CONTENTS

SECTION I

How to Approach Clinical Problems

Part 1. Approach to the Patient

The transition from textbook or journal article learning to an application of the information in a specific clinical situation is one of the most challenging tasks in medicine. It requires retention of information, organization of the facts, and recall of a myriad of data with precise application to the patient. In anesthesiology, this application of information acquires an additional dimension: time. **Time** is an ever present consideration for anesthesiologists because in the most dire situations such as the inability to secure an airway or to preserve cardiac output, life is sustained for only minutes, not hours.

The purpose of this text is to facilitate this process. The first step is gathering information, also known as establishing the **database**. This includes recording the patient's history; performing the physical examination; and obtaining selective laboratory examinations and/or imaging tests. Of these, the historical examination is the most important and most useful in aiding the anesthesiologist's assessment of risks to the patient, and the formulation of plans to mitigate those risks. However, unlike many specialties, when an acute problem becomes apparent, the patient is usually anesthetized and unable to provide verbal information. In this setting, an assessment of vital signs, gas analysis, lab tests, and imaging guide the diagnosis.

Clinical Pearl

➤ When an acute problem becomes apparent and the patient is anesthetized, an assessment of vital signs, gas analysis, lab tests, and imaging often guide the diagnosis.

Anesthesiologists also face an additional challenge in their approach to a patient: a short period of time to develop the physician-patient relationship. While patients will most likely have had multiple interactions with most of their physicians including their surgeon, anesthesiologists are all too often strangers who appear seemingly out of nowhere, and of whose activities patients are largely unaware. Taking the time for an unhurried introduction and actively working to develop a rapport go a long way toward inspiring a patient's confidence. "Little things" such as providing a warm blanket, or inquiring about a patient's fears are especially welcome. In contrast to the prevailing opinion that anesthesiologists are impersonal and only monitor physiological processes, the skilled anesthesiologist must be able to "read" many different types of patients during stressful times and develop a trusting relationship in a short time frame. In the preoperative period, patients are often anxious, and acutely aware of their interactions with the anesthesiologist, everyone, and everything.

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➤ Since anesthesiologists often have a short period of time to develop the physician-patient relationship, this activity requires special attention.

Part 2. Approach to Clinical Problem Solving

There are generally seven distinct steps that an anesthesiologist takes to systematically solve most clinical problems:

1. Vigilance: discovering an abnormal, unusual, or changing condition.
2. Assessing the situation.
3. Considering the treatment of the clinical sign(s) even before reaching the diagnosis.
4. Formulating a differential diagnosis.
5. Initiating treatment based on the probability of occurrence.
6. Formulating a backup plan.
7. Observing the patient's response.

Then the cycle may begin all over again.

1. DETECTING AN ABNORMAL, UNUSUAL, OR CHANGING CONDITION

Anesthesia is a discipline of vigilance. During an operative case, the anesthesiologist frequently—if not almost constantly—scans the anesthesia machine and evaluates the displaying of the patient's vital signs, oxygen saturation, and the concentration of gases at the end of expiration (end-tidal CO_2, or end-tidal desflurane, etc.), and the patient's physical signs such as papillary dilatation, sweating, tearing, the position of his or her extremities, the extent of his or her neuromuscular blockade, the progress of the surgery, etc.

Clinical Pearl

➤ The most important part of clinical problem solving during anesthesiology is **vigilance.** Vigilance allows the detection of information that is abnormal, and which requires prompt assessment by the anesthesiologist.

2. ASSESSING THE SITUATION

When anything is unusual, the anesthetist promptly assesses the situation. This involves integrating the patient's current clinical information with pre-existing information obtained during the preoperative evaluation. It is

important to quickly determine "how bad" the situation is, and whether it is likely to be a "big" problem (implying a situation that is life threatening or can degenerate into a situation that is life threatening), or a "little" problem which can be fixed with "fine-tuning." For example, the appearance of new premature ventricular arrhythmias (PVAs) could be a "big problem" representing a myocardial event, or a "little problem" resulting from an endotracheal tube tickling the carina, or hypoventilation-induced hypercarbia which is easily corrected by changing the ventilator settings. Similarly, the new onset of unifocal premature ventricular complexes (PVCs) in a frequency of 3 to 5 per minute is a very different situation from the onset of frequent runs of ventricular tachycardia.

Clinical Pearl

➤ The second step in clinical problem solving during anesthesiology is **assessing the situation and the severity of the problem.**

3. CONSIDER TREATING THE ABNORMAL CLINICAL SIGN

Because of the urgent nature of complications, anesthesiology is one of the few specialties where treatment is often initiated prior to obtaining a diagnosis, or indeed, even establishing a differential. This practice reflects the fact that abnormalities in some of the physical signs such as blood pressure, heart rate, and oxygen saturation, for example, can be harmful and even life threatening in and of themselves. For example, if a patient with coronary artery disease becomes hypotensive, the hypotension can reduce coronary blood flow to vulnerable areas of the myocardium and result in ischemia. Thus a vasopressor would often be administered, even before the cause of the hypotension was determined. In addition to preventing the ischemia, treating the hypotension would also "buy time" to allow the formulation of a differential diagnosis.

