

# POSTOPERATIVE NAUSEA AND VOMITING

David H. Wilks, M.D.

Postoperative nausea and vomiting (PONV) is the most common postanesthetic complication,<sup>1</sup> occurring in as many as 30% of patients who are not treated with antiemetics.<sup>2</sup> In one study 38% of patients reported that PONV was "as, or more debilitating than the after effects of the surgery itself."<sup>3</sup> Severe vomiting can result in hypokalemia, hyponatremia, alkalosis and dehydration, pulmonary aspiration, and wound disruption (especially after ocular, abdominal, or plastic surgery).<sup>2</sup> PONV may be caused by other factors (presence of an oral airway; metabolic, vestibular, psychogenic, or GI disorders; intracranial hypertension; and emetic drugs). PONV in ambulatory patients is particularly distressing because discharge may be delayed or admission may be required. It is important to identify patients at risk preoperatively. Risk factors include a history of motion sickness, a previous history of PONV, and surgical procedures lasting more than 1 hour. Children and women are more susceptible. An important component of an anesthetic plan is prophylaxis of PONV. Patients receiving regional anesthesia or MAC have a lower incidence of postoperative N/V than patients who receive general anesthesia.<sup>4,5</sup> Selection of general anesthetic agents will influence the incidence of PONV. Inhalation agents have a higher incidence than propofol.<sup>6-8</sup> It has become very common to use antiemetics (ondansetron,<sup>3,6</sup> droperidol) prophylactically.

- A. Review the medical history, operative procedure, anesthetic technique, and all medications received. Procedures frequently associated with PONV include intraabdominal, intracranial, middle ear, laparoscopic, ophthalmologic (particularly strabismus), and genital operations. Common causes include anesthetic drugs (narcotics, cholinergic stimulants), pain or fear, air swallowing, sudden positional changes (especially fast turns at corners during transfers from the OR to the PACU), hypotension, and obesity.
- B. Only 10% of patients complain of PONV without accompanying pain.<sup>9</sup> Most PONV is relieved by correcting hypotension, hydration, providing analgesia, and/or the administration of an antiemetic agent. Mechanical factors (poorly positioned, kinked, or otherwise nonfunctioning gastric tube together with air swallowing or inflation by earlier mask ventilation) can lead to gastric distension. The patient who had a "full stomach" preoperatively (pain, narcotics, pregnancy) continues to be at risk in the postoperative period. Rupture of the tympanic membrane (perforation

