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Case Files

Problem-Based Learning

A Review of Case Selection
& Learning Resources

McGraw Hill Red Paper Series

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What is Problem-Based Learning (PBL)?

Problem-Based Learning (PBL) has become an integral component of medical education curricula in the last few decades. Research and evidence-based practices revealed remarkable learning gains demonstrated by medical students at both knowledge and skills levels. This approach to learning takes advantage of clinical cases – whether authentic or hypothetical – in a pedagogical manner that promotes students' responsibility towards their own learning and provokes their analytical thinking skills as well as maximizing the level of effective participation in groups.

Why Problem-Based Learning (PBL)?

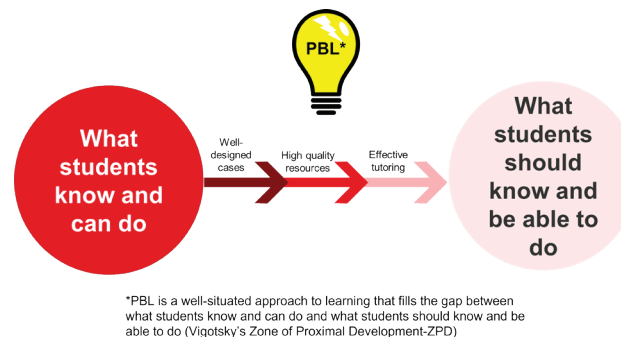
PBL is now adopted in many medical and non-medical schools all over the world. Interestingly, yet logically, this approach to learning was originally created for medical students. In the 1960s, many North American medical students reported their disappointment by the huge amount of information traditionally taught to them during their early years of study. They also realized at later study phases that they were unable to remember and process this information practically and pragmatically. Hence, the need for an innovative pedagogical approach was created to acclimate with the evolving philosophy of education at that time whilst catering for students' needs and interests on a similar ground.

How does PBL work?

Learning by solving problems is distinguished from other approaches to learning in that it exposes medical students to open-ended medical scenarios. The goal is for students to experience a series of mental processes in order to bridge the gap between what they know about the topic and what they should know to be able to solve the problem. This journey of learning allows students to explore and acquire knowledge and skills needed to handle the medical case. The series of cognitive processes range through goal setting, formulating, and testing hypotheses, setting priorities, gathering information, and arriving at conclusions. Students' roles constantly vary as leader, secretary, coordinator, and organizer of small group dynamics. Instructors/tutors roles are also fundamental in this journey of learning. They facilitate students' work, help address challenges they may face, and guide them on the right path. More precisely, instructors/tutors' role is to manage

the workflow in the group to maintain optimal level of engagement as the path of this journey is as important as its destination.

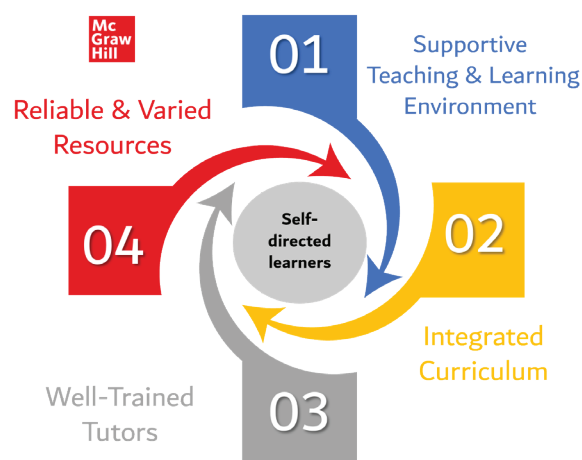
Figure 1: PBL Philosophy



What are PBL core components?

In order for this journey to be a success, some essential components should be considered including horizontal and vertical curriculum, well-trained instructors who believe in the value of this approach, positive learning environment, self-directed learners, as well as varied and reliable learning resources. At McGraw Hill, we provide these resources in an interactive and easily accessible manner where faculty members and learners can benefit from a range of recourse types that allow them to construct and address the medical cases/problems from different angles and perspectives.

Figure 2: PBL Core Components



How to create and assign an effective PBL case?

Constructing effective PBL cases is the art which requires teamwork and meaningful input from several disciplines. Many steps are involved in this process starting from forming multidisciplinary teams to building the cases that help achieve the intended learning outcomes. More importantly, adapting the cases to students' learning needs, levels, and prior knowledge is also an integral part of this process.