Clinical Pearl

➤ The third step in clinical problem-solving is to consider treating the abnormal clinical sign in order to mitigate any potential complications from the abnormality and "buy time" to establish a differential diagnosis.

4. FORMULATING A DIFFERENTIAL DIAGNOSIS

A diagnosis is made by a prompt evaluation and analysis of the available information, assessing the risk factors, and developing the list of possibilities

(the differential diagnosis). Experience, knowledge, and years of training help the anesthetist to "key in" on the most important possibilities. A long list of possible diagnoses is usually pared down to two or three that are the most likely for the given situation. For example, a patient who experiences tachycardia under anesthesia may be too "light" and require more anesthesia, or hypovolemic, perhaps secondary to a bowel prep prior to surgery and require fluids, or be manifesting signs of malignant hyperthermia, more likely if the patient also presents with muscular dystrophy.

Clinical Pearl

➤ The fourth step in clinical problem solving in anesthesiology is **formulating a differential diagnosis.**

5. TREATING BASED ON PROBABILITY

Many illnesses are stratified according to severity because the prognosis and treatment often vary based on the severity. In anesthesiology, because of the importance of time in life-threatening situations, the treatment is based on the most likely diagnosis. But since the most likely diagnosis is not necessarily the only possible diagnosis, the patient's response to treatment must be carefully observed. For example, if a patient is hypotensive early in the course of a colectomy, and the most likely diagnosis is considered to be a high concentration of an inhalation agent such as isoflurane, it is important to observe whether the hypotension abates as the concentration of isoflurane is reduced.

Clinical Pearl

➤ The fifth step in most cases is tailoring the treatment to most likely diagnosis.

6. FORMULATING A BACKUP PLAN

The steps of **treating based on probability and formulating a backup plan** are naturally interconnected. As the most likely diagnosis and its treatment are determined, it is natural to concurrently formulate a backup plan. The anesthetist must be prepared to know what to do if the patient does not respond according to what is expected. Is the next step to treat again and if so, how and when? Or is the next step to reassess the diagnosis, or to follow up with another more specific test? For example, if the patient

undergoing colectomy does not respond to reducing the concentration of isoflurane, then perhaps he is hypovolemic secondary to dehydration from his bowel prep.

Because the abnormalities in physical signs can be harmful, it is common to undertake the treatment plan and the backup plan almost simultaneously. But at this time, a "backup" to the "backup" is always in mind. As in the game of chess, the anesthesiologist is trained to think of alternatives and the appropriate response several steps ahead. For example, in the colectomy patient, the isoflurane would be reduced and fluids would be administered at almost the same time.

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➤ Clinical problem solving in anesthesiology involves thinking several steps ahead.

7. FOLLOWING THE RESPONSE TO TREATMENT

The final step in the approach to disease is to follow the patient's response to the therapy. The "measure" of response is recorded and monitored. Some responses are clinical, such as improvement (or lack of improvement) in a patient's blood pressure, or oxygen saturation. Other responses can be followed by invasive monitors, such as pulmonary artery wedge pressure, continuous cardiac output, or transesophageal echocardiography.

Clinical Pearl

➤ **The seventh step** in clinical problem-solving **is to monitor treatment response or efficacy,** which can be measured in different ways.

Part 3. Approach to Reading

The clinical problem-oriented approach to reading is different from the classic "systematic" research of a disease. A patient's presentation rarely provides a clear diagnosis; hence, the student must become skilled in applying textbook information to the clinical setting. Furthermore, one retains more information when one reads with a purpose. In other words, the student should read with the goal of answering specific questions. There are seven fundamental questions that facilitate **clinical thinking:**

1. What is the most likely diagnosis?
2. How can you confirm the diagnosis?

3. What should be your next step?
4. What is the most likely mechanism for this disease process?
5. What are the risk factors for this disease process?
6. What are the complications associated with this disease process?
7. What is the best therapy?

Clinical Pearl

➤ Reading with the purpose of answering the seven fundamental clinical questions improves retention of information and facilitates the application of book knowledge to clinical knowledge.

WHAT IS THE MOST LIKELY DIAGNOSIS?

The method of establishing the diagnosis has been covered in the previous section. One way of attacking this problem is to develop standard approaches to common clinical problems. It is helpful to understand the most common causes of various presentations, such as the fact that "the most common locations of a leak in the breathing circuit begin at the patient, and become less frequent the farther away from the patient and closer to the anesthesia machine."

The clinical scenario might be "A 38-year-old woman undergoing breast biopsy under general anesthesia has a leak in the breathing circuit, noted by a failure of the ventilator bellows to rise. The patient is not receiving an adequate tidal volume, and the oxygen saturation is beginning to decline. Where should the student check first? What is the most likely location for the leak?"

With no other information to go on, the student uses the "most common cause" information, makes an educated guess that the patient has a leak in the endotracheal tube cuff, and adds more air to the cuff's balloon.

Then student uses the clinical pearl: "When detecting a leak in the breathing circuit, start at the patient and work back toward the machine."

Clinical Pearl

➤ When detecting a leak in the breathing circuit, start at the patient and work back toward the machine. Thus, the first step in detecting the location of the leak is to add air to the endotracheal tube's cuff. If the leak continues, move one step toward the machine, and check the connection of the endotracheal tube, followed by the connection of the end-tidal CO_2 tubing, etc.