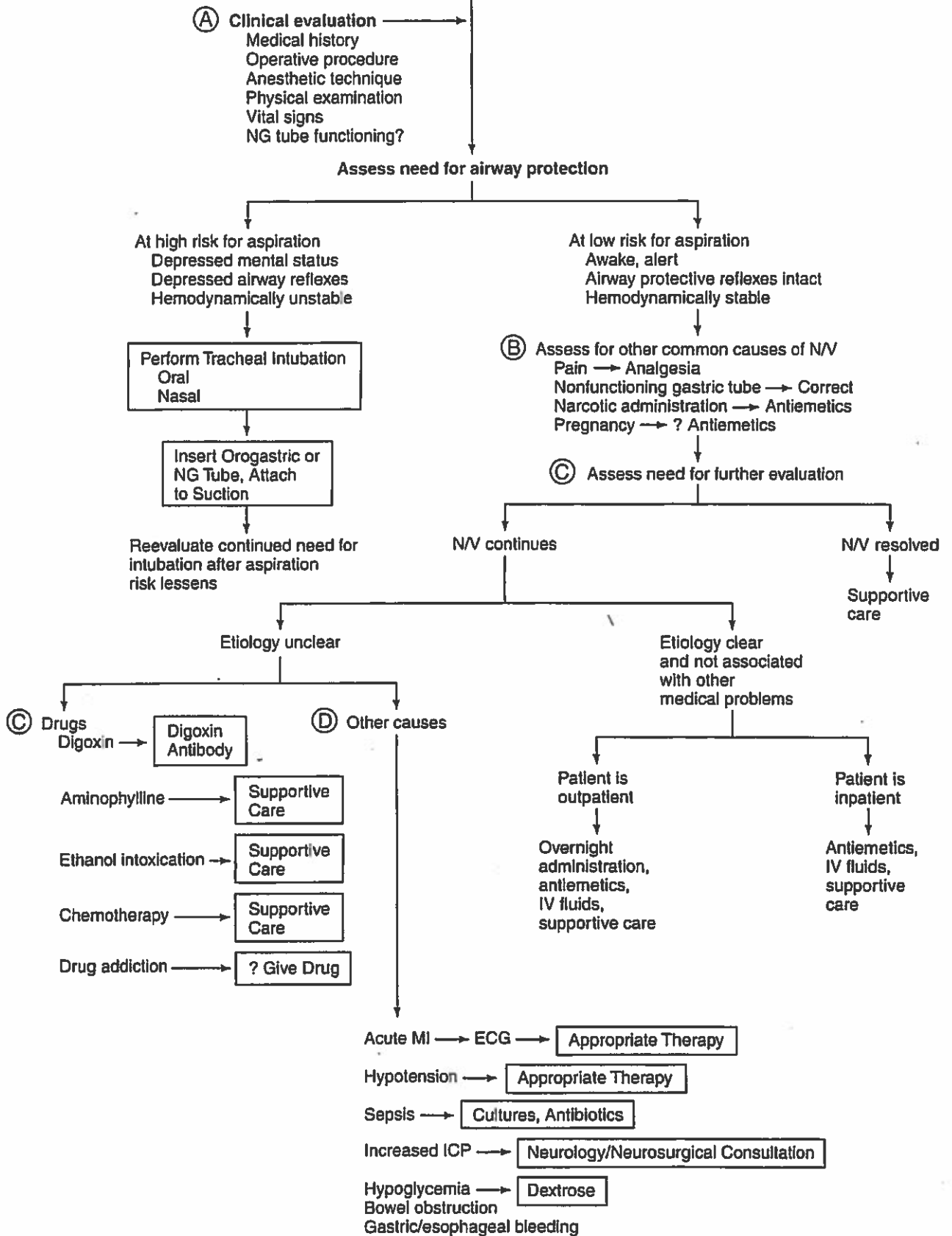
by a temperature probe, poor eustachian tube function, and N<sub>2</sub>O exposure) can lead to vertigo and nausea but is typically accompanied by ear pain.

- C. Patients may develop nausea from excessive doses of digoxin or aminophylline. A patient with a previously unrecognized addiction may develop nausea during withdrawal.
- D. PONV associated with arm or chest pain and ECG changes may indicate myocardial infarction. Vital signs and other indications of infection may indicate septicemia. Other neurologic signs, along with knowledge of the patient's history and operative procedure, may indicate rises in ICP.

## References

1. Levy ML, Coakley CS. Organization and experience with outpatient anesthesia in a large university hospital. *Int Anesthesiol Clin* 1976; 14(2):131.
2. Palazzo MGA, Strunin L. Anaesthesia and emesis I: etiology. *Can Anaesth Soc J* 1984; 31:178.
3. Kovac AL, Pearman MH, Khalil SN, et al. Ondansetron prevents postoperative emesis in male outpatients. S3A-379 Study Group. *J Clin Anesthesia* 1996; 8(8):644.
4. Jellish WS, Thalji Z, Stevenson K, et al. A prospective randomized study comparing short- and intermediate-term perioperative outcome variables after spinal or general anesthesia for lumbar disc and laminectomy surgery. *Anesth Analg* 1996; 83(3):559.
5. Parnass SM, McCarthy RJ, Bach BR Jr, et al. Beneficial impact of epidural anesthesia on recovery after outpatient arthroscopy. *Arthroscopy* 1993; 9(1):91.
6. Eriksson H, Korttila K. Recovery profile after desflurane with or without ondansetron compared with propofol inpatients undergoing outpatient gynecological laparoscopy. *Anesth Analg* 1996; 82(3):533.
7. Phillips AS, Mirakhor RK, Glen JB, et al. Total intravenous anesthesia with propofol or inhalational anesthesia with isoflurane for major abdominal surgery. Recovery characteristics and postoperative oxygenation—an international multicentre study. *Anaesthesia* 1996; 51(11):1055.
8. Lien CA, Hemmings HC, Belmont MR, et al. A comparison: the efficacy of sevoflurane-nitrous oxide or propofol-nitrous oxide for the induction and maintenance of general anesthesia. *J Clin Anesthesia* 1996; 8(8):639.
9. Anderson R, Krohg K. Pain as a major cause of postoperative nausea. *Can Anaesth Soc J* 1976; 23:366.

