CHAPTER 44

Ambulatory, Nonoperating Room, & Office-Based Anesthesia

KEY CONCEPTS

1. Out of the operating room anesthesia requires the anesthesia provider to work in remote locations in a hospital, where ease of access to the patient and anesthesia equipment is compromised; furthermore, the staff at these locations may be unfamiliar with the requirements for safe anesthetic delivery.
2. In their guidelines and statements, the American Society of Anesthesiologists reminds anesthesia staff that it is important that both the physical and operational infrastructure is in place at any location to ensure the safe conduct of anesthesia.
3. The underlying reason for ambulatory anesthesia and surgery, is that it is less expensive and more convenient for the patient than inpatient admission.
4. Regional and local anesthetic techniques are becoming increasingly popular in managing ambulatory orthopedic surgery.
5. In general, ambulatory surgeries should be of a complexity and duration such that one could reasonably assume that the patient will make an expeditious recovery.
6. Factors considered in selecting patients for ambulatory procedures include: systemic illnesses and their current management, airway management problems, sleep apnea, morbid obesity, previous adverse anesthesia outcomes (eg, malignant hyperthermia), allergies, and the patient's social network (eg, availability of someone to be responsive to the patient for 24 h).

Outpatient/ambulatory anesthesia is the subspecialty of anesthesiology that deals with the preoperative, intraoperative, and postoperative anesthetic care of patients undergoing elective, same-day surgical procedures. Patients undergoing ambulatory surgery rarely require admission to a hospital and are fit enough to be discharged from the surgical facility after the procedure.

Nonoperating room anesthesia (or out of the operating room anesthesia) refers to both inpatients and ambulatory surgery patients who undergo anesthesia in settings outside of a traditional operating room. These patients can vary greatly, ranging from claustrophobic individuals in need of anesthesia for magnetic resonance imaging (MRI) procedures to critically ill septic patients undergoing endoscopic retrograde cholangiopancreatography in the gastrointestinal suite. Out of the operating room anesthesia requires the anesthesia provider to work in remote locations in a hospital, where ease of access to the patient and anesthesia equipment is compromised; furthermore, the staff at these locations may be unfamiliar with the requirements for safe anesthetic delivery.

Office-based anesthesia refers to the delivery of anesthesia in a practitioner's office that has a procedural suite incorporated into its design. Office-based anesthesia is frequently administered to patients

undergoing cosmetic surgery, and anesthesia for dental procedures is also routinely performed in an office-based setting.

Although treatment may be similar for inpatients, ambulatory surgery center patients, out of the operating room patients, and office-based anesthesia patients, there are nonetheless various guidelines and statements from the American Society of Anesthesiologists (ASA) that pertain to these different locations. All of these recommendations should be reviewed at the ASA website (www.asahq.org/For-Healthcare-Professionals/Standards-Guidelines-and-Statements.aspx), as they are subject to change and modification. In their guidelines and statements, the ASA reminds anesthesia staff that it is important that both the physical and operational infrastructure is in place at any location to ensure the safe conduct of anesthesia. In addition to the ASA guidelines, state regulatory guidelines, which include specific requirements for safety, governance, and emergency protocols for both office-based and free-standing ambulatory surgery centers, have also been established. Accreditation agencies, such as the Joint Commission, Accreditation Association for Ambulatory Healthcare, and American Association for the Accreditation of Ambulatory Surgical Facilities, engage in various inspections and reviews to ensure that facilities meet acceptable standards for the procedural services provided. Anesthesia staff should confirm that both the infrastructure and operational policies are consistent with acceptable anesthesia practice standards before providing anesthesia in such settings.

ADVANCES IN AMBULATORY ANESTHESIA AND SURGERY

Most patients are no longer admitted prior to the day of elective surgery. The trend for same-day admittance has been facilitated by advancements in surgical technique and technology (eg, laparoscopy), resulting in less invasive surgery, advancements in anesthesia care (eg, shorter acting medications) and improved postoperative pain and nausea management. The underlying reason for ambulatory anesthesia and surgery is that it is less expensive and more convenient for the patient than inpatient admission. The transition from open cholecystectomy to a laparoscopic approach represents the type of development that permits a shortened postoperative course and ambulatory patient management. Consequently, a common procedure that once required hospital admission is now performed as outpatient surgery.

The use of short-acting anesthetic agents (eg, propofol, desflurane, and rocuronium) has likewise contributed to making ambulatory surgery easier; however, such cases were performed successfully using thiopental, isoflurane, and succinylcholine when the newer agents were not available. Although inhalational agents (eg, sevoflurane and desflurane) lead to prompt emergence, they also contribute to postoperative nausea and vomiting (PONV). Propofol, which may have antiemetic effects as a part of total intravenous anesthesia (TIVA), can potentially reduce PONV; however, TIVA may require more time for patients to meet discharge criteria. Regional and local anesthetic techniques are becoming increasingly popular in managing ambulatory orthopedic surgery. The use of ultrasound and nerve stimulation has improved regional block success rates. The use of regional techniques decreases postoperative opioid requirements, potentially reducing the likelihood of PONV. For example, paravertebral blocks are increasingly used to manage office-based breast augmentation surgery. Improved airway management using devices, such as the laryngeal mask airway (LMA) and video laryngoscopy, have likewise contributed to improved patient care. Consequently, anesthesia personnel working as solo providers in an office-based setting are better able to avoid airway catastrophes.

CANDIDATES FOR AMBULATORY AND OFFICE-BASED ANESTHESIA

With an aging and increasingly obese population, patients with significant comorbidities present for ambulatory surgery. Although age *per se* is not a factor in determining candidacy for ambulatory procedures, each patient must be considered in the context

of his or her comorbidities, the type of surgery to be performed, and the expected response to anesthesia.

5 In general, ambulatory surgeries should be of a complexity and duration such that one could reasonably assume that the patient will make an expeditious recovery. ASA physical status and a thorough history and physical exam are crucial in the screening of patients selected for ambulatory or office-based surgery. ASA 4 and 5 patients normally would not be candidates for ambulatory surgery, whereas ASA 1 and 2 patients would be prime candidates for such surgery. ASA 3 patients with diabetes, hypertension, and stable coronary artery disease would not be precluded from an ambulatory procedure provided that their diseases are well controlled. Ultimately, the surgeon and anesthesia provider must identify patients for whom an ambulatory or office-based setting is likely to provide benefits (eg, convenience, reduced costs and charges) that outweigh risks (eg, the lack of immediate availability of all hospital services, such as a cardiac catheterization laboratory, emergency cardiovascular stents, assistance with airway rescue, rapid consultation).

