetic machine, equipment, and medication check-out are briefly described in Box 6-21. Box 6-22 is a modification of the American Society of Anesthesiologist standards for basic intraoperative monitoring. It describes the basic intraoperative monitoring checklist that should be completed before the induction of anesthesia. Pediatric equipment is described in Chapter 5.

**Airway Management**

**Face Mask**

General anesthesia without tracheal intubation can be provided for many outpatient surgeries, including dilatation and curettage, cone biopsy, perineal operations, orthopedic or general surgery on extremities and trunk, inguinal hernia repair, and hydrocele operations. During these operations, the airway can usually be managed via an appropriate size face mask and possibly with an oropharyngeal (Guedel) or a nasopharyngeal airway.

**Tracheal Intubation**

The indications of tracheal intubation during outpatient surgery are listed in Box 6-23.

Airway management under special circumstances

The endotracheal tube is most commonly inserted orally. However, there are many other endotracheal tube options as well as methods of insertion. For many surgical procedures (e.g., oral surgery), nasal endotracheal intubation may be necessary so that adequate surgical access can be provided. For laser ENT procedures additional preparation is necessary because the anesthesiologist

**Box 6-21 Standard Anesthesia Machine, Equipment, and Medications**

**Standard Anesthetic Machine Check**

- Attach an anesthetic breathing system with a properly sized face mask, and confirm the ability to provide positive pressure ventilation of the lungs with oxygen.
- Check anesthetic breathing system valves.
- Calibrate oxygen analyzer with air and oxygen, and set alarm.
- Check soda lime for color changes and liquid level of vaporizers.
- Confirm function of mechanical ventilator and audible disconnect alarm.
- Confirm availability of end-tidal CO₂ monitor.
- Confirm availability and function of wall suction.
- Check position of flowmeters, vaporizer, and monitor (alarm) settings.

**Standard Drugs Available for Any Anesthetic Technique**

- Lidocaine
- Propofol or barbiturate
- Atropine
- Catecholamine to treat an allergic reaction (epinephrine) and a sympathomimetic
- Depolarizing (succinylcholine) and nondepolarizing muscle relaxant
- Antagonist for muscle relaxants (anticholinesterase) and narcotics (e.g., naloxone)

**Standard Equipment**

- Angiocatheter for vascular cannulation and intravenous fluid with connecting tubing
- Suction catheter
- Oral (No. 3 to 5) and/or nasal airway (No. 28 to 34) with lidocaine lubricant to ease insertion
- Face masks of assorted sizes
- Laryngeal mask airways of assorted sizes
- Laryngoscope (MAC 3 is the most commonly used, but other sizes and makes may be necessary depending upon the circumstances.)
- Endotracheal tube (6.5 to 8.0 mm for women, and 8.0 to 9.0 mm for men) with lubricated stylet available
- Latex gloves
Box 6-22 Checklist Before the Induction of All Anesthetics

- Intravenous access
- Oxygen analyzer present and inspired oxygen measured
- Pulse oximeter placed for continuous monitoring
- ECG placed for continuous evaluation
- Blood pressure cuff placed and cycled at least every 5 minutes
- Peripheral nerve stimulator placed (only for general anesthesia with muscle relaxants)
- Capability to auscultate breath and cardiac sounds
- Temperature monitoring capabilities available
- Baseline ECG, blood pressure, pulse rate, and pulse oximetry data recorded

Box 6-23 Indications for Tracheal Intubation During Outpatient Surgery

- Allow easier surgical access (e.g., operations in the head and neck area)
- Secure the airway where an existing anatomic problem or the operative procedure may compromise the airway when the patient is anesthetized (e.g., operation in the airway, anatomic abnormality of head and neck)
- Protect the airway where pulmonary aspiration is probable (e.g., patients considered to have a full stomach, diabetics, pregnant patients, operation in the oropharynx, increased intraabdominal pressure as in laparoscopic procedures)
- Provide surgical relaxation by using a neuromuscular blocking agent (e.g., laparoscopic procedure, laparotomy, or thoracoscopy)
- Where controlled ventilation is necessary (e.g., intrathoracic or intracranial procedure)

and the surgeon must share the same airway, and because there is a potential for airway fire. Under these special circumstances, a metal, a wrapped metal, or an impregnated endotracheal tube should be considered. Although red rubber endotracheal tubes are less flammable than the polyvinyl chloride endotracheal tubes, they are more flammable than the other materials and should not be used unless wrapped with metal. Additional measures to diminish the risk of fire include injecting saline or lidocaine into the endotracheal cuff.