Patient with POSTOPERATIVE NAUSEA AND VOMITING



# DELAYED AWAKENING

Barbara A. Dodson, M.D.

A common situation in clinical anesthesia is appropriate management of the patient who fails to awaken from a general anesthetic or who emerges with a change in neurologic status. Evaluation emphasizes rapid diagnosis and treatment of reversible conditions and/or prevention of further neurologic injury.

- A. Relevant factors include preoperative status of the patient (preexisting conditions), intraoperative events (cardiac arrhythmias, hypertension, hypotension, treatment with pressors) and type of surgery (risk for neurologic injury).
- B. The DSM(R) III diagnosis of *delirium* is based on four key features: acute change in mental status from the preoperative state, inattention, disorganized thinking, and altered level of consciousness. Predictors for postoperative delirium include age >70 years, alcohol abuse, decreased orientation preoperatively, poor physical status, preoperative electrolyte and glucose abnormalities, and vascular, aortic, or thoracic surgery.<sup>1</sup> The incidence of postoperative delirium is >10% in the elderly population, and is associated with poorer surgical outcomes, major complications (e.g., MI, cardiac arrest, respiratory failure), length of stay, and percent discharged to skilled nursing facilities.<sup>1,2</sup>
- C. Prolonged drug effect is the most common etiology of delayed awakening. Anesthetic requirements vary with age, ethnicity, size, and physical status of the patient—relative anesthetic overdose occurs even with an experienced practitioner. Nonanesthetic agents that affect cognitive function include tranquilizers, antihypertensives, anticholinergics, and H<sub>2</sub> blockers.<sup>1,2</sup> Penicillin-derived antibiotics, amphotericin B, and immunosuppressive agents can induce changes in mental status.<sup>3</sup> Patients with renal and/or hepatic insufficiency are particularly at risk for adverse

drug interactions. Consider sequelae from drug abuse in all patients regardless of age. Approximately 10–15% of elderly persons take hypnotic drugs regularly, and 15–18% abuse alcohol.<sup>4</sup>

- D. Postoperative hypoxia is exacerbated by anemia, hypotension, and/or low cardiac output.<sup>5</sup> Significant hypercapnia can exist in the presence of normal O<sub>2</sub> saturation.<sup>6</sup> Look for surgically induced electrolyte abnormalities (i.e., hyponatremia [transurethral surgery and hysteroscopy], hypocalcemia [thyroid and parathyroid surgery]). Mental changes occur in the preeclamptic/eclamptic patient from increased ICP, seizures, intracranial hematoma, and/or hypermagnesemia from MgSO<sub>4</sub> therapy.
- E. Postanoxic ischemic encephalopathy can be related to intraoperative hypotension treated by inotropic drugs, documented circulatory arrest, asphyxia, and/or hemorrhagic shock.<sup>3</sup> The risk for perioperative stroke increases with age (0.03–0.08% for the fourth decade to 3–4% for the eighth decade).<sup>7</sup> In general, deliberate hypotension is well tolerated even in the at-risk patient.<sup>7,8</sup> Problems occur when BP falls outside the upper and lower limits for cerebral autoregulation. Conditions associated with hemorrhagic infarcts (i.e., BP above cerebral autoregulatory limits) include carotid endarterectomy, post AVM removal, preeclampsia and, perhaps, anticoagulation therapy. Conditions associated with acute perioperative ischemic stroke (i.e., BP below cerebral autoregulatory limits) include cardiac arrhythmias (especially atrial fibrillation), acute MI, cardioversion, embolic phenomena, diabetic dysautonomia, and previous cerebrovascular accidents.<sup>9</sup> Surgical procedures with increased risks for cerebral embolism include CABG, orthopedic (especially joint replacements), valvular, peripheral vascular, and aortic surgeries.<sup>10</sup>

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Patient with DELAYED AWAKENING OR DELIRIUM

Ⓐ Definition of delayed awakening

Subjective  
Preoperative patient status  
Intraoperative conditions  
Type of surgery

Ⓑ Definition of delirium

Change in mental status from preop  
Inattention  
Disorganized thinking  
Altered level of consciousness

Differential diagnosis

Ⓒ Prolonged drug effect  
Prolonged sedation—most  
common cause  
Drug intoxication  
Drug abuse—overt or covert  
Prolonged neuromuscular  
blockage

(Cont'd on p 601)

Ⓓ Nonneurologic abnormality  
Hypotension, hypothermia  
Hypoxia, hypercarbia  
Glucose abnormalities:  
hypoglycemia, diabetic  
ketoacidosis, hyperosmolar  
nonketotic coma  
↓Na<sup>+</sup>, Ca<sup>++</sup>, ↑  
Preeclampsia, sepsis, renal,  
adrenal or hepatic insufficiency,  
etc.