6 Factors considered in selecting patients for ambulatory procedures include: systemic illnesses and their current management, airway management problems, sleep apnea, morbid obesity, previous adverse anesthesia outcomes (eg, malignant hyperthermia), allergies, and the patient's social network (eg, availability of someone to be responsive to the patient for 24 h).

Patients with known or likely difficult airways should probably not be candidates for office-based procedures; however, they may be appropriately cared for in a well equipped and fully staffed ambulatory surgery center. Important considerations for such patients include the availability of difficult airway equipment, such as an intubating LMA or videolaryngoscope, the availability of additional experienced anesthesia providers, and surgeons/anesthesiologists capable of performing emergency tracheostomy/cricothyroidotomy. If there are concerns regarding the ability to manage the airway in an ambulatory surgery setting, or if a surgical airway is thought to be a possibility, the patient may be better served in a hospital setting where immediate consultation and assistance is available.

Similarly, patients with unstable comorbid conditions, such as decompensated congestive heart failure or uncontrolled hypertension, may benefit more from having their procedure performed in a hospital than a free-standing facility. Indeed, many patients undergo ambulatory procedures in a hospital, as opposed to a free-standing surgery center or office. Such patients have the benefit of both the availability of a hospital's resources and the convenience of being an ambulatory patient. Should their condition warrant additional care, hospital admittance is possible; however, such flexibility comes with the costs associated with hospital care.

The anesthesiologist must know which preexisting medical conditions predict a specific intraoperative and/or postoperative adverse event (AE) for the patient in question. Likewise, procedures suitable for ambulatory surgery should have a minimal risk of perioperative hemorrhage, airway compromise, and no particular requirement for specialized postoperative care. Based on risk identification, the anesthesiologist should be able to mitigate unforeseen AEs and provide optimal care for patients in this type of setting. Although current evidence-based medicine can provide recommendations for some high-risk ambulatory issues, evidence is lacking for most such situations.

SPECIFIC PATIENT CONDITIONS AND AMBULATORY SURGERY

Obesity and Obstructive Sleep Apnea

Obesity is associated with many concomitant disease states, such as hypertension, diabetes, hyperlidipemia, and obstructive sleep apnea (OSA). The physiologic derangements that accompany these conditions include changes in oxygen demand, carbon dioxide production, alveolar ventilation, and cardiac output. Patients with obesity and OSA are at increased risk of postoperative respiratory complications, such as prolonged airway obstruction and apnea. Scores for predicting the probability of these complications can aid in the preoperative assessment and referral to a hospital setting (Tables 44–1 and 44–2). Although a sleep study is the standard way to

TABLE 44–1 Identification and assessment of obstructive sleep apnea: example.

A. Clinical signs and symptoms suggesting the possibility of OSA
   1. Predisposing physical characteristics
      a. BMI 35 kg/m^2 [95th percentile for age and gender][1]
      b. Neck circumference 17 inches (men) or 16 inches (women)
      c. Craniofacial abnormalities affecting the airway
      d. Anatomical nasal obstruction
      e. Tonsils nearly touching or touching In the midline
   2. History of apparent airway obstruction during sleep (two or more of the following are present; if patient lives alone or sleep is not observed by another person, then only one of the following needs to be present)
      a. Snoring (loud enough to be heard through closed door)
      b. Frequent snoring
      c. Observed pauses in breathing during sleep
      d. Awakens from sleep with choking sensation
      e. Frequent arousals from sleep
      f. [Intermittent vocalization during sleep][1]
      g. [Parental report of restless sleep, difficulty breathing, or struggling respiratory efforts during sleep][1]
   3. Somnolence (one or more of the following is present)
      a. Frequent somnolence or fatigue despite adequate "sleep"
      b. Falls asleep easily in a nonstimulating environment (e.g., watching TV, reading, riding in or driving a car) despite adequate "sleep"
      c. [Parent or teacher comments that child appears sleepy during the day, is easily distracted, is overly aggressive, or has difficulty concentrating][1]
      d. [Child often difficult to arouse at usual awakening time][1]

If a patient has signs or symptoms in two or more of the above categories, there is a significant probability that he or she has OSA. The severity of OSA may be determined by sleep study (see below). If a sleep study is not available, such patients should be treated as though they have moderate sleep apnea unless one or more of the signs or symptoms above is severely abnormal (e.g., markedly increased BMI or neck circumference, respiratory pauses that are frightening to the observer, patient regularly falls asleep within minutes after being left unstimulated), in which case they should be treated as though they have severe sleep apnea.

B. If a sleep study has been done, the results should be used to determine the perioperative anesthetic management of a patient. However, because sleep laboratories differ in their criteria for detecting episodes of apnea and hypopnea, the Task Force believes that the sleep laboratory's assessment (none, mild, moderate, or severe) should take precedence over the actual AHI (the number of episodes of sleep-disordered breathing per hour). If the overall severity is not indicated, it may be determined by using the table below:

Severity of OSA	Adult AHI	Pediatric AHI
None	0–5	0
Mild OSA	6–20	1–5
Moderate OSA	21–40	6–10
Severe OSA	>40	>10

AHI, apnea-hypopnea index; BMI, body mass index; OSA, obstructive sleep apnea; TV, television.

[1]Items in brackets refer to pediatric patients.

Reproduced, with permission, from Gross JB, Bachenberg KL, Benumof JL, et al: Practice guidelines for the perioperative management of patients with obstructive sleep apnea: a report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea. Anesthesiology 2006;104:1081.

diagnose sleep apnea, many patients with OSA have never been identified as having OSA. Consequently, an anesthesiologist may be the first physician to detect the presence or risk of sleep apnea. The ASA has provided suggestions on the types of procedures and anesthetics that can safely be used in ambulatory patients with OSA (Table 44–3). In addition to the usual discharge criteria, the ASA also recommends the following in patients with OSA:

- Return of room air oxygen saturation to baseline level
- No hypoxemic episodes or periods of airway obstruction when left alone

TABLE 44–2 Obstructive sleep apnea scoring system: example.

