Medical Students Guide to

PEDIATRIC SURGERY

Children's National

WELCOME TO PEDIATRIC SURGERY

This is a busy surgical service with lots to see and do. Our goal is to integrate you into the service so that you can get the best experience possible during your time here. This guide details the structure of our service along with some pointers to help get you up and running.

DAILY SCHEDULE		
6 a.m.	Morning rounds *	6th fl, East, NICU front desk
7 a.m.	Radiology rounds	2nd fl, East, Radiology Body reading room
7:30 a.m.	OR start (starts at 8:30 a.m. on Thurs)	2nd fl, Main
8 a.m. - 4 p.m.	Clinic	4th fl Main, Suite 4400
5 p.m.	Afternoon rounds	5th fl, East (outside room 501)

**Sat & Sun rounds start at 7 or 7:30 a.m., confirm time with team*

ROTATION SCHEDULE

Your rotation will start on August 31 and will end on September 18, 2020. See attached schedule.

1. General surgery clinic days are Mondays, Tuesdays, Thursdays and Fridays in Suite 4400
2. Telehealth clinics are generally scheduled at the end of clinic
3. General surgery elective OR days by faculty members are each day.
4. The add-on room runs each day.
5. Your schedule will include time spent in the surgery clinic, in the OR, with the consult resident, and with the surgeon of the day.

TEACHING SESSIONS:

7:00 - 9:00 A.M.
Thursday
Morning Pediatric Surgery Conference
Guzzetta Library

3:00 - 5:30 P.M.
generally between Tuesdays and Fridays
Medical student lectures
Guzzetta Library

TOPICS COVERED:

- Lab values
- Newborn intestinal obstruction
- Trauma/Burn
- Pyloric Stenosis/Electrolytes
- Abdominal pain/appendicitis
- Interesting Case Discussions

THE ROTATION INTENDS TO:

- Provide broad exposure to a number of conditions common in general surgical practice
- Provide exposure to surgical conditions unique to the pediatric and neonatal population
- Introduce and refine effective verbal and written communication regarding surgical patients
- Introduce the basic tenets of trauma and burn care
- Introduce the evaluation and examination of pediatric and neonatal patients
- Hone your skills in performing the abdominal exam
- Provide Coaching on:
  a. Presentations
  b. Notes
  c. Physical Exam
  d. Procedures
- Help you feel like a member of the team by having you participate in:
  a. Presentations
  b. Following patients
  c. Performing tasks on the in-patients
  d. Taking Call

ROUNDS:

- **Morning rounds** – You are expected to be at the NICU front desk at 6 a.m. (Monday thru Friday). Check for weekend rounds timing with the fellows, and whether you are expected to join.
- On your first day you will see that the resident on call the previous night presents the patients. Pay attention to understand the current issues. Once you are more familiar with the service, you will assume the role of presenting patients on morning rounds.
- You should present patients you have met either in the ER, on their admission, or at the time of their operation.
- Rounds proceed in a "top-down" fashion working through the various medical and surgical units and end in the radiology department. In radiology, pertinent imaging and plans for each patient will be reviewed. Write these plans down and offer to help the residents/NPs with following up on tasks.
- Afternoon Rounds-start around 5 p.m. (Monday thru Friday) on 5 East, outside room 501 and are not as extensive as morning rounds, but this is a good opportunity to present patients that you are following. It is helpful to let the NP or Consult Resident know that you are ready to present the case.
- Your goal by the end of the rotation is to be presenting 2-4 patients to the team on morning rounds and/or afternoon rounds.
- Your day usually ends around 6:30 p.m..

PRESENTATIONS:

- Presentations should follow a SOAP format. (see below)
- Students should organize and prioritize information according to the diagnosis and structure the presentation to substantiate the assessment and plan. Include details only if they are going to be addressed in the assessment and plan.

History

Physical Examination

Data

Differential Diagnosis

Treatment

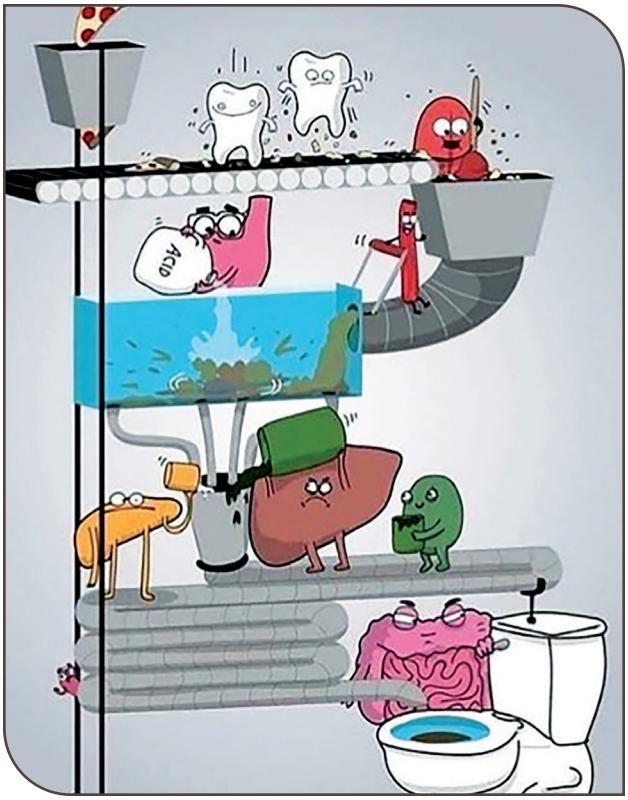
SOAP NOTE EXAMPLE:	
ID: BB is POD#5	He has had a lap appy for perforated appendicitis
Subjective:	complaints, overnight events, diet progress
Objective	Tmax, UOP (cc/kg/hr) pertinent exam findings labs/studies
Assessment:	(doing well, persistent ileus, persistent fevers)
Plan:	(discharge home, continue NPO, continue antibiotics plan for CT scan POD#7)

OPERATING ROOM:

- The operating room is on the 2nd floor near the East Inpatient Tower elevators.
- Review the anatomy, patient history, and the planned surgery the night before. You can get the schedule for the next day on Cerner under the "Case Selection" Tab. You should ask the fellows which cases you will be involved with so you can prepare in advance.
- Use the tracking boards in the preop area to identify the OR room and approximate start times. Once all parties have "gone green" on the tracking board, the patient will be taken from the preop area to the OR. This is a good way to estimate when surgery will start, but the most reliable way to make sure you are in the OR on time, is to be with the patient in preop. Feel free to introduce yourself to the patient and family, and be ready to accompany the patient to the OR.
- Tips for interpreting the tracking board:
  - **OR 99** – lists the add-on cases for the day
  - **OR 21** – lists cases which have been cancelled
  - OR Rooms listed with the surgery attendings: Sandler, Petrosyan, Badillo, Kane, Burd, Nadler, Thenappan, Torres, Lukish, Levitt, Feng
- **OR etiquette –** When you come to the operating room, always introduce yourself to the surgical attending, circulating nurse, and scrub tech. If you will be scrubbing in, offer to get your own gloves and gown. Be respectful of the sterile field (e.g. don't touch anything blue.) Ask another medical student or a scrub tech to orient you if you do not know what you are doing.
- You can offer to help with:
  - Transporting the patient to/from the OR
  - Transferring the patient to the operating table/bed
  - Moving the bed into/out of the hallway
  - Strapping/unstrapping the patient to the table

CONSULTS:

- Work alongside the consult resident – make sure they can reach you if there is a new consult on the floor or in the ER.
- These are an excellent opportunity to do a complete H & P and to satisfy the Abdominal and Vascular Exam requirements for the rotation
- Be **PROACTIVE** and offer to see the consults **FIRST**



CLINIC:

- The primary focus of clinic is to gain exposure to outpatient surgical care
- Surgery clinic is located in the Main Building, 4th floor, Suite 4400.
- You will work one-on-one with an attending
- Please dress in clinic attire, scrubs are also ok.

CALL ROOMS:

- Students usually leave their things in the intern call room, E5000, on 5 East. This a good place to stash water bottles or a review book, especially since it's on 5 East, but it is not locked. For overnight call, the students should use the call rooms on 4 Main.
- The room numbers are:
  - M4280 is the female call room (across the hall from the pharmacy window).
  - M4278 is the male call room (around the corner from the female call room).

  (The doors are locked and the code is 9375 for both.)
- There are also lockers in these rooms, so students can lock their valuables there.
- The rooms are generally very clean and have fresh linens out, but they are shared with the medical students on pediatrics and some of the NPs. If the sheets need changing on the beds, there is a number for facility management on the back of the call room door.

IMPORTANT WEBSITES:

- http://amion.com is where you find the residents' and fellows' call schedules. The password is pedsurg. You'll mainly use this site to determine which resident/intern you're on call or doing consults with.
- http://intranet.cnmc.org is where you can find the link to text page a pager. In the right hand corner, hover over the golden "Helpful Links" menu then click on "Paging and Staff Directory." You can search for a person by name or pager number.