ABGs  
Temperature  
Electrolytes  
Train of Four  
Blood Pressure

(Cont'd on p 601)

Ⓔ Neurologic injury  
Postanoxic, ischemic  
encephalopathy  
Intracerebral hematoma,  
subarachnoid hemorrhage  
Acute ischemic stroke  
↑ICP  
Seizure and/or postictal state

(Cont'd on p 601)

- F. Review perioperative medications and preoperative neurologic status. Give small doses of anesthetic reversal drugs for diagnostic purposes. Monitor vital signs and temperature. Maintain ventilation and cardiac output. Treat any metabolic and electrolyte abnormalities. Treat any cardiac cause for decreased mental status (arrhythmias, MI). Consider other causes for decrease in cognitive function, such as sepsis, hypo- and hyperthyroidism, and adrenal, renal, and/or hepatic insufficiency.
- G. Aggressively rule out neurologic causes of delayed awakening when non-neurologic causes are eliminated or focal neurologic deficits occur.<sup>11</sup> If increased ICP is suspected, intubate and hyperventilate the patient while maintaining tight BP control. Obtain neurosurgery and/or neurology consults. Patients may require expedited neurosurgical exploration or stroke therapy (i.e., tissue plasminogen activator) to prevent permanent neurologic deficits.

#### References

1. Marcantonio ER, Goldman L, Mangione CM, et al. A clinical prediction rule for delirium after elective noncardiac surgery. *JAMA* 1994; 271:134.
2. Parikh SS, Chung F. Postoperative delirium. *Anesth Analg* 1995; 80:1223.
3. Wijdicks EFM. Neurological complications in critically ill patients. *Anesth Analg* 1996; 83:411.
4. O'Keefe ST, Chonchubhair A. Postoperative delirium in the elderly. *Br J Anaesth* 1994; 73:673.
5. Moller JT, Johannessen NW, Espersen K, Ravlo O. Randomized evaluation of pulse oximetry in 20,802 patients: II. Perioperative events and postoperative complications. *Anesthesiology* 1993; 78:445.
6. Drummond KJ, Fearnside MR, Chee A. Transcutaneous carbon dioxide measurement after craniotomy in spontaneously breathing patients. *Neurosurgery* 1997; 41:361.
7. Kim J, Gelb AW. Predicting perioperative stroke. *J Neurosurg Anesth* 1995; 7:211.
8. Sharrock NE, Bading B, Mineo R, Blumenfeld JD. Deliberate hypotensive epidural anesthesia for patients with normal and low cardiac output. *Anesth Analg* 1994; 9:899.
9. Bladin CF, Chambers BR. Frequency and pathogenesis of hemodynamic stroke. *Stroke* 1994; 25:2179.
10. Newman MF, Wolman R, Kanchuger M, et. al. Multicenter preoperative stroke risk index for patients undergoing coronary artery bypass graft surgery. *Circulation* 1996; 94(Suppl II):74.
11. Black S, Enneking FK, Cucchiara RF. Failure to awaken after general anesthesia due to cerebrovascular events. *J Neurosurg Anesth* 1998; 10:10.

Patient with DELAYED AWAKENING OR DELIRIUM  
(Cont'd from p 599)

- Ⓕ Reversal of anesthetic drugs  
Naloxone  
Physostigmine  
Flumazenil  
Neostigmine

Clinical evaluation  
Ensure adequate ventilation and cardiac output  
Rule out nonneurologic causes  
Vital signs  
Appropriate patient language  
Cardiac history and examination → ECG  
Metabolic and endocrine status → Echocardiogram

ECG  
Echocardiogram

Abnormal

Negative

Treat

Awake  
↓  
Observe

No change

Awake  
↓  
Observe

No change

- Ⓖ Rule out neurologic causes  
Neurologic history and examination  
Consultation

CT  
MRI  
Angiogram  
EEG