Selecting a case is subject to an array of factors that constitute an effective learning case:

- 1. The case itself:** should be real, challenging, multidisciplinary, carefully formulated and of a clear language, reflective of the intended learning outcomes.
- 2. The content of the case:** requires chronological flow of information, logical sequence, can be close-ended or open-ended with appropriate and reasonable closure.
- 3. Pedagogical considerations:** Case aligned with learners' levels and prior knowledge, supports group discussions, ensures the utilization of higher order thinking skills.

Which resources are used in case writing?

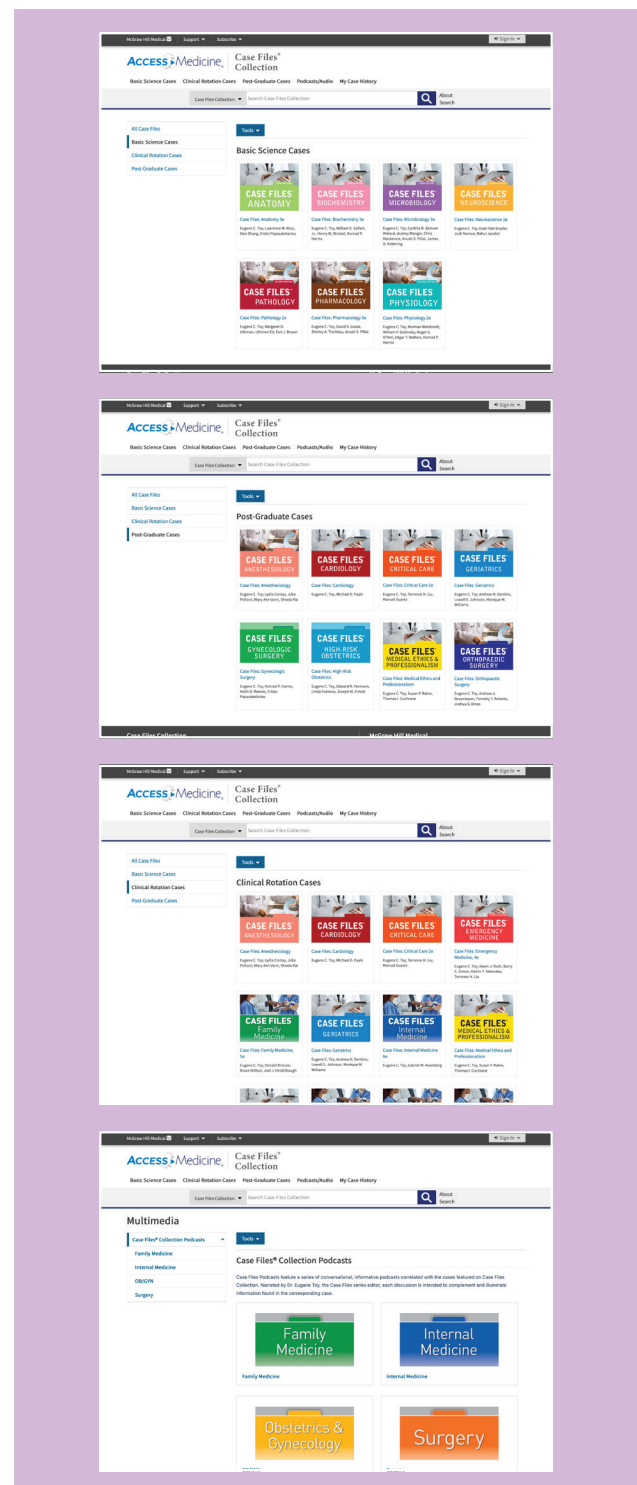
This includes narrative cases which can be used by itself or combined with following to add more value based on the availability and richness of the resources:

- ▶ Medical investigations such as chest X-Ray, complete blood count, histopathology report, ECG, etc.
- ▶ Well-designed visual resources that supplement information gained from the written case. These visual resources can be static or animated images, a photo drawn by a child in pediatric cases especially in child abuse topics, a video, etc.
- ▶ Audiological resources and soundtracks such as heart and chest sounds, podcast, a part of conversation between a patient and a healthcare provider i.e., psychiatric disorder history taking.

At McGraw Hill we offer diverse platforms that strongly support educators during case formation stage that are appropriate for all levels of learners: novice, advanced, and post-graduate. You can find Case Files Collection in AccessMedicine, as well as cases section

in other Access platforms. Additionally, 1000+ cases are also found in textbooks. You can also support any cases educators create by many other resources in our Access platforms such as radiology studies, heart and lung sounds, auscultation classroom etc. to broaden case dimensions and add more perspectives.