	Points
A. Severity of sleep apnea based on sleep study (or clinical indicators if sleep study not available). Point score _____ (0–3)[1-2]	
Severity of OSA (Table 44–1)	
None	0
Mild	1
Moderate	2
Severe	3
B. Invasiveness of surgery and anesthesia. Point score _____ (0–3)	
Type of surgery and anesthesia	
Superficial surgery under local or peripheral nerve block anesthesia without sedation	0
Superficial surgery with moderate sedation or general anesthesia	1
Peripheral surgery with spinal or epidural anesthesia (with no more than moderate sedation)	1
Peripheral surgery with general anesthesia	2
Airway surgery with moderate sedation	2
Major surgery, general anesthesia	3
Airway surgery, general anesthesia	3
C. Requirement for postoperative opioids. Point score _____ (0–3)	
Opioid requirement	
None	0
Low-dose oral opioids	1
High-dose oral opioids, parenteral or neuraxial opioids	3
D. Estimation of perioperative risk. Overall score = the score for A plus the greater of the score for either B or C. Point score _____ (0–6)[3]	

A scoring system similar to this table may be used to estimate whether a patient is at increased perioperative risk of complications from obstructive sleep apnea (OSA). This example, which has not been clinically validated, is meant only as a guide, and clinical judgment should be used to assess the risk of an individual patient.

[1]One point may be subtracted if a patient has been on continuous positive airway pressure (CPAP) or noninvasive positive-pressure ventilation (NIPPV) before surgery and will be using his or her appliance consistently during the postoperative period.

[2]One point should be added if a patient with mild or moderate OSA also has a resting arterial carbon dioxide tension ($Paco_2$) greater than 50 mm Hg.

[3]Patients with score of 4 may be at increased perioperative risk from OSA; patients with a score or 5 or 6 may be at significantly increased perioperative risk from OSA.

Reproduced, with permission, from Gross JB, Bachenberg KL, Benumof JL, et al: Practice guidelines for the perioperative management of patients with obstructive sleep apnea: a report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea. Anesthesiology 2006;104:1081.

TABLE 44–3 Consultant opinions regarding procedures that may be performed safely on an outpatient basis for patients at increased perioperative risk from obstructive sleep apnea.

Type of Surgery/Anesthesia	Consultant Opinion
Superficial surgery/local or regional anesthesia	Agree
Superficial surgery/general anesthesia	Equivocal
Airway surgery (adult, e.g., UPPP)	Disagree
Tonsillectomy in children less than 3 years old	Disagree
Tonsillectomy in children greater than 3 years old	Equivocal
Minor orthopedic surgery/local or regional anesthesia	Agree
Minor orthopedic surgery/general anesthesia	Equivocal
Gynecologic laparoscopy	Equivocal
Laparoscopic surgery, upper abdomen	Disagree
Lithotripsy	Agree

OSA, obstructive sleep apnea; UPPP, uvulopalatopharyngoplasty.

Reproduced, with permission, from Gross JB, Bachenberg KL, Benumof JL, et al: Practice guidelines for the perioperative management of patients with obstructive sleep apnea: a report by the American Society of Anesthesiologists Task Force on Perioperative Management of patients with obstructive sleep apnea. Anesthesiology 2006;104:1081.

- Monitoring for 3 hours longer prior to discharge than patients without OSA
- Monitoring for 7 hours following an episode of airway obstruction or hypoxemia while breathing room air in an unstimulating environment

According to the ASA Task Force on Obesity and OSA, these OSA patients can be managed safely as outpatients; however, they have an increased risk of postoperative complications requiring increased monitoring, availability of radiologic/laboratory services, and availability of continuous positive airway pressure and mechanical ventilation, thus making an office-based setting potentially inadequate for managing complications that may arise. Nonetheless, under certain conditions, anesthesia and surgery

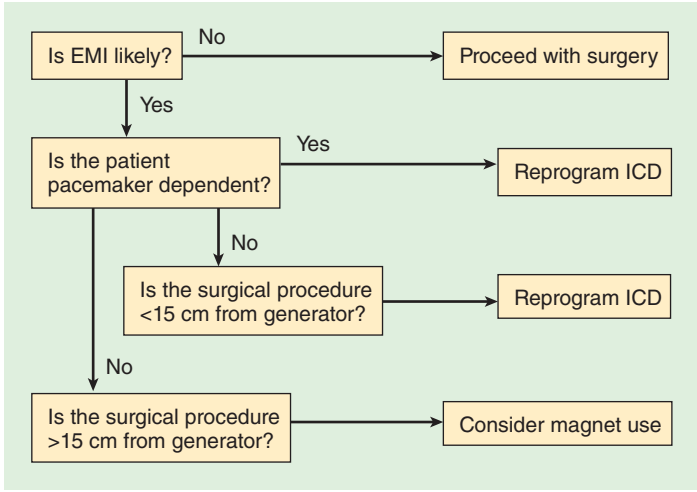

FIGURE 44–1 Preoperative considerations in a patient with an implanted cardioverter defibrillator. EMI, electromagnetic interference; ICD, implanted cardioverter defibrillator. (Reproduced, with permission, from Joshi GP: Perioperative management of outpatients with implantable cardioverter defibrillators. Curr Opin Anaesthesiol 2009;22:701.)

can be performed in an ambulatory surgery center or hospital outpatient facility.

Cardiac Conditions

Increasingly, patients present to ambulatory surgery with a variety of cardiac conditions treated both pharmacologically and mechanically (eg, cardiac resynchronization therapy, implantable cardioverter-defibrillators [ICDs], stents). It is therefore likely that anesthesia staff working in ambulatory settings will encounter increasing numbers of such patients, who, despite a cardiac history, have stable cardiac conditions. Patients previously treated with stents are likely to be on antiplatelet regimens. As always, these agents should not be discontinued unless a discussion has occurred between the patient, cardiologist, and surgeon regarding both the necessity of surgery and the discontinuation of antiplatelet therapy. Likewise, β-blockers should be continued perioperatively. Angiotensin-converting enzyme inhibitors and angiotensin receptor blockers may contribute to transient hypotension with anesthesia induction, but their continuation or discontinuation perioperatively seems to have minimal effects, as patients so treated likely will need to have intraoperative hypotension corrected in either case. The ASA guidelines recommend that patients presenting with a pacemaker or ICD should not leave a monitored setting until the device is interrogated, if electrocautery was employed; however, this ASA recommendation is controversial, as some argue that if bipolar cautery is used at a distance of greater than 15 cm from the device, immediate interrogation of the device is not necessary prior to discharge from a monitored setting. Likewise, if an ICD is present, and there is anticipated electromagnetic interference the device's antitachycardia features should be inhibited perioperatively (see Figures 44–1 and 44–2).

Glucose Control

In a consensus statement on perioperative glucose control, the Society for Ambulatory Anesthesia found insufficient evidence to make strong recommendations about glucose management in ambulatory patients, and thus management suggestions parallel those of the inpatient population; however, the panel recommends a target intraoperative blood glucose concentration of <180 mg/dL.

Malignant Hyperthermia

Patients with a history of malignant hyperthermia can be safely given nontriggering anesthetics and discharged as ambulatory patients. Prophylactic dantrolene should not be administered.