RESIDENT ASCOM NUMBER:

- 202-476-8207 or 8208– On call resident
- 202-476-8209 – Fellow/Senior resident on call

HIGH YIELD THINGS TO REVIEW/READ ON ROTATION:

- Hernias (of all kinds); know the anatomy for hernias
- Watch the WiseMD cases for the pediatric cases
- Read the Pediatric Surgery section of Surgical Recall
- Read the Acute Abdomen Section of Surgical Recall, the Pestana Review, and do all the Access Surgery questions (make sure you know the ways appendicitis presents and the differential, especially for females - this repeats over and over during Consult Week and when you are on call)
- Symptom based diagnoses readings
- Review the anatomy for cases that you scrub into

TAKING INITIATIVE

- Do not be afraid to ask questions even of people not affiliated directly with the general surgery team.
- This rotation is a great chance to learn the basics of anesthesia, communicate with nurses (during morning rounds on 5E the charge nurse will have a sheet with the nurses' overnight notes on patients, don't be afraid to walk with the nurse and ask to read those notes in addition to what our team is presenting)
- Learn about critical care in the ICU. The ICU attendings and fellows are willing to answer questions at the appropriate time.

ON CALL

- Identify yourself to the fellow and resident on call while on afternoon rounds
- Hierarchy of educational activities while on call is based on acuity and frequency
  - OR cases
  - Trauma activations
  - Consults
  - Floor work, post op checks
- Students have the option to leave at 8 p.m. or stay overnight
  - Maximize your learning experience
- If you stay overnight, you leave the following day after morning rounds

WEEKENDS

- You do not have to come in on the weekend, unless you're on call but you can choose to come in to help on these rounds.
- Weekend rounds usually start at 7 or 7:30 a.m., but this can change so confirm rounding time with the fellow
- The student on call the night before should text the next student on call if they hear any changes in the rounding time

SELF-LEARNING

- Always have something in hand to read
- Symptom based learning is key at this stage of your training
- The concept of 9 out of 10 cannot be over emphasized
- Create a Book of Pearls

APPENDIX A

Medical Student Case Presentation – circle any word you do not recognize

A 34 week ex-premature infant boy, who was prenatally diagnosed with polyhydramnios and an absent gastric bubble, was born today. You are called to see them in the NICU. There was meconium staining at delivery and APGARs were 5 and 8. He experienced respiratory distress, with saturations in the 80s, responsive to oxygen, but which worsened. He then required intubation, starting with high PEEPs and PIPs of 20 over 5. Once on positive pressure ventilation, his respiratory status worsened and he had to go onto the oscillator. ABGs showed a respiratory acidosis, and his cyanosis continued. An OG tube would not pass and stayed just below the clavicles on x-ray. The team became suspicious that this was esophageal atresia. On the x-ray the 3-0 ET tube was 3 cm above the carina. There was a significant air leak. A larger tube was placed, this time a little deeper in an attempt to cover the trachea-esophageal fistula. Lung movements remained good and he was hemodynamically stable. MAPs remained in the mid 30's and he was started on pressors. A PICC line was placed in the left antecubital vein, knowing that he would be NPO and would need parenteral nutrition. He was started on D10 with electrolytes. The abdominal xray had also shown a gastric bubble and distal air was noted. The rest of his exam was normal including no signs of VACTERL syndrome, however he did have a 3 over 6 holosystolic murmur, and the ECHO confirmed a VSD. The aortic arch was on the left side. He went to surgery on day of life one for a right thoracotomy with TEF ligation. The distal esophagus was noted at the level of the carina where it was ligated. A primary esophageal repair was performed using 5-0 PDS, with no tension. He returned to the NICU with a chest tube and pleurovac at 15 mm Hg, on low wall suction. On postoperative day 2 he was extubated but had an episode of stridor. ENT performed bedside laryngoscopy and noted that the right vocal cord was not moving, and there was concern for an injury to the recurrent laryngeal nerve. A transanastomotic tube had been left and distal feedings were started. An esophagogram is planned for postoperative day seven.

APPENDIX B

Potential components of a differential diagnosis:

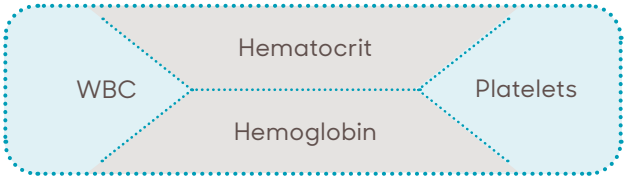
"V – TIT – MEND – FC"

Vascular
Tumor
Infection/inflammation
Trauma/Toxin
Metabolic
Endocrinologic
Nutritional
Degenerative
Functional
Congenital

THE CLINICAL VALUE OF LABORATORY VALUES

Marc A Leuitt, M.D. Children's National Hospital

THE COMPLETE BLOOD COUNT (CBC)



- Patients with sickle cell disease normally have elevated WBCs because they have auto-infarcted their spleen over time, and therefore have a great amount of white cells circulating in the blood stream, rather than sequestered in the spleen.
- When you see an elevated WBC, check the hematocrit. Sometimes the elevated WBC is a reflection of hemoconcentration from dehydration.
- If a patient is anemic, check the MCV. A low MCV, i.e. hypochromic microcytic anemia is due to iron deficiency anemia (in surgery patients from occult blood loss such as a colon cancer, or heavy menses), sideroblastosis (lead poisoning), thalassemia trait, or chronic disease.
- Patients with thalassemia trait can be diagnosed by performing a hemoglobin electropheresis.
- If the WBC is low, check the other blood elements. A low WBC, HgB, and platelet count may represent marrow suppression, and thus all blood lines are depressed.
- In trauma, the initial hematocrit may be normal, because blood has been lost from the intravascular space, but equilibriation between intravascular and extravascular fluid may not yet have occurred.
- A very low WBC may occur in sepsis, particularly in babies and the elderly
- Anemia with a high MCV is due to either folate or BI2 deficiency.
- Infections that lead to very high WBC counts, (greater than 25K) include pyleonephritis and clostridium difficile.
- A high platelet count can be an indicator that the patient is sick or stressed as platelets are an acute phase reactant.
- A high platelet count can also indicate the absence of the spleen, such as thrombocytosis that develops within weeks of splenectomy.
- Platelets are an acute phase reactant and are elevated when the patient is stressed.
- A very high hematocrit can be due to polycythemia vera.
- A decreased platelet count can be caused by H2 blockers
- Premature infants with necrotizing enterocolitis often have a low platelet count
- Hypochromic microcytic anemia can be due to iron deficiency anemia, chronic disease, thalassemia minor, and sideroblastosis (lead poisoning)
- With uremia, the platelet count can be normal, but the platelets don't function well.
- Patients with Crohn's disease or in other situations with a non-functioning or resected terminal ileum, the patient may become B12 deficient and develop a macrocytic anemia.
- In this case, the B12 levels can be normal, the B12 just cannot be absorbed.
- Intrinsic factor is required for B12 absorption, so patients with absent intrinsic factor (gastric resections, pernicious anemia) can develop B12 deficiency anemia.
- Infections may not lead to elevated WBC's but remember to check the differential which may show a bandemia or elevated neutrophil count.
- The causes of hypochromic, microcytic anemia include: Iron deficiency anemia, thalassemia minor (thal trait), chronic disease, and sideroblastosis (Lead poisoning)

ELECTROLYTES

Sodium	Chloride	BUN
Potassium	Bicarb	Creatinine

- Depending on the condition of the heart and lungs, dehydration and hypovolemia can lead to either hypematremia or hyponatremia. In healthy people, it usually causes hypematremia.
- The BUN to creatitine ratio reflects hydration status because with increased GFR (which happens when the body is trying to hold onto free water), urea is reabsorbed, but creatinine flows out because it is neither secreted or reabsorbed, thus relative to creatitine, the BUN goes up. When hypovolemia becomes more pronounced and renal blood flow stars to decrease, creatinine will start to rise.
- Hyperkalemia occurs with gangrene, ischemic bowel, and other conditions with non-perfused tissues.
- A low bicarbonate reflects acidosis. In surgical patients, this anion gap acidosis is often due to lactate, which can occur with ischemic bowel.
- In a hyperglycemic patient, one must adjust the Na concentration before treating hyponatremia– for every 100 mg/dL glucose increase above 200, sodium decreases by –1.6 mEq/L
- Volume trumps acid base status when the body needs to choose between the two
- Dehydration for 4 or more days can lead to acute tubular necrosis
- Osmotic diuresis from hyperglycemia can lead to dehydration
- For a slightly low potassium consider and aldosterone secreting tumor or adrenal insufficiency
- Maintenance rate of fluids can be calculated using the 4:2:1 rule, 4 cc for the first 10 kg, 2 cc for the next 10 kg, and 1 cc for each kg thereafter. e.g. A 20 kg child requires 10 x 4 + 10 x 2 = 60 cc per hour.

