Lesson 274: PreAnesthetic Assessment of the Patient Who Reports Previous Intraoperative Awareness

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NEEDS STATEMENT  
Over the past few years, intraoperative awareness has been sensationalized in the media as a major problem during anesthesia. The true incidence and prevalence have been questioned. This lesson is a review of the pertinent data. The topic has been identified by committee as required learning by clinical anesthesiologists.

TARGET AUDIENCE  
Anesthesiologists

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LEARNING OBJECTIVES  
At the end of this activity, the participant should be able to:  
1. Define intraoperative awareness.  
2. Describe widely used diagnostic instruments for recognizing awareness.  
3. Identify risk factors for awareness.  
4. Describe the psychological effect of awareness.  
5. Outline a management plan for the patient who has experienced intraoperative awareness.  
6. List the preoperative considerations for the patient who has experienced intraoperative awareness.  
7. Discuss the prevention of intraoperative awareness.  
8. Recognize the limitations of brain function monitors.  
9. State the incidence of postoperative awareness.  
10. List the types of surgery most likely to result in awareness.

CASE HISTORY  
A 25-year-old man with no underlying medical illness was scheduled for open reduction and internal fixation of malunion after a fracture of the distal right femur. The operation was expected to last more than 3 hours, and the use of a fracture table was planned. Four months earlier, the patient had undergone emergency surgery after a motor vehicle accident in which his pelvis and distal right femur had been fractured. He reported having experienced intraoperative awareness during anesthesia. He stated that he had heard voices and the sound of metal and hammering and had felt moderate pain and helplessness at the time. He expressed his considerable fear of undergoing anesthesia again and was apprehensive that such an episode might recur. Since the surgery, he had experienced nightmares and the signs and symptoms of post-traumatic stress disorder. A review of the patient’s anesthetic record showed that he had been in hypovolemic shock with blood pressure values ranging from 50/30 to 85/40 mm Hg and a heart rate of 130 beats/min. He was reported to have been semiconscious before the induction of anesthesia, and his American Society of Anesthesiologists (ASA) physical status classification was IV-E.

Intraoperative awareness under general anesthesia is rare, with an incidence of 0.1% to 0.2%; however, given that some 21 million anesthetics are administered annually in the United States alone, these figures translate to an occurrence of awareness in 20,000 to 40,000 cases. Anesthesia awareness is considered a distressing complication that can have significant psychological sequelae, including post-traumatic stress disorder.6 It has been discussed on television talk shows and sensationalized by a Hollywood movie, and it has been the topic of many published articles and discussion panels at meetings. As such, anesthesia awareness has become a general concern of the public that has increased the professional liability of practitioners.1,3 As part of its sentinel event policy, the Joint Commission issued an alert in 2004 on the prevention of anesthesia awareness and the management of its effects.6 The Joint Commission concluded that anesthesia awareness is underrecognized and undertreated in health care organizations and established several guidelines to help prevent and manage this complication. Among the measures recommended to reduce its incidence are

PREANESTHETIC ASSESSMENT  
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A COURSE OF STUDY FOR AMA/PRA CATEGORY 1 CREDIT  
Read this article, reflect on the information presented, then go online and complete the lesson post-test and course evaluation before June 30, 2009. (CME credit is not valid past this date.) You must achieve a score of 80% or better to earn CME credit.  
TIME TO COMPLETE ACTIVITY: 2 hours  
RELEASE DATE: June 2008  
TERMINATION DATE: June 30, 2009

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Detection of Awareness

The diagnostic instrument most often used to detect awareness is the structured interview. It should be conducted as an ongoing process because the nature of awareness involves memory that may gradually emerge over time. Previous studies have revealed that patients who deny experiencing awareness when interviewed immediately after surgery may confirm an experience of awareness in subsequent interviews. In a study by Sebel et al., 50% of the cases of awareness were discovered in the second interview. A delayed memory of awareness can be the consequence of the residual effects of anesthesia and the diversion of attention to symptoms such as pain, nausea, and vomiting during the early recovery phase. In addition, it has been suggested that the psychological trauma of awareness itself may lead to memory dissociation that impairs the recall process. Therefore, the detection of awareness depends on the technique, timing, frequency, and structure of the interview. As long ago as 1970, Brice et al. introduced an interview technique in which a questionnaire was used as the standard tool for detecting awareness. The questionnaire was later modified and comprised 5 questions:

1. What is the last thing you remember before going to sleep?
2. What is the first thing you remember after waking up?
3. Do you remember anything in between?
4. Do you remember any dreams during your operation?
5. What was the worst thing about your operation?