Figure 3: AccessCase Files Platform



How can our resources and content help in both case creation/selection as well as solve the case?

Some examples from McGraw Hill Medical Learning Solutions:

Example 1 from AccessCase Files:

Case Files include the following items for each case:

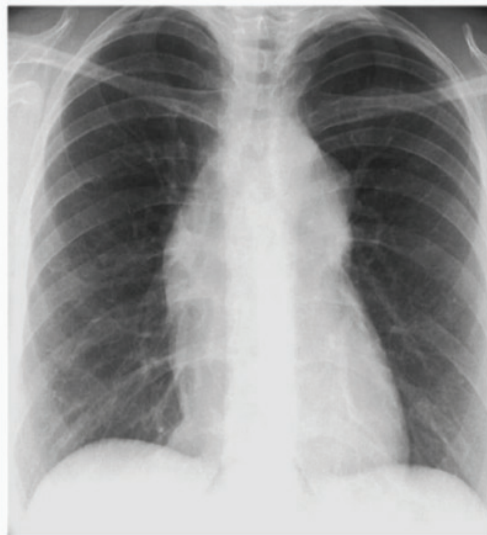
1. The case itself: this section includes the ready-to-use case and all relevant investigations as applicable.
2. Case approach: this section includes a brief scientific background about the case.
3. Case-related pearls: this section includes the most significant point that should not be missed about the case and case topic.
4. Case references: references used to prepare the case.
5. Comprehension questions: this section includes questions to assess learner's understanding and comprehension.

An example of Acute type A Aortic Dissection for advanced medical students/clinical level students from Case Files Cardiology ([Link to case](#)):

A 28-year-old man with no medical history presents with acute chest pain. The pain started suddenly approximately 2 hours ago, and he describes it as a severe (rated at 10/10) tearing sensation radiating to the back between the scapulae. He never experienced this pain before. His family history is unremarkable. He doesn't smoke, use alcohol, or take illicit drugs. On presentation, vitals were as follows: heart rate 120 bpm, blood pressure in left arm 100/40 mmHg and in right arm 105/40 mmHg, respiratory rate 25 breaths/min, temperature 37.2°C (98.96°F), and his oximetry (O₂ saturation) was 96% on 2 L/min of oxygen. His height is 2 m (6.56 ft) and weight 100 kg (220 lb). Physical examination revealed a tall, young gentleman in moderate distress. Cardiac examination revealed a regular rhythm with tachycardia, jugular venous pressure at 9 cm H₂O, III/IV diastolic murmur with highest intensity in the left lower sternal border, and no rubs. Chest exam revealed pectus carinatum and mild bibasilar crackles. His neurological exam is intact. Other features included mild scoliosis and arachnodactyly in his fingers. His presenting ECG and chest x-ray are shown in [Figures 27-1](#) and [27-2](#). Laboratory data were normal except for an elevated CK, CK-MB, and troponin T.

FIGURE 27-2.

PA Chest x-ray for main subject of this case.

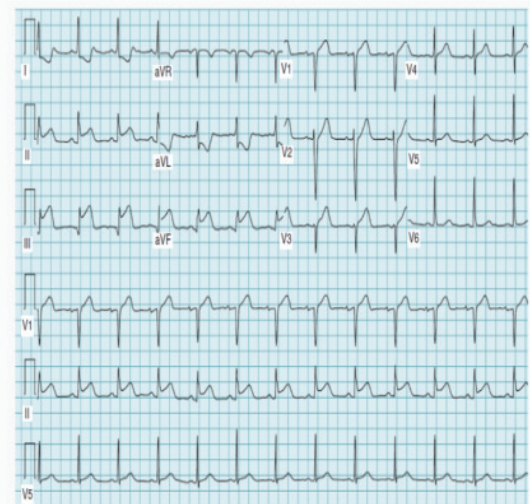


Source: Eugene C. Toy, Michael D. Faulk:
Case Files®: Cardiology
www.mhmedical.com
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FIGURE 27-1.

ECG for main subject of this case. Note the ST segment elevation in the inferior leads.