LIVER FUNCTION

- The tests that help determine synthetic function of the liver include prothrombin time, albumin, and cholesterol.
- Transaminases (ALT and AST) are present in the hepatocyte and if elevated represent liver cell injury, i.e. trauma, hepatitis.
- Alkaline phosphatase is present in both the bile duct and bone, so elevations are not necessarily specific to biliary inflammation or obstruction.
- Normally alkaline phosphatase levels in growing children are elevated due to bone development. Low levels are commonly seen in chronically ill children.
- An obstructed bile duct does not allow bile into the duodenum which thus prevents absorption of fat. Without micelles, fat soluble vitamins are not absorbed, and therefore the vitamin K dependent factors are not available to the liver. In this situation, the prothrombin time can be elevated despite normal liver function, and is due to the lack of vitamin K dependent factors that resulted from the biliary obstruction.
- Elevated conjugated bilirubin usually means an obstruction of biliary flow
- PT is the most sensitive indicator for decreased liver function
- Newborns clotting function is immature, and because of this, all newborns receive vitamin K in the delivery room.
- Elevated conjugated bilirubin means that the liver is working but cannot get the bilirubin out due to an obstruction of bile flow.
- Elevated unconjugated bilirubin means there is excess bilirubin created in the bloodstream that the liver cannot handle and must allow to pass through it back into the bloodstream, i.e. hemolysis.

1 **A patient with progressive liver cirrhosis presents to the emergency room malnourished and with new onset ascites. Which of the following laboratory values does not help you determine his synthetic liver function?**

a. Transaminase
b. Cholesterol
c. Prothrombin time
d. Albumin
e. Pre-albumin

Answer: A

---

2 **A 10 year old child presents with abdominal pain, diarrhea, and vomiting for three days. You suspect that he might have appendicits. His white blood cell count is 12, 000. His Hematocrit is 49. The next step in your management would be:**

a. Take him urgently to the operating room. The elevated white blood cell count is a sign of infection, and with these symptoms confirms your suspicion of appendicitis.

b. Initiate hydration and continue with the evaluation. The white blood cell count of 12,000 demonstrates that he is hemoconcentrated which occurs because of his relative hypovolemia.

c. Analyze a blood smear to evaluate the elevated hematocrit.

d. Transfuse two units of packed red cells

e. Send him home, recommend two tablets of acetominophen, and instruct the family to call you in the morning.

Answer: B

---

3 **A 60 year old man presents with weakness and abdominal pain. You note on his initial laboratory evaluation that he is anemic, with a hemoglobin of7. A stool guiac test is positive, demonstrating occult blood. His heart rate and blood pressure are normal.**

a. His MCV would likely be low, suggesting a chronic blood loss and iron deficiency anemia. You should be suspicious of a GI malignancy.

b. His MCV would be high as he likely has a vitamin deficiency which can explain this presentation.

c. His MCV would be normal. He has had an acute GI bleed within the last 48 hours and needs an urgent blood transfusion.

d. The next test should be a bone marrow biopsy to assess his iron stores.

e. Analyis of his blood smear would show hyperchromic macrocytic red cells.

Answer: C

---

4 **An 80 year old man is brought to the emergency room lethargic. His granddaughter found him in his apartment, confused, and states that it seemed like he had not eaten or had anything to drink in three days since her last visit. His heart rate is ll 0 and his blood pressure is 90/60. His initial laboratory evaluation demonstrates a BUN of 30 and a creatinine of 1.6. The explanation for the elevation in the normal BUN to creatinine ratio is:**

a. His dehydration forces the kidney to absorb more creatinine.

b. His dehydration leads to an imbalance in the sodium and potassium transport mechanism

c. Because of his dehydration, his GFR is elevated, and thus he reabsorbs more urea relative to creatinine

d. Creatinine is not secreted when there is relative hypovolemia

e. More urea is made by the liver in a state of dehydration.

Answer: D

---

5 **A 2 year old child has an ileocolic intussusception. He weighs 12 kilograms. He has been sick at home with crampy abdominal pain and vomiting for the last three days until the parents brought him in. His diaper is dry, he is crying but you note no tears. Your next step in initial management is to place intravenous access and:**

a. Administer a fluid bolus of 48 cc of NS

b. Administer a fluid bolus of 240 cc of 05W

c. Start maintenance fluids at a rate of 24 cc per hour, 051/2 NS

d. Administer a fluid bolus of 240 cc of NS

e. Start maintenance fluids at a rate of 48 cc hour, 051/2 NS + 40 meQ KCL/liter

Answer: E

6 **A 50 year old man presents with jaundice. You determine that he has obstructive jaundice from a pancreatic tumor. You note on his initial laboratory values that his prothombin time is elevated. He has a direct hyperbilirubinemia. A possible explanation for the elevated PT is:**

a. He is in liver failure from the blockage of his bile duct

b. His liver function has declined significantly and thus he cannot make clotting factors

c. His liver function is normal, but because of obstruction of the bile duct, he cannot make micelles, and thus cannot absorb vitamin K dependent clotting factors.

d. Because of the underlying malignancy, his bone marrow is suppressed, affecting his coagulation cascade

e. APT elevation is a known lab error that can occur when the bilirubin is elevated.

Answer: E

EDUCATIONAL STRATEGIES TO PROMOTE CLINICAL DIAGNOSTIC REASONING

Judith L. Bowen, M.D.

From the Department of Medicine, Oregon Health and Science University, Portland.Address reprint requests to Dr. Bowen at the Department of Medicine, 3181 S.W. Sam Jackson Park Rd., L-475, Portland, OR 97239, or at bowenj@ohsu.edu. N Engl J Med 2006;355:2217-25.

Clinical teachers differ from clinicians in a fundamental way. They must simultaneously foster high-quality patient care and assess the clinical skills and reasoning of learners in order to promote their progress toward independence in the clinical setting.[1] Clinical teachers must diagnose both the patient's clinical problem and the learner's ability and skill.

To assess a learner's diagnostic reasoning strategies effectively, the teacher needs to consider how doctors learn to reason in the clinical environment.[2-4] Medical students in a classroom generally organize medical knowledge according to the structure of the curriculum. For example, if pathophysiology is taught according to organ systems, then the student's knowledge will be similarly organized, and the recall will be triggered by questions related to specific organ systems or other contextual clues. In the clinical setting, the patient's health and care are the focus. Clinical problems may involve many organ systems and may be embedded in the context of the patient's story and questions. Thus, in the clinical setting, the student's recall of basic science knowledge from the classroom is often slow, awkward, or absent. Only after learners make new connections between their knowledge and specific clinical encounters can they also make strong connections between clinical features and the knowledge stored in memory.[5,6] This report focuses on how clinical teachers can facilitate the learning process to help learners make the transition from being diagnostic novices to becoming expert clinicians.

DIAGNOSTIC REASONING

There is a rich ongoing debate about our understanding of the complex process of clinical diagnostic reasoning.[2,3] In this report, some of the basic processes involved in clinical reasoning, as understood according to current knowledge, are translated into practical and specific recommendations for promoting the development of strong diagnostic reasoning skills in learners. The recommendations are illustrated by a clinical case presentation.

Clinical teachers observe learners gathering information from patients, medical records, imaging studies, results of laboratory tests, and other health care providers. On the basis of their observations, and through the discussion of clinical cases, teachers draw conclusions about the learners' performance, including their reasoning processes. A hypothetical case provides an example of a conversation involving a patient, two learners with different levels of expertise, and the clinical teacher (see Box). In this case,[7-9] a patient with knee pain makes an urgent visit to an ambulatory care practice. A novice resident (with relatively little experience with this patient's problem, which is gout) and an expert resident (who is familiar with this problem, having seen other patients with

gout) each independently interviews the patient, performs an examination, presents the case to the preceptor, and separately discusses the case with the preceptor. As becomes evident, the expert resident has transformed the patient's story into a meaningful clinical problem. The novice resident has also transformed the patient's story, but less elaborately. What the teacher hears from both residents differs substantially from what the patient told them.

The expert resident brought two sets of skills to the encounter with the patient. First, this resident probably formed an early impression — a mental abstraction — of the patient's story. Although possibly unaware of this formulation, the resident's mental abstraction influenced his diagnostic strategy. Guided by his early impression, the resident probably asked a series of questions, and the patient's responses guided both further questioning and the planning of a focused physical examination. The resident's approach involved a search for information that could be used to discriminate among any number of diagnostic explanations of the patient's problem. The novice resident might not have formed a mental abstraction of the case and probably was not sure which questions to pose to the patient.

Second, the expert resident's clinical case presentation was a succinct summary of the findings, providing the teacher with a clinical picture of the patient as seen through the resident's eyes. On the basis of the case presentations by both the expert and the novice residents, the teacher may or may not have had a firm idea of what was wrong with the patient. Rather than offer an opinion, however, the teacher asked the expert resident to reason aloud about the case, thereby providing the teacher with additional clinical information about the patient as well as considerable insight into the resident's clinical reasoning skills. The teacher used the same strategy with the novice resident, and although the result added little information about the patient, the teacher learned something about the novice resident's limited clinical reasoning.

Key elements of clinical diagnostic reasoning are shown in **Figure 1.** The first step in diagnostic reasoning, which is based on knowledge, experience, and other important contextual

THE CASE AS SEEN BY A NOVICE RESIDENT AND AN EXPERT RESIDENT

PATIENT'S STORY: My knee hurt me so much last night, I woke up from sleep. It was fine when I went to bed. Now it's swollen. It's the worst pain I've ever had. I've had problems like this before in the same knee, once 9 months ago and once 2 years ago. It doesn't bother me between times.