It is recommended that patients be interviewed on 3 occasions—before discharge from the postanesthesia care unit, 1 to 3 days later, and after 7 to 14 days—and that the modified structured interview of Brice et al. be used.9,10

Risk Factors for Awareness

Because of the low incidence of awareness, data to identify risk factors for awareness are limited. However, a number of significant risk factors have been reported in the literature (Table 1).11-16

It is important to identify patients at risk for intraoperative awareness by reviewing medical records, conducting a thorough physical examination, and interviewing patients (and their families, if appropriate).17 Patient characteristics such as female sex and relatively young age were suggested as risk factors for intraoperative awareness in a 1999 analysis of closed claims11,18 and in other, more recent studies. However, in a US multicenter study, Sebel et al. did not find an association between gender, age, and awareness during anesthesia. This discrepancy may be explained by a loss to follow-up at postoperative interviews, especially at institutions with high numbers of study patients. The incidence of awareness may be higher in obese patients, possibly because obesity is associated with difficult airway, in which endotracheal intubation is prolonged; other possible risk factors are awake intubations and improper dosing of anesthetic agents, resulting in light anesthesia.18 Hemodynamic instability secondary to poor cardiac reserve often leads anesthesiologists to use lesser amounts of anesthetics, which puts the patient at risk for intraoperative awareness. A patient with a history of intraoperative awareness must be carefully evaluated, especially concerning the emotional effect of this complication, because the patient may be reluctant to reveal psychological changes to medical personnel. Such patients should be provided with information about intraoperative awareness and be reassured that every effort will be made to prevent awareness.19

The most common cause of intraoperative awareness is probably light anesthesia or inadequate anesthetic dosing.18,19,20 There are several situations in which anesthetic personnel may inadvertently administer light anesthesia. Difficult endotracheal intubation, interruption of the anesthetic drug supply, and improper technique with low fresh gas flows can all increase the risk for awareness.21 In addition, a rapid tapering of anesthesia in an attempt to facilitate operating room turnover increases the risk for intraoperative awareness.22

The choice of agent may also influence the incidence of awareness anesthesia. A closed claims analysis revealed an increased incidence of intraoperative awareness when the use of N2O opioids, muscle relaxants, and no or low concentrations of volatile agents were the main techniques.23 However, whether the choice of anesthetic (i.v. vs volatile agents) affects the incidence of awareness has yet to be answered conclusively. Eger and Sonner suggested that the incidence of awareness was lower in patients who had been adequately anesthetized with a potent inhaled anesthetic at 0.5 minimum alveolar concentration or more.24 By contrast, Bowdle et al. have cautioned against relying on a particular drug or dose because of the considerable biological variations seen in response to anesthetic agents and the various arousing effects of surgery among surgical patients.25 Elnaud also has commented that no absolute answer has yet been found regarding the effect of the choice of anesthetic on the risk for awareness.26

Failure to use brain function monitors when appropriate is also reported to be a risk factor for awareness. However, to date, no anesthesia brain monitor has been adequately validated in the presence of neuromuscular blocking drugs. Therefore, the ASA Task Force on Intraoperative Awareness practice advisory statement has recommended that a brain function monitor be used on a case-by-case basis for selected patients at risk for awareness.5

Intraoperative awareness has been linked to certain types of surgery. Descriptive studies and case reports have reported an incidence of 0.2% to 0.4% in nonobstetric and noncardiac surgeries, 0.4% in cesarean deliveries, and 0.3% to 4% in cardiac surgery.27,28 The incidence of intraoperative awareness is high in patients undergoing surgery for major trauma because hypovolemia and hemodynamic instability necessitate light anesthesia. In patients undergoing rigid bronchoscopy and microlaryngeal endoscopic surgery, an increased risk for awareness of 1% to 7% has been reported.29

Management of Patients Reporting Awareness

All patients who report intraoperative awareness must be thoroughly evaluated to obtain details of the event and discuss the possible causes. Clinicians must acknowledge the reality of the experience and recognize the emotional effect on the patient. When an episode of intraoperative awareness has been detected and verified by an adjudication committee, an occurrence report should be completed for the purpose of quality assurance and follow-up. Patients should be offered counseling or psychological support on multiple occasions.5

