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CRITICAL CARE

- 42 clinical cases with cutting edge discussions and practical management tips for critically ill patients
- Clinical pearls highlight key points
- Review questions reinforce learning
- Primer teaches you how to approach clinical problems

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CASE FILES®
Critical Care

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DEDICATION

To the Honorable Representative Lois W. Kolkhorst of Brenham, Texas, whose courage, vision, and dedication to Texas is like a fiery torch, giving light and warmth in the cold and darkness;

To the Texas Neonatal ICU and the Perinatal Advisory Councils of which Representative Kolkhorst championed and breathed life;

To the brilliant, unselfish, and talented members of these two Councils, whose noble goals are to improve health care for the pregnant women and newborns of Texas;

To David Williams and Matt Ferrara, two tireless state staff members, who are the heart and soul of the Councils;

To the pregnant women and newborns of the Great State of Texas, to whom I have devoted my energies, passion, talents, and professional career.

—ECT

To all the staff, medical students, residents, and colleagues that I have had the pleasure to teach and be involved with.

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—MS

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Eugene C. Toy

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INTRODUCTION

Mastering the cognitive knowledge within a field such as critical care is a formidable task. It is even more difficult to draw on that knowledge, procure and filter through the clinical and laboratory data, develop a differential diagnosis, and, finally, to make a rational treatment plan. In critical care, a detailed understanding of hemodynamics, cardiovascular and pulmonary medicine, and pharmacology are important. Sometimes, it is prudent to initiate therapy for significant derangements rather than finding out the precise underlying disorder. For instance, in a patient with respiratory failure, therapy to increase oxygenation and ventilation is initiated while simultaneously determining the etiology. It is done through a more precise understanding of the pathophysiology that allows for rational and directed therapy. The critical care setting does not allow for much error. A skilled critical care physician must be able to quickly assess the patient's situation and produce an efficient diagnostic and therapeutic plan.

These skills the student learns best at the bedside, guided and instructed by experienced teachers, and inspired toward self-directed, diligent reading. Clearly, there is no replacement for education at the bedside, especially because in "real life," delay in correct management leads to suboptimal outcome. Unfortunately, clinical situations usually do not encompass the breadth of the specialty. Perhaps the best alternative is a carefully crafted patient case designed to stimulate the clinical approach and the decision-making process. In an attempt to achieve that goal, we have constructed a collection of clinical vignettes to teach diagnostic or therapeutic approaches relevant to critical care medicine.

Most importantly, the explanations for the cases emphasize the mechanisms and underlying principles, rather than merely rote questions and answers. This book is organized for versatility: it allows the student "in a rush" to go quickly through the scenarios and check the corresponding answers, and it allows the student who wants thought-provoking explanations to obtain them. The answers are arranged from simple to complex: the bare answers, an analysis of the case, an approach to the pertinent topic, a comprehension test at the end, clinical pearls for emphasis, and a list of references for further reading. The clinical vignettes are placed in a systematic order to better allow students to gain an understanding of the pathophysiology and mechanisms of disease. A listing of cases is included in Section III to aid the student who desires to test his/her knowledge of a certain area, or to review a topic, including basic definitions. Finally, we intentionally did not use a multiple-choice question format in the opening case scenarios, because clues (or distractions) are not available in the real world.

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SECTION I

How to Approach Clinical Problems

Part 1 Approaching the Patient

Part 2 Approach to Clinical Problem Solving

Part 3 Approaching Reading

Part 1. Approaching the Patient

The transition from the textbook or journal article to the clinical situation is one of the most challenging tasks in medicine. Retention of information is difficult; organization of the facts and recall of a myriad of data in precise application to the patient is crucial. The purpose of this text is to facilitate in this process. The first step is gathering information, also known as establishing the database. This includes taking the history (asking questions), performing the physical examination, and obtaining selective laboratory and/or imaging tests. Of these, the historical examination is the most important and useful. Sensitivity and respect should always be exercised during the interview of patients.

CLINICAL PEARL

- The history is the single most important tool in obtaining a diagnosis. All physical findings, laboratory, and imaging studies are first obtained, and then interpreted, in the light of the pertinent history.