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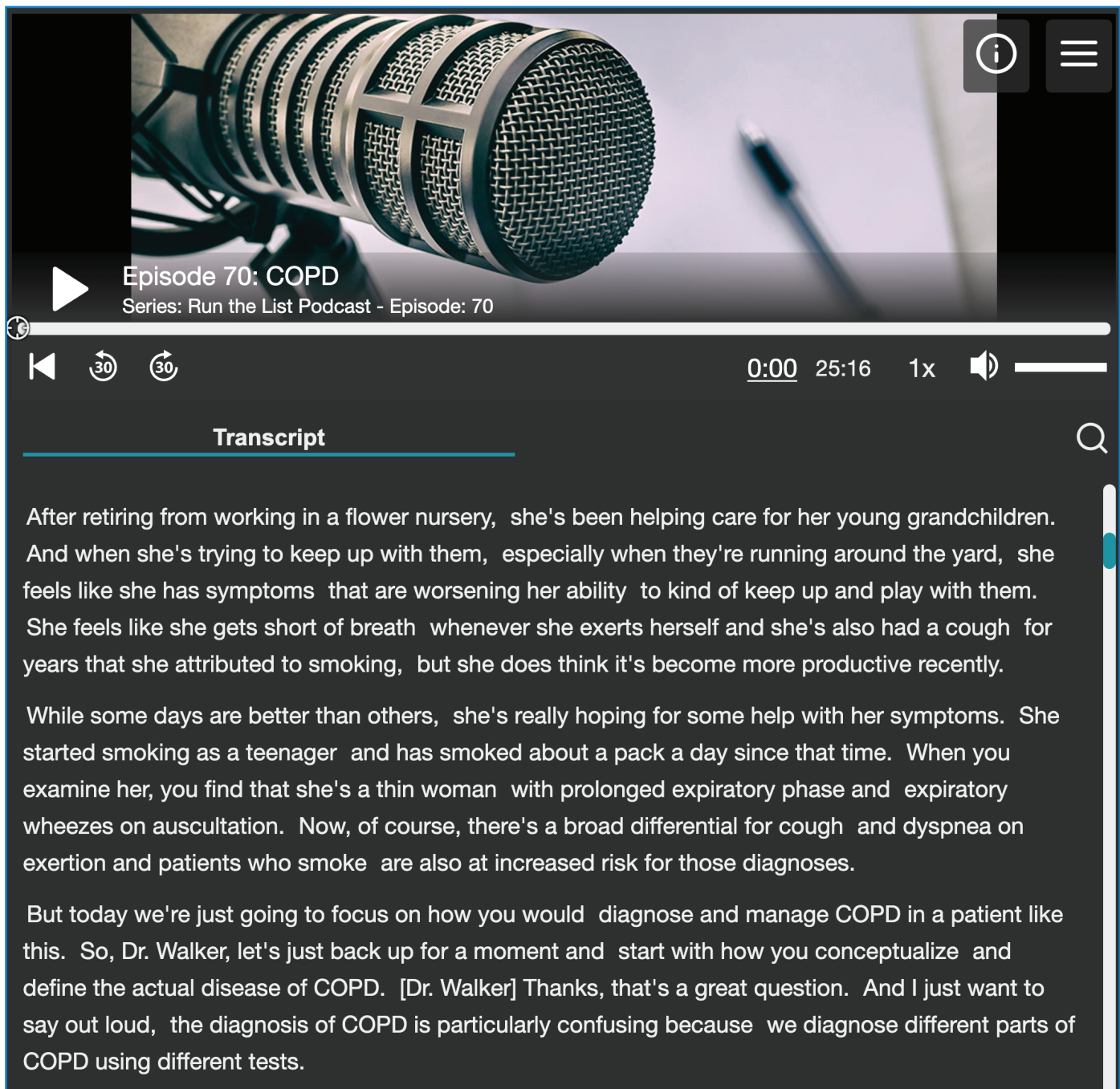
Sample useful resources for problem solving

| | | | |
|---|--|---|---|
| Textbooks | <u>Fuster and Hurst's The Heart, 15e/ Diseases of the Aorta/AORTIC DISSECTION</u> | <u>Principles of Critical Care, 4e/ Aortic Dissection</u> | <u>Cardiac Surgery in the Adults/chapter 47 Aortic Dissection</u> |
| Images/Tables | <u>Fuster and Hurst's The Heart, 15e/ Diseases of the Aorta/image B Type A acute aortic dissection</u> | <u>Principles of Critical Care 4e/Aortic Dissection/figure: Classification of aortic dissection</u> | <u>Schwartz's Principles of Surgery, 11e > Thoracic Aneurysms and Aortic Dissection/table/ Anatomic complications of aortic dissection and their associated symptoms and signs</u> |
| Multimedia | <u>The Infographic Guide to Medicine > Cardiology/ Aortic Dissection</u> | <u>Video/Hypertension and aortic dissection</u> | <u>Interactive module/Aortic Dissection</u> |
| Optional: activate your students' prior knowledge: Flipped Classroom | <u>Cardiovascular Physiology, 9e/Overview of the Cardiovascular System</u> | <u>Anatomy of the Aorta</u> | <u>Pathophysiology of Disease: An Introduction to Clinical Medicine, 8e/ Cardiovascular Disorders: Vascular Disease/NORMAL VASCULAR STRUCTURE & FUNCTION</u> |

How can our resources and content help in both case creation/selection as well as solve the case?