NOVICE RESIDENT'S PRESENTATION:
My next patient is a 54-year-old white man with knee pain. It started last night. He does not report any trauma. On examination, his vital signs are normal. His knee is swollen, red, and tender to touch. It hurts him a lot when I test his range of motion. He's had this problem twice before.

EXPERT RESIDENT'S PRESENTATION:
My next patient is a 54-year-old white man with a sudden onset of pain in his right knee that awakened him from sleep. He does not report any trauma and was essentially asymptomatic when he went to bed. His history is remarkable for two episodes of similar, severe pain 9 months and 2 years ago. He is pain-free between episodes. He is afebrile today. His knee is swollen, tender to touch, and erythematous.

TEACHER'S INQUIRY: What do you think is causing this patient's knee pain?

NOVICE RESIDENT'S RESPONSE:
It could be an infection. It could be a new onset of rheumatoid arthritis. It could be Lyme disease. Since he doesn't recall falling, I doubt it's an injury. I don't know whether osteoarthritis ever presents like this, but he does have a history of knee pain.

EXPERT RESIDENT'S RESPONSE:
The patient has acute gout. He has had multiple discrete episodes with abrupt onset of extremely severe pain involving a single joint with evidence of inflammation on examination. Before all his episodes, he is asymptomatic. I would have expected gout to affect the first metatarsophalangeal joint, but it can present in the knee. Nothing suggests any ongoing, chronic problem in the knee. I don't see any portal of entry to suggest acute infectious arthritis and he looks quite well for that. His other joints are normal on examination. I doubt that he has a flare-up of osteoarthritis with pseudogout or a systemic, inflammatory arthritis such as rheumatoid arthritis.

factors,[10] is always data acquisition. Data acquisition, depending on the setting, may include elements of the history, the findings on physical examination, and the results of laboratory testing and imaging studies. Another early step is the creation of the mental abstraction or "problem representation," [2,8,11] usually as a one-sentence summary defining the specific case in abstract terms. Clinicians may have no conscious awareness of this cognitive step. The problem representation, unless elicited in the teaching setting, is rarely articulated. Rather, the teacher infers the learner's problem representation from the learner's presentation of the case.

For the case used as the example, the expert resident's problem representation, had it been elicited, might have been the following: "The acute onset of a recurrent, painful, monoarticular process in an otherwise healthy middle-aged man." The problem representation illustrates the transformation of patient-specific details into abstract terms. "Last night" became "acute onset," "I've had problems like this before" became "recurrent," "same knee" became "monoarticular," and the patient's age, sex, and medical history are summarized as "otherwise healthy, middle-aged man." In this transformation, the characterization of the problem facilitates the retrieval of pertinent information from memory.[7] The novice resident may be less able than the expert resident to develop an accurate problem representation.

When prompted by the teacher to reason about the case, the expert resident used abstract semantic qualifiers to describe the case findings. Semantic qualifiers are paired, opposing descriptors that can be used to compare and contrast diagnostic considerations. The resident used several implied pairs when considering hypotheses for a diagnosis of gout: multiple (not single) and discrete (not continuous) episodes, abrupt (not gradual) onset, severe (not mild) pain, and a single joint (not multiple joints). The use of such semantic qualifiers is associated with strong clinical reasoning.[7-9]

To create a concise, appropriate problem representation and to reason succinctly, the resident must have clinical experience with similar patients

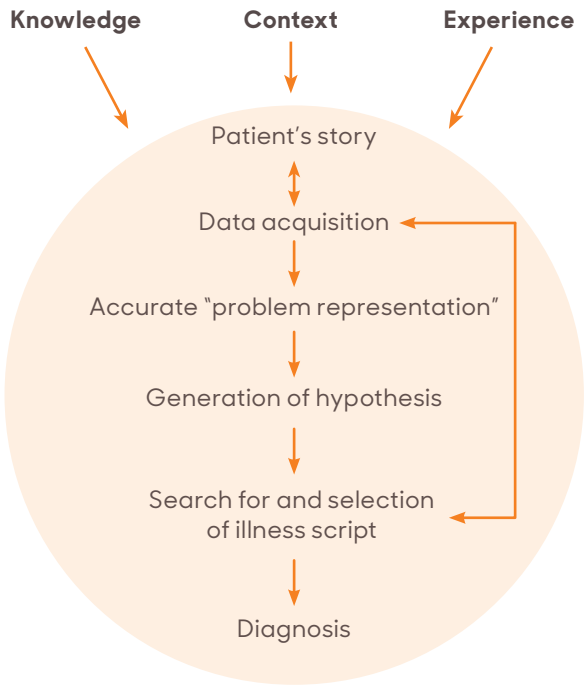


FIGURE 1. Key Elements of the Clinical Diagnostic Reasoning Process.

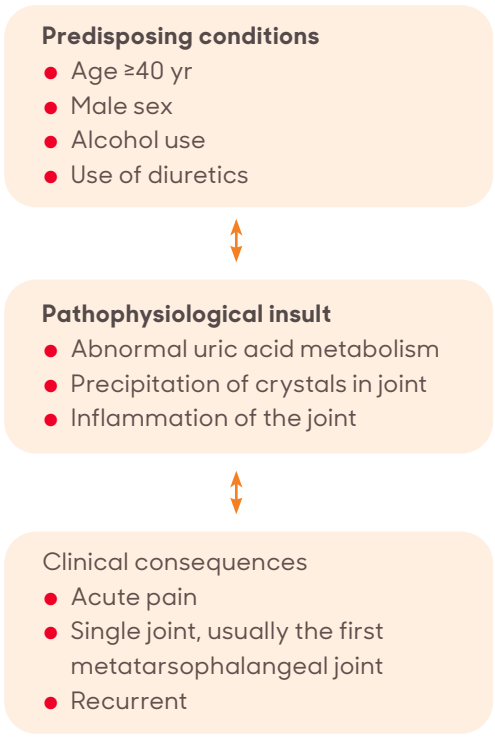


FIGURE 2. Example of an Illness Script for Gout.

and must be able to recognize the information that establishes gout as the diagnosis while ruling out other possibilities. The way the clinical experience is stored in memory either facilitates or hinders the ability to formulate the problem representation. Expert clinicians store and recall knowledge as diseases, conditions, or syndromes — "illness scripts" — that are connected to problem representations. [2,4,12,13] These representations trigger clinical memory, permitting the related knowledge to become accessible for reasoning. Knowledge recalled as illness scripts has a predictable structure: the predisposing conditions, the pathophysiological insult, and the clinical consequences **(Fig. 2)**.

Constructed on the basis of exposure to patients, illness scripts are rich with clinically relevant information. Their content varies for each physician and among physicians. Some illness scripts are conceptual models, such as groups of diseases, whereas others are representational memories of specific syndromes. With experience, clinicians also store memories of individual patients, and the recollection of a particular patient often triggers the recall of relevant knowledge.[14] The defining and discriminating clinical features **(Fig. 3)** of a disease, condition, or syndrome become "anchor points" in memory. In the future, recollection of such stored experiences expands the clinician's ability to recognize subtle but important variations in similar cases.[13]

When prompted to reason aloud, the novice resident listed possible causes of knee pain. The expert resident, however, compared and contrasted several relevant hypotheses — acute gout, infectious arthritis, osteoarthritis with pseudogout, and rheumatoid arthritis — and included the discriminating features of each possibility. Such reasoning may represent the mental processes of searching for and verifying an illness script, with the elimination of hypotheses for which the defining features of a specific illness script are absent.[2,4,12,13] Such comparisons often take place in the expert clinician's mind during the data-acquisition phase and form the basis of a focused strategy for questioning the patient and for the physical examination. Additional data gathering is purposeful: it is a search for the defining and discriminating features of each illness script under consideration.

Clinicians familiar with the clinical presentation of gout will recognize the pattern of symptoms and signs of gout in the expert resident's case presentation. Such rapid, nonanalytic clinical reasoning is associated with experience with the type of problem, in this case gout. The defining features for a diagnosis of gout are associated in memory as an illness script and, for some clinicians, are also associated with memories of individual patients. Access to these memories is easily triggered when the clinical findings of gout are present. The expert resident recognized the pattern of symptoms and signs of gout and selectively accessed the illness script constructed on the basis of experience.

The novice resident's clinical experience withgout was limited; perhaps knowledge gained fromprior cases of gout failed to be transferred to memory. The novice resident used a slower, more deliberate method of testing a hypothesis for this clinical problem, generating multiple plausible hypotheses

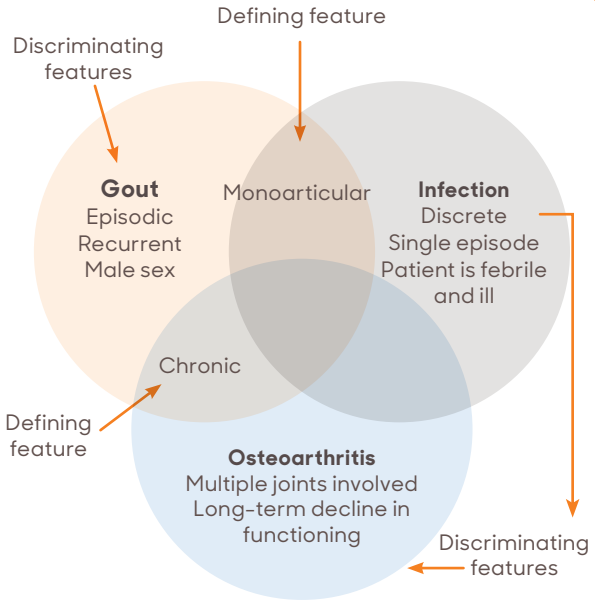


FIGURE 3. Defining and Discriminating Features of a Set of Diagnostic Hypotheses for Acute Arthritis.

