



2024

Ethiopian Health Professionals Licensing Examination(EHPLE)

INFORMATION BOOKLET

MEDICAL RADIOLOGY TECHNOLOGY



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MINISTRY OF HEALTH - ETHIOPIA

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HEALTH CARE FOR ETHIOPIAN PEOPLE



Institute of
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Message From the State Minister, Ministry of Health -Ethiopia



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Improving healthcare quality is a global priority for sustainable development, with high quality healthcare being a key component of universal health coverage. One strategy to maintain health care standards is through provision of health professional competency assessment. Consequently, in 2019, the Ministry of Health Ethiopia, initiated the Ethiopian Health Professionals Licensing Examination (EHPLE) for undergraduates in seven health disciplines, which has since expanded to include 13 health disciplines.

The main goal of this competency assessment is to identify health professionals with minimal competencies necessary to perform their duties safely and competently, thus enhancing the quality of health care services. This initiative is overseen by a dedicated Health and Health Related Institutions and Professionals' Regulatory Lead Executive Office (LEO), comprising four desks, which plays a pivotal role in strengthening the system and enabling the LEO to conduct the competency exam more extensively and with improved organization and quality.

It is important to note that this competency assessment differs significantly from traditional academic or employment examinations. Hence, this information booklet has been created to address the informational needs of both examinees and teaching faculty regarding the Ethiopian Health Professionals' Licensure Examination. Additionally, it aims to facilitate the assessment process, while promoting transparency and ensuring the sustainability of the program.

The preparation of this guideline involved the collaboration of esteemed experts from various higher education institutions, the Ministry of Health, JHPIEGO-Ethiopia, Amref/HWIP, Health Professionals' Associations, and the Ministry of Education. Their invaluable contributions are acknowledged with sincere gratitude, alongside appreciation for the Ministry of Health staff for their unwavering commitment and hard work throughout the project.

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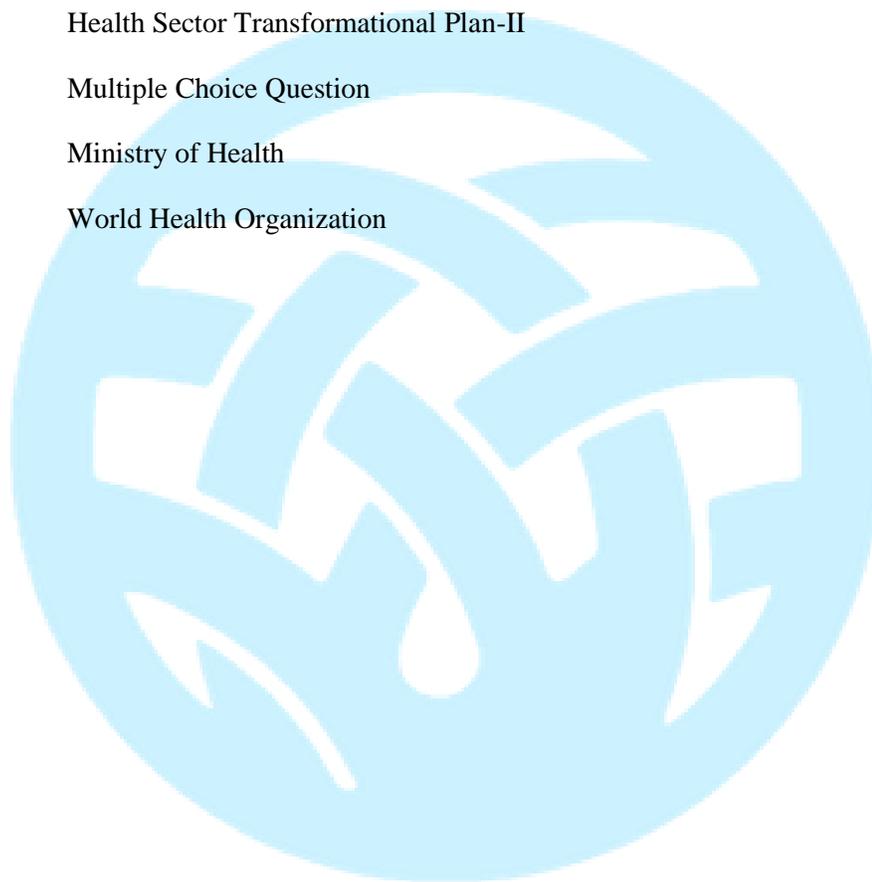
This Information Booklet for Ethiopian Health Professional's Licensure Examinations is a contribution from several educators, researchers, students and concerned individuals with a genuine interest to propel Ethiopia's medical and health sciences education forward.

