March 2023

Problem-based learning (PBL) cases handbook for Bachelor of science in Anesthesia

Volume 1

Addis Ababa

Ethiopia

ACKNOWLEDGMENT

This Problem-based learning (PBL) case handbook for the anesthesia program is developed by a group of anesthesia experts from three universities, the Ethiopian Association of Anesthetists (EAA), and the USAID-funded Health Workforce Improvement Program (HWIP).

We would like to thank the Department of Anesthesia at Debre Tabor University, particularly Mr. Tadesse Tamire, for sharing draft cases and additional resources that aided in the development of this case handbook.

This handbook is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the Cooperative Agreement 72066320CA00008. The contents are the responsibility of teaching institutions and do not necessarily reflect the views of USAID or the United States Government.

The Higher Education institutions involved in the development and review of this PBL case handbook were:

- Debre Birhan University (DBU)
- Debre Tabor University (DTU)
- Dire Dawa University (DDU)

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CONTENTS

INTRODUCTION

The national harmonized competency-based anesthesia curriculum incorporated problem-based learning (PBL) as a complementary learning strategy, primarily in its first-year system-based learning modules. PBL is a pedagogical approach in which students work on a complex, ill-structured problem or issue to develop solutions. It is a student-centered instructional strategy where students learn collaboratively in small groups (6-10 students).

It has been reported that incorporating PBL helps students develop an integrated body of knowledge and problem-solving skills, which motivates their learning and facilitates retention of what is learned while minimizing cognitive overload. The primary goal, however, is **NOT** to solve the problem but to use it as a vehicle to drive learning through discussion of relevant integrated contents encompassing basic science, social and population health, and ethics and professionalism.

PBL has been used in pre-deployment undergraduate training in Ethiopia since the graduate entry New Innovative Medical Education Initiative (NIME) curriculum was launched a decade ago. Meanwhile, Debre Tabor University (DTU) paved the way for PBL implementation in its hybrid innovative curricula curriculum for all undergraduate training programs. PBL was first used for undergraduate anesthesia training at DTU before becoming a formal part of the nationally harmonized curriculum approved by the Ministry of Education in 2022.

PBL has been incorporated as a required teaching strategy for the nine system-based integrated biomedical modules in the 2022 MOE-endorsed curriculum. Each system-based module included one to three PBL problems/cases, each designed to take four hours to complete in a week (two sessions per problem per week, each session requiring 2 hours). The respective module syllabi also proposed a potential list of problems/ cases. However, it has been reported that the lack of well-constructed cases and a guide on facilitating, coupled with limited faculty development opportunities, have hampered PBL implementation.

RATIONALE

The rationale for developing this PBL case handbook is to assist baccalaureate anesthesia teaching institutions in effectively implementing nationally harmonized competency-based curricula by standardizing content and delivery approach to proposed PBL cases/problems. The following are the specific objectives for developing this handbook:

- Equip anesthesia faculty with the knowledge and skills to develop compelling PBL cases.
- Create a pool of PBL cases required to train baccalaureate anesthesia students and help address the critical shortage.
- Improve case quality and complexity, thereby ensuring inter-disciplinary integration while deemphasizing the sole growing emphasis on clinical diagnosis and management.
- Provide faculty with a guide to facilitate discussions beyond the predominant clinical orientation.
- Encourage teaching institutions to use similar case formats and templates with two-step progressive information unfolding (subjective and objective data).

CASE DEVELOPMENT AND STRUCTURE

We primarily followed the contextualized recommendations made by Alemseged et al. in their problem-based learning case writing guide[1]. Accordingly, the 16 PBL cases included in this handbook were carefully crafted to address integrated content domains such as biomedical and clinical sciences, social and population health (SPH) principles, and aspects of professionalism and ethics. To guide case assembly with comprehensive content, we used a matrix that highlighted different content areas (table 1).

Table 1: Sample summary matrix utilized to ensure case content comprehensiveness

Body system	Problem(s)	Normal process (e.g.)	Abnormal process (e.g.)	SPH aspect (e.g.)	Ethical aspect (e.g.)
Body fluids and homeostasis	Easy fatigability	Normal structure and functions of RBCs	Mechanisms of anemia	Economic impacts of easy fatigability	The right to be healthy and anemia from malnutrition
Body fluids and homeostasis	Nasal bleeding	Mechanism of clotting cascades	Mechanism of bleeding	Impact of bleeding diathesis on quality of life	Incomplete medical recording
Cardiovascular system	Chills, fever, and malaise	Blood circulation and regulation	Low blood pressure and shock	Awareness of healthcare delivery	Patient refusal of clinical care

[1] Alemseged Woretaw, Solomon Worku, and Mekdim Tadesse. 2021. Case writing guide for problem-based learning. Unpublished document.

Body system	Problem(s)	Normal process (e.g.)	Abnormal process (e.g.)	SPH aspect (e.g.)	Ethical aspect (e.g.)
Respiratory system	Shortness of breath	Normal structure and function of the bronchial tree	Mechanism of shortness of breath	Impact of weather on health	Brand medication prescription
Respiratory system	Cough and chest pain	Normal structure and function of the bronchial tree	Mechanism of cough and chest pain	Psychosocial impacts of smoking and cough	Taking unprescribed medication
Respiratory system	Chest injury	Structure and function of the thorax	Mechanisms of pneumothorax	Driving and car accident	Autonomy vs duty to report the danger to others
Genitourinary system	Vaginal discharge	Gross and microscopic structures of the vagina, and cervix	Burning sensation during urination	Behavioral factors predisposing to STI	Ethical concern on pelvic examination
Gastro-intestinal system	Abdominal pain	Blood circulation to the intestine and its regulation	Nausea, vomiting, and abdominal pain	Excessive alcohol consumption and health	Treating oneself
Gastrointestinal system	Yellowish discoloration (jaundice)	Mechanisms of body system detoxication	Abdominal distension and eye discoloration	Psychosocial impact of chronic alcohol intake	Confidentiality and substance abuse (marijuana)
Musculoskeletal system	Falling upper eyelid (ptosis)	Muscle excitation-contraction and regulation	Excitation-contraction disorder	Genetics in muscle weakness	Lack of care due to social stigma
Musculoskeletal system	Joint pain	Structure and function of synovial joints	Joint pain	Psychosocial effects of long-term immobility	Taking traditional and herbal medications
Nervous system	Loss of consciousness and body sensation	Intracranial pressure (ICP) regulation	Mechanism of loss of consciousness	Lifestyle factors and health	Consent for caring unconscious patient
Nervous system	Facial pain	Somatosensory cortex	Mechanism of neuropathic pain	Pain and quality of life	

Accordingly, we encourage future PBL case writers to carefully integrate content on psychosocial, economic, cultural, and other critical issues into patient scenarios, ensuring the holistic nature of clinical cases. This will motivate students to explore the complete contexts around patient health problems (person-centeredness) rather than focusing solely on biological aspects.

HOW TO USE THIS HANDBOOK

This handbook can be used by anesthesia faculty and departments to facilitate PBL sessions. Each PBL session will consist of two two-hour sessions (a total of four hours per week). Session one should take place on early weekdays (Monday or Tuesday), while session two should take place on later weekdays (Thursday or Friday), with two to three days in between for students to self-study.

In this handbook, each case has two components: a) the student copy, which contains patient information and discussion questions, and b) the tutor guide, which describes the expected role and response of the tutor. Students will rotate the roles of scribe and chairperson on a weekly basis, ensuring that everyone has an opportunity to experience both roles. The scribe will record the outcomes of group discussions, while the chairperson will introduce the case, invite and encourage participation, elaborate and reformulate the case, monitor the overall process, and summarize the case.

We redesigned our cases to reveal the case information during session one using two steps: subjective and objective data, rather than the routine extended unfolding steps that forced learners to primarily focus on ‘solving’ the ‘clinical’ piece of the patient problem.

Step 1: Subjective data

In this step, learners will be presented with subjective data obtained from the patient, allowing them to clarify unfamiliar terms, identify and analyze presenting problems, create a list of hypotheses connecting the various patient problems, identify learning issues, and enquire about further objective data to test their hypotheses. This step will be conducted for 60 minutes.