The problem representation is "acute onset of a recurrent, painful, monoarticular process in an otherwise healthy middle-aged man." Defining features are descriptors that are characteristic of the diagnoses (e.g., gout, septic arthritis, osteoarthritis). Discriminating features are descriptors that are useful for distinguishing the diagnoses from one another.

for acute arthritis. Additional data gathering would be useful either to confirm or to rule out these diagnostic considerations in a conscious, analytic fashion.

Both nonanalytic and analytic reasoning strategies are effective and are used simultaneously, in an interactive fashion.[3] Nonanalytic reasoning, as exemplified by "pattern recognition," is essential to diagnostic expertise,[2-4,6,12,13] and this skill is developed through clinical experience. Deliberative analytic reasoning is the primary strategy when a case is complex or ill defined, the clinical findings are unusual, or the physician has had little clinical experience with the particular disease entity. Clinicians often unconsciously use multiple, combined strategies to solve clinical problems, suggesting a high degree of mental flexibility and adaptability in clinical reasoning.[3,4]

By prompting the learner to reason aloud or eliciting the learner's uncertainties, the clinical teacher can uncover the reasoning process used by the learner. In responses to the teacher's questions "What do you think?" or "What puzzled you?" weak and strong diagnostic reasoning can be readily distinguished.[15] As was true of the novice resident in the case example, learners whose discussion is poorly organized, characterized by long, memorized lists of causes of isolated symptoms, or only weakly connected to information from the case are reasoning poorly.[16] They do not connect stored knowledge with the current clinical case because they lack either experience with such cases or basic knowledge.

Learners with strong diagnostic reasoning skills often use multiple abstract qualifiers to discuss the discriminating features of a clinical case, comparing and contrasting appropriate diagnostic hypotheses and linking each hypothesis to the findings in the case. The discussion between such a learner and the clinical teacher is often quite concise and may be so abbreviated that its result, the diagnosis, appears to be a lucky guess. In such situations, the teacher may need to ask additional questions that probe the learner's reasoning or uncertainties to be sure that reasoning, rather than luck, brought the diagnosis to light. Strong diagnosticians can readily expand on their thinking.[15,16]

RECOMMENDATIONS FOR CLINICAL TEACHERS

Clinical teachers can use several strategies to promote the development of strong diagnostic reasoning skills. The recommendations that follow are drawn from research on how doctors reason. [1-4,6,8,9,11-15,17,18] Although experienced clinical teachers will recognize the validity of some of these recommendations, many of the ideas still need empirical testing in the clinical teaching environment.

Experience with patients is essential for establishing new connections in memory between learned material and clinical presentations, for developing illness scripts, and for developing the ability to reason flexibly with the use of analytic reasoning and pattern recognition.[3] As learners listen to patients' stories, learn to transform these stories into case presentations, develop their own illness scripts, and learn to reason about clinical information, teachers can use case-specific instructional strategies to help learners strengthen their skills **(Table 1).**

Articulating Problem Representations

Failure to generate an appropriate problem representation can result in the random generation of hypotheses that are based on isolated findings in the case. When the case presentation or discussion is disorganized, the clinical teacher can prompt the learner to create a one-sentence summary of the case with the use of abstract terms.[9] However, teaching learners to articulate problem representations as an isolated teaching strategy is insufficient. [9] Rather, problem representation must be connected to the type of clinical problem — a connection that facilitates the learner's retrieval of pertinent information from memory.

In the teaching environment, several learners with different levels of expertise may be involved in the same case, and eliciting the learners' various problem representations will help the clinical teacher to understand their different perspectives and learning needs. In complex, ill-defined clinical cases, more than one problem representation

may need to be considered. The discussion of the different problem representations will help novice learners to appreciate the complexity of the case as well as their own early, limited understanding.

Teachers should articulate their own problem representations to demonstrate the type of abstract summary they seek from learners. Teachers can then reason aloud, linking the summary statement to their own illness scripts and highlighting the discriminating features clinicians seek in the history and physical examination for the consideration of appropriate diagnostic possibilities.[17]

Strategies for Comparing and Contrasting

Novice learners often generate numerous possible diagnoses for any given case. To prioritize such a lengthy list, they should be encouraged to compare and contrast possible diagnoses on the basis of the relationship among the actual clinical data on the case, typical presentations for each diagnostic possibility, and the relative probabilities of different diagnoses.[17,18] Forcing learners to prioritize the list of diagnostic possibilities and explain their justifications helps them to create linkages between the clinical findings in the case and relevant diagnoses, bolstering their ability to develop pertinent illness scripts.

The development of elaborate illness scripts and pattern recognition involves knowledge of the typical presentation of a problem as well as the many atypical presentations or variations on the typical one. It is important for novice learners to begin by creating in memory an anchor prototype of the typical presentation, rather than giving equal consideration to a number of undifferentiated possibilities.[17,19] Early in their training, medical students should be assigned to evaluate patients with common problems — ideally, problems for which there are prototypical presentations. After the features of the prototype have been solidified in memory, additional clinical exposure to similar problems can offer a basis for comparison with the prototypical case, providing learners with an appreciation of atypical or subtle findings.[18,19]

Varying Expectations According to Developmental Level

The teacher's expectation of evidence of strong reasoning should vary according to the stage of trainingof the learner, but the learner's developmentallevel is often related more to the extent of clinicalexperience with the case at hand than to the yearof training. First-year residents, for example, may have clinical reasoning skills that are as advanced as those of senior residents when it comes to common clinical problems that they saw frequently as medical students.[20] Thus, although the stage of training is somewhat helpful to the teacher in determining expectations of and roles for learners, specific questioning strategies are necessary to probe the understanding and elicit the uncertainties of learners at any level.[15] Several different strategies can be used, but open-ended questions are especially useful for assessing the learner's clinical reasoning ability.[21,22] Using this or other similar frameworks, clinical teachers can evaluate a learner's performance on the basis of the expected performance at different developmental levels.

Providing Cognitive Feedback

The clinical teacher should provide the learner with specific cognitive feedback. The teacher should point out diagnostically meaningful information in the data on the case, identify redundant or irrelevant findings, and highlight the discriminating features, including their relative weight or importance for drawing conclusions as to the correct diagnosis.[17] When a learner suggests a possible but not plausible diagnostic consideration, the teacher can ask the learner to describe the key features of a prototypical case and then to compare the prototype with the findings in the case at hand.[16]

Encouraging useful Reading Habits

Learners should be encouraged to read about their patients' problems in a way that promotes diagnostic reasoning, rather than to read about topics in a rote-memorization fashion, without context. The organization of knowledge stored in memory facilitates the recall of key concepts for application to the next relevant clinical case.[5] To enhance their organization of knowledge and their understanding, novice learners should read about at least two diagnostic hypotheses at the same time (e.g., gout and infectious arthritis), comparing and contrasting the similarities and discriminating features. Clinical teachers should encourage reading that promotes conceptualization rather than memorization and provides learners with an opportunity to share what they have learned,

TABLE 1. **Strategies for Diagnosing a Learner's Skills and Addressing Problems in Clinical Reasoning**

SKILL	CLUE IN CASE PRESENTATION	DIAGNOSIS	EDUCATIONAL STRATEGY	EXAMPLE OF STRATEGY
Data acquisition and reporting	Presentation lacking important information	Learner has not identified what is important, obtained important information, or both.	Go to the bedside, examination room, or medical record and model the acquisition of important findings; request that the learner revise the presentation accordingly.	"I'd like you to watch me take the history and examine this patient. Look for things I do that are particularly useful in eliciting information. Then let's discuss your observations."
Problem representation	Disorganized presentation, discussion, or both.	Learner has no experience with this clinical problem or lacks a conceptual approach to it.	Go to the bedside, examination room, or medical record and elicit or confirm important findings; think aloud with the learner, linking important findings to your own problem representation.	"Now that we've reviewed the important findings, let's think together about how they point to acute arthritis as the likely problem. I'm considering acute arthritis because. . . ."
	Summary statement only loosely related to the case.	Learner has not identified a problem representation, lacks a coherent understanding of the case, or both.	Instruct the learner regarding the importance of the problem representation; ask for a summary statement (if necessary, compare and contrast it with your own).	"Concise, accurate problem representation is a critical entry point to differential diagnosis. Can you give me a one- or two-sentence summary of this case? Here's how I think it might be put together. . . ."
Generation of hypothesis: Search for and selection of illness script	Multiple diagnoses generated in a random order with no attempt to prioritize them.	Learner has not identified a problem representation or formulated illness scripts for the diagnostic considerations.	Ask the learner to list all important findings from the case, create a problem representation based on selected findings, and prioritize diagnostic considerations that identify discriminating features for each consideration.	"What are the main findings? Can you summarize these in abstract terms in one or two sentences? What are the diagnostic considerations for patients with acute arthritis? Which cause of acute arthritis is most likely to be correct in this case? Why?"
	Discussion of differential diagnosis not linked to findings from the case.	Learner has not formulated illness scripts for the diagnostic considerations or is unable to compare and contrast relevant illness scripts.	Ask the learner to support his or her diagnosis using findings from the case; then ask for at least one additional plausible diagnosis and have learner compare it with alternative diagnostic possibilities. If necessary, provide your own analysis of the case.	"What are your main and alternative diagnoses? What features of the case helped you to discriminate between them?"