Some examples from McGraw Hill Medical Learning Solutions:

Example 2 from Multimedia/Podcast/COPD case ([Link to case](#)):



The image shows a video player interface for a podcast episode. The video frame displays a close-up of a professional microphone. Below the video frame, the title 'Episode 70: COPD' and the series name 'Series: Run the List Podcast - Episode: 70' are visible. The player includes standard controls: a play button, a progress bar at 0:00 of 25:16, a 1x speed setting, and volume controls. Below the player, a 'Transcript' section is displayed with a search icon. The transcript text is as follows:

After retiring from working in a flower nursery, she's been helping care for her young grandchildren. And when she's trying to keep up with them, especially when they're running around the yard, she feels like she has symptoms that are worsening her ability to kind of keep up and play with them. She feels like she gets short of breath whenever she exerts herself and she's also had a cough for years that she attributed to smoking, but she does think it's become more productive recently.

While some days are better than others, she's really hoping for some help with her symptoms. She started smoking as a teenager and has smoked about a pack a day since that time. When you examine her, you find that she's a thin woman with prolonged expiratory phase and expiratory wheezes on auscultation. Now, of course, there's a broad differential for cough and dyspnea on exertion and patients who smoke are also at increased risk for those diagnoses.

But today we're just going to focus on how you would diagnose and manage COPD in a patient like this. So, Dr. Walker, let's just back up for a moment and start with how you conceptualize and define the actual disease of COPD. [Dr. Walker] Thanks, that's a great question. And I just want to say out loud, the diagnosis of COPD is particularly confusing because we diagnose different parts of COPD using different tests.


Sample useful resources for problem solving

| | | | |
|---|---|--|--|
| Textbooks | <u>Harrison's Principles of Internal Medicine, 21e/ Chronic Obstructive Pulmonary Disease</u> | <u>Current Medical Diagnosis & Treatment 2023/ Chronic Obstructive Pulmonary Disease</u> | <u>John Murtagh's General Practice, 8e/Chronic obstructive pulmonary disease</u> |
| Images | <u>Clinical Emergency Medicine > Chronic Obstructive Pulmonary Disease / Figure/Chest radiograph of a patient with chronic obstructive pulmonary disease</u> | <u>Principles and Practice of Hospital Medicine, 2e > Chronic Obstructive Pulmonary Disease / Pathogenesis of chronic obstructive pulmonary disease</u> | <u>Clinical Emergency Medicine > Chronic Obstructive Pulmonary Disease /COPD diagnostic algorithm</u> |
| Multimedia | <u>Video/Overview of Pathophysiology of COP</u> | <u>Video/Pathophysiology of Large and Small Airway Disease in COPD</u> | <u>The Infographic Guide to Medicine > Pulmonology/ COPD</u> |
| Optional: activate your students' prior knowledge: Flipped Classroom | <u>Huppert's Notes: Pathophysiology and Clinical Pearls for Internal Medicine/Anatomy and Physiology in Pulmonology</u> | <u>Huppert's Notes: Pathophysiology and Clinical Pearls for Internal Medicine/Diagnostics in Pulmonology</u> | <u>The Big Picture: Medical Biochemistry/THE RESPIRATORY SYSTEM</u> |

How can our resources and content help in both case creation/selection as well as solve the case?

Some examples from McGraw Hill Medical Learning Solutions:

Example 3 from Multimedia/Podcast/Biliary Tract Stone Disease case ([Link to case](#)):



The image shows a podcast player interface. The top section features a large image of a professional microphone. Below the image, the title 'RTL- Ep 82- Biliary Tract Stone Disease' is displayed. The player includes standard controls: a play button, a progress bar, and buttons for previous, 30-second rewind, 30-second fast forward, and next. The current time is 0:00, and the total duration is 21:22. The playback speed is set to 1x. A search icon is visible in the top right corner of the player area.