INTRAOPERATIVE CONSIDERATIONS

Intraoperative management in the ambulatory patient undergoing surgery is aimed at providing rapid emergence, good analgesia, and minimal PONV while creating acceptable operating conditions. Often these

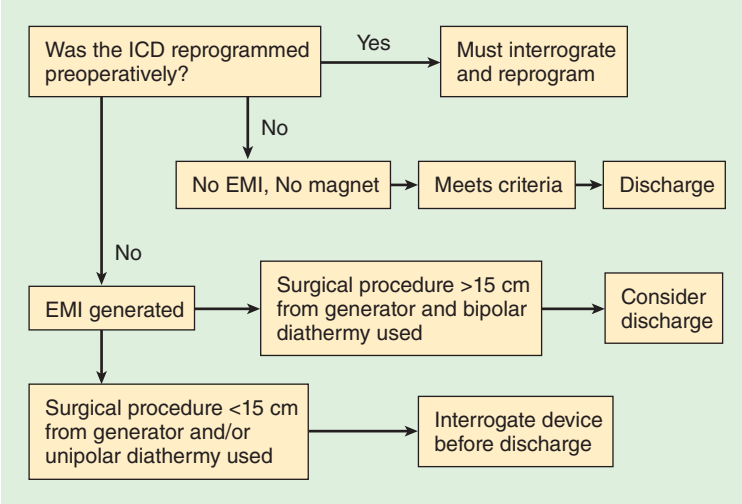

FIGURE 44–2 Postoperative considerations in a patient with an implanted cardioverter defibrillator. EMI, electromagnetic interference; ICD, implanted cardioverter defibrillator. (Reproduced, with permission, from Joshi GP: Perioperative management of outpatients with implantable cardioverter defibrillators. Curr Opin Anaesthesiol 2009;22:701.)

goals compete with one another. Although inhalational anesthesia with sevoflurane may speed emergence, compared with total intravenous anesthesia (TIVA), the likelihood of PONV may be greater, if an additional prophylactic drug is not administered. Numerous studies conducted by regional anesthesiologists have shown how regional anesthesia can speed discharge time, compared with general anesthetics, in the ambulatory population—in part, by potentially reducing the incidence of PONV. Nitrous oxide increases the likelihood of PONV, but this effect can be overcome by adding a prophylactic agent. Likewise, multimodal perioperative analgesia can be approached using a variety of drugs, including local anesthetics, acetaminophen, and nonsteroidal anti-inflammatory agents (NSAIDs) to reduce the use of opioids, which contribute to PONV risk.

Thromboembolism remains a risk after ambulatory and office-based surgery, as with inpatient surgery. Pneumatic compression devices and pharmacologic thromboprophylaxis should be used in patients at increased risk. During monitored anesthesia care, supplemental oxygen can contribute to operating room fires by creating an oxygen-rich environment that facilitates ignition by cautery devices. During head and neck surgery, anesthesia providers must be especially vigilant not to create an environment where fire becomes more likely. When oxygen is administered via a nasal cannula or face mask, the minimal amount of supplemental oxygen should be delivered, if any, and tenting of the drapes around the patient's head should be prevented.

POST ANESTHESIA RECOVERY AND DISCHARGE

Managing a patient's emergence, postoperative pain, and PONV is critical to expediting discharge. A plan to handle complications, such as postoperative pain and PONV, should be in place preoperatively to standardize and streamline management as much as possible.

The entire anesthetic experience of the ambulatory surgery patient should be focused on minimizing complications, especially postoperative pain and PONV. Multimodal approaches to both complications are advised; see Chapter 17 for a discussion of PONV management. Use of a combination of agents (eg, ondansetron, dexamethasone, and droperidol) has shown greater efficacy than monotherapy (eg, ondansetron alone) in patients at high risk of PONV. Likewise, analgesia regimens that minimize opioid use reduce PONV.

Pain management is centered on the combined use of regional techniques, opioids, and NSAIDSs (multimodal analgesia). Gabapentinoids (gabapentin, pregabalin) may have beneficial effects as part of a multimodal pain regimen. Likewise, oral, rectal, or intravenous acetaminophen or NSAIDs can be useful in the ambulatory setting. Cyclooxygenase-2

selective inhibitors have been used as part of multimodal pain management approaches, but their potential for prothrombotic effects has restricted their use.

DISCHARGE CRITERIA

Scoring systems have been devised to facilitate timely and safe PACU discharge and assess home readiness after ambulatory surgery. The Aldrete scoring system, which includes activity, respiration, circulation, consciousness, and oxygen saturation, helps guide recovery from the PACU in the ambulatory surgery unit. Scoring systems and guidelines that standardize patient discharge from the ambulatory surgery center to home are also available (see Tables 44–4, 44–5, 44–6, and 44–7).

Criteria for discharge generally require that the patient:

- Is alert and oriented to time and place
- Has stable vital signs
- Has pain controlled by oral analgesics or peripheral nerve block
- Has nausea or emesis controlled
- Is able to walk without dizziness
- Has no unexpected bleeding from the operative site
- Is able to take oral fluids and void
- Has discharge instructions and prescriptions from the surgeon and anesthesiologist
- Accepts readiness for discharge
- Has a responsible adult escort present

TABLE 44–4 Stages of recovery.

Stage of Recovery	Clinical Definition
Early recovery	Awakening and recovery of vital reflexes
Intermediate recovery	Immediate clinical recovery Home readiness
Late recovery	Full recovery Psychological recovery

Data from Steward DJ, Volgyesi G: Stabilometry: a new tool for measuring recovery following general anaesthesia. Can Anaesth Soc J 1978;25:4.

TABLE 44–5 The modified Aldrete scoring system for determining when patients are ready for discharge from the postanesthesia care unit.

Activity: able to move voluntarily or on command	
4 extremities	2
2 extremities	1
0 extremities	0
Respiration	
Able to deep breathe and cough freely	2
Dyspnea, shallow or limited breathing	1
Apneic	0
Circulation	
BP ± 20 mm of preanesthetic level	2
BP ± 20–50 mm of preanesthesia level	1
BP ± 50 mm of preanesthesia level	0
Consciousness	
Fully awake	2
Arousable on calling	1
Not responding	0
O_2 saturation	
Able to maintain O_2 saturation >92% on room air	2
Needs O_2 inhalation to maintain O_2 saturation >90%	1
O_2 saturation <90% even with O_2 supplementation	0

A score ≥9 was required for discharge.

BP, blood pressure.