The Ministry of Health is grateful for the contribution of many individuals and institutions in realizing this endeavor. Among these are Professional Associations, Student Association, Higher Education Institutions (both public and private), JHPIEGO-Ethiopia, AMREF/HWIP, MOE (Ethernet), UNFPA, AAU-IER and all HHRIPR LEOs staff.



Acronyms and Abbreviations

EHPLE	Ethiopian Health Professionals Licensing Examination
ETA	Educational and Training Authority
HEIs	Higher Education Institutions
HHrIPR-LEO	Health and Health-related Institutions and Professionals Regulatory Lead Executive Office
HSTP-II	Health Sector Transformational Plan-II
MCQ	Multiple Choice Question
MoH	Ministry of Health
WHO	World Health Organization



Purpose of the Information Booklet

The Ethiopian Health Professionals' Licensure Examination (EHPLE) Information Booklet serves as a comprehensive guide for those individuals seeking information about the exam. It typically outlines basic information for candidate registration, exam development and administration processes and procedures, result notification, and the licensing process. It also includes information on the exam framework, i.e., the exam domain, sub-domain, content, process, and task, with sample exam items specific to each profession.

The publication of this Booklet is crucial for the following reasons:

- **Clarity and guidance:** It provides clear information about the exam by ensuring candidates understand the necessary information to prepare them.
- **Accessibility:** It serves as a readily accessible resource for individuals pursuing to take the exam, consolidating essential information in one document and facilitating easy access to necessary details. It also helps other stakeholders who might be interested in such resources.
- **Transparency:** It promotes transparency in the examination process and fosters trust among stakeholders about the exam.

In summary, the publication of this Booklet is essential for creating a transparent, standardized, and accessible framework that guides candidates through the EHPLE process.

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Definition of terms

- **Domain:** a broad category or area of knowledge or skills of a profession
- **Sub-domain:** a subset of a broader domain that focuses on knowledge or skills related to the overarching domain
- **Content:** a more specific subcategory, which is a breakdown of the sub-domain
- **Task:** the responsibility, knowledge, skill, and attitude of a junior undergraduate professional in an actual work environment
- **Process:** a systematic sequence of steps or actions designed to achieve a specific outcome
- **Learning outcome:** a clear and measurable statement that describes what the examinee is expected to know or be able to do
- **Relative emphasis:** the proportional importance or weight assigned to different content areas or categories within the assessment
- **Item:** a particular multiple-choice question
- **Item developer:** a subject matter expert responsible for writing test items or questions that make up the examination
- **Item reviewer:** a subject matter expert responsible for reviewing and refining the test items or questions that make up the examination
- **Standard setting:** a process of determining a cut-off point or passing score for an exam
- **Item difficulty index:** a statistical measure that indicates the proportion of examinees who answered a particular test item correctly
- **Discrimination index:** a statistical measure that evaluates how well a particular test item differentiates between high-performing and low-performing examinees
- **Admission paper:** a printout paper generated by the system after completing registration that contains the examinee's photo, QR code, and necessary information

1. Introduction

1.1. Background

Competency assessment is one of the strategies for controlling the standard of healthcare services provided in healthcare facilities. The World Health Organization (WHO) recommends all healthcare professionals to have necessary competencies. In Ethiopia, the Health Sector Transformational Plan-II (HSTP-II) states competency assessment of all graduates before joining the health workforce as one of the strategic initiatives.

The Ministry of Health (MoH) launched the Ethiopian Health Professionals Licensing Examination (EHPLE) for undergraduates in 2019. The Health and Health-related Institutions and Professionals Regulatory Lead Executive Office (HHrIPR-LEO) of the Ministry of Health was given a mission to implement the Ministry's objective to achieve competency-related goals. It has the responsibility to ensure that the EHPLE meets technical, professional, and legal standards, and to protect the health, safety, and welfare of the public by assessing candidates' abilities to practice competently.