Step 2: Objective data

In this second phase of the first PBL session, students will be presented with patient objective data comprising findings of the clinical examination and relevant laboratory or imaging investigations.

In this step, students will be supported to summarize the new information they obtained from the objective data and explain how this new data could be used to rearrange their hypotheses. At the end of this phase, students are expected to rearrange their hypotheses and organize all learning issues identified during steps one and two. This step will also take 60 minutes.

To guide the overall session framework in this handbook, we followed the typical seven steps of PBL: Steps 1–5 will be covered in session one, while the rest will be covered in self-study and session two.

Problem 1: Easy fatigability

Student copy

Module name and code: Basics of biomedicals, body fluids & homeostasis [BioMM-2192]

Problem: Easy fatigability

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 35-year-old mother came to the OPD of a referral hospital complaining of easy fatigability. She complains that she started feeling tired three months back, which progressively worsened, and she can't perform her daily tasks. She reported feeling lightheaded sometimes, especially when she tries to stand up from a sitting position. Additional history revealed that she used to have repeated admissions to a nearby clinic in Asayta, Afar, for malaria treatment. She has four children; her last menstrual date was a week ago. Her parents are alive, and none has ever faced a similar illness. She usually feeds injera made from Barley and 'Teff', with 'Shiro' wot made of peas and beans. "I occasionally eat meat on holidays," she added.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, she was chronically sick-looking with pale conjunctiva, palmar crease, and buccal mucosa. Her vital signs were blood pressure: 110/65 mmHg, pulse rate: 110 beats per minute, respiratory rate: 25 breaths per minute, and a body temperature of 36.5^{o}C. She has a rapid and irregular radial pulse. Her spleen is enlarged as revealed by deep palpation. No other abnormal finding was noted on examination.

The laboratory investigation results are as follows:

Test		Patient's lab results	normal adult value
CBC:	WBC	10,300/ul	4,800-11,000
	Hemoglobin	6.0 gm/dl	11-15
	Hematocrit	19.0%	35-47
	Platelets	200k/ul	150-500k/ul
	MCV	70 fl	80-100 fl
	MCH	25	28-34

Other organ function tests were normal.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session one. Take these issues for self-study.

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Tutor guide

Module name and code: Basics of biomedical sciences, body fluids, and homeostasis

Problem: Easy fatigability

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discus the development, normal structure, and functions of red blood cells
2. Explain the pathophysiology of anemia including its effects on body systems
3. Discuss risk factors associated with anemia (diet, environmental, physiological, lifestyle, and family history)
4. Identify and interpret basic investigations required in patients with anemia
5. Explain the preventive and curative principles for anemia
6. Discuss the pharmaco-kinetics and dynamics of different classes of drugs used for the prevention and treatment of anemia
7. Discuss the psychosocial impact of easy fatigability

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does easy fatigability happen in the human body?
- How could easy fatigability and repeated hospital admissions affect individuals and the community at large (psychosocial effects)?
- How do dietary habits and repeated malaria infection relate to easy fatigability?
- What can be the management and prevention principles for patients with easy fatigability?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Poor dietary style → lack of energy → easy fatigability
- Poor dietary style →decreased red blood cell production→decreased oxygen and nutrient transportation →easy fatigability
- Repeated attack of malaria →decreased red blood cells →easy fatigability
- Repeated attack of malaria →increased blood glucose consumption→ easily fatigability
- Repeated hospital admission + easy fatigability → decreased productivity → poor dietary style → easy fatigability

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Mechanism of producing and maintaining red blood cell
- Pathophysiology and etiology of easy fatigability
- Risk factors associated with easy fatigability/ anemia
- Prevention and treatment principles of anemia

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (Pathophysiology). Ensure that the following issues are raised:

- The derangements in vital signs
- The enlarged spleen
- The derangements in complete blood counts

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of maintaining normal blood cell functions
- Mechanisms and risk factors of anemia
- Socioeconomic impacts of easily fatigability and anemia
- Management principles of anemia

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 2: Nasal bleeding

Student copy

Module name and code: Basics of biomedicals, body fluids & homeostasis [BioMM-2192]

Problem: Nasal bleeding

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 68-year-old man presented to the OPD complaining of repeated nosebleeds lasting two weeks. He said: “I have reddish and wet bruises all over my skin, headache, and dizziness”. He reported that two years ago, he underwent a laparotomy for a diagnosis of colon cancer and was taking unspecified medications; however, his medical record was incomplete for verification. He works in a supermarket and occasionally drinks alcohol. He denied having any personal or family history of other illnesses.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, he looks chronically sick-looking with pale conjunctiva, icteric sclera, and visible petechiae on his soft palate. His vital signs were blood pressure: 90/50 mmHg, pulse rate: 110 beats per minute, respiratory rate: 25 breaths per minute, and a body temperature of 36.5^{o}C. No other abnormal finding was noted on examination.

Investigation results:

Test		Patient’s lab result	normal adult value
CBC:	WBC	3000/ul	4,800-11,000
	Hemoglobin	8.0 gm/dl	11-15

	Hematocrit	23.5%	35-47
	Platelets	50k/ul	150-500k/ul
RFT	Cr	1.5 mg/dl	0.8-1.2
	BUN	25 mg/dl	6-20
	Glucose	90 mg/dl	60-115
Coagulation profile			
	Bleeding time (BT)	12 min	2-8 min
	Prothrombin time (PT)	20sec	10-15Sec
	INR	2.0	0.9-1.3
	PTT	50 sec	25-40 sec

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

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1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
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Tutor guide

Module name and code: Basics of biomedical sciences, body fluids, and homeostasis

Problem: Nasal bleeding

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discuss how the coagulation pathway maintains homeostasis.
2. Discuss the physiology of the coagulation cascade.
3. Explain how different risk factors contribute to bleeding diathesis (DIC, thrombocytopenia, coagulation disorder)
4. Discuss risk factors associated with bleeding disorders (DIC, thrombocytopenia, coagulation disorder).
5. Identify basic investigations required for common homeostatic disorders.
6. Propose preventive and management options for bleeding disorders.
7. Discuss the pharmaco-kinetics and dynamics of different classes of drugs used for the prevention and treatment of bleeding disorders.
8. Discuss the psychosocial impact of bleeding diathesis on quality of life

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does nasal bleeding happen?
- How does bleeding affect body functions?
- How do red and wet body bruises associate with bleeding?
- How do dizziness and headache associate with bleeding?
- How could the history of previous surgery relate to the current problem?
- What principles should be applied to manage patients with nasal bleeding?
- How could bleeding abnormalities affect individuals and the community psychosocially (psychosocial effects)?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage

students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Clotting factors deficiency → coagulation abnormalities → bleeding
- Platelet abnormalities → bleeding
- Bleeding under the skin → bruises?

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Mechanism of clotting cascades
- Pathophysiology of coagulation abnormalities
- Management principles of bleeding disorders
- Psychosocial effects of dizziness and headache

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical issues care rise in relation to the clinical care of this patent.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

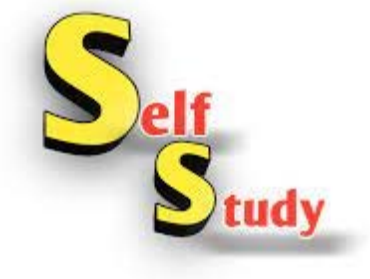
Eighth. Ask students to identify and clarify new terms, abnormal clinical examination and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- Pale conjunctiva and visible petechiae on the soft pallet
- Vital sign derangements
- The derangements in CBC and coagulation profile results

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.



SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of maintaining normal coagulation cascades
- Mechanisms of nasal bleeding
- Socioeconomic impacts of bleeding disorders
- Management principles of coagulation disorders

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 3: Chills, fever, and malaise

Student copy

Module name and code: Cardiovascular system [BioMM2212]

Problem: Chills, fever and malaise

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 34-year-old male patient arrived at the ER complaining of severe abdominal pain and cramping. He was brought to the hospital by his family because he was exhausted. He stated that he went to a nearby clinic three days ago, was diagnosed with a small bowel obstruction, and was immediately referred to a general hospital for further treatment. When he arrived at the hospital, he was told to have surgery, but he preferred rejecting the recommended care, signing a disagreement paper, and leaving the hospital. He presented with chills, fever, malaise, and a lack of energy to perform any activity. He reported having severe abdominal pain, nausea, and vomiting for a week.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, he appears acutely sick-looking, flushed, and toxic, with vital signs of BP=80/50mmHg, PR=120bpm, RR=24bpm, and T=39oC. On HEENT, he has pink conjunctiva, non-icteric sclera, and dry buccal mucosa. His extremities are warm and moist, and his capillary refill time is four seconds. The abdomen is slightly distended, with severe tenderness over the entire abdomen and guarding.