Reproduced, with permission, from Aldrete AL: The post anesthesia recovery score revisited (letter). Clin Anesth 1995;7:89.

TABLE 44–6 Guidelines for safe discharge after ambulatory surgery.

Vital signs must have been stable for at least 1 h
The patient must be
Oriented to person, place, and time
Able to retain orally administered fluids
Able to void
Able to dress
Able to walk without assistance
The patient must not have
More than minimal nausea and vomiting
Excessive pain
Bleeding
The patient must be discharged by both the person who administered anaesthesia and the person who performed surgery, or by their designates. Written instructions for the postoperative period at home, including a contact place and person, must be reinforced.
The patient must have a responsible, "vested" adult escort them home and stay with them at home.

Reproduced, with permission, from Korttila K: Recovery from outpatient anaesthesia, factors affecting outcome. Anaesthesia 1995;50 (suppl)22-28.

TABLE 44–7 Postanesthesia discharge scoring system (PADS) for determining home-readiness.

Vital signs	
Vital signs must be stable and consistent with age and preoperative baseline	
BP and pulse within 20% of preoperative baseline	2
BP and pulse 20%–40% of preoperative baseline	1
BP and pulse >40% of preoperative baseline	0
Activity level	
Patient must be able to ambulate at preoperative level	
Steady gait, no dizziness, or meets preoperative level	2
Requires assistance	1
Unable to ambulate	0
Nausea and vomiting	
The patient should have minimal nausea and vomiting before discharge	
Minimal: successfully treated with PO medication	2
Moderate: successfully treated with IM medication	1
Severe: continues after repeated treatment	0
Pain	
The patient should have minimal or no pain before discharge	
The level of pain that the patient has should be acceptable to the patient	
Pain should be controllable by oral analgesics	
The location, type, and intensity of pain should be consistent with anticipated postoperative discomfort	
Acceptability	
Yes	2
No	1
Surgical bleeding	
Postoperative bleeding should be consistent with expected blood loss for the procedure	
Minimal: does not require dressing change	2
Moderate: up to two dressing changes required	1
Severe: more than three dressing changes required	0

Maximal score = 10; patients scoring ≥9 are fit for discharge.

Reproduced, with permission, from Marshall SI, Chung F: Assessment of "home readiness": discharge criteria and postdischarge complications. Curr Opin Anesthiol 1997;10:445.

Increasingly, patients are not being required to drink or void before discharge from ASCs. Such patients require plans and instructions for follow-up care to provide for possible rehydration and bladder catheterization, if required.

UNANTICIPATED HOSPITAL ADMISSION FOLLOWING AMBULATORY SURGERY

Various complications can occur that necessitate emergent transfer to a nearby hospital. Some surgical complications cannot be repaired in the ambulatory operating suite. Inadequately controlled pain and postoperative nausea and vomiting are the two most frequent causes of unplanned hospital admission from ASCs, with other causes less frequent. Accreditation agencies mandate that office based operating rooms have emergency equipment, drugs, and protocols for patient transfers. In addition to advanced cardiac life support medications, dantrolene and intravenous lipid emulsion should be available to treat malignant hyperthermia and local anesthetic-induced cardiotoxicity. Additionally, surgeons operating in an office-based practice must have admitting privileges at a nearby hospital or arrangements with an accepting physician to provide for patient transfer, if necessary in addition to a hospital transfer protocol in place. The American Association for Accreditation of Ambulatory Surgery Facilities reviewed 1,141,418 outpatient procedures from 2001 to 2006 in the facilities it accredits and noted 23 deaths. Pulmonary embolism following abdominoplasty was the leading cause of death in an office-based surgery facility (**Figures 44–3** and **44–4**).

NON-OPERATING ROOM ANESTHESIA

Off-site anesthesia (nonoperating room anesthesia) encompasses all sedation/anesthesia provided by anesthesiology services outside of the operating room environment. Over the past few decades, requests for these services in remote locations have been steadily increasing, and in many large hospitals today more anesthetics are routinely administered for procedures off-site than in the operating room suite. According to some estimates, nonoperating room anesthesia accounts for 12.4% of all anesthetic care in the United States. As a result, some clinical facilities have determined that is it safer and more cost-effective to assign anesthesia team(s) for

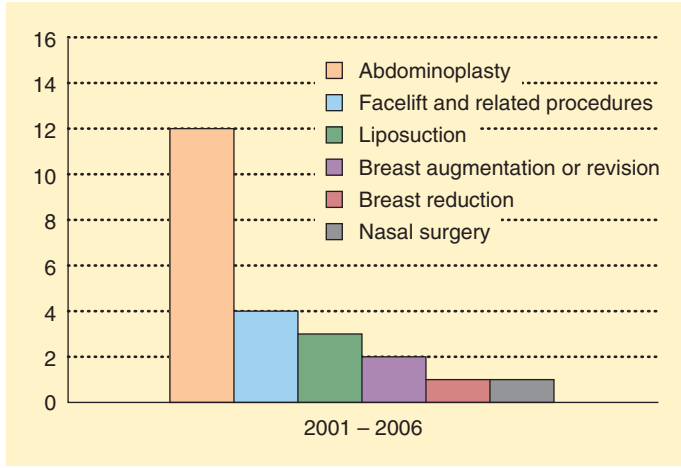

FIGURE 44–3 Bar chart showing the 23 deaths by procedure. (Reproduced, with permission, from Keyes GR, Singer R, Iverson RE, et al: Mortality in outpatient surgery. Plast Reconstr Surg 2008;122:245.)

scheduled blocks of times to provide care for such procedures, and some institutions are constructing procedural suites where bronchoscopy, gastrointestinal endoscopy, cardiac, and interventional radiology procedures can be performed in a centralized area for increased safety and efficiency. It is important to remember that the same basic standards for anesthesia care need to be met, regardless of the location. Furthermore, the challenges of unfamiliar environments that are far removed from the surgical suite, including anesthesia-naïve personnel, require advance planning for the off-site anesthesiologist.