Currently, the exam is given for 13 health professions (Medicine, Nursing, Public Health, Pharmacy, Medical Laboratory Science, Anesthesia, Midwifery, Dental Medicine, Medical Radiology Technology, Environmental Health, Psychiatric Nursing, Pediatric and Child Health Nursing, and Emergency and Critical Care Nursing). Since its introduction until February 2024, a total of 166293 examinees took the exam in 14 rounds.

1.2. The Rationale of EHPLE

One of the critical functions of the MoH is to guarantee the efficiency, quality, and equity of healthcare delivery and to protect the public from any undesirable consequences in healthcare delivery practices. As professionals' competence is a significant determinant of the quality of health, evaluation of health professionals' competence has now been given due attention. The licensing examination for health professionals serves as a crucial step to ensure that individuals entering the field meet specific competency standards. The sole aim of the competency assessment is to safeguard public health by verifying that health professionals have the minimal basic knowledge, attitude, and skill required to provide safe and effective care.

Licensing exams act as a preventive measure, ensuring that only competent professionals join the health workforce, which, in turn, contributes to reducing the occurrence of medical errors and enhancing overall patient safety. By setting standards through examinations, regulatory bodies strive to minimize the risk of medical errors caused by incompetence.

2. Key processes of EHPLE

EHPLE involves several key processes to ensure the quality and reliability of the examination.

2.1. Registration of candidates

EHPLE has a mandatory online registration system for both new and repeat candidates, which can be found at www.hple.moh.gov.et

Please note these important notes during registration.

New Test Takers:



- The list of eligible candidates from governmental and private Higher Education Institutions (HEIs) will be sent from Ministry of Education (MoE) to MoH and uploaded to the online registration system by MoH.
- Once the name of the candidate is uploaded to the system and registration has opened for the current exam round, the candidate must register at www.hple.moh.gov.et by uploading the necessary documents listed below.
 - ✓ a scanned original or temporary degree
 - ✓ a scanned government-issued ID, passport, driving license, or any other legal ID
 - ✓ a passport-size photo of the candidate
 - ✓ For international candidates:
 - Equivalence document from ETA
 - Completing an externship attachment according to assignment by the regulatory body
 - Externship attachment completion letter

Repeat Test Takers:



- Since the information about re-exam candidates already exists in the system, the candidate should register by directly going to www.hple.moh.gov.et. There is no need for re-exam candidates to upload their documents.

Both new and repeat candidates:



- After completing the registration, the candidate must download and print the admission paper by logging into his/her account using his/her email address and password
- The candidate can change the exam center by logging into his/her account only during the registration period
- Once an examinee has selected his/her exam center during the registration period, an application for center change will not be allowed

2.2. Task Analysis

The first step of exam development involves conducting a comprehensive task analysis study, which identifies the tasks, knowledge, skills, and abilities required from a junior undergraduate professional in the specific profession. The analysis is typically done through surveys, interviews, or observations of practitioners in the actual work environment, as well as through the Delphi method with subject matter experts.

2.3. Exam Blueprint

Based on the task analysis findings, a test blueprint is created that outlines the content areas to be covered in the examination and the weight or emphasis given to each area. This ensures that the exam reflects the key competencies and knowledge needed for competent practice in that specific profession. Blueprint or test specification is the matrix or chart that shows the number and type of test questions represented across the topics in the content area, consistent with the learning outcome and relative weight of the test given to each content area. The blueprint also identifies the percentage weighting of cognitive dimensions as the level of competence tested in each knowledge domain.

Key components of a blueprint are:

- Domain
- Sub-domain
- Content
- Task
- Process
- Learning outcome
- Assessment methods
- Assessment tools/instrument (test format)
- Relative emphasis (in percentage)

2.4. Item Development

The items are developed following specific guidelines to ensure clarity, relevance, and fairness. Subject matter experts with experience in the field are selected from HEIs to develop test questions (items) that align with the test blueprint. The exam questions will focus mainly on “knows how” according to the competency level of the Miller's pyramid. The items are produced in a secure location on designated computers that are free from internet connectivity. The items are scenario-based and constructed with stem, lead-in, and four options/alternatives. All items will have a single-best-answer type of Multiple Choice Question (MCQ) that addresses the learning outcome defined in each content area. Standard text books, updated guidelines, and standards are used as reference materials.