Lennmarken and Sydjo studied a group of patients who denied any mental problems in the immediate postoperative period but who were found to have moderate to severe symptoms 2 years later.9 The experience of awareness can cause immediate as well as longstanding psychological symptoms. Furthermore, the experience often leads to dissatisfaction with anesthetic care of subsequent anesthesia, not to mention a poor public opinion of anesthesia providers. The psychological
sequelae of awareness differ among affected patients. Some report mild or no mental disorders, but symptoms of post-traumatic stress disorder2,10 a serious psychiatric disease that is diagnosed according to 6 main criteria, develop in many (Table 2).17

The study by Lennmarken and Sydöjo regarding the long-term mental effects of awareness revealed the entire spectrum of diagnostic criteria. Samuelsson et al found that an acute emotional response, such as fear, panic, and a feeling of helplessness, was significantly related to the later development of psychological symptoms.19 Therefore, a professional psychiatric assessment, therapy, and follow-up are recommended and constitute standard practice for the management of these patients.9

Prevention of Awareness

The risk for intraoperative awareness can be minimized at 3 different stages: the preoperative assessment, the preinduction phase of anesthesia, and intraoperative management. During the preoperative assessment, patients at risk for intraoperative awareness (Table 1) should be identified.22 The ASA Task Force on Intraoperative Awareness practice advisory statement has suggested that patients who are at a substantially higher risk should be informed of the possibility of intraoperative awareness.9 They should also be reassured that every effort will be made to prevent the complication. During the preinduction phase, anesthesia personnel must check the functioning of anesthesia delivery systems, including vaporizers (ensuring that they are filled and that low-level alarms are functioning) and infusion pumps; the adequacy of fresh gas flow; and the appropriate placement and functioning of I.V. cannulas.5 The prophylactic administration of benzodiazepines has been studied widely. Many anesthesiologists believe that using a benzodiazepine such as midazolam in the anesthetic regimen can reduce the risk for awareness.12 One double-blind randomized clinical trial compared the efficacy of prophylactic midazolam with that of a placebo during an ambulatory procedure and reported a lower incidence of intraoperative awareness in the midazolam group. In 2 other randomized clinical trials, recall was also reduced in patients who received midazolam, but subsequent intraoperative awareness was not examined.23 Both studies indicated that midazolam could not be used to reliably reduce retrograde amnesia. Thus, the ASA Task Force has recommended the use of prophylactic benzodiazepines on a case-by-case basis for selected patients (eg, patients requiring lower doses of anesthetics) and has cautioned that the use of benzodiazepines can delay emergence.5

Intraoperative management and monitoring include clinical techniques, conventional monitoring, and monitoring the electrical activity of the brain.24 The clinical techniques used to assess a patient for intraoperative consciousness include observation of purposeful or reflex movement, response to commands, eye opening, presence of eyelash reflex, and brisk pupillary responses. In the absence of muscle relaxants, patient movement and altered or irregular breathing patterns can also be used to determine that a patient is inadequately anesthetized. These useful signs are absent if muscle relaxants have been administered. Typical physiologic responses—autonomic signs such as increased blood pressure and heart rate, sweating, tearing, and pupillary responses—are masked by medications such as β-blockers and calcium channel blockers. The “isolated forearm” technique has been used to evaluate depth of anesthesia in the presence of neuromuscular blocking drugs. However, the technique is quite cumbersome and not widely used.31

Conventional monitoring includes ASA standard monitoring methods such as electrocardiography, measurement of blood pressure and heart rate, pulse oximetry, capnography, and end-tidal anesthetic analysis. In correlation studies, various prediction probability values have been reported for the association between physiologic responses and depth of anesthesia; these values have ranged from 0.5 (probability equal to chance) to 0.9 (nearly perfect association). The findings confirm that clinical techniques and conventional monitoring are valuable in the assessment of patients for intraoperative consciousness as long as practitioners are aware of their limitations. The use of brain function monitoring has been advocated to recognize ongoing intraoperative awareness. Brain monitoring systems can be divided into 2 groups: those that process spontaneous electroencephalographic (EEG) and electromyographic activity, and those that acquire evoked responses to auditory stimuli (auditory evoked potentials [AEPs]).3 Spontaneous EEG and AEP modalities both provide information about the hypnotic state of the patient. The raw waveforms, too complicated to interpret on a continuous basis, are processed by a computer into a dimensionless parameter.12 AEPs are the electrical responses of the brain stem, which is relatively insensitive to anesthetics. By contrast, early cortical responses, known as middle-latency AEPs, change predictably with increasing concentrations of both volatile and I.V. anesthetics; the latency of the various waveform components increases and their amplitude decreases.5 A number of the commercially available brain monitoring systems are scaled from 0 (indicating deep anesthesia) to 100 (awake).2 Values within the range of 40 to 60 are reported to reflect a low probability of consciousness in patients undergoing general anesthesia. However, 2 case reports have described patients who experienced intraoperative awareness despite monitor readings indicating adequate depth of anesthesia. Additionally, several case reports have indicated that certain intraoperative events (eg, cerebral hypoperfusion, gas embolism) and patient conditions may affect monitor readings.1