Unlike patients undergoing office-based or ambulatory surgery center procedures, out of the operating room patients are frequently among the sickest of inpatients. Anesthesia staff are often called to work in the gastrointestinal suite, cardiac catheterization laboratory, electrophysiology laboratory, radiology suite, radiation oncology suite, and, occasionally, the critical care unit. Often these locations were constructed without anticipation that anesthesia would be provided there. Consequently, anesthesia work space is routinely constrained, and access to the patient is limited. Moreover, the procedure physicians and ancillary staff in these areas often fail to understand what is required to safely deliver anesthesia (hence the frequent request to "give them a squirt" of propofol) and do not know how to assist

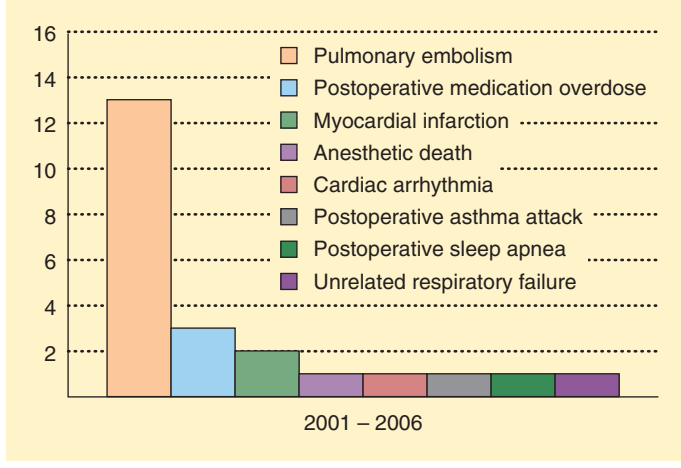

FIGURE 44–4 Bar chart showing the cause of death. (Reproduced, with permission, from Keyes GR, Singer R, Iverson RE, et al: Mortality in outpatient surgery. Plast Reconstr Surg 2008;122:245.)

TABLE 44–8 American Society of Anesthesiologists guidelines for nonoperating room anesthetizing locations.

Reliable O_2 source with backup	Sufficient space for anesthesia personnel, equipment
Suction apparatus	Emergency cart, defibrillator, drugs, etc.
Waste gas scavenging	Reliable means for two-way communication
Adequate monitoring equipment	Applicable facility, safety codes met
Safe electrical outlets	Appropriate post-anesthesia management
Adequate illumination, battery backup	

Data from American Society of Anesthesiologists guidelines for nonoperating room anesthetizing locations (2008). Committee of Origin: Standards and Practice Parameters (approved by the ASA House of Delegates on October 15, 2003 and amended on October 22, 2008.

the anesthesia provider when difficulty arises. As noted in the ASA guidelines, the expectations for out of the operating room anesthesia are the same as in any practice location (Table 44–8).

Basic principles for nonoperating room anesthesia can be broadly classified into three categories: patient factors, environmental issues, and procedure-related aspects. Patient factors include comorbidity, airway assessment, fasting status, and monitoring. Environmental issues include anesthesia equipment, emergency equipment, and magnetic and radiation hazards. Procedure-related aspects include duration, level of discomfort, patient position, and surgical support.

The ASA Closed Claims Database has demonstrated that claims related to out of the operating room anesthesia care have a greater severity of injury than closed claims related to operating room anesthesia care. Monitored anesthesia care was the primary technique in more than half of the claims reviewed. Many of these closed claims arose from injuries related to inadequate oxygenation/ventilation during procedures in the gastrointestinal suite. Suggested requirements for the safe delivery of out of the operating room anesthesia are presented in Tables 44–9, 44–10, 44–11, and 44–12.

TABLE 44–9 Specific conditions that warrant special care when providing anesthesia or sedation outside the operating room.

Patient unable to cooperate, e.g. severe intellectual disability
Severe gastroesophageal reflux
Medical conditions predisposing patients to reflux, e.g. gastroparesis secondary to diabetes mellitus
Orthopnea
Severe increased intracranial pressure
Decreased level of consciousness/depression of protective airway reflexes
Known difficult intubation especially when procedure is outside the operating room
Dental, oral, craniofacial, neck or thoracic abnormalities that could compromise the airway
Presence of respiratory tract infection or unexplained fever
Obstructive sleep apnea
Morbid obesity
Procedures limiting access to the airway
Lengthy, complex or painful procedures
Uncomfortable position
Prone position
Acute trauma
Extremes of age

Reproduced, with permission, from Robbertze R, Posner KL, Domino KB: Closed claims review of anesthesia for procedures outside the operating room. Curr Opin Anaesthesiol 2006;19:436.

TABLE 44–10 Personnel requirements for safe sedation and anesthesia outside the operating room.

Anesthesia staff
Trained in the clinical assessment of preanesthesia patients
Trained and experienced in airway management and cardiopulmonary resuscitation
Trained in the use of anesthetic and resuscitation drugs and equipment, and must ensure that the equipment is present and functional prior to induction
Dedicated to the continuous monitoring of the patient's physiologic parameters
Continuously present and vigilant
Nonanesthesia staff
Appropriately trained to help deal with a cardiopulmonary emergency
Assistant for the anesthesiologist—this person must be familiar with anesthetic procedures and equipment
Assistant to help with positioning
Staff trained in postprocedure observation and resuscitation

Reproduced, with permission, from Robbertze R, Posner KL, Domino KB: Closed claims review of anesthesia for procedures outside the operating room. Curr Opin Anaesthesiol 2006;19:436.

TABLE 44–11 Location/space requirements for nonoperating room anesthesia.

Adequate size with good access to the patient
Uncluttered floor space
An operating table, trolley or chair which can be readily tilted into Trendelenburg position
Adequate lighting including emergency lighting
Sufficient electrical outlets including clearly marked electrical outlets connected to an emergency back-up power source
Suitable clinical area for recovery of the patient which must include oxygen, suction, resuscitation drugs and equipment
Emergency back-up call system to summon assistance from the main operating room

Reproduced, with permission, from Robbertze R, Posner KL, Domino KB: Closed claims review of anesthesia for procedures outside the operating room. Curr Opin Anaesthesiol 2006;19:436.

TABLE 44–12 Equipment/monitoring requirements for nonoperating-room anesthesia.

Appropriate (for deep sedation, general anesthesia and a cardiorespiratory emergency)
Immediately available
Regularly serviced (service date indicated on the equipment)
Same standard as in the operating room (minimum pulse oximetry, end-tidal capnography, blood pressure, electrocardiogram, and temperature)
Alarms activated (with appropriate settings) and sufficiently audible
Airway gas with the recognized safety devices (e.g. indexed gas connection system, reserve supply of oxygen, oxygen analyzer, oxygen supply failure alarm, multiple gas analyzer, a volatile anesthetic agent monitor, a breathing system disconnection alarm and a scavenging system)
Anesthesia work cart stocked to operating-room standard (including appropriate anesthetic and resuscitation drugs, airway management equipment, a self-inflating hand resuscitator bag and a range of intravenous equipment)
Suction
Ready access to a defibrillator and a fully stocked emergency cart

Reproduced, with permission, from Robbertze R, Posner KL, Domino KB: Closed claims review of anesthesia for procedures outside the operating room. Curr Opin Anaesthesiol 2006;19:436.