2.5. Item Review

Once developed, the items undergo a rigorous review process by item reviewers. The main purpose of the exam review process is to evaluate content relevance, technical accuracy, clarity, and sensitivity related to culture and religion. More experienced subject matter experts as well as psychometric experts will do the review to ensure the items meet psychometric standards. Subject matter experts shall review the items to confirm that they are accurate, clearly stated, and correctly

keyed using the checklist. Psychometric experts shall reviews the items to ensure that they are not technically flawed. They also work on editorial review to check grammar, punctuation, and spelling errors. This helps ensure the reliability and validity of the items.

2.6. Standard setting method

The standard setting or cut-off point of the EHPLE is determined using the Modified-Angoff method, which is one of the most widely used and legally defensible standard setting approaches to set a cut-off point for high-stake competency examinations.

The method involves a panel of subject matter experts who evaluate each test question and then estimate the probability that a minimally competent examinee would answer each test item correctly. The average of the experts' predictions for a test question becomes its predicted difficulty. The average of the predicted difficulty values across all items on a test is the recommended cut-off point. This point indicates the minimum level of knowledge and skill required to pass.

2.7. Exam Administration

The EHPLE is administered following established protocols and guidelines. Proper test administration procedures, appropriate security measures, and appropriate consideration for test-takers who need special support will be applied during exam administration at exam centers. The exam is administered in selected HEIs nationally, where candidates can choose based on their convenience at the time of registration. The exam schedule will be posted ahead of time on the MOH website and official Facebook page. Examinees who have a valid admission paper are eligible to sit for the exam. The mode of exam administration is computer-based testing.

CAUTIONS

-
- Candidates are allowed



- Attend the orientation session in order to sit for the exam
- Arrive at the exam center on time
- Bring a legal ID and admission paper
- Complete the exam within the allotted time frame

➤ Candidates are **NOT** allowed



- To bring reference materials, blank paper, or notes into the exam center
- To smoke, eat, or drink in the exam room
- To bring mobile phones, tablets, smart watches, camera devices, eyeglasses, calculators or any type of electronic device into the exam center
- To bring their personal belongings to the exam center
- To bring weapons and sharp materials into the exam center
- To give or receive assistance to or from other candidates during the examination

2.8. Scoring and post exam analysis

Once the exam is completed, the scoring process begins. The exam scoring process involves computerized scoring using software.

Post-exam analysis is the process of analyzing examinees' responses to individual test items in order to assess the quality of the items and the exam as a whole. This phase helps to identify any poorly performing items that may need revision or removal from the exam. The item difficulty index, discrimination index, and reliability coefficient are elements of exam analysis.

2.9. Result notification and appeal management

After scoring and analysis, individual score reports are generated and provided to examinees through the website www.hple.moh.gov.et. After result notification, examinees can submit their appeal through phone or email within 10 working days after result notification.

2.10. Licensing

The list of examinees who passed the exam will be sent to regional and city administration regulatory bodies. A license is obtained from the regional/zonal health bodies where he/she permanently lives.

Requirements for professional licensing are:



- Passing the EHPLE
- Original or temporary degree
- Educational documents (10th and 12th certificates)
- Medical certificate
- Government issued ID
- Additional prerequisites based on the requirements of regional regulatory bodies

3. Exam Framework

The key broader professional roles, also known as domains or main knowledge areas serve as a building framework for the licensing examination content for Medical Radiology Technology professionals. The domains are further divided into discrete professional attributes that constitute sub-units (also referred to as sub-domains) defining the professional identity of Medical Radiology Technology professionals. Tasks specifying the performance level of each sub-domain serve as the final characteristic of the professional duties on which the licensing exam focuses.

The contents of the licensing examination are presented below, structured into key roles (domains), sub-units (sub-domains), and tasks. The examination emphasis for each domain and sub-domain, out of the total 100% questions, is indicated in brackets.