SKILL	CLUE IN CASE PRESENTATION	DIAGNOSIS	EDUCATIONAL STRATEGY	EXAMPLE OF STRATEGY
Cognitive feedback	Far-fetched diagnosis.	Learner has a poor understanding	Ask the learner to describe the prototypical presentation for this particular diagnosis, to be followed by a comparison with the findings in this case; identify additional data that would be needed to rule in the diagnosis.	"What is the classic presentation for your diagnosis? What findings in this case fit the typical presentation? Are there enough key features present to continue with this line of reasoning? What else do we need to know about this patient?"
Developmental stage	Presentation or reasoning below the expected level for a common problem.	Learner has not created an "anchor" prototype in memory, has too little experience with this type of problem to create illness scripts, or both.	Ask the learner about his or her experience with this type of case or problem; assign the learner patients who have common problems and prototypical presentations; instruct the learner when reading about the case to compare the primary diagnosis with at least one other consideration, identifying relevant key and discriminating features; and have learner follow up to explain what was learned. Determine whether the learner's difficulty is an isolated or recurring one.	"Have you taken care of other patients with acute arthritis? What do you remember about those patients? I want you to read about the typical presentation of gout and compare it with the typical presentation of infectious arthritis. Identify key and discriminating features for both diagnoses. Tomorrow, tell me what you have learned."
Contextual considerations	Disorganized presentation of a complex and illdefined clinical problem.	More than one problem representation is possible, there is a risk of premature closure (learner may be making a lucky guess), or both.	Elicit some plausible problem representations; ask the learner to identify and defend primary and secondary diagnoses, using key and discriminating features of the case; articulate your own problem representations and clinical reasoning.	"Tell me how your primary diagnosis is supported by the clinical findings. Choose a reasonable alternative diagnosis and tell me why it does not fit the clinical findings." (Repeat this procedure for each plausible problem representation.)
	Evidence of varying levels of understanding.	Within the group, there is likely to be a broad range of case experience (the stage of training may only partially predict the learner's ability to reason about a case).	Elicit problem representations from two or three other learners present; ask questions to assess each learner's level of expertise; ask more senior learners to reason aloud; articulate your own problem representation and clinical reasoning.	Ask the group: "Does anyone have a different problem representation?" Ask each learner: "What questions do you have about this case?" Ask the senior resident: "Tell us your primary diagnosis and how it is supported by the clinical findings. Did you consider any other diagnosis, and if so, how did you rule it out?"

testing what has been understood well enough to be explained[19] and reinforcing the importance of self-directed learning.

Some medical textbooks are better organized than others to encourage learning by comparing and contrasting diagnostic considerations.[23] The judicious use of the original literature, even by novices, can be an effective clinical learning tool, especially when it provides important new organizing principles or pathophysiological insights that have yet to permeate textbooks. Learners should be encouraged to identify progressively broader and more complex issues, explore them more deeply, and apply the principles of evidencebased medicine in arriving at answers.

In summary, clinical teachers can promote the development of diagnostic reasoning while simultaneously diagnosing both the patient's disorder and the learner's abilities. To do so, however, they must have an appreciation of clinical learning theory and practice and an accurate understanding of the clinical problem in question. Such an undertaking requires that the teacher accompany the learner to the bedside or examination room and perform an independent assessment of the patient and, at the same time, assess the developmental stage and clinical reasoning ability of the learner. Ensuring the quality of patient care and modeling professionalism while promoting diagnostic reasoning skills constitute the true art of clinical teaching.

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Irby DM. How attending physicians make instructional decisions when conducting teaching rounds. Acad Med 1992; 67:630-8.

2. Schmidt HG, Norman GR, Boshuizen HP. A cognitive perspective on medical expertise: theory and implications. Acad Med 1990;65:611-21. [Erratum, Acad Med 1992;67:287.]

3. Eva KW. What every teacher needs to know about clinical reasoning. Med Educ 2005;39:98-106. [Erratum, Med Educ 2005; 39:753.]

4. Norman G. Research in clinical reasoning: past history and current trends. Med Educ 2005;39:418-27.

5. Mandin H, Jones A, Woloschuk W, Harasym P. Helping students to think like experts when solving clinical problems. Acad Med 1997;72:173-9.

6. Coderre S, Mandin H, Harasym PH, Fick GH. Diagnostic reasoning strategies and diagnostic success. Med Educ 2003; 37:695-703.

7. Bordage G. Why did I miss the diagnosis? Some cognitive explanations and educational implications. Acad Med 1999; 74:Suppl:S138-S143.

8. Chang RW, Bordage G, Connell KJ.The importance of early problem representation during case presentations. Acad Med 1998;73:Suppl:S109-S111.

9. Nendaz MR, Bordage G. Promoting diagnostic problem representation. Med Educ 2002;36:760-6.

10. Koens F, Mann KV, Custers E, Ten Cate OT. Analysing the concept of context in medical education. Med Educ 2005;39: 1243-9.

11. Bordage G, Lemieux M. Semantic structures and diagnostic thinking of experts and novices. Acad Med 1991;66: Suppl:S70-S72.

12. Elstein AS, Schwarz A. Clinical problem solving and diagnostic decision making: selective review of the cognitive literature. BMJ 2002;324:729-32.

13. Custers EJ, Regehr G, Norman GR. Mental representations of medical diagnostic knowledge: a review. Acad Med 1996;71: Suppl:S55-S61.

14. Hatala RM, Norman GR, Brooks LR. Influence of a single example upon subsequent electrocardiogram interpretation.Teach Learn Med 1999;11:110-7.

15. Connell KJ, Bordage G, Chang RW, Howard BA, Sinacore J. Measuring the promotion of thinking during precepting encounters in outpatient settings. Acad Med 1999;74:Suppl:S10-S12.

16. Bordage G. Elaborated knowledge: a key to successful diagnostic thinking. Acad Med 1994;69:883-5.

17. Wigton RS, Patel KD, Hoellerich VL. The effect of feedback in learning clinical diagnosis. J Med Educ 1986;61:816-22.

18. Hatala RM, Brooks LR, Norman GR. Practice makes perfect: the critical role of mixed practice in the acquisition of ECG interpretation skills. Adv Health Sci Educ Theory Pract 2003;8:17-26.

19. Bordage G. The curriculum: overloaded and too general? Med Educ 1987;21:183-8. Irby DM. What clinical teachers in medicine need to know. Acad Med 1994; 69:333-42.

20. Neher JO, Gordon KC, Meyer B, Stevens N. A five-step "microskills" model of clinical teaching. J Am Board Fam Pract 1992;5:419-24.

21. Aagaard E, Teherani A, Irby DM. Effectiveness of the one-minute preceptor model for diagnosing the patient and the learner: proof of concept. Acad Med 2004; 79:42-9.

22. Bordage G, Lemieux M. Which medical textbook to read? Emphasizing semantic structures. Acad Med 1990;65:Suppl: S23-S24.

BECOMING A PHYSICIAN: THE SCRIPT

Benjamin Brody, B.A.

What happened?" the patient asked. She was coming out of anesthesia after six hours of surgery. A weary resident cleaned dried blood and iodine from the skin around the surgical wound on her abdomen. The anesthesiologist had just removed her breathing tube. The patient, to my surprise, was staring straight at me — the medical student. She asked again: "What happened?"

During the previous 6 months, a rapidly expanding abdominal mass had developed. Early in her surgery, a frozen section had been sent to the laboratory, and 20 minutes later a voice over the intercom had confirmed what the surgeons had surmised: she had ovarian cancer. The tumor had spread through the pelvis and abdomen, attacking the uterus and loops of bowel. The surgeon and residents meticulously resected all visible disease, but the prognosis was grim and everyone in the operating room knew it — except the patient. But surely it was not my place to relay this news.

The surgeon bailed me out. "Your surgery's over," he said in a calm, soothing voice. He told her they would talk more when she had fully awakened. But what — and how, exactly — would he tell her?

In medical school, we're taught to follow a script: "What brought you to the hospital today?" it begins. It's a starting point based on the assumption that you haven't already read a triage nurse's notes, reviewed the results of laboratory tests ordered in the emergency department, or met the patient during a previous examination. We learn to take a detailed history of the present illness before proceeding to the medical history, the social history, and a series of questions: Current medications? Allergies? Surgical history? Prior hospitalizations? "Ask the questions in the same order, and you'll never forget anything," I was advised during my medicine clerkship.