Transcript

So, this is an admission we're getting paged about from the ED and you hear this is a 43-year-old woman with obesity, diabetes, hyperlipidemia, and she's coming in with a couple of days of persistent right upper quadrant pain. She describes this sensation actually like a wrapping sensation from her epigastric area around her abdomen with some radiation to her right shoulder as well, and she does report some nausea and vomiting that's also been associated.

Kind of on further history as you gather it, this patient's had more intermittent postprandial pain over the last year or so and it does typically resolve quickly and it's been bothersome, but never really severe. And so life's been busy, she hasn't had a chance to seek care for it yet and has not had any imaging or labs previously. When she had more severe pain, especially today she called her PCP who has obviously recommended she present to the emergency department where she was found to be afebrile, her heart rate was in the 70s, her blood pressure was 114/67, her sats were normal on room air and she's only on metformin and atorvastatin, those are her only two medications.

She's uncomfortable-appearing, but she's not in any acute distress. Her right upper quadrant is tender on exam. And her labs show a white count of 12,000 an ALT of 82, AST of 21, a TBILI of 1.4, and alk phos of 197, but otherwise they're largely unremarkable. And we, as I mentioned, don't have a prior baseline and her first imaging study she'll have had, right upper quadrant ultrasound is

Sample useful resources for problem solving

| | | | |
|---|--|---|--|
| Textbooks | <u>Huppert's Notes: Pathophysiology and Clinical Pearls for Internal Medicine/Diseases and Pathophysiology in Gastroenterology/ GALLBLADDER STONE DISEASES</u> | <u>Harrison's Principles of Internal Medicine, 21e/ Diseases of the Gallbladder and Bile Ducts</u> | <u>Current Medical Diagnosis & Treatment 2023/ Cholelithiasis (Gallstones)</u> |
| Images | <u>Harrison's Principles of Internal Medicine, 21e > Diseases of the Gallbladder and Bile Ducts /Scheme showing pathogenesis of cholesterol gallstone formation</u> | <u>Current Medical Diagnosis & Treatment 2023 > Cholelithiasis (Gallstones) / Multiple gallstones on an abdominal radiograph</u> | <u>Schwartz's Principles of Surgery, 11e > Gallbladder and the Extrahepatic Biliary System /Gallbladder with cholesterol stones</u> |
| Multimedia | <u>The Infographic Guide to Medicine > GI/Hepatology/ Biliary Tract Conditions</u> | <u>Video/Acute Cholecystitis: Robert L. Trowbridge, MD, discusses the clinical examination for acute cholecystitis</u> | <u>Video/Gall Bladder Disease</u> |
| Optional: activate your students' prior knowledge: Flipped Classroom | <u>The Big Picture: Gross Anatomy, 2e/ Foregut/ LIVER AND GALLBLADDER</u> | <u>Gastrointestinal Physiology, 2e/Gallbladder Function</u> | <u>High-Yield Q & A Review for USMLE Step 1: Biochemistry and Genetics/ Digestive Processes/Gall Bladder</u> |

How can our resources and content help in both case creation/selection as well as solve the case?

Some examples from McGraw Hill Medical Learning Solutions:

Example 4 from cases found in a textbook: Pharmacotherapy Casebook: A Patient-Focused Approach, 11th Edition/Breast Cancer ([Link to case](#)):

Breast Cancer

Authors: Jonathan W. Malar; Bonnie Lin Boster

Learning Objectives Patient Presentation Questions Clinical Pearl References

Listen

Chief Complaint

"I have a lump in my breast."

HPI

Rosalita Garza is a 61-year-old woman presenting for evaluation of a new mass in her left breast. She first noticed a palpable breast mass on self-examination approximately 14 months ago but was unable to have this further investigated due to loss of health insurance. The patient describes the mass as intermittently painful. A mammogram was performed prior to her current visit, which was suspicious for malignancy.

PMH

Musculoskeletal injury 6 years ago. Fell from a chair while at work and suffered injuries to her cervical spine. The patient has required bone grafting from her right hip to her cervical spine. She has been prescribed multiple as-needed medications for pain control but uses them infrequently.

Depression (diagnosed 7 years ago)

FH

Meds

Protonix 40 mg PO once daily
 Zoloft 50 mg PO once daily
 Ambien CR 12.5 mg PO at bedtime PRN sleep
 Neurontin 300 mg PO TID
 Hydrocodone/acetaminophen 5 mg/300 mg, one to two tablets PO Q 6 H PRN pain

All

NKDA

ROS

Negative except for complaints noted above

Physical Examination

Gen

WDWN 61-year-old Hispanic woman. Awake, alert, in NAD.