Key professional roles/ domains

- Patient Care (78%)
- Scholar (7%)
- Professionalism (5.0%)
- Leadership and management (6.0%)
- Health promotion and disease prevention (4.0%)

Key role/ domain 1: Patient Care (78%)

Description: This domain encompasses the professional role of medical radiology technologists in the provision of high-quality, safe, and patient-centered medical radiology service for diverse groups of patients. The provision of up-to-date, ethical, and resource-efficient radiologic services requires the application of integrated knowledge of biomedical, clinical, social, and behavioral sciences within their scope of practice. As patient care providers, medical radiology technologists shall possess applied knowledge of patient positioning, selection of appropriate technical factors and equipment to produce optimum diagnostic images, performing appropriate diagnostic imaging, and interpretation of medical radiologic images within their scope of practice and with an understanding of the limits of their expertise. To demonstrate competence in this domain, candidate shall apply an integrated knowledge in the following sub-units/sub-domains:

- X-ray (26.5%)
- Special procedures (4.5 %)
- Ultrasound (22.5%)
- Computed Tomography/ CT scan (11%)
- Magnetic Resonance Imaging/ (9.5%)
- Quality assurance and safety (4%)

Key role/ domain 2: Scholar (7.0%)

Description: This domain encompasses the professional roles of medical radiology technologists in generating and utilizing scientific data to improve the health and well-being of the community and broaden their scientific knowledge within the healthcare system and community setting. Providing this service requires the application of integrated knowledge in research methods, measurements of health and disease, biostatistics, epidemiology, clinical audit, evidence-based practice, and research ethics. To demonstrate competence in this domain, candidates must possess

applied knowledge in planning, problem identification, data collection, analysis, interpretation, report writing, and dissemination of research findings.

Key role/ domain 3: Professionalism (5.0%)

Description: This domain encompasses the professional commitment of medical radiology technologists to promoting the health and well-being of individuals and society through adhering to ethical standards, maintaining personal integrity, and upholding high standards of competence in all areas of practice. To exhibit competence in this domain, candidates must possess applied knowledge of ethical principles, medico-legal practices, effective communication, accountability to the profession and society, maintenance of professional excellence and personal health, continuous professional development and professional values such as, integrity, honesty, altruism, and humility, motivated, compassionate, and respectful care.

Key role/ domain 4: Leadership and management (6.0%)

Description: This domain encompasses the professional roles of medical radiology technologists in envisioning a high-quality healthcare system through self-awareness, active participation in healthcare team development and leadership, and managing health systems. Providing this service requires the application of integrated knowledge in continuous quality improvement, effective health system leadership, management, and healthcare ethics. To demonstrate competence in this domain candidate shall possess applied knowledge to plan, organize, staff, lead, execute, monitor, and control healthcare resources and activities.

Key role/ domain 5: Health promotion and disease prevention (4.0%)

Description: This domain encompasses the professional roles of medical radiology technologists in enhancing the health and well-being of patients, communities, and the larger populations they serve through health advocacy, disease prevention, health promotion, health protection, and the promotion of health equity. Providing this service takes an integrated understanding of determinants of health, health informatics, epidemiology, communicable disease control, and health education.

Table Exam Content For Medical Radiology Technology Profession

Domain 1: Patient Care	
Sub-domain	Tasks
X-RAY	Prepare X-ray machine
	Perform Upper limb X-ray
	Perform Lower Limb X-ray
	Perform Vertebral X-ray
	Perform Abdominal X-ray
	perform Skull and Facial X-ray
	Perform Thorax X-ray
SPECIAL PROCEDURES	Prepare flourosopic machine and patients
	Perform the IVU, HSG, and Cystourethrography (cysto,urethro)
	Perform barium studies (swallow, meal and enema)
ULTRA-SOUND	Perform abdominal ultrasound
	Perform pelvis ultrasound
	Perform obstetrics ultrasound
CT-SCAN	Prepare CT machine and patients

	Perform head and neck CT examinations (brain, PNS, TMJ, Orbit)
	Perform spine CT (Cervical, Thoracic, LS)
	Perform thorax (Chest, HRCT)
	Perform abdominal, pelvis and CT urography
	Perform MSK (lower and upper extremity) CT scan
	Perform CT angiography
MRI	Prepare MRI machine and patients
	Perform head and neck MRI examination
	Perform MSK MRI (Humerus, shoulder, Arm, Hand and Wrist, hip, thigh, leg, knee, ankle and foot)
	Perform spine MRI examination (cervical, thoracic and lumbar LS)
	Perform thorax and abdominal MRI
	Perform pelvic MRI
	Perform MR angiography
QUALITY ASSURANCE AND SAFETY	Perform radiological equipment acceptance test
	Perform preventive and corrective maintenance
	Apply magnetic and radiation safety