On investigation, Hgb: 16, WBC: 15000/µL, neutrophil: 5500/ µL, lactic acid level: 2.5 mmol/L, and RBS: 102 mg/dl. The plain abdominal film reveals a small bowel perforation.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
3. Explain the mechanisms of important problems identified
4. Rearrange the hypotheses
5. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

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1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
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Tutor guide

Module name and code: Cardiovascular system

Problem: Severe abdominal pain

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discuss blood circulation and its regulation (Medical physics of pressure, flow, and resistance)
2. Discuss the pathophysiology and systemic effects of shock
3. Differentiate the different types of shock
4. Discuss the management of shock
5. Analyze ethical considerations of treatment withdrawal
6. Explain how community awareness of surgery and anesthesia affects health outcomes

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does bowel obstruction lead to perforation?
- Why patient withdraws treatment as the idea of surgery was mentioned?
- Why is the patient feeling chill, malaise, and powerless?
- What is the systemic impact of nausea and vomiting?
- What ethical concerns could arise from treatment withdrawal?
- How could awareness of clinical care affect individuals and communities socioeconomically?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Infection → chills + malaise → loss of power

- Continuous vomiting → dehydration → hypotension → weakness
- Untreated infection → septic shock

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Discuss the effect of septic shock on the cardiovascular system
- The impact of delaying medical intervention on health
- Regulation of blood flow in the body

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- Deranged vital signs.
- Warm and moist extremities.
- Delayed capillary refill
- Distended abdomen with severe tenderness over the whole abdomen
- Deranged laboratory investigation results

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain individual problems. Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanisms of blood circulation and regulation (pressure, flow, and resistance)
- Mechanisms of different types of shocks
- Management principles of shock
- Ethical consideration of treatment withdrawal
- Explain how community awareness of surgery and anesthesia affects health outcomes

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 4: Shortness of breath

Student copy

Module name and code: Respiratory system [BioMM-2222]

Problem: Shortness of breath

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 34-year-old male patient presented to the medical OPD with a complaint of recurrent shortness of breath lasting two years. Associated with this, he reported chest tightness and a productive cough with whitish sputum. He described the symptoms as seasonal and occurring more frequently after summer-fall. He reported visiting a nearby clinic months ago for this illness, where he was prescribed a brand medication that he couldn't afford and thus didn't take. He denied family history of related illnesses.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, he appeared acutely ill with cardiorespiratory distress. He has a blood pressure of 100/60 mmHg, a pulse rate of 120 beats per minute, a respiratory rate of 34 breaths per minute, a body temperature of 37.5 °C, and an arterial oxygen saturation of 82%. His tongue and lips turned bluish (cyanosed), and his digits were clubbing. He has a barrel-shaped chest with sub-costal retraction and an expiratory wheeze with a prolonged expiratory phase of respiration. On percussion, there is hyper-resonance all over his chest.

Laboratory investigation revealed elevated CBC, while the chest X-ray film showed hyperinflation with flattening of the diaphragm. No other abnormal findings were found upon examination and laboratory investigation.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

References

1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
2. Snell RS. Clinical anatomy by regions. 9th ed. Lippincott Williams & Wilkins; 2011.
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Tutor guide

Module name and code: Respiratory system

Problem: shortness of breath

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discus the normal structure and function of the bronchial tree
2. Explain the mechanism of shortness of breath
3. Discuss risk factors associated with shortness of breath
4. Identify and interpret basic investigations required in patients with shortness of breath
5. Discuss the pharmaco-kinetics and dynamics of different classes of medications used for the management of asthmatic patient
6. Discuss the psychosocial impact of asthma

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does shortness of breath happen?
- What could be the possible cause for shortness of breath & chest tightness?
- What principles should be applied to manage shortness of breath?
- Implication of cough with whitish sputum
- What are the possible causes of shortness of breath?
- Why symptoms are exacerbated after the fall of summer?
- How could shortness of breath affect individuals and the community psychosocially (psychosocial effects)?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Prescribing brand medications → unable to afford → unable to buy and take medics → disease worsens
- Chest tightness → shortness of breath
- Mechanisms of breathing and ventilation → shortness of breath
- Environmental and seasonal factors → cough → shortness of breath

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Structures involved in breathing and ventilation
- Pathophysiology of shortness of breath
- Management principles of shortness of breath
- Environmental factors and psychosocial effects of shortness of breath

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical and other issues arise from prescribing costly brand medications.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (Pathophysiology). Ensure that the following issues are raised:

- The cardio-respiratory distress with derangements in vital signs
- The decreasing oxygen saturation
- Cyanosis of his tongue and lips, and clubbing of digits
- Barrel-shaped chest with sub-costal retraction
- The implications of expiratory wheezes and hyper-resonance
- The prolonged expiratory phase and pulmonary hyperinflation

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of breathing
- Mechanisms of shortness of breath
- Management principles of shortness of breath
- Possible causes and risk factors of asthma
- Management principles of asthma

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 5: Cough and chest pain

Student copy

Module name and code: Respiratory system [BioMM-2222]

Problem: Cough and chest pain

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 27-year-old male presented to a referral hospital medical OPD complaining of "cough and chest pain." On further questioning, he stated that he had a "productive cough of purulent sputum" for seven days. "I also experience a stabbing sort of right-sided chest pain exacerbated by heavy breathing and coughing," he continued. He also complained of breathing difficulties, fatigue, and a headache. He added that he took two drugs purchased by himself from a nearby drug store for his problems, but there was no improvement. When asked about his habits and medical history, he stated that he had smoked a packet of cigarettes daily for 15 years but had "no such illness in the family." He reported drinking local beer occasionally and currently lives with his wife and three children in a two-room home with one door, two windows, and a separate kitchen for cooking.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, he appeared acutely sick. He has a blood pressure of 80/50 mmHg, a pulse rate of 110 beats per minute, a respiratory rate of 32 breaths per minute, a body temperature of 38.5^{o}C, and an arterial oxygen saturation of 80%. The patient uses his accessory muscles to breathe, with increased tactile fremitus on palpation, dullness on percussion at the right upper 2/3rd of the lung field, and crepitation over the same area on auscultation. No other abnormal finding was noted on examination.

Laboratory investigation revealed that WBC: 16,000, 80% neutrophil, Lymphocyte 15%, [Normal: 5000 to 11000] with other results within normal ranges. The chest x-ray film showed opacity over the right upper lung field.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

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1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
2. Snell RS. Clinical anatomy by regions. 9th ed. Lippincott Williams & Wilkins; 2011.
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Tutor guide

Module name and code: Respiratory system

Problem: Cough and chest pain

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discus the normal structure and function of the bronchial tree
2. Explain the mechanism of cough and chest pain
3. Discuss risk factors associated with cough
4. Identify and interpret basic investigations required in patients with cough
5. Discuss the pharmaco-kinetics and dynamics of different classes of medications used for the management of a coughing patient
6. Discuss the psychosocial impact of cough and smoking
7. Identify ethical issues associated with taking unprescribed medication

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does cough form in the human body?
- How does smoking affect lung functions?
- How does a cough associate with shortness of breath and chest pain?
- What principles should be applied to manage cough and chest pain in patients?
- How could cough affect individuals and the community psychosocially (psychosocial effects)?
- What ethical concerns could arise from utilizing unprescribed medications?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Smoking + coughing → discrimination → delay in seeking help + cost
- Excessive effort of breathing → use of accessory muscles
- Lung membranes filled with fluid → stabbing pain worsening on coughing
- Chronic smoking → airway inflammation → coughing
- Poor hose ventilation + large family → increased risk of respiratory infection