HISTORY

1. **Basic information:**
   a. **Age, gender, and ethnicity:** These should be recorded because some conditions are more common at certain ages; for instance, pain on defecation and rectal bleeding in a 20-year-old may indicate inflammatory bowel disease, whereas the same symptoms in a 60-year-old would more likely suggest colon cancer.
2. **Chief complaint:** What is it that brought the patient into the hospital or office? Is it a scheduled appointment, or an unexpected symptom? The patient's own words should be used if possible, such as, "I feel like a ton of bricks are on my chest." The chief complaint, or real reason for seeking medical attention, may not be the first subject the patient talks about (in fact, it may be the last thing), particularly if the subject is embarrassing, such as a sexually transmitted disease, or highly emotional, such as depression. It is often useful to clarify exactly what the patient's concern is; for example, they may fear their headaches represent an underlying brain tumor.
3. **History of present illness:** This is the most crucial part of the entire database. The questions one asks are guided by the differential diagnosis based on the chief complaint. The duration and character of the primary complaint, associated symptoms, and exacerbating/relieving factors should be recorded. Sometimes, the history will be convoluted and lengthy, with multiple diagnostic or therapeutic interventions at different locations. For patients with chronic illnesses, obtaining prior medical records is invaluable. For example, when

extensive evaluation of a complicated medical problem has been done elsewhere, it is usually better to first obtain those results than to repeat a "million-dollar workup." When reviewing prior records, it is often useful to review the primary data (eg, biopsy reports, echocardiograms, serologic evaluations) rather than to rely upon a diagnostic label applied by someone else, which then gets replicated in medical records and by repetition acquires the aura of truth, when it may not be fully supported by data. Some patients will be poor historians because of dementia, confusion, or language barriers; recognition of these situations and querying of family members is useful. When little or no history is available to guide a focused investigation, more extensive objective studies are often necessary to exclude potentially serious diagnoses.

4. **Past history:**
   a. **Any illnesses** such as hypertension, hepatitis, diabetes mellitus, cancer, heart disease, pulmonary disease, and thyroid disease should be elicited. If an existing or prior diagnosis is not obvious, it is useful to ask exactly how the condition was diagnosed; that is, what investigations were performed. Duration, severity, and therapies should be included.
   b. **Any hospitalizations and emergency room visits** should be listed with the reason(s) for admission, intervention, and the location of the hospital.
   c. **Transfusions** with any blood products should be listed, including any adverse reactions.
   d. **Surgeries:** The year and type of surgery should be recorded and any complications documented. The type of incision and any untoward effects of the anesthesia or the surgery should be noted.
5. **Allergies:** Reactions to medications should be recorded, including severity and temporal relationship to the medication. An adverse effect (such as nausea) should be differentiated from a true allergic reaction.
6. **Medications:** Current and previous medications should be listed, including dosage, route, frequency, and duration of use. Prescription, over-the-counter, and herbal medications are all relevant. Patients often forget their complete medication list; thus, asking each patient to bring in all their medications—both prescribed and nonprescribed—allows for a complete inventory.
7. **Family history:** Many conditions are inherited, or are predisposed in family members. The age and health of siblings, parents, grandparents, and others can provide diagnostic clues. For instance, an individual with first-degree family members with early onset coronary heart disease is at risk for cardiovascular disease.
8. **Social history:** This is one of the most important parts of the history which includes the patient's functional status at home, social and economic circumstances, and goals and aspirations for the future. These are often critical in determining the best way to manage a patient's medical problem. Living arrangements, economic situations, and religious affiliations may provide important clues for

puzzling diagnostic cases, or suggest the acceptability of various diagnostic or therapeutic options. Marital status and habits such as alcohol, tobacco, or illicit drug use may be relevant as risk factors for the disease.

9. **Review of systems:** A few questions about each major body system ensure that problems will not be overlooked. The clinician should avoid the mechanical "rapid-fire" questioning technique that discourages patients from answering truthfully because of fear of "annoying the doctor."

PHYSICAL EXAMINATION

The physical examination begins as one is taking the history, by observing the patient and beginning to consider a differential diagnosis. When performing the physical examination, one focuses on body systems suggested by the differential diagnosis, and performs tests or maneuvers with specific questions in mind; for example, does the patient with jaundice have ascites? When the physical examination is performed with potential diagnoses and expected physical findings in mind ("one sees what one looks for"), the utility of the examination in adding to diagnostic yield is greatly increased, as opposed to an unfocused "head-to-toe" physical.