"But I've already answered these questions five times," patients occasionally protest midway through the script. "I'm sorry, but it's important that we don't miss anything," I respond, noting that the patient is alert and oriented. From the first weeks of medical school through the licensing exam, this initial encounter is the focus of medical education. Whether you're examining an elderly woman with diabetes who has a foot ulcer, a young man having a panic attack, or a vomiting infant, instructors drill this script into your head. Taking histories from real patients during the past year has made me begin to feel like a real doctor.

But then the script ends. And the unscripted conversations that follow always remind me that I am still very much a student. As a clinical clerk, I felt well prepared to take obstetrical histories — but flummoxed at the prospect of talking with patients who were actually in the middle of labor.

When I worked in the emergency department as a psychiatry clerk, I took longer histories and became confident of my ability to evaluate a patient's need for hospitalization. But late one afternoon, a young woman presented with a 6-month history of hearing voices and seeing animals in the walls of her apartment. Her mother was worried about her daughter's talking to herself. My training gave me a differential diagnosis and a good sense of which tests and medications might be useful. But after all my questions, the patient had one for me.

"Do you think I'm crazy?"

Just like that, I was in over my head. I had no script — only clinical judgment, that perplexing skill that can't be reviewed in morning rounds or diagrammed on PowerPoint slides. "Well, I think you might very well be sick," I said. "But I think you can probably be helped here." I excused myself, feeling nauseated at this young patient's prognosis, and went off to find an attending.

These are the conversations I find the most difficult — and, I submit, the ones for which medical schools do the worst job of preparing students. They generally happen after the histories are taken, when the patients' questions begin, especially with patients who are angry or frustrated with me, the

doctors who are caring for them, or simply their own failing health. Over time, I always thought, I'd learn how to respond as the best clinicians did, defusing confrontational situations with a mix of compassion, authority, and carefully wielded humor. To be sure, this stuff is difficult to teach. There's always a component of improvisation. And it's hard, as a student, to know how much of yourself to put out there: you have to be emotionally involved enough to connect with the patient, but not so emotional as to become overwhelmed. One physician told me, "See another 10,000 patients, and I absolutely promise that you'll improve." Until that happened, I figured, there would always be a wise attending down the hall, ready to take over when I ran into trouble.

But in the middle of my medicine clerkship, a patient I'll call Mrs. Hayworth was transferred to our service. She had presented several days earlier with bizarre behavior and focal neurologic deficits. Computed tomography (CT) had revealed a brain mass and hemorrhagic stroke. Her condition had been stabilized in the intensive care unit (ICU), but she still had no definitive diagnosis. The situation was like many others I'd encountered since beginning on the wards. The patient could not tell me what had happened to her. She couldn't remember any medical history. Allergies? Surgical history? Prior hospitalizations? All question marks. So much for the script. Mrs. Hayworth did have a son, a resident had noted in her chart, but no one had been able to reach him. On her own, she was able to tell me that she used to smoke. "But it's my head that's the matter," she protested. "I've just been confused. It's not like that's the smoking."

This history did not make for a thorough presentation at rounds the following morning, and I apologized my way through a regurgitation of notes from the ICU and from neurology and neurosurgery consultants. "Get in touch with the son and see what he can tell you," my attending instructed. "And send her for a CT of the chest, abdomen, and pelvis."

When I reached the son on the telephone, he had difficulty appreciating the severity of his mother's illness. "Perhaps you could come to the hospital to see your mom, and we could talk in person," I suggested. He agreed to come in the following day after work.

Mrs. Hayworth had her CT overnight. It revealed a lung mass that almost certainly represented her primary tumor. Our team scrolled through the black-and-white images at rounds the next morning and went over the plan: bronchoscopy for a biopsy, and then chemotherapy and radiation therapy or palliative care.

"You'll explain what all that means when the family comes today," the attending said, gesturing to me, the intern, and the resident. But it was another day on a busy medicine service, and we had other new patients to discuss, consultants to call, and lectures to attend. When the son didn't show up at the appointed time, we called and left a message. Eventually, the resident and intern went home, while I stuck around to do some homework. On my way out, I checked on Mrs. Hayworth one last time. I found her crying, more lucid than she'd been earlier, and talking to her son, who had finally arrived. "What's happened to my mother, Doctor?" he demanded.

"Mr. Hayworth, I'm the medical student you talked to yesterday on the phone," I began. My heart was racing. I spoke slowly, trying to imagine what the doctors I admire might say. "I know it's very upsetting to see your mother this way. Let me try to explain what's happened and what we're going to do."

Without a resident or attending waiting down the hall, I felt I didn't have a choice. So I went through the whole story: his mother's neighbor's calling an ambulance, the intracranial bleeding and tumor, the ICU stay, the lung mass the subsequent studies had revealed, and the biopsy we wanted to perform. They would have some decisions to make.

"Thank you, Doctor," he said.

"I'm not a doctor quite yet," I said — returning, finally, to the script that's been drilled into my head. "But you can call me whatever you're comfortable with."

Mr. Brody is a fourth-year medical student at the Albert Einstein College of Medicine, New York.

SLOWING DOWN TO LET THE MOMENT SINK IN

By Jessica L. Israel, M.D.

It's Monday morning and I meet my new medical student, Nelson, on the hospice unit. I am there to sign a death certificate for a man who died the night before. Nelson is flipping through the patient's chart, and he asks me, "What are we going to do for this patient today?"

I wonder if he's kidding, and I say: "Nothing. He's dead." Later, recalling this conversation, I still cannot believe I said it so matter-of-factly.

Nelson is still holding the chart and I think I see his hands shake.

"Hey, are you O.K.?" I ask. "You do know what you signed up for, don't you? It is a palliative-care and hospice elective. People are going to die every day."

"I know, I know," he says. "I've just never been near anyone who has died before." Then he says, "Wow, it's really a big deal." And he sits down because he needs to, I think; he needs to respect the moment.

In this moment I learn something from Nelson, a lesson I thought I already knew. I learn to slow down, to feel the gravity of the moment, the power of time and the depth of this important work. Nelson is right. It is a big deal.

Nelson's "wow" makes me think back to my first death. I was a third-year medical student at Mount Sinai. It was a big day for me because my resident was going to let me do a paracentesis.

Patients with advanced liver disease can have something called ascites too much fluid in the abdominal cavity, which can be uncomfortable and can make it hard to breathe. A paracentesis is a way to remove that extra fluid. You place a needle, and then a catheter, through the skin and muscle under the navel. Then you let it drain into bottles lined up on the floor.

As I was about to start, my patient became unconscious. Someone called a code and what seemed like a million doctors and nurses ran into the room. They did CPR, pushed meds, used the paddles. I had my sterile gloves on, but I was pushed to one side. I heard my patient's ribs crack under the weight of the compressions. I watched residents bag his mouth until the anesthesiologist intubated him and hooked up the ventilator. Electrocardiogram strips littered the bedside; an intern tried to place a central line in his groin. After 20 minutes the lead resident said: "That's it. Thank you all very much. Time of death 3:15."

Everyone left just as quickly as they had arrived, and for a moment, my moment, I was alone with this dead man. Me with my sterile gloves, and him naked with his mouth open. My eyes filled with tears, and I hoped nobody noticed. I had been so preoccupied by the opportunity to stick a needle into a belly that I overlooked the seriousness of his disease.

I covered him with a sheet crumpled at the foot of his bed. I learned that day that I needed to slow myself down, to appreciate the gravity of the moment, the power of time and the depth and proximity of my work. It was a very big deal.

Nelson comes and goes, and I have a new student. Again, I'm rushing to get everything done. This time I am on the hospice unit and I go in to see a patient I haven't seen since before the weekend. She is sleeping, and her hair is brushed back from her face. I introduce myself to her son. He tells me he thinks she is comfortable, but had a rough night. I decide not to wake her, because I figure rest is more important than agitating her out of her sleep. I am on my way off the unit when her son calls after me: "Can you come back? My mom wants to tell you something."

I am back at the bedside. This time her eyes are open. I touch her cool hands. "Do you want to tell me something?"

She holds my hand to her face and pulls me close. "I wanted to thank you for this. Thank you."

There it is again another moment, another near miss. I was rushing to get the day started. I would not have awakened her. I would have just moved on to the next thing I had to do. I would have missed the chance to feel the "wow." It is a very big deal. How quickly we forget, and how lucky we are to be reminded, before it's too late.

Jessica L. Israel is chief of geriatrics and palliative medicine at Monmouth Medical Center in Long Branch, N.J.

A PARENT'S PRAYER

By Garrison Keillor

A perfect shiny summer day and a crowd of jittery children in clusters on the corner, about to board a yellow bus, their backpacks in a pile, their mothers giving urgent last-minute reassurances, and I stop and stare at this Large Life Event.