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Structures involved in gas exchange (oxygenation and ventilation)
- Mechanism of cough and chest pain
- Pathophysiology of cough and chest pain
- Smoking and lung disease
- Management principles of cough
- Psychosocial effects of smoking and cough

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical and other issues arise from using unprescribed medications.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- The derangements in vital signs
- The decreasing oxygen saturation
- The dullness and crepitations over the lung fields
- The increase in the WBC count

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of breathing
- Mechanisms of cough
- Socioeconomic impacts of smoking and coughing
- Management principles of cough

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 6: Chest injury

Student copy

Module name and code: Respiratory system [BioMM-2222]

Problem: Chest injury

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 30-year-old male driver arrived at the emergency department four hours after being involved in a car accident. He complains of chest pain and breathing difficulties. "I was driving a lorry in the middle of the day, and while driving along the roads, a cow got trapped in my way, and when I tried to save the cow, I lost the main road and crashed with an electric pole," he said. He also said he did not remember what happened next or how he ended up in the hospital. He added, "I have severe chest pain, a chest laceration, a headache, breathing difficulties, and pain while breathing. He denied any prior personal or family history of chronic illnesses.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, he appeared acutely sick with shallow breathing. He is barely able to finish a sentence due to shortness of breath. He has a blood pressure of 100/50 mmHg, a pulse rate of 135 beats per minute, a respiratory rate of 38 breaths per minute, a body temperature of 36.1oC, and an arterial oxygen saturation of 85%. His buccal mucosa was bluish (cyanosed), and his chest had a superficial laceration. There is a decreased breath sound on the right chest. On percussion, there is hyper-resonance on his right chest. No other abnormal finding was noted on examination.

Laboratory investigation revealed average CBC results. The chest x-ray film showed air trapping on the right lung, tracheal deviation to the left, depressed right hemidiaphragm, and dark right hemithorax.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

References

1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
2. Snell RS. Clinical anatomy by regions. 9th ed. Lippincott Williams & Wilkins; 2011.
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Tutor guide

Module name and code: Respiratory system

Problem: Chest injury

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discus the normal structure and function of the thorax
2. Explain the mechanism of pneumothorax
3. Discuss risk factors associated with pneumothorax
4. Identify and interpret basic investigations required in patients with a chest injury
5. Discuss the management principles of patients with a chest injury
6. Discuss the psychosocial impact of a car accident
7. Identify ethical issues associated with taking care of a patient who reported crushing a car

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does the difficulty of breathing happen?
- How could the loss of consciousness be explained?
- How could the headache, chest injury, and unconsciousness be related?
- What principles should be applied to manage patients with chest injuries?
- How could road traffic accidents affect individuals and the community psychosocially (psychosocial effects)?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Road traffic accident + loss of consciousness → chest pain?
- Chest laceration → pulmonary contusion → difficulty of breathing

- Chest injury → rib fracture → pneumothorax? → difficulty of breathing
- Brain tissue contusion → transient loss of consciousness → ?

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- The mechanics of gas exchange and pleural and airway pressures
- Mechanism of shortness of breath
- Pathophysiology of pneumothorax
- Management principles of pneumothorax
- Psychosocial effects of chest trauma

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical and other issues arise from managing a patient who reported crashing a car?

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (Pathophysiology). Ensure that the following issues are raised:

- The derangements in vital signs
- The decreasing oxygen saturation
- The hyper resonance over the right lung fields
- The tracheal deviation
- The decreased breath sounds

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of has exchange
- Mechanisms of chest pain
- Mechanisms of pneumothorax
- Management principles of patients with chest injury/ pneumothorax

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 7: Vaginal Discharge and pain during peeing

Student copy

Module name and code: Genitourinary system [BioMM-2232]

Problem: Vaginal Discharge and pain during peeing

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 22-year-old woman presented to the regular Gynecology OPD with odorless vaginal discharge for two weeks associated with an itching sensation around her genitalia and burning pain while passing urine. "I also experience mild pain during sexual intercourse", she added. "My menstrual cycle is regular; it comes every 26 to 30 days and lasts three days," she replied when asked about her menses. Her menstruation is due in two weeks, according to the cycle. She stated that she had previously experienced similar illnesses. She lives near the piazza and works as a waitress in one of the nightclubs. She admitted to going out with customers and drinking beer, chewing Khat, and occasionally smoking cigarettes.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, she appears healthy. She has a blood pressure of 90/70 mmHg, a heart rate of 90 beats per minute, a respiratory rate of 22 breaths per minute, and a body temperature of 36.7°C. Pelvic examination reveals scanty vaginal discharge (roughly cottage cheese-like) with a slightly swollen erythematous vulva. Speculum examination showed normal-appearing cervical and vaginal walls; no visible discharge was observed.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

References

2. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
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Tutor guide

Module name and code: Nervous system

Problem: Loss of consciousness and body sensation

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this PBL session, students will be able to:

1. Explain the gross and microscopic structures of the vagina, and cervix.
2. Discuss the normal physiology of menstruation.
3. Explain the mechanism of the burning sensation during urination
4. Discuss how the environmental, lifestyle, and behavioral factors would predispose to reproductive tract infection (vaginitis).
5. Propose preventive and management principles for reproductive tract infection (vaginitis).
6. Explain the mechanism of action of drugs used for the management of vaginitis
7. Analyze the ethical concern associate with pelvic examination

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- What does it mean by odorless Vaginal discharge?
- How does pathologic vaginal discharge occur?
- Why there is a burning and itching sensation during urination?
- How does the female reproductive system relate to the renal system?
- What principles should be applied to manage patients with vaginal discharge and pain during urination?
- What are the psychosocial effects of having multiple sexual partners?
- What ethical concerns could arise when performing a genitourinary examination?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Burning and itching during urination → urinary tract infection
- Multiple sexuality → acquire infection → reproductive tract infection
- Expecting menses after two weeks → ovulation

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Structures involved in normal menses
- Pathophysiology of vaginal discharge
- Mechanisms of pain during urination
- Describe the clinical presentations a reproductive tract infection patient.
- Environmental, lifestyle, and behavioral factors predisposing to reproductive tract infection
- Propose preventive strategies for reproductive tract infections.

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical and other issues arise from a vaginal examination.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- The derangements in vital signs
- The scanty vaginal discharge
- The swollen and erythematous vulva
- The clinical relevance of speculum examination

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Gross and microscopic structures of the vagina and cervix.
- How the environmental, lifestyle, and behavioral factors would predispose to reproductive tract infection (vaginitis)?
- Preventive and management principles for reproductive tract infection (vaginitis).
- Mechanism of action of drugs used for management of vaginitis.
- Ethical concern associated with pelvic examination

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 8: Abdominal pain

Student copy

Module name and code: Gastrointestinal system [BioMM-2242]

Problem: Abdominal pain

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 42-year-old male patient presented to a hospital complaining of worsening abdominal pain, nausea, and vomiting that began three days ago. He has had four similar episodes lasting between 3 and 5 days over the past five years. He denied constipation or associated hematemesis, fever, chills, or urinary symptoms. During the first five-year episode, he reported being evaluated at a local health center and being diagnosed with gastric ulcers, for which he reported purchasing and taking an omeprazole pill on his own. He reported drinking 3-4 bottles of alcohol the past 10 years. In connection with the present complaint, he has a cough and shortness of breath; he has also complained of a headache.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, he appeared to be acutely ill. He has a blood pressure of 100/70 mmHg, a pulse rate of 120 beats per minute, a respiratory rate of 22 breaths per minute, and a body temperature of 37 °C. Examination of the abdomen revealed a distended abdomen on observation, abdominal guarding on palpation, a predominant tympany on percussion, and no bowel sounds on auscultation. However, there was no palpable mass.