1. **General appearance:** A great deal of information is gathered by observation, as one notes the patient's body habitus, state of grooming, nutritional status, level of anxiety (or perhaps inappropriate indifference), degree of pain or comfort, mental status, speech patterns, and use of language. This forms your impression of "who this patient is."

2. **Vital signs:** Temperature, blood pressure, heart rate, and respiratory rate. Height and weight are often placed here. Blood pressure can sometimes be different in the 2 arms; initially, it should be measured in both arms. In patients with suspected hypovolemia, pulse and blood pressure should be taken in lying and standing positions to look for orthostatic hypotension. It is quite useful to take the vital signs oneself, rather than relying upon numbers gathered by ancillary personnel using automated equipment, because important decisions regarding patient care are often made using the vital signs as an important determining factor.

3. **Head and neck examination:** Facial or periorbital edema and pupillary responses should be noted. Funduscopic examination provides a way to visualize the effects of diseases such as diabetes on the microvasculature; papilledema can signify increased intracranial pressure. Estimation of jugular venous pressure is very useful to estimate volume status. The thyroid should be palpated for a goiter or nodule, and carotid arteries auscultated for bruits. Cervical (common) and supraclavicular (pathologic) nodes should be palpated.

4. **Breast examination:** Inspect for symmetry, skin or nipple retraction with the patient's hands on her hips (to accentuate the pectoral muscles), and also with arms raised. With the patient sitting and supine, the breasts should then be palpated systematically to assess for masses. The nipple should be assessed for discharge and the axillary and supraclavicular regions should be examined for adenopathy.

5. **Cardiac examination:** The point of maximal impulse (PMI) should be ascertained for size and location, and the heart auscultated at the apex as well as at the base. Heart sounds, murmurs, and clicks should be characterized. Murmurs should be classified according to intensity, duration, timing in the cardiac cycle, and changes with various maneuvers. Systolic murmurs are very common and often physiologic; diastolic murmurs are uncommon and usually pathologic.

6. **Pulmonary examination:** The lung fields should be examined systematically and thoroughly. Wheezes, rales, rhonchi, and bronchial breath sounds should be recorded. Percussion of the lung fields may be helpful: hyperresonance may indicate tension pneumothorax, while dullness may point to a consolidated pneumonia or a pleural effusion.

7. **Abdominal examination:** The abdomen should be inspected for scars, distension, and discoloration (example: the Grey-Turner sign of flank discoloration indicates intra-abdominal or retroperitoneal hemorrhage). Auscultation of the bowel can identify normal versus high-pitched, and hyperactive versus hypoactive sounds. The abdomen should be percussed, including assessing for liver and spleen size, and for the presence of shifting dullness (indicating ascites). Careful palpation should begin initially away from the area of pain, involving one hand on top of the other, to assess for masses, tenderness, and peritoneal signs. Tenderness should be recorded on a scale (eg, 1 to 4 where 4 is the most severe pain). Guarding, whether it is voluntary or involuntary, should be noted.

8. **Back and spine examination:** The back should be assessed for symmetry, tenderness, and masses. The flank regions are particularly important to assess for pain on percussion, which might indicate renal disease.

9. **Genitalia:**
   a. **Females:** The pelvic examination should include an inspection of the external genitalia, and with the speculum, evaluation of the vagina and cervix. A pap smear and/or cervical cultures may be obtained. A bimanual examination to assess the size, shape, and tenderness of the uterus and adnexa is important.
   b. **Males:** An inspection of the penis and testes is performed. Evaluation for masses, tenderness, and lesions is important. Palpation for hernias in the inguinal region with the patient coughing to increase intra-abdominal pressure is useful.

10. **Rectal examination:** A digital rectal examination is generally performed for individuals with possible colorectal disease or gastrointestinal bleeding. Masses should be assessed, and stool for occult blood should be tested. In men, the prostate gland can be assessed for enlargement and for nodules.

11. **Extremities:** An examination for joint effusions, tenderness, edema, and cyanosis may be helpful. Clubbing of the nails might indicate pulmonary diseases such as lung cancer or chronic cyanotic heart disease.