Kids from nice homes being abandoned by their mothers in broad daylight and sent off to summer camp and God Knows What. The sweet fragility of the kids, especially the gawky boy with glasses. And the elaborate cool of the college kids in charge. The vast love of the mothers, who are on the verge of tears, watching their pups board the bus. (Do the brakes work? Who is the driver? Is he licensed? Sober? Might he be carrying a pistol? Are the wheels securely fastened to the hubs? Two days from now, will I think back to this moment and wonder, Why didn't I go around and check the lug nuts?)

There is more drama on this corner than on the silver screen, and I see it from three angles at once: I am the geek (when I was 12, I imagined the word was meant for me personally since my initials are G.E.K.), and I was at one time the cool camp counselor with the shades and the enigmatic smile, and now I am a parent and quite familiar with trauma.

Three protagonists in the play and I am each one of them. In my geek years, I was a solemn boy with pipestem arms, wire-rim glasses and a homemade haircut, and attended summer Bible camp where we learned about the total depravity of man and then came home and picked potatoes at a nearby truck farm. I assumed I'd grow up and live alone in a tiny room over the bus depot and earn my living by walking around with a sandwich board (EAT AT THE BANDBOX CAFE).

Instead, I went to college, became a cool counselor, and once took 18 young boys in canoes across Lake Vermilion in northern Minnesota in a major thunderstorm, along with another counselor who had smoked dope that morning and basically cut his ties to earth and lay in his canoe singing "A Whiter Shade of Pale" as lightning tore the sky and we plowed across a mile of whitecaps. I yelled at the boys to steer into the storm and keep paddling no matter what.

We made it to shore and pitched four tents in a downpour, and then the boy who'd been constipated all week because he couldn't bring himself to go in the woods went tearing off and then was too embarrassed to come back for paper, and wiped himself with leaves, and chose the wrong ones. Of all the leaves that God provided in the forest, these were the exact ones God didn't intend us to use for that purpose. And of course it was the tubby kid. He tried to be brave but he desperately needed his mother and I was not her. I woke up that night to hear him weeping.

I can still hear him and the trees dripping and Roger sitting by the fire exploring the frontiers of consciousness, though years have passed and I have a 12-year-old daughter, who can go through exaltation, hilarity, despair, all in the space of a minute, and when I send her off to school in the morning, I say, "Lord, have mercy. God, have mercy." Over and over. It is a parent's prayer.

And here they are, on one street corner, the three great strands of life — Defenselessness, Cluelessness and Helplessness — and now the innocent children are on the bus, it swings out into traffic: Oh God, no seat belts!! Have mercy.

Some people believe that God has revealed Himself to us and not to the others, the barbarians, and it is His Will that our tribe vanquish the others and rain death and destruction on them. Others believe that our understanding of God is incomplete but that He has bestowed this beautiful world on us, and other gifts, which should be shared, and we should walk softly and praise His Name.

I walk softly to the café and order a large mocha and pray for the forgiveness of incompetence and for mercy to children. And thanks for the day, which happens to be perfect.

Tribune Media Services

FIRST DAY

Robert E. Murphy, Lexington, Ky

I was not going to be late my first day.

I laid out my white coat the night before, carefully rearranging its contents for accessibility and balance. In the left lower pocket was the "Scut Monkey Handbook" and an ECG card and ruler. In the lower right, the "Washington manual," two Vacutainer barrels, several needles, some Vacutainer tubes, my stethoscope. The upper pocket contained a penlight, a stack of index cards, and three black pens. Through my jacket's buttonhole hung a rubber tourniquet. The inside pocket stored four tongue blades, pamphlets on the physical exam and antimicrobial therapy, and a pack of peanuts. I was ready.

I got to the CCU 30 minutes before rounds and sat down at 'the nurses' station. The ward clerk spotted me: "You must be the new third-year student." I wondered how she could tell.

Before I could even nod my head she continued: "Okay, I'll go over this once. Routine sticks are done at 6:30 AM. Orders need to be in the night before or you do them yourself. They need to be signed by a doctor, flagged, and put in the rack. For x-rays, fill out a yellow slip, stamp it, and give it to me. ECGs and ECHOs need a red slip and be sure it's stamped too. If you do your own sticks, panel 1's go in a red tube, PT/PTTs go in a blue tube on ice, calcium goes in a green tube on ice, and blood cultures go in the yellow tubes. Be sure to get two tubes from different sites and be sure to wipe the top of the tube with Betadine, okay?"

Then what I assumed was my team walked in. Introductions were made and everyone reminisced about his or her first day on the wards. The resident's advice was "Quit now—it just gets worse."

The intern presented the first case. He talked fast, throwing out abbreviations and numbers that everyone else understood and processed. I stood on the periphery, still trying to figure out what the patient's problem was when the first question came: "This patient has a warm lower leg, his skin is erythematous and edematous, and there is a positive Homans' sign. What do you want todo?"

Twenty eyes stared at me. This wasn't like the multiple-choice questions answered during my first 2 years. I mumbled something about CHF and diuretics and watched them snicker and roll their eyes. An easy follow-up question went to the fourth-year: "Why are we concerned about DVTs?" But wait, I wanted to interrupt, I know the answer to that one!

And the rest of the morning was a blur. I felt more hopelessly lost with each presentation. Each intern, resident, nurse, dietician, and ward clerk took me aside to tell me how to be an "efficient" third-year student. I learned to use the computer, how to do an arterial blood gas, where to check out x-rays, medical records, and ECG files. I didn't find time for lunch.

By 4 o'clock I had indecipherable scribbles on four pages of progress notes and nine index cards and unreadable phone numbers on the palms of my hands. I ate my peanuts.

Then the resident's teaching conference—more questions. There was nowhere to hide. After I'd missed several in a row, the resident just looked at me and said, "Did you even have physiology? The lawyers are going to be licking their chops... ."

After conference I started working on my two progress notes for the day; I finished at 7. The nurses constantly interrupted me with more questions: What do you want to do for Mr. Jones' blood pressure? Mr. Smith's diarrhea? Mrs. Wilson's nausea? With every question I could only answer, "I'll have to check with the intern." I felt more and more stupid as the evening wore on.

At 8 o'clock I was told to stick Mr Hunt for cardiac enzymes. I had only drawn blood on three classmates (and missed one of those). I wanted to try my hardest to look like I knew what I was doing. I palpated a nice vein in his left arm and was ready to stick him when he said, "You know, I don't think you're supposed to draw that above the IV." Even the patients knew more than I did.

As I tried to find the vein on the right side, I started to explain why we had to draw his blood every 6 hours. He wanted to know the difference between a heart attack and angina, what we could see with that "sonar machine," how an ECG could tell us where his heart attack was. I enjoyed explaining what we were doing, putting the complex physiology (of which I had only a rudimentary grasp) into simple language Mr Hunt could understand.

I missed his vein three times. I apologized and said I would get the intern. "Naw," said Mr Hunt. "Give it another shot. I know you can do it."

I was touched by his confidence in me. I tried again and failed. "One more time," he said. "You'll get it this time."

And I did.
When I apologized once more and started to leave for dinner, it was almost 9 o'clock. As I said good night, he asked, "You're one of those student doctors, aren't you?" I nodded yes and confessed that he was my first patient.

"You know," he said, "nobody had sat down and said a word to me for 2 days. I know you're real smart and you're a mighty nice fella. You're gonna be a good doctor, I can tell."

It was a very good first day.

SURGICAL FACULTY

Anthony D. Sandler, MD
Senior Vice President and Surgeon-in-Chief
The Diane and Norman Bernstein Professor of Pediatric Surgery
Director, Sheikh Zayed Institute for Pediatric Surgery Innovation
Professor of Surgery and Pediatrics

Timothy D. Kane, MD
Chief, Division of Pediatric Surgery
Professor of Surgery and Pediatrics

Mikael Petrosyan, MD, MBA
Associate Chief, Division of Pediatric Surgery
Director, Surgical Residency Training Program
Associate Professor of Surgery and Pediatrics

Andrea Badillo, MD
Surgical Director, Fetal Medicine Institute
Associate Professor of Surgery and Pediatrics

Randall S. Burd, MD, PhD
Chief, Division of Trauma & Burn Services
Professor of Surgery and Pediatrics

Marc A. Levitt, MD
Chief, Division of Colorectal & Pelvic Reconstructive Surgery
Professor of Surgery and Pediatrics

Martin R. Eichelberger, MD
Professor of Surgery and Pediatrics

Christina Feng, MD
Surgical attending, Pediatric and Colorectal Surgery

Philip C. Guzzetta, MD
Professor of Surgery and Pediatrics

Jeffrey R. Lukish, MD
Associate Professor of Surgery and Pediatrics

Louis M. Marmon, MD, PhD
Professor of Surgery and Pediatrics

Evan P. Nadler, MD, MBA
Co-Director, Children's National Obesity Institute
Director, Child and Adolescent Weight Loss Surgery Program
Associate Professor of Surgery and Pediatrics

Manuel B. Torres, MD
Chief, Pediatric Surgery
Medstar Georgetown University Hospital
Assistant Professor of Surgery and Pediatrics

Yvette Dill
Medical Student Coordinator

All faculty appointments are at the George Washington University School of Medicine.

Children's National

111 Michigan Ave. NW
Washington, DC 20010

** childrensnational.org**

Design by Design Central, Inc.