VS

BP 127/71 mm Hg, P 89 bpm, RR 16, T 36.7°C; Wt 137 lb, Ht 5'1"

HEENT

Abd

Soft, NT/ND, normoactive bowel sounds. No appreciable hepatosplenomegaly.

Spine

Slight tenderness to percussion

Ext

No CCE

Neuro

No deficits noted

Labs

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| | | | |
|--------------------------|------------------------------------|-----------------------------------|--------------------|
| Na 142 mEq/L | Hgb 12.9 g/dL | WBC $8.7 \times 10^3/\text{mm}^3$ | AST 36 IU/L |
| K 3.7 mEq/L | Hct 37.6% | Neutros 55% | ALT 17 IU/L |
| Cl 102 mEq/L | RBC $4.13 \times 10^6/\text{mm}^3$ | Lymphs 35% | LDH 488 IU/L |
| CO ₂ 26 mEq/L | Plt $410 \times 10^3/\text{mm}^3$ | Monos 8% | T. bili 0.2 mg/dL |
| BUN 9 mg/dL | PT 11.9 seconds | Eos 2% | CA 27.29 36.2 U/mL |
| SCr 0.7 mg/dL | INR 1.09 | | |

Labs

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| | | | |
|--------------------------|------------------------------------|-----------------------------------|--------------------|
| Na 142 mEq/L | Hgb 12.9 g/dL | WBC $8.7 \times 10^3/\text{mm}^3$ | AST 36 IU/L |
| K 3.7 mEq/L | Hct 37.6% | Neutros 55% | ALT 17 IU/L |
| Cl 102 mEq/L | RBC $4.13 \times 10^6/\text{mm}^3$ | Lymphs 35% | LDH 488 IU/L |
| CO ₂ 26 mEq/L | Plt $410 \times 10^3/\text{mm}^3$ | Monos 8% | T. bili 0.2 mg/dL |
| BUN 9 mg/dL | PT 11.9 seconds | Eos 2% | CA 27.29 36.2 U/mL |
| SCr 0.7 mg/dL | INR 1.09 | | |
| Glu 83 mg/dL | aPTT 30.1 seconds | | |

Chest X-Ray

Lungs are clear.

Other Diagnostic Tests

Diagnostic bilateral mammogram (Fig. 148-1):

- American College of Radiology category V, highly suspicious for malignancy in the left breast. There is a high-density, irregular

Sample useful resources for problem solving

| | | | |
|---|--|--|--|
| Textbooks | <u>Gynecologic Oncology: Clinical Practice and Surgical Atlas/Breast Cancer and Related Diseases</u> | <u>Harrison's Manual of Oncology, 2e / Explore section 12: Breast Cancer</u> | <u>Hematology-Oncology Therapy, 3e/ Breast Cancer</u> |
| Images | <u>Harrison's Principles of Internal Medicine, 21e > Breast Cancer /Evaluation and workup of breast lesions</u> | <u>Women's Health Across the Lifespan, 2e > Breast Cancer /TNM Staging</u> | <u>Women's Health Across the Lifespan, 2e > Breast Cancer /Stage Grouping</u> |
| Multimedia | <u>INTERACTIVE MODULES /Breast Cancer: 3D animation</u> | <u>The Infographic Guide to Medicine > Obstetrics/ Gynecology/Breast Cancer</u> | <u>The Infographic Guide to Medicine > Obstetrics/ Gynecology/ Benign Breast Disease</u> |
| Optional: activate your students' prior knowledge: Flipped Classroom | <u>The Big Picture: Gross Anatomy, 2e/Anterior Thoracic Wall/THE BREAST</u> | <u>Pathology: A Modern Case Study, 2e/Breast Pathology</u> | <u>Huppert's Notes: Pathophysiology and Clinical Pearls for Internal Medicine/Diseases & Pathophysiology in Oncology/BREAST CANCER</u> |

How can our resources and content help in both case creation/selection as well as solve the case?

Some examples from McGraw Hill Medical Learning Solutions:

Example 5 from cases found in a textbook: Vanderbilt Internal Medicine and Pediatrics/Anemia Evaluation in Children ([Link to case](#)):

Case 1

A 12-month-old African American boy was seen in primary care clinic for a well-child exam. His mother reports that over the last 2 days he has had fever, cough, and congestion. He has had some diarrhea for the last 2 days. He has good oral intake of solids and liquids and has been active and playful throughout this illness. She reports that he is crawling up the stairs, is sitting alone steadily, says "mama" and "dada," plays peek-a-boo, says bye-bye, and often feeds himself.