Laboratory tests showed hemoglobin: 11 g/dL, hematocrit: 33%, neutrophils: 75%, and platelets: 250,000/mm3. An abdominal radiograph showed distended small bowel loops, while abdominal ultrasonography showed free fluid throughout the abdomen and pelvis.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

References

1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
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Tutor guide

Module name and code: Nervous system

Problem: Loss of consciousness and body sensation

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discus the normal structure and function of the intestine
2. Explain the mechanism of abdominal pain
3. Relate peptic ulcer disease with abdominal pain, nausea, and vomiting
4. Discuss risk factors associated with inflammation of peritoneum (peritonitis)
5. Identify and interpret basic investigations required in patients with peritonitis
6. Discuss the pharmaco-kinetics and dynamics of different classes of medications used for the management of a peritonitis patient
7. Discuss the psychosocial impact of nausea and vomiting
8. Identify ethical issues associated with taking unprescribed medication

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does peritonitis form in the human body?
- How does peritonitis affect intestinal functions?
- What are the causes of peritonitis?
- How does peritonitis associate with abdominal pain, nausea, and vomiting?
- What principles are applied to manage patients with abdominal pain?
- How could peritonitis affect individuals and the community psychosocially (psychosocial effects)?
- What ethical concerns arise from utilizing unprescribed medications?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Less emphasis to problem (treating by self) → delay in seeking help → increased cost + decreased clinical outcome
- Excessive alcohol consumption → gastric wall lining damage → abdominal pain
- Peptic ulcer disease → peritonitis

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Structures involved in abdominal pain, nausea, and vomiting
- Mechanism of abdominal pain, nausea, and vomiting
- Pathophysiology of peritonitis
- Management principles of peritonitis
- Psychosocial effects of peritonitis

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them *what ethical and other issues arise from using unprescribed medications*.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- Deranged vital signs
- Distended abdomen and abdominal guarding,
- Tympanic predominance on percussion.
- Generalized abdominal tenderness on palpation
- Distended loops of small bowel

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of abdominal pain during peritonitis
- Mechanisms of nausea and vomiting
- Socioeconomic impacts of peritonitis
- Management principles of peritonitis

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 9: Yellowish discoloration of eyes

Student copy

Name of Module: Gastrointestinal system [BioMM-2242]

Problem: Yellowish discoloration of eyes

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 55-year-old man was admitted to a medical OPD at General Hospital after presenting with yellowish discoloration of his eyes, easy fatigability, and abdominal distension for the past month. He also said he experienced a generalized itching sensation all over his body and a loss of armpit hair. He reported drinking at least 4-6 cups a day of local alcohol (**ኦሪቂ**) for the past 20 years and taking marijuana occasionally. He is a broker (**ደላላ**) by profession and currently lives with his wife and two daughters. He denied that none of his family members had a similar illness.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, he appeared chronically ill. He has a blood pressure of 110/70 mmHg, a pulse rate of 90 beats per minute, a respiratory rate of 18 breaths per minute, and a body temperature of 37 °C. It was evident from facial inspection that he has pink conjunctiva, and the otherwise white part of the eye was deeply yellowish (icteric sclera). When he undressed for the examination, scratch marks were visible all over his body. Both testes were shrunken (atrophied) on the lymphoglandular system, while both parotid glands were enlarged. Air entry was reduced in the right lower third of his lungs with dullness over the same area on percussion. The abdomen

is grossly distended with visible superficial veins and dull on percussion, while the spleen moves on respiration (ballotable).

From laboratory tests: Aspartate transferase (AST): 425 U/L, Alanine aminotransferase (ALT): 220U/L, international normalized ratio (INR): 2.5, Prothrombin time (PT): 18, Partial thromboplastin time (PTT): 40 seconds, and negative for viral markers. Analysis of the peritoneal fluid showed transudate with minimal inflammatory cells. Chest x-ray showed a right-sided pleural effusion, while abdominal ultrasound showed cirrhosis and splenomegaly with a normal echo pattern.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

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2. Snell RS. Clinical anatomy by regions. 9th ed. Lippincott Williams & Wilkins; 2011.
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Tutor guide

Module name and code: Gastrointestinal system

Problem: A case of Jaundice

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Explain the structure and functions of the hepatobiliary system
2. Explain the pathophysiology of common hepatobiliary disorders
3. Describe the common pathologies of the liver (infectious & non-infectious)
4. Explain the common complications of liver diseases
5. Discus management of cirrhosis patients
6. Discus risk factors, incidence, and prognosis of cirrhosis
7. Discuss the psychosocial impact of chronic alcohol intake
8. Discuss the psychosocial impact of frequent body scratching and itching
9. Identify ethical issues associated with taking marijuana

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does alcohol affect liver function?
- How does chronic alcohol intake associate with yellowish discoloration of the eyes, easy fatigability, and abdominal distension?
- What principles should be applied to manage alcoholic cirrhosis patients?
- How could alcohol affect individuals and the community psychosocially?
- What ethical concerns could arise from cirrhotic patients?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Alcohol intake → social discrimination → delay help-seeking + cost
- Mood swing → memory loss
- Esophageal varices + stomach ulcer → gastritis → abdominal distension
- Swollen liver → cirrhosis → hepatitis

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Structures involved in detoxification
- Mechanism of alcohol damage to the liver
- Pathophysiology of cirrhosis
- Alcohol and liver disease
- Management principles of alcoholic hepatitis
- Psychosocial effects of alcohol and alcoholic hepatitis

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical and other issues arise from taking marijuana.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- Diminished air entry and dullness on the right lower third lung field
- Deeply icteric sclera
- Bilateral testicular atrophy and parotid gland enlargement.
- Diffuse scratch marks
- Grossly distended abdomen with visible superficial veins
- Ballotable spleen dull for percussion
- Transudate fluid with minimal inflammatory cells.

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of alcohol-induced liver damage
- Mechanisms of cirrhosis
- Socioeconomic impacts of alcohol and CLD
- Management principles of chronic liver disease

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 10: Falling of the upper eyelid

Student copy

Module name and code: Musculoskeletal and integumentary system [BioMM-2252]

Problem: Falling of the upper eyelid (ptosis)

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 30-year-old female patient arrives at the medical OPD with the primary complaint of difficulty opening her right upper eyelid and having a double vision for the past two years. "I've had difficulty chewing food and combing my hair for the past month," she added. She is a rural housewife, and her husband is a model farmer. She stated that she had no history of trauma to any part of her body, used medication, and had a family history of similar illnesses. She reported that she had no regular health checkups. She claimed she didn't socialize with any of her friends and avoided them because she feared gossip and was stigmatized.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On physical examination, she appeared healthy, with vital signs of blood pressure 110/70 mmHg, pulse rate 80 bpm, respiratory rate 17 bpm, and temperature 36.7°C. Her body weight was 60 kg, and her height was 167 cm. She has a pink conjunctiva, a nonicteric sclera, and an intact pupillary reflex with right lid ptosis. There was no visible muscle wasting or rash. There was increased tension in the right pectoralis major and upper trapezius fibers. Right-hand strength was 4/5, right shoulder flexion 90, and right shoulder abduction 100 (limited by pain and weakness). All other major joints of the upper and lower extremities were within normal range. She had normal sensations and reflexes; no other abnormal findings were noted on clinical examination.

The electromyography test showed a rapid reduction in the evoked response amplitude, while the edrophonium test showed resolution of the ptosis.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
3. Rearrange the hypotheses
4. What principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

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1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
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Tutor guide

Module name and code: Musculoskeletal and integumentary system

Problem: Falling of the upper eyelid (ptosis)

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Explain the mechanism of skeletal muscle excitation-contraction and regulation
2. Describe the common disorders of muscle excitation-contraction and regulation
3. Explain the pathophysiology of myasthenia gravis
4. Explain the epidemiology of myasthenia gravis
5. Explain the psychosocial effects of myasthenia gravis
6. Discuss the treatment principles and options for patients with myasthenia gravis
7. Explain the pharmacokinetics and dynamics of anticholinesterase and corticosteroids

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How muscle weakness develops?
- Why proximal muscle groups are affected most in this patient?
- What factors can contribute to muscle disorders?
- Relation of muscle weakness and autoimmunity disorder?
- What is the mechanism of action of common drugs used for the treatment of muscle contraction disorders?
- What psychosocial effects are related to muscle weakness?
- How do social norms affect health?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Disorders of muscle receptor sites for neurotransmitter/ acetylcholine → poor muscle contraction → muscle weakness (e.g. Myasthenia gravis, Lambert-Eaton myasthenic syndrome (LEMS)
- Medications cause muscular weakness by inhibiting acetylcholine release or competing binding with acetylcholine receptors (e.g. antibiotics). Hormonal disorders → alterations in metabolisms of protein and carbohydrate → muscle weakness (e.g. endocrine disorders)
- Toxins and infection blocking acetylcholine release → weakness (e.g. botulism)
- Nervous system disorders (e.g. intracranial mass lesions)
- Weakness of eye muscles (e.g. progressive external ophthalmoplegia)