Increasingly, nonanesthesia providers in the gastrointestinal lab and the emergency department provide sedation with a variety of agents, including propofol and ketamine. In fact, some reports indicate that nonanesthesia providers provide administer sedation and analgesia for almost 40% of the procedures performed in the United States. The ASA guidelines and the Joint Commission have described the continuum of depth of sedation, ranging from minimal sedation to general anesthesia (Table 44–13). Recently, the Centers for Medicare and Medicaid Services has mandated that all sedation in a hospital be under the direction of a physician—generally, the anesthesia service chief. Consequently, anesthesiologists must not only from time to time provide anesthesia in a nonoperating room setting, but must also develop policies and quality assurance review mechanisms for nonanesthesia providers to safely provide sedation. Such policies should be focused on assuring that the "sedationist" has the necessary skills to provide for patient rescue, should mild or moderate sedation become deep sedation or general anesthesia.

TABLE 44–13 Continuum of depth of sedation/analgesia/anesthesia.

Level	Type	Responsiveness	Airway	Spontaneous Ventilation	Cardiovascular Function
1	Minimal	Normal to verbal stimulation	Unaffected	Unaffected	Unaffected
2	Moderate	Purposeful response to verbal or tactile stimulation	No intervention required	Adequate	Usually maintained
3	Deep	Purposeful after repeated or painful stimulus	Intervention may be required	May be inadequate	Usually maintained
4	General Anesthesia	Unarousable to painful stimulus	Intervention often required	Often inadequate	May be impaired

Data from American Society of Anesthesiologists.

TABLE 44–14 Complications associated with sedation and analgesia.

Airway	
	Airway obstruction
	Aspiration
	Regurgitation
	Dental/soft tissue injury
Respiratory	
	Respiratory depression
	Hypoxemia
	Hypercarbia
	Apnea
Cardiovascular	
	Hypotension
	Cardiac arrhythmias
Neurologic	
	Deeper level of sedation
	Unresponsiveness
Other	
	Undesirable patient movement
	Drug interactions
	Adverse reactions
	Unanticipated admission

Data from American Society of Anesthesiologists.

TABLE 44–15 Common locations for nonoperating room anesthesia.

- Radiology
  - Neurointerventional Radiology
  - Vascular Radiology
  - MRI/CT
  - PET Scan
- Endoscopy Suite
  - Gastrointestinal Suite
  - Bronchoscopy
- Intensive Care Unit
  - Tracheostomy, Percutaneous gastrostomy
  - Intracranial and other catheter placement
  - Abdominal/pelvic explorations
- Invasive Cardiology Suite
  - Cardiac Catheterization Lab
  - Cardioversion
  - Electrophysiology Suite
- Radiation Therapy
- Emergency Medicine Suite
- Psychiatry
  - Electroconvulsive Therapy suite
- Urology - Lithotripsy
- Dental Surgery

Data from American Society of Anesthesiologists.

Risks associated with sedation/analgesia are highlighted in Table 44–14. Sedation providers should know how to reverse benzodiazepines and opioids and provide bag/mask airway support and to be facile in the use of airway adjuvants. A mechanism to ensure the timely arrival of anesthesia personnel capable of airway rescue must likewise be incorporated into such policies.

SPECIAL CONSIDERATIONS IN OUT OF THE OPERATING ROOM LOCATIONS

Anesthesia services are requested at various locations throughout the hospital facility; some of these are delineated in Table 44–15. As noted throughout this chapter, routine anesthetic standards apply wherever the patient is anesthetized. Out of the operating room patients often present with a wide range of illnesses, unlike the elective patients generally found in an ambulatory setting. Furthermore, disposition postprocedure (whether discharge or admission), needs appropriate coordination by the anesthesiologist for postanesthesia care and/or safe transport from the remote unit.

Patients presenting to the gastrointestinal endoscopy suite include healthy individuals for routine diagnostic screenings, as well as patients with fulminant cholangitis and sepsis or coexisting difficult airways. As always, the patient's condition, as well as the specific diagnostic/therapeutic procedure, determines both the anesthetic techniques (propofol deep sedation or general anesthesia vs. general anesthesia with LMA or endotracheal tube) and the monitoring required.

General anesthesia is usually required in patients undergoing endoscopic procedures for airway and pulmonary pathology; an added complexity may include the presence of a shared airway, and, in many patients, marginal pulmonary status.

Patients undergoing cardiac catheterization are routinely sedated by cardiologists without

involvement of an anesthesiologist. Occasionally, a patient with significant comorbidities, (eg, morbid obesity) requires the presence of a qualified anesthesia provider. General anesthesia is often required for placement of aortic stents, which are increasingly being performed by cardiologists in the cardiac catheterization laboratory. Anesthesia staff should be prepared with arterial pressure monitoring and the necessary vascular access to facilitate resuscitation, should emergent open aneurysm repair be required.

Patients requiring electrophysiology procedures for catheter-mediated arrhythmia ablation often need general anesthesia. Such patients frequently have both systolic and diastolic heart failure, leading to potential hemodynamic difficulties perioperatively. Sudden hypotension can herald the development of pericardial tamponade secondary to catheter perforation of the heart. Other patients require sedation for the placement of ICDs. Once placed, the device will be tested by inducing ventricular fibrillation. During testing, deeper levels of sedation are required, as the defibrillation shock can be frightening and very uncomfortable. Likewise, anesthesia staff are called upon to provide anesthesia for cardioversion of patients in atrial fibrillation. These patients usually have associated cardiac diseases and require brief intravenous anesthetics to facilitate cardioversion. Oftentimes, a transesophageal echocardiogram must be performed prior to cardioversion to rule out clot in the left atrial appendage. In such cases, anesthesia staff may also provide sedation for this procedure. Determination as to whether a patient needs sedation or general anesthesia with or without intubation is dependent upon routine patient assessment.

Children and some adults (ie, those that are claustrophobic, developmentally disabled, or have conditions that prevent them to be still or to lie flat) require anesthesia or sedation for MRI and computed tomography (CT). Additionally, painful CT-guided biopsies may require anesthesia management. Anesthetic technique is dependent upon patient comorbidities.

MRI creates numerous problems for anesthesia staff. First, all ferromagnetic materials must be excluded from the area of the magnet. Most institutions have policies and training protocols to prevent catastrophes (eg, oxygen tanks flying into the scanner). Second, all anesthetic equipment must be compatible with the magnet in use. Third, patients must be free of implants that could interact with the magnet, such as pacemakers, vascular clips, ICDs, and infusion pumps. As with all out of the operating room anesthesia, the exact choice of technique is dependent upon the patient's comorbidities. Both deep sedation and general anesthesia approaches with intubation or supraglottic airways can be used, depending on practitioner preference and patient requirements.