Laryngeal Mask Airway (LMA)

With the recent introduction of the laryngeal mask airway (LMA), we now have an alternative method to manage the airway during outpatient anesthesia. Laryngeal mask airway (LMA), developed by Dr. A. I. J. Brain of Britain, is a boat-shaped miniature face mask that is attached to a short endotracheal tube (Fig. 6-1). The mask, when properly placed and inflated with air, sits directly on the laryngeal inlet. The distal end of the tube is connected to the anesthetic circuit. The LMA is made entirely of surgical silicone, which can be resterilized many times by autoclaving. The LMA is usually placed blindly into the mouth of either a deeply anesthetized patient or a topically anesthetized awake patient.

Fig. 6-1 Laryngeal mask airway (LMA).
In general, there are three indications for LMA: (1) in the spontaneously breathing anesthetized patient, in place of a face mask; (2) in place of an endotracheal tube, as long as the inflation pressure is not more than 20 cm of water when ventilation is controlled; and (3) in the patient who has an expected or unexpected difficult airway or tracheal intubation that requires management. The major concern with LMA is that it does not protect against gastric regurgitation and pulmonary aspiration. Thus, LMA should not be used (1) where gastric regurgitation and pulmonary aspiration is probable, and (2) where controlled ventilation is likely to require a high-inflation pressure, more than 20 cm H₂O, e.g., bronchospastic disease or morbid obesity (Box 6-24).

LMA is supplied in five sizes, 1, 2, 2.5, 3, and 4. The smaller three sizes (Nos. 1, 2, and 2.5) are for pediatric use; No. 3 is suitable for small adults and No. 4 for average and large adults. Because propofol tends to relax the jaw and pharyngeal muscles better than thiopental, deep propofol anesthesia is ideal for the insertion of a LMA. After testing the LMA for leaks and fully deflating the cuff, the posterior aspect of the appropriate size LMA is lubricated with a water-soluble lubricant. The LMA can be inserted either after an adequate general anesthesia (more common), or after a good topical anesthesia of the mouth and the upper airway. The patient may be completely anesthetized with propofol or volatile anesthetic and placed in the classical supine “sniffing” position. The LMA is then inserted into the mouth blindly in the midline, with concavity forward, by pressing on the anterior shaft with the tip of the index finger toward the hard palate and guiding it toward the pharynx. When the upper esophageal sphincter is reached, a characteristic resistance is felt. Depending on the size of LMA, the cuff is inflated with 10 to 30 ml of air, and then the tube is attached to the anesthetic circuit. A No. 3 LMA requires 20 ml, and a No. 4 LMA requires 30 ml of air for cuff inflation. Alternatively, especially in children, the LMA may be inserted back-to-front (i.e., like insertion of a Guedel airway), with the cuff either partially inflated or deflated, and then turned counterclockwise 180 degrees while advancing it in the hypopharynx. End tidal CO₂ should be observed in the monitor, either as the patient breathes spontaneously or on gentle intermittent positive pressure ventilation. Anesthesia can then be maintained either with a continuous infusion of propofol or a volatile anesthetic agent. At the end of the operation, the LMA may be left in place until the patient is awake; this prevents aspiration of accumulated pharyngeal secretions. However, it should be remembered that regurgitation of stomach contents and pulmonary aspiration are possible while the LMA is in place, especially when the patient is waking up and coughs and bucks.

Innumerable case reports and anecdotes have been published where LMA has been a lifesaver in cases of expected or unexpected airway failure. In such a situation, the LMA may be used either in place of an endotracheal tube, or a 6.0 mm endotracheal tube may be inserted (blindly or with the help of a fiberoptic bronchoscope) in the trachea through the lumen of the LMA after the LMA has already been placed. Accordingly, an entire set of LMAs should be available during general anesthesia for outpatient surgery.

This alternative form of airway management offers many potential benefits for outpatients having surgery. In patients who do not need an endotracheal intubation, the LMA provides more reliable airway control than does the face mask, and it frees up the anesthesiologist’s hands. In cases where it is used as an alternative to an endotracheal tube, there are less hemodynamic alterations. Whether the LMA causes less airway trauma or sore throat is still
it does not protect against gastric regurgitation and pulmonary aspiration. The LMA may offer many potential benefits for outpatients in reducing sore throat, and in preventing complications of laryngoscopy and muscle relaxants.

References


**General Anesthesia**

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**Induction of anesthesia**
- Thiopental
- Methohexital
- Midazolam
- Etomidate
- Ketamine
- Propofol

**Maintenance**
- Nitrous oxide
- Opioids
- Propofol
- Potent inhaled agents

**Endotracheal intubation**

**Neuromuscular blocking agents**
- Depolarizing agents
- Nondepolarizing agents

**Total intravenous anesthesia**

**Summary**

General anesthesia techniques are commonly used to provide anesthesia for ambulatory surgery. While it may appear easy to provide an acceptable outcome for ambulatory patients, it is considerably more difficult to provide an excellent outcome. To provide this higher level of care, one must first define the specific needs of the ambulatory patient and then tailor a general...