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Mechanism of skeletal muscle excitation-contraction
- Mechanism of skeletal muscle contraction regulation
- Pathophysiology of muscular weakness in MG
- Management principles muscular weakness (MG)
- Role of genetics in muscle weakness
- Pharmacokinetics and dynamics of medications used for the treatment of muscle weakness (anticholinesterase and corticosteroids)
- Psychosocial effects of muscle weakness

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- The decrement in proximal muscle tone
- The decreased range of elbow and shoulder flexion
- The edrophonium (tensilon) test and improved ptosis

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism and regulation of skeletal muscle excitation and contraction
- Pathophysiology of skeletal muscle weakness (emphasis on MG)
- Management principles for muscle weakness (emphasis on MG)
- Socioeconomic impacts of muscle weakness

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 11: Joint pain

Student copy

Module name and code: Musculoskeletal and integumentary system [BioMM-2252]

Problem: Joint pain

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 45-year-old woman, accompanied by her brother, arrived at the medical OPD and stated, "I have severe pain and swelling on my right knee joint." The patient reported pain in her left hand and elbow joints over the past six months, followed by swelling at the exact location. She also stated that she had been experiencing foot pain for four months but had not visited a health facility. When describing the pain and swelling, she mentioned a gradual onset at the knee joint, primarily the right one, and she is currently unable to touch the ground with her right leg. She stated that she needed at least two hours in the morning before moving her leg. For this reason, she went to a traditional healer, and her leg was tied with herbal medication from which she received no benefit. She is a merchant with no other history of illness, but her mother did have a similar disease.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On physical examination, the patient appears chronically ill with vital signs of blood pressure 110/70mmHg, pulse rate 98 beats per minute, respiratory rate 20 breaths per minute, and temperature 37.10C. She weighs 90 kg and is 167 cm tall. She has a pink conjunctiva, a non-icteric sclera, and an intact pupillary reflex. The right knee joint is severely swollen and sensitive to touch. There is a discrepancy of 2cm between the right and left knee joints. No other pertinent physical findings were noted.

On investigation, Hgb: 10.8mg/dl while other parameters were in the normal range. Synovial fluid analysis showed WBC-15000/mm3, neutrophil-85%, and a positive result for rheumatoid factor. X-ray of the right knee shows bone erosion and joint space narrowing.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
3. Explain the mechanisms of important problems identified
4. Rearrange the hypotheses
5. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

References

1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
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Tutor guide

Module name and code: Musculoskeletal and integumentary system

Problem: Joint pain

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Describe the normal structure and function of synovial joints
2. Analyze the risk factors of joint diseases
3. Analyze risk factors for joint disease (emphasis on rheumatoid arthritis)
4. Discuss the pathological change of joint disease (emphasis on rheumatoid arthritis)
5. Identify and interpret basic investigations required in patients with joint pain
6. Discuss the pharmaco-kinetics and dynamics of different classes of medications used for the management of joint disease (emphasis on rheumatoid arthritis)
7. Discuss the long-term consequences and psychosocial effects of joint diseases and immobility
8. Discuss preventive and curative principles for joint disease (emphasis on RA)
9. Identify ethical issues associated with taking traditional herbal medications

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How do joint pain, edema, and tenderness occur simultaneously?
- What are the epidemiology and risk factors of joint pain?
- What principles should be applied to manage joint pains?
- How joint pain affects other body systems and the community at large psychosocially?
- What ethical concerns could arise from taking traditional medications?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Overweight → bone disease → joint disease (osteo/ rheumatoid arthritis)
- Job nature → piercing injury → predisposition to microorganisms → infection (septic arthritis, tuberculosis arthritis)
- Immune reactions + certain environmental factors → autoimmune disease (psoriatic arthritis, systemic lupus erythematous) → joint pain and swelling

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Structures involved in joint movement
- Mechanism of synovial joint and fluid dynamics
- Pathophysiology of synovial joint infection
- Management principles of joint pain and swelling (rheumatoid arthritis)
- Pharmacokinetics/ dynamics of NSAID, anticholinesterase and steroids
- Psychosocial effects of long-term immobility due to joint diseases

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- Edema, tenderness, and pain
- Synovial fluid analysis result
- Elevated blood counts
- The positive rheumatoid factor
- Bone erosion and Joint space narrowing

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of joint movement and synovial joint function
- Mechanism of joint pain and swelling
- Systemic impact of joint diseases (rheumatoid arthritis)
- Management principles of joint pain and swelling
- Socioeconomic impacts of joint disease and immobility

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 12: Loss of consciousness and body sensation

Student copy

Module name and code: Nervous system [BioMM2092]

Problem: Loss of consciousness and body sensation

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 27-year-old car driver was brought to a referral hospital emergency OPD at midnight after he sustained a stick injury and reported a headache and being unable to move his legs for an hour. He reported being "robbed and physically assaulted by a group of men" as he was heading home from a local bar where he had spent the night with old friends. He reported being hit with a thick stick over his head and lower back before the attackers fled with his money and cell phone. "I didn't know what happened for some time and found myself in a health center", he added. The attendants who brought him stated they found him unconscious and bleeding from his head and rushed him to a nearby health center, where the scalp was sutured and his consciousness regained. He was referred urgently since he continued to have a headache and decreased leg sensation and movement. On arriving at the hospital, he complained of generalized headache, lower abdominal distension, nausea, and two episodes of vomiting of ingested matter. "I also have lower back pain and am unable to move my legs as much as I would want," he added.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On clinical examination, he was in pain and had a bandage over the right temporal region, as well as tenderness in that location. He has a blood pressure of 150/90 mmHg, a pulse rate of 58 beats per minute, a respiratory rate of 26 breaths per minute, and a body temperature of 36.4^{o}C. He has bruises and T-8 vertebral point tenderness. He was admitted with a Glasgow coma scale

(GCS) of E4M5V6 (15), which eventually dropped to E4M4V4 (12) after four hours. He has 3/5 bilateral lower extremity muscular strength and a decreased sense of light touch, pain, and vibration below the umbilicus. Deep tendon reflex was 2/4 on both arms at the biceps, triceps, and supinator muscles, and 1/4 on both legs at the ankle and knee. No other abnormal finding was noted on examination.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

References

1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
2. Snell RS. Clinical anatomy by regions. 9th ed. Lippincott Williams & Wilkins; 2011.
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Tutor guide

Module name and code: Nervous system

Problem: Loss of consciousness and body sensation

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discus the normal structure and function of the structures involved in awareness and lower extremity sensation
2. Explain the mechanism of loss of consciousness and of body sensation
3. Discuss risk factors associated with increased ICP
4. Discuss the pharmaco-kinetics and dynamics of different classes of analgesics used for pain management in head and spinal cord injury patient
5. Discuss the psychosocial impact of losing consciousness and body sensation
6. Identify ethical issues associated with the care of the unconscious patient

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How does head injury result in headaches and loss of consciousness?
- How spinal cord injury causes lower extremity weakness?
- How could head and spinal cord injury result in vomiting and lower abdominal distension?
- How can pain in head injury patients be managed?
- How could head and spinal cord injury affect individuals and the community psychosocially (psychosocial effects)?
- What ethical concerns could arise when handling unconscious patients?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Delayed arrival to hospitals → more damage to the brain
- Trauma → skull fracture and brain contusion
- Torn to blood vessels due to trauma → bleeding into epidural space → headache and loss of consciousness
- Torn to blood vessels due to trauma → bleeding into subdural space → headache, loss of consciousness, nausea, vomiting,
- Trauma of spinal cord → decreased sensation to extremities, loss of bladder or bowel control

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Mechanism of ICP regulation
- Pathophysiology of raised ICP
- Pathophysiology of spinal nerve root damage?
- Management principles of raised ICP
- Management of pain in the head and spinal cord injury patient