Domain 2: Leadership and Management

Tasks

- Apply principles and functions of management and leadership
- Develop strategic and operational plan
- Apply resource management principles
- Develop and cascade program monitoring and evaluation

Domain 3: Health promotion and disease prevention

Tasks

- Apply health promotions principle
- Select health education theory/model suitable for medical radiological services
- Provide health education related to medical radiological services

Domain 4: Professionalism

Tasks

- Adhere to legal and ethical principles pertaining to MRT practice
- Establish and maintain a motivated and compassionate care along with a collaborative working relationship with clients, client families, the MRT team, and other working colleagues
- Produce and maintain accurate documentation of activities, procedures and results

Domain 5: Scholar

Tasks

- Assess community health status to ascertain determinants of health
- Develop research proposal
- Collect data for quantitative study
- Analyze and interpret research findings

Sample questions

1. A radiology technologist sets imaging protocol for a 17-year-old young patient who is referred to an MRI department for Magnetic Resonance Urography (MRU) examination.

What is the most appropriate protocol the technologist should use during MRU scanning?

- (A) 3D T1 post-contrast with MPR and MIP images
- (B) Long TE scans producing heavy T1 weighting
- (C) Short TE scans producing heavy T2 weighting
- (D) 3D T2 imaging with thick slices

Answer Key: The answer is **A**

Explanation: The use of a 3D T1 post-contrast image with multi-planar reformat and maximum intensity projection is the most appropriate protocol for this MRU examination as it provides a better spatial resolution. On the other hand, long echo-time scans producing heavy T2 weighting images allow better visualization of renal pathologies, but not long echo-time scans producing heavy T1 weighting images (Option B). Short echo-time scans are not sufficient to visualize fluid distribution in the urinary tract (Option C) and 3D T2 imaging with thick slice gaps (Option D) may miss small pathologies and have low resolution in the scanning process.

2. A 55-year-old male patient comes to a radiology department with a request paper for Intravenous Urography (IVU) procedure. A radiology technologist appoints the patient for the next day after giving instructions.

What is the most important patient preparation that has to be taken place at home?

- (A) Emptying the bladder
- (B) Psychological readiness
- (C) NPO for 5 hours prior to examination
- (D) Drinking more water prior to examination

Answer Key: The answer is **D**

Explanation: In order to prepare the patient for an IVU procedure, the patient cannot take food 5 hours prior to the examination. This is needed to clear gas from the bowel that may obscure suspected pathology and to avoid artifacts. On the other hand, though psychological preparation (Option A) is desirable, it is not effective in clearing the bowel. Equally, drinking water only distends the stomach (Option B) which is not important in this case and emptying the bladder (Option C) is not effective in clearing the bowel additionally this procedure does not increase urine secretion.

3. A patient comes to a radiology department for a Para-nasal sinus /PNS/ x-ray examination. A radiology technologist on duty positions the patient and takes a PNS Waters view.

What is the most anterior anatomical landmark to position the patient??

- (A) Inion (B) Nasion (C) Gonion (D) Acanthion

Answer Key: The answer is **D**

Explanation: The proper anatomical landmark for this case is the Acanthion (Option D) which is the midline junction of the upper lip and nose as the projection would position the patient facing the upright Bucky in contact with the chin and nose. Using the Acanthion as an exit point displays the sinuses and allows the petrous ridge to appear below the maxillary sinus. On the other hand, using the Inion (Option A) and Gonion (Option C) distorts the orbitomeatal line angle needed for this projection. In the same vein, using the Nasion (Option B) does not produce the proper Water's view but instead displays PA Cladwell projection.

4. A 45-year-old patient comes to a radiology department for knee joint x-ray. A radiologic technologist puts the patient in prone position by adjusting the leg parallel with the long axis of table and flexing the joint slightly more than 90 degrees. The radiographic image shows the patella which is projected anterior to the distal femur.

What is the most likely patient positioning applied by the radiologic technologist in this case?