Patients usually require general anesthesia and tight blood pressure control to facilitate coiling and embolization of cerebral aneurysms or arteriovenous malformations. Patients taken to the radiology suite for relief of portal hypertension via creation of a transjugular intrahepatic portosystemic shunt (TIPS) are frequently hypovolemic, despite profound ascites, and at risk of esophageal variceal bleeding and aspiration. General anesthesia with intubation is preferred for management of the TIPS procedure.

Anesthesia for electroconvulsive therapy is often provided in a separate suite in the Psychiatry Unit or a monitored area in the hospital (eg, PACU). Patient comorbidity, drug interactions with various psychotropic medications, multiple anesthetic procedures, and effects of anesthetic agents on the quality of electroconvulsive therapy also need to be taken into account.

Anesthesia staff are at times called to provide anesthesia in the intensive care unit (ICU) for bedside tracheostomy or emergent chest and abdominal exploration in patients considered too critically ill to tolerate transport to the operating room. In most of these cases, the anesthesia staff generally employ ICU ventilator and monitors. Intravenous agents are typically used along with muscle relaxants. When performing anesthesia for bedside tracheostomy, it is important that the endotracheal tube not be withdrawn from the trachea until end tidal CO_2 is measured from the newly placed tracheostomy tube.

Pediatric patients deserve special mention; the (**Table 44–16**). Anesthesia considerations for nonoperating room anesthesia are summarized in **Table 44–17**.

TABLE 44–16 Goals of sedation in pediatric patients for diagnostic and therapeutic procedures.

Guard the patient's safety and welfare
Minimize physical discomfort and pain
Control anxiety, minimize psychological trauma, and maximize potential for amnesia
Control behavior and/or movement to allow safe completion of procedure
Return patient to a state in which safe discharge from medical supervision is possible

Data from American Society of Anesthesiologists.

TABLE 44–17 Basic considerations for nonoperating room anesthesia.

Patient
• ASA status, co-morbidity, emergent/elective
• Airway assessment
• Allergies – contrast
• Anesthesia plan – sedation/anesthesia
• Monitoring –
▪ Basic/Standard: oxygenation, ventilation, circulation, temperature
▪ Advanced: invasive hemodynamic, TEE, BIS
Environment
• Anesthesia equipment
• Anesthesia monitors
• Suction
• Resuscitation equipment
• Personnel
• Technical equipment
• Radiation hazard
• Magnetic fields
• Ambient temperature
• Warming blanket
• Portable transport monitors
• Oxygen cylinders
Procedure
• Diagnostic or therapeutic
• Duration
• Level of discomfort/pain
• Patient position
• Special requirements, e.g. monitoring
• Potential complications
• Surgical support

Data from American Society of Anesthesiologists.

CASE DISCUSSION

Acute Hypoxia after TIPS Procedure in the Radiology Suite

A 58-year-old Caucasian female with decompensated cryptogenic cirrhosis and refractory ascites, currently on the liver transplant list, is scheduled for an urgent TIPS procedure.

What does a TIPS procedure entail? What are its indications and contraindications?

TIPS (transjugular intrahepatic portosystemic shunt) involves the passage of a catheter, usually inserted through the internal jugular vein and directed into the liver, which creates a low-resistance conduit between a portal vein and a hepatic vein by deployment of an intrahepatic expandable stent. Hemodynamically, this allows immediate decompression of portal hypertension by partial or complete diversion of portal flow from hepatic sinusoids into the inferior vena cava and the systemic circulation.

Indications for the TIPS procedure include: variceal bleeding not controlled by endoscopic or medical therapy, intractable ascites, hepatic hydrothorax, Budd–Chiari syndrome, hepatorenal syndrome and hepatopulmonary syndrome, and bridge to liver transplantation. Some contraindications of TIPS are: primary prevention of variceal hemorrhage, congestive heart failure, severe pulmonary hypertension and tricuspid regurgitation, severe hepatic failure, hepatocellular carcinoma, active intrahepatic or systemic infection, and severe coagulopathy or thrombocytopenia.

What are the anesthetic strategies for TIPS? What are some preoperative and intraoperative concerns in these patients?

TIPS can be performed under moderate sedation, monitored anesthesia care, or general anesthesia. Given the usual need for long immobilization, potential risk of aspiration, and significant comorbidity, general anesthesia is often the recommended anesthetic plan.

Preoperative considerations include: risk of aspiration, gastrointestinal bleeding, decreased functional residual capacity from ascites, pleural effusions, coagulopathy, thrombocytopenia, and hepatic encephalopathy. Special intraoperative considerations should include careful hemodynamic monitoring (usually via arterial catheter), frequent performance of blood gases for electrolyte abnormalities and coagulation parameters, and testing to determine blood glucose and urine output levels. Altered pharmacokinetics of anesthetic agents should also be kept in mind.

Following informed consent and plan for general anesthesia, the patient is induced with etomidate, fentanyl, and succinylcholine, using rapid sequence induction; atraumatic intubation is accomplished uneventfully. Prior to placement of the TIPS, the radiologist evacuates approximately 8 L of ascitic fluid.

What are your concerns about this paracentesis? How would you balance these hemodynamic fluid shifts?

Large volume paracentesis is believed to be a relatively safe and effective procedure; however, it can lead to paracentesis-induced circulatory dysfunction (PICD), a frequently occurring silent complication. PICD is characterized by a marked activation of the renin–angiotensin axis, as well as accentuation of an already established arteriolar vasodilatation that may be combated with salt-free albumin as the plasma expander of choice, especially if at least 8 L are evacuated.

The TIPS procedure lasts about 2 hours; the patient is reversed appropriately with neostigmine and glycopyrrolate. She emerges smoothly and is transferred to the PACU on oxygen via a face mask at 6 L/min. Within 15 min of admission to the PACU, the patient complains of mild chest pain and shortness of breath. Bilateral wheezing is noted, followed by crackles at the bases.

What are some complications of TIPS procedure? How would you attempt to manage this patient?

Complications following TIPS are not insignificant; 3-month mortality has been reported to be approximately 32% to 45%. Complications can be broadly categorized as being associated with the anesthesia, patient comorbidity, and procedure. Patient- and anesthesia-related factors are similar to the ones described in the previous section. With regard to procedure-related factors, special note should be made of cardiopulmonary consequences resulting from a sudden increase in pulmonary artery pressures and systemic pressures, leading to pulmonary congestion.

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