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical issues care rise in relation to the clinical care of unconscious patent.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify, new terms abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- The decreasing GCS
- The derangements in vital signs
- The loss of sensation and motor tone in the lower extremities

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of maintaining normal intracranial pressure
- Mechanisms of loss of consciousness and sensation
- Socioeconomic impacts of Etiology of increased ICP
- Management principles of increased ICP

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 13: Pain sensation on the face

Student copy

Module name and code: Nervous system [BioMM2092]

Problem: Pain sensation on the face

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 45-year-old man presented to the OPD with complaints of right-sided facial pain for two months. He stated that it is a sharp, stabbing pain lasting 15 to 20 seconds and occurs about five times daily. He added that the pain radiates from the front part of the right ear to the lower right jaw, teeth, and tongue. The pain is intense and disrupts his activities of daily living. He reported losing body weight in the past month. At first, he thought it must be related to a toothache and went to a dentist. However, symptoms were not relieved despite taking unidentified oral antibiotics. Otherwise, he has no history of trauma and no self or family history of chronic illness.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial list of hypotheses
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

Physical examination revealed that the patient is in pain with tenderness for palpation of the right cheek and jaw area. His vital signs were BP: 120/70mmHg, PR: 82 bpm, RR: 20 breath/min, and body temperature: 36.9^{O}C. Neurologic examination revealed 2/4 for deep tendon reflexes on both arms at the biceps, triceps, and supinator muscles and 4/4 on both legs at the ankle and knee. The numeric rating scale showed a pain score of 8/10. No other abnormal finding was noted on examination.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

References

1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
2. Snell RS. Clinical anatomy by regions. 9th ed. Lippincott Williams & Wilkins; 2011.
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Tutor guide

Module name and code: Nervous system

Problem: Pain sensation on the right face

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discus the gross and microscopic structure of the dorsal column–medial lemniscus system and somatosensory cortex.
2. Explain the mechanism of neuropathic pain
3. Discuss risk factors associated with neuropathic pain
4. Analyze the dual pathways for the transmission of pain signals into the central nervous system and pain suppression (“analgesia”) system in the brain and spinal cord.
5. Discuss the pharmaco-kinetics and dynamics of different classes of analgesics used for neuropathic pain
6. Discuss the psychosocial impact of neuropathic pain

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- Hou does the facial pain happen?
- What implication would a radiating pain to the lower jaw, teeth, and tongue have?
- Why the pain worsened on chewing, brushing, and shaving)
- How does the weight loss happen/ explained?
- Why the pain is irresponsive for antibiotic treatment?
- What principles should be applied to manage a patient’s facial pain?
- How could facial pain affect individuals and the community psychosocially (psychosocial effects)?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Facial nerve damage/ irritation → facial pain →
- Migraine headache → facial pain →
- Other forms of headache → facial pain →
- Pain worsens on movement → fear of eating → weight loss

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Mechanism of sensation and regulation
- Pathophysiology of neuropathic pain
- Pathophysiology of trigeminal neuralgia
- Management principles of neuropathic pain

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical issues care rise in relation to the clinical care of this patent.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- Implication of high numeric pain rating scale (NRS=8/10)
- Tenderness on facial palpation
- Abnormal neurologic examination (deep tendon reflexes of upper extremity)

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanisms of pain sensation and regulation
- Pathophysiology of neuropathic pain
- Socioeconomic impacts of neuropathic pain
- Management principles of neuropathic pain

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 14: Hearing impairment

Student copy

Module name and code: Nervous system [BioMM2092]

Problem: Hearing impairment

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 13-year-old eighth-grade student, accompanied by his mother, came to the ENT department of a hospital and had been complaining of hearing loss for three months. His mother reported that he had intermittent pussy discharge through his right ear. The discharge was reported starting seven weeks ago, which is progressively increasing in volume and unpleasant odor. The discharge recurs during attacks of colds. The mother added that his appetite had decreased over the weeks, and he had trouble sleeping at night. When asked, the mother expressed concern that his school performance and grades had suddenly dropped that year. She also reported noticing that he needed a louder voice to understand conversations. The child admitted having difficulty hearing his teachers as clearly as before for six months. He prefers to sit in the front row. Otherwise, he has no history of trauma or other chronic illnesses.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial list of hypotheses
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

Physical examination revealed that the child seems depressed and has purulent discharge with mild right mastoid bone tenderness. His vital signs were; BP: 90\60mmHg, PR: 102bpm, RR: 26, and temperature: 36.7oC.

An otoscopic examination of the right ear showed perforation of the tympanic membrane at the marginal zone (posterior superior quadrant) and a white polypoidal mass visible through the perforation. No other abnormal finding was noted on examination.

Discussion questions

1. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
2. Explain the mechanisms of important problems identified
3. Rearrange the hypotheses
4. What principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

References

1. Moore KL, Dalley AF, Agur AM. Clinically oriented anatomy. 7th ed. Lippincott Williams & Wilkins; 2013.
2. Snell RS. Clinical anatomy by regions. 9th ed. Lippincott Williams & Wilkins; 2011.
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Tutor guide

Module name and code: Nervous system

Problem: hearing impairment

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discus the macroscopic and microscopic structure and function of the ear
2. Discuss the central auditory mechanism
3. Explain the pathophysiology of hearing impairment
4. Discuss risk factors associated with hearing impairment
5. Discuss the psychosocial impact of hearing impairment

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How hearing impairment does occur?
- Implication of hearing impairment and decreased appetite?
- Difficulty of hearing, the difficulty of sleep, depression?
- How is purulent discharge associated with the common cold?
- How could the decline in his school performance be explained?
- What principles should be applied to manage patients with hearing impairment?
- How could hearing impairment affect individuals and the community psychosocially (psychosocial effects)?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems.Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Common cold → ear infection → purulent ear discharge → hearing impairment

- Hearing impairment → decreased appetite? → decreased school performance
- Hearing impairment → feels insecure → decreased school performance

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Mechanism of hearing
- Pathophysiology of hearing impairment
- Pathophysiology of otitis media
- Management principles of otitis media and hearing impairment

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis. In the meantime, ask them what ethical issues care rise in relation to the clinical care of a child patient.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- The hearing impairment
- The compromised audition
- The purulent discharges through the ear
- Depression
- Perforation of tympanic membrane

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanisms of hearing and regulation
- Pathophysiology of hearing impairment
- Socioeconomic impacts of hearing impairment
- Management principles of hearing impairment
- Psychosocial support to patients with hearing impairment

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 15: Pounding heartbeat

Student copy

Module name and code: Endocrine system [BioMM-2272]

Problem: Pounding heartbeat

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 50-year-old woman presents to the emergency department complaining of a pounding heartbeat. This condition came about after she had a violent argument with her husband. When asked about other ailments, she said: "I have frequent episodes of headaches, sweating, heat intolerance, and easy fatigability, which are particularly aggravated when I get angry." She also mentioned her significant but unquantified weight loss and increased appetite. For this condition, she visited a health facility and was given unspecified medication, which she took for a month but showed no improvement.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On assessment, she appears acutely ill with a vital sign of BP = 140/90 mmHg, PR = 110 bpm, RR = 20 bpm, and T=37.3 ^{o}C. On examination, she has pink conjunctiva, non-icteric sclera, and a 2x2 cm anterior neck swelling. She has a pan-systolic murmur at the apical area. Her skin is moist; she has a fine tremor. Otherwise, there is no other pertinent finding.

Laboratory investigation revealed CBC in the normal range while fine needle aspiration shows some hyperplastic colloid with increased activity. Thyroid-stimulating hormone (TSH): 0.1 mcU/ml (normal range 0.4-4.2 mcU/ml), Triiodothyronine (T3): 3.5 µg/dl (normal range 0.8-1.8 µg/dl), and Thyroxine (T4): 20µg/dl (normal range 4.6-12 µg/dl).