- (A) Lateral view (C) Postero-anterior view
(B) Skyline view (D) Antero-posterior view

Answer Key: The answer is **B**

Explanation: The positioning described in the above case is typical of Skyline view (Option B), which can demonstrate the patella projected anterior to the distal femur. The lateral view (Option A) demonstrates the patella clear of the femur on the side not anteriorly. The postio-anterior view (Option C) helps in bringing the patella in close proximity to the cassette and demonstrates the patella more clearly, but it is not able to demonstrate the patella anterior to the distal femur. The antero-posterior view (Option D) shows the patella centralized and superimposed over the femur.

5. A 45-year-old female patient comes to a radiology room for pelvic ultrasound examination. She has a clinical history of menorrhagia, irregular mensus and pelvic pain. Ultrasound image shows a well-demarcated, round and hypoechoic lesion within the normal homogeneous myometrial echopatterns.

What is the most likely diagnosis for this case?

- (A) Adenomyosis (B) Hyperplasia (C) Myoma (D) Polyp

Answer Key: The answer is **C**

Explanation: In the above scenario, the patient's signs and symptoms are highly suggestive of uterine mass. The results of the ultrasound, a well-demarcated, round and hypoechoic lesion within the normal homogeneous myometrial echopatterns, also indicates the sonographic features of Myoma (Option C). Moreover, Myomas are common benign lesions, present in more than 30% of woman aged 40-60 years of age. Adenomyosis (Option A) is not an answer because the most specific ultrasound signs of adenomyosis are subendometrial echogenic linear striations, a globular configuration to the uterus and myometrial cysts. Hyperplasia (Option B) has ultrasound features of persistent thickening over 10mm. It can also contain tiny cystic spaces. Polyp (Option D) has ultrasound feature of a focal area of echogenic endometrial thickening.

6. A radiology technologist on duty is preparing a CT-scan machine for examination in the early morning. While performing short tube conditioning using phantom to warm up the tube, the radiology technologist identifies ring artifact on the resultant images. To resolve the artifact and proceed the examination, he has planned to take interventional management.

What is the most appropriate initial interventional management that has to be taken by the radiology technologist?

- (A) Decrease scan time
 (B) Adjust pitch settings
 (C) Increase KVP settings
 (D) Recalibrate the scanner

Answer key: The answer is **D**

Explanation: One of the major roles of the radiology technologist in the CT-scan room is to warm up the machine before doing any examination. This is to identify artifacts, keep machine safety and to produce high quality images. In this scenario, the technologist identified ring artifact. Ring artifacts appear on the CT images as a ring centered on the rotational axis with third generation scanners. These artifacts are caused by imperfect detector elements which are either faulty or simply out of calibration. There are interventional managements taken when artifacts occur. The most appropriate initial interventional management to eliminate ring artifact is recalibrating the scanner (Option D). If the rings persist after recalibrating the scanner, the problem must be reported to a service engineer for repair. Decreasing the scan time (Option A) is not preferred since it helps to manage motion effect but not ring artifact. Adjust pitch setting (Option B) will help to manage aliasing effect and spiral interpolation artifacts. Increase KVP setting (Option C) will help to eliminate beam-hardening artifact and metallic streaks.

7. A 60-year-old patient comes to a radiology department for intravenous urography examination. A radiologic technologist has positioned the patient to take a preliminary image after properly preparing the patient.

What is the most appropriate positioning in the above case?

- (A) PA, erect
 (B) AP, supine
 (C) 30° anterior obliques
 (D) 30° posterior obliques

Answer key: The answer is **B**

Explanation: Proper positioning of the patient during radiographic procedures is mandatory to enhance the diagnostic value of the procedure. The preliminary image should be taken prior to the administration of contrast agent for the procedure. This image is evaluated for preparation of the patient, proper exposure factor selection, patient positioning and centering. In the above case, the radiologic technologist positioned the patient for obtaining the preliminary image. AP, supine (Option B) is the most appropriate positioning technique during preliminary image. PA erect (Option A) is not a preferred positioning since intravenous urography procedure is performed in supine position. Moreover, 30° anterior oblique (Option C) cannot be used for intravenous urography procedure. As well, 30° posterior oblique (Option D) is used in the sequences after contrast agent administration; it is not used in the preliminary image.

8. A radiologic technologist has designed a successive health education and promotion interventions to improve radiation protection utilization during x-ray examinations. The first intervention focuses on improvement of knowledge and skills regarding type and application of radiation protection materials. The second intervention is designed to avail all necessary radiation protection materials while the third intervention is devised to increase the contribution made by senior leaders and professionals in utilizing radiation protection materials.