On general exam, he is happy, playful, and in no acute distress. His weight is 9.5 kg (25th percentile), height is 72 cm (10th percentile). His exam is normal for age.

Lab work showed a hemoglobin of 10.1 g/dL. Newborn screen was normal and showed no hemoglobinopathies. His complete blood count (CBC) with differential is shown below.

☆ | [Download \(.pdf\)](#) | [Print](#)

| | Abbreviation | Reference Value | Patient Value |
|---|--------------|-----------------|---------------|
| White blood cell ($10^3/\text{mCL}$) | WBC | 4-14.6 | 9.5 |
| Hemoglobin (g/dL) | Hb | 10.5-13.5 | 10 |
| Packed cell volume (%) | PCV | 32-39 | 29 |
| Platelet ($10^3/\text{mCL}$) | PLT | 150-400 | 333 |
| Red blood cell ($10^6/\text{mCL}$) | RBC | 3.8-5.5 | – |
| Mean corpuscular volume (fL) | MCV | 69-85 | 62 |
| Mean corpuscular hemoglobin (pg/cell) | MCH | 23-31 | – |
| Mean cell hemoglobin concentration (g/dL) | MCHC | 31-37 | – |
| Red cell distribution width (%) | RDW | 11-14.3 | – |
| Reticulocyte count (%) | Retic | (none) | 1% |
| Absolute reticulocyte | RetAbs | | – |
| Ferritin (ng/mL) | | 7-140 | 9 |
| C-reactive protein (mg/L) | CRP | 0.1-1 | – |

Reference values from Vanderbilt University Medical Center Lab for child 12 months old.

Sample useful resources for problem solving

| | | | |
|---|---|--|--|
| Textbooks | <u>Rudolph's Pediatrics, 23e / Anemia</u> | <u>Pathophysiology of Blood Disorders, 2e/Overview of the Anemias</u> | <u>Williams Manual of Hematology, 10e/ Classification of Anemias and Erythrocytoses</u> |
| Images | <u>Principles and Practice of Hospital Medicine, 2e > Abnormalities in Red Blood Cells /Differential diagnosis of anemia</u> | <u>Symptom to Diagnosis: An Evidence-Based Guide, 4e > Approach to the Patient with Anemia - Case 1 /Diagnostic approach: anemia</u> | <u>Harrison's Manual of Medicine, 20e > Anemia and Polycythemia /The physiologic classification of anemia</u> |
| Multimedia | <u>Video/Anemia: Pathophysiology and Diagnostic Approach</u> | <u>The Infographic Guide to Medicine > Hematology/ Oncology/Anemia, Iron Deficiency</u> <u>The Infographic Guide to Medicine > Hematology/ Oncology/Anemia, Sickle Cell</u> | <u>Podcast/Anemia</u> |
| Optional: activate your students' prior knowledge: Flipped Classroom | <u>Williams Hematology, 10e/ Erythropoiesis and Red Cell Turnover</u> | <u>The Big Picture Physiology: Medical Course & Step 1 Review, 2e/Blood</u> | <u>Ganong's Review of Medical Physiology, 26e/ Blood as a Circulatory Fluid & the Dynamics of Blood & Lymph Flow/RED BLOOD CELLS</u> |

REFERENCES:

- Onyon C. (2012). Problem-based learning: a review of the educational and psychological theory. The clinical teacher, 9(1), 22–26. <https://doi.org/10.1111/j.1743-498X.2011.00501.x>
- Dasgupta A. (2020). Problem based learning: its application in Medical Education. J West Bengal Univ Health Sci.; 1(2):11-18.
- Robinson, S.P.A. and Knight, V. (2019). Handbook of research on critical thinking and teacher education pedagogy. Hershey, Pa: Information Science Reference.
- Harland, Tony. (2003). Vygotsky's Zone of Proximal Development and Problem-based Learning: Linking a theoretical concept with practice through action research. Teaching in Higher Education. 8. 263-272. 10.1080/1356251032000052483.
- Azer S. A. (2009). Interactions between students and tutor in problem-based learning: the significance of deep learning. The Kaohsiung journal of medical sciences, 25(5), 240–249. [https://doi.org/10.1016/S1607-551X\(09\)70068-3](https://doi.org/10.1016/S1607-551X(09)70068-3)

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