Based on such case reports, and on study results suggesting caution when monitors are used to guide general anesthesia in the presence of neuromuscular blocking drugs, it is recommended that all anesthesia brain monitors be adequately validated before they are used to guide the administration of anesthetic agents in individual patients. At present, there is inconclusive evidence to justify a standard, guideline, or absolute requirement that brain function monitors be used to reduce the occurrence of intraoperative awareness in high-risk patients undergoing general anesthesia.12,22 The ASA Task Force has recommended that the decision to use a brain function monitor be made on a case-by-case basis by the individual practitioner for selected patients.5

Management of the Case Presented

In the presented case, the attending anesthesiologist further questioned the patient to evaluate the psychological effect of intraoperative awareness. The patient reported that he felt a fear of future anesthesia but could still continue his normal life. He had experienced nightmares in the first few weeks after his accident, but eventually the dreams had subsided. He had not shared his experience of awareness or subsequent distress with anyone. The anesthesiologist apologized to the patient for his previous experience with awareness. He was told that although he did have explicit recall of the previous anesthesia, such incidences are rare with general anesthesia. The previous anesthesiologist probably had evaluated the patient’s unstable hemodynamic state and had decided to administer light anesthesia to maintain his cardiovascular reserve function. At the present time, the patient appeared to be stable with normal vital signs, and the attending anesthesiologist reassured him that she would make every effort to prevent another experience of intraoperative awareness. The attending anesthesiologist decided that a combined general anesthesia and epidural technique would provide optimal analgesia for the patient, both intraoperatively and postoperatively. A sedative was ordered for the patient the night before surgery—which was scheduled as the first surgery on the following day. The anesthesiologist and other equipment were checked. A 16G I.V. cannula was placed and confirmed to be functioning well; 4 mg of midazolam and 50 mcg of fentanyl were administered. An epidural catheter was inserted successfully at the L3-4 level; the proper position was confirmed with a test dose of lidocaine 2% with epinephrine 1:200,000.

Anesthesia was induced with an I.V. propofol at a dose of 2 mg/kg, administered after a second 100-mcg dose of fentanyl. Rocuronium was administered at a dose of 0.9 mg/kg for paralysis. The trachea was intubated and anesthesia was maintained with N2O, O2, and sevoflurane. No further opioid was administered because a neuraxial opioid was planned postoperatively. The epidural dose of 2% lidocaine with epinephrine 1:200,000 was titrated accordingly to combine with the general anesthetics. A brain function monitor was not available. However, the anesthesiologist combined clinical techniques to assess the patient for intraoperative consciousness (eg, checking for eyelash reflex and pupillary response) with observation of other autonomic signs of light anesthesia. The findings were documented every 15 minutes. The surgery was uneventful.

The patient’s experience was evaluated in a structured interview on 3 occasions: before discharge from the postanesthesia care unit, on the first postoperative day, and in a follow-up telephone call after 10 days. The patient reported no experience of intraoperative awareness, and he was discharged home safely. He stated that his fear of future anesthesia was now diminished.

Table 2. Awareness Symptoms According to Criteria for Post-Traumatic Stress Disorder9,14

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Score</th>
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<tr>
<td>Intense fear, helplessness, horror</td>
<td>1</td>
</tr>
<tr>
<td>Recurrent and intrusive recollections of the traumatic event, including</td>
<td>2</td>
</tr>
<tr>
<td>images, thoughts, perceptions, or dreams</td>
<td></td>
</tr>
<tr>
<td>Persistent avoidance of thoughts, feelings, conversation, or activities</td>
<td>3</td>
</tr>
<tr>
<td>associated with the event</td>
<td></td>
</tr>
<tr>
<td>Persistent symptoms of increased arousal (not present before the trauma)</td>
<td>4</td>
</tr>
<tr>
<td>evidenced by 2 or more of the following:</td>
<td></td>
</tr>
<tr>
<td>• difficulty falling or staying asleep</td>
<td></td>
</tr>
<tr>
<td>• irritability or outbursts of anger</td>
<td></td>
</tr>
<tr>
<td>• difficulty concentrating</td>
<td></td>
</tr>
<tr>
<td>• hypervigilance, and</td>
<td></td>
</tr>
<tr>
<td>• exaggerated startle response</td>
<td></td>
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<tr>
<td>Duration of the disturbance (symptoms in criteria 2-4) is more than 1</td>
<td>5</td>
</tr>
<tr>
<td>month</td>
<td></td>
</tr>
<tr>
<td>The symptoms cause significantly disturbed</td>
<td>6</td>
</tr>
<tr>
<td>functioning in social, occupational, or other important areas of</td>
<td></td>
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<tr>
<td>functioning</td>
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Summary