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
3. Explain the mechanisms of important problems identified
4. Rearrange the hypotheses
5. What principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

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Tutor guide

Module name and code: Endocrine system

Problem: Pounding heartbeat

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Discuss the anatomy and physiology of the thyroid gland.
2. Explain the actions of thyroid hormones
3. Correlate thyroid hormone abnormalities with clinical signs and symptoms, laboratory findings, and microscopic changes in thyroid tissue
4. Discuss the mechanism of action of drugs used in the management of thyroid function abnormalities
5. Discuss the epidemiology, risk factors, and psychosocial impact of thyroid gland abnormality (hyperthyroidism)

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How do clinical features like a pounding heartbeat, headache, sweating heat intolerance, easy fatigability, and weight loss occur?
- How do clinical features are related to the patient's emotional state?
- How T3 and T4 can be secreted?
- How do thyroid hormone abnormalities affect body systems?
- How does thyroid hormone abnormality affect individuals and the community psychosocially (psychosocial effects)?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Emotional state of the patient → increased sympathetic stimulation → occurrence of heart attack and other clinical features
- Hypertension → effect on cerebral blood perfusion → headache
- Increased T3 & T4 → hyperthyroidism → patients clinical feature →
- Blood glucose decrease → fatigue, sweeting → Hypoglycemia
- Increased metabolism → increased appetite + sweating + fatigue
- Psychiatric disorder (stress) →

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Mechanism of thyroid hormone regulation
- Actions of thyroid hormones
- Pathophysiology of raised thyroid hormone (including signs & symptoms)
- Epidemiology and risk factors for thyroid gland abnormality
- Psychosocial impact of thyroid gland abnormality

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- Deranged vital sign
- The 2x2 cm anterior neck swelling
- Pan-systolic murmur at the apical area
- Moist skin and fine tremor
- Hyperplastic colloid with increased activity (FNC)
- Altered thyroid function test

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Thyroid hormone regulation mechanism
- Mechanism of developing a pounding heartbeat
- Management principles of raised thyroid hormone
- Systemic effects of thyroid gland abnormality (Hyperthyroidism)
- Psychosocial and economic impacts of thyroid hormone abnormality (hyperthyroidism)

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).

Problem 16: Weight loss

Student copy

Module name and code: Endocrine system [BioMM-2272]

Problem: Weight loss

Allocated time: 240 min (in two sessions)

PART ONE: Trigger and relevant history [Subjective data]

A 28-year-old male patient presented to a medical OPD complaining of weight loss and easy fatigue for the past month. He also explained that he has recently developed excessive thirst and never gets full even after drinking plenty of water. He added that he pees 4-5 times per night. He reported an unusual feeling of hunger that started months ago. He mentioned that he had some reduction in daily activities. Upon further inquiry, he could not provide a family history of other illnesses or childhood illnesses. Its staple foods are potatoes and injera made from barley, teff, and corn mixed in varying proportions.

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Identify and analyze presenting problems and risk factors that you will use to develop an initial hypothesis list
3. Make a list of hypotheses on the mechanisms causing the patient's problems
4. What clinical examination and investigation data do you need to know to test your hypotheses?

N.B. Identify and document agreed-upon learning issues from this discussion.

PART TWO: Physical examination and investigations [Objective data]

On assessment, he appears to be a sick-looking person with vital signs of BP=100/70mmhg, PR=110bpm, RR=20bpm, T=37.1oC. on HEENT evaluation; he has Pink conjunctiva, non-icteric Sclera, and Dry buccal mucosa. There is no chest deformity or intercostal or subcostal retraction on the respiratory system; it is clear and resonant. On CVS: S1 and S2 are well heard, with no murmur or gallop. The abdomen is flat and moves with respiration. No other pertinent finding on Physical examination.

On investigation, CBC was in the normal range, RBS: 450mg/dl (normal range 70-180mg/dl), HgA1c = 7.5 mmol/L, and on urinalysis, glucose: +4 (reference range: negative), Protein: negative (reference range: negative), and Ketone: +3 (reference range: negative). Serum electrolyte showed Na+ =136mmol/L (reference 135- 145 mmol/L), K+ = 3.5 mmol/and L (reference 3.5 - 5 mmol/).

Discussion questions

1. Clarify unfamiliar terms and concepts
2. Summarize the new information you received and explain how it helped you in rearranging your hypotheses.
3. Explain the mechanisms of important problems identified
4. Rearrange the hypotheses
5. What should principles could help to manage the patient's problems

N.B. Add and finalize learning issues from session 1. Take these issues for self-study.

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Tutor guide

Module name and code: Endocrine system

Problem: Weight loss

Allocated time: 240 min (in two sessions)

Learning objectives: At the end of this session the students will be able to:

1. Explain the endocrine function (hormone-related) and structure of the pancreas.
2. Correlate pancreatic hormone abnormalities with the chemical/ clinical features of DM
3. Explain the mechanisms of complications of DM.
4. Discuss the treatment principle of DM
5. Describe the mechanism of actions and major adverse effects of different classes of oral hypoglycemic agents and insulin.
6. Discuss the risk factors, public health impact, and prevention mechanisms of endocrine dysfunction (DM).

SESSION ONE

Duration: 120 minutes

PART ONE: Trigger and relevant history [60 minutes]

First. Start by sharing part one data (trigger and relevant history) and allow students to read it.

Second. Ask students to identify and clarify unfamiliar and unclear terms and concepts in the presented data so that everyone understands the given information.

Third. Allow students to identify problems from the given data and continue this discussion until all problems are documented, while also ensuring that the predicted issues listed below are included.

- How are weight loss and fatigue related to diabetes mellitus?
- How insulin and glucagon can be secreted?
- Why glucose abnormalities can affect body systems?
- How does the common clinical feature of diabetes mellitus occur? (Polydipsia, polyphagia, and polyuria)?
- How could diabetes and its clinical features affect individuals and the community psychosocially (psychosocial effects)?

Fourth. Allow students to brainstorm as many ideas and concepts as they can from their prior knowledge to help them understand the identified problems. Then, engage students through in-depth discussions of the concepts they generated earlier to better understand each problem.

Fifth. Based on the given data, ask students to develop hypotheses (which could be a working diagnosis) that can connect and explain the individual problems. Make sure that the following hypotheses are forwarded:

- Increased fluid loss → decrease night time sleep → fatigue
- Increased appetite + decreased body weight → Hyperthyroidism
- Decreased secretion of ADH → increased loss of body water via urine (Diabetes insipidus)
- Insulin problem → increased urination + drinking + appetite
- Primary(psychogenic) polydipsia

Along with this, allow students to identify their learning issues from the discussion made so far. Ensure the following points are included:

- Function and structure of the pancreas
- Pathophysiology of diabetes mellitus
- The relation between electrolyte imbalance and DM, and its complications
- Risk factors of diabetes mellitus
- Types and diagnostic criteria of diabetes mellitus
- Management principles/options of DM and their side effects
- Epidemiological aspect and psychosocial impact of diabetes mellitus.

Sixth. Ask students what physical examination, laboratory, and imaging results they need to revise their hypothesis.

PART TWO: Physical examination and investigations [60 minutes]

Seventh. Start by providing part two data (physical examination and investigations) and allow students to read it. Follow the below steps for facilitation.

Eighth. Ask students to identify and clarify new terms, abnormal clinical examination, and investigation findings in the presented data and discuss the mechanism of how these key findings resulted (pathophysiology). Ensure that the following issues are raised:

- Dry buccal mucosa
- Deranged vital sign
- The reason behind increased RBS, HbA1C
- Urine analysis (+ve glucose, +ve ketone)

Ninth. Based on the given new data, ask students to prioritize their hypotheses (which could be a working diagnosis) that can connect and explain the individual problems.

Along with this, allow students to identify their learning issues from the discussion made so far.

Tenth. Ask students to organize all learning issues identified so far and remind each of the students to research all the learning issues using the suggested resources.

SESSION TWO

Duration: 120 minutes

PART ONE: Discussion on the problem [90 minutes]

Start by welcoming students to the session.

First. Allow students to share their learning and debate on the learning issues identified in session one. Then, summarize the session using the below list of PBL case summary points.

- Mechanism of regulating body glucose
- Mechanisms of an increase in body glucose
- Pathophysiology and type DM
- Management principles of diabetes mellitus
- Socioeconomic impacts of diabetes mellitus

PART TWO: Learning assessment and evaluation [30 minutes]

Second. Allow students to review what they have learned from working on the problem.

Third. Allow students to reflect on self and each person's including tutor contribution to PBL process. Document each student performance in the assessment sheet (assessment tool annexed).