The management and monitoring of patients for intraoperative awareness require multiple modalities. In addition to clinical techniques, conventional monitoring systems and a brain function monitor should be used when appropriate. Vigilance, improved training, and supervision cannot be overemphasized. Although the ASA and the American Association of Nurse Anesthetists have both developed guidelines and practice advisories for the prevention of intraoperative awareness, the Joint Commission recommends that individual hospitals and anesthesia departments develop and implement their own policies.

References


Post-test

1. Which of the following describes intraoperative awareness?
   a. An implicit memory
   b. An explicit memory
   c. A dream during general anesthesia
   d. A purposeful response during general anesthesia

2. Regarding the diagnostic instrument for intraoperative awareness, which factor(s) influence(s) the detection of awareness?
   a. The interview technique
   b. The timing and frequency of the interview
   c. The structure of the interview questionnaire
   d. All of the above

3. Which of the following is an incorrect statement about risk factors for intraoperative awareness?
   a. Female gender and relatively young age were suggested as risk factors by the American Society of Anesthesiologists (ASA) closed claims analysis in 1999.
   b. Obese patients may be at increased risk because of a higher incidence of difficult intubation.
   c. It has been proved that I.V. anesthesia is associated with a higher incidence of awareness than is inhalation anesthesia.
   d. The ASA Task Force on Intraoperative Awareness recommends the use of a brain function monitor on a case-by-case basis.

4. Which of the following types of surgery is commonly associated with intraoperative awareness?
   a. Cesarean delivery
   b. Trauma surgery
   c. Cardiac surgery
   d. All of the above

5. Which of the following is a correct statement regarding the psychological sequelae of awareness?
   a. Post-traumatic stress disorder will not develop in a patient who denies any emotional disturbance at the first interview.
   b. Symptoms of fear, panic, and helplessness are reported later by many patients.
   c. A professional psychiatric consultation should be offered at the patient’s request.
   d. Patients who experience persistent symptoms of hyperarousal always have a history of emotional outburst before the purported intraoperative awareness.

6. Proper management of the patient who reports intraoperative awareness includes:
   a. an explanation to the patient that the incidence of awareness is very rare, and that what he or she had experienced during surgery was just a dream
   b. psychiatric therapy that should be offered only when the symptoms of post-traumatic stress disorder persist more than 1 month
   c. an in-depth interview to obtain details and discuss possible causes of the occurrence
   d. no acknowledgment by the anesthesiologist of the problem of awareness before confirmation from a psychiatrist

7. What are the preoperative considerations for a patient with previous intraoperative awareness?
   a. A thorough preanesthetic assessment to identify risk factors for awareness
   b. A complete physical examination and an interview to assess the emotional effect on the patient
   c. Reassurance about all possible efforts to avoid intraoperative awareness in the future
   d. All of the above

8. Which of the following is a true statement regarding the prevention of awareness?
   a. The intraoperative administration of benzodiazepines has been proved to always be effective.
   b. The best choice of anesthesia to prevent awareness is a potent inhaled anesthetic agent with no muscle relaxation.
   c. Brain function monitor values below 75 always indicate an adequate depth of anesthesia.
   d. Brain function should be monitored in patients at increased risk for awareness.

9. Which statement is true regarding brain function monitors?
   a. All anesthesia brain monitors should be adequately validated before being used to guide the administration of anesthetic agents for individual patients.
   b. The combined use of commercially available brain function monitors has successfully detected awareness in all cases.
   c. Single-channel monitors are used more commonly than other monitors because they reliably indicate adequate depth of anesthesia.
   d. Brain function monitors are routinely recommended to prevent intraoperative awareness.

10. What is the most common cause of intraoperative awareness?
    a. Failure to routinely use a brain function monitor
    b. The use of total I.V. anesthesia
    c. Insufficient knowledge of awareness by the anesthetic care team
    d. Light anesthesia