Which principles of health education is applied by the technologist?

- (A) The hierarchical principle
 (B) Principle of cumulative learning
 (C) Principle of educational diagnosis
 (D) The known to unknown principle

Answer Key: The answer is **A**

Explanation: The interventions that the radiology technologist has made are to improve radiation protection utilization has showed sequences of measures to influence the behavior of the senior leaders and professionals who are working in the department of radiology. The first measure taken is to address predisposing factors by narrowing the knowledge and skill gaps on application of the radiation protection materials. The second measure taken is accessing the necessary materials. Finally, reinforcing measure was taken by means of applying the obtained knowledge and skill of radiation protection using availed materials. Thus, the principle applied by the radiology

technologist for the improvement of the radiation safety indicates hierarchical principle (Option A).

9. A 58-year-old female patient presents with a chronic lower back pain. Lumbar x-ray shows decreased bone density, exaggerated width of disc space and biconcave vertebrae.

What is the most likely diagnosis for the patient's problem?

- (A) Infection (C) Osteoporosis
(B) Metastasis (D) Paget's Disease

Answer Key: The answer is C

Explanation: In this scenario, the patient's age indicates that she is in the post-menopausal period. Her chronic back pain related with the x-ray features: i.e., decreased bone density, exaggerated width of disc space and biconcave vertebrae, indicate typical appearance of osteoporosis of the vertebrae (Option C). Infection (Option A), metastasis (Option B) and Paget's disease (Option D) all increase the radiographic density of the vertebral body.

10. A radiologic technologist has performed an MRI coil quality control test. The technologist has used a phantom to measure the maximum and mean signal to noise ratio of the coil.

What is the most likely MRI coil function test that has been done in this case?

- (A) Head coil test (C) Surface coil test
(B) Body coil test (D) Volume coil test

Answer Key: The answer is C

Explanation: Radiofrequency coils are devices used in MRI to transmit and receive radiofrequency pulse during MRI scanning. Quality control tests are performed regularly to check the functionality and uniformity of these coils. Measurement of the maximum and mean signal to noise ratio are used to test the surface coils quality (Option C). Head coil (Option A) and body coil (Option B) are the types of volume coil (Option D) and the quality control test needed for these coils are Measurements of Image uniformity, Signal to noise ratio and percent signal ghosting.

11. A radiologic technologist has noticed a gestational sac while he has been scanning a 25-year-old female patient, who comes for abdomino-pelvic ultrasound. The ultrasound machine of curvilinear transducer with frequency ranging from 2.5MHz to 5MHz has been used during scanning. The radiologic technologist wants to assess the gestational sac for presence of yolk sac and embryo, and to measure takes the true gestational sac diameter.

What is the next most appropriate technique that the technologist should use?

- (A) Changing the frequency to 5MHz
 (B) Changing the frequency to 3.5MHz
 (C) Changing the frequency to 2.5MHz
 (D) Changing the frequency to 7.5 MHz

Answer Key: The answer is **D**

Explanation: The probe frequency indicates the penetration capability and image resolution of the ultrasound. The high frequency ultrasound has low penetration capability and high image resolution. In this case, the technologist wants to assess the presence of yolk sac, embryo and gestational sac measurement which are the signs of early pregnancy that need high image resolution. Therefore, to achieve this, the curvilinear probe frequency has to be changed to 5 MHz (Option D). A frequency of 2.5MHz (Option A) and a frequency of 3.5MHz (Option B) are used for deep organs and not for early pregnancy. What is more, 7.5 MHz (Option C) is not applicable in the curvilinear probe because they are used in linear probe to scan superficial organs.

12. A 47-year-old obese patient with complaints of severe steady ache in the right upper quadrant, which begins suddenly and occurs after fatty meals and lasts for several hours, comes for abdominal ultrasound. A radiologic technologist on duty has identified a hyperechogenic intraluminal structure which is gravity-dependent and casts a posterior acoustic shadow within gallbladder.

What is the most likely diagnosis of this patient?

- (A) Cholelithiasis
 (B) Cholesterolosis
 (C) Adenomyomatosis
 (D) Choledocholithiasis

Answer Key: The answer is **D**

Explanation: In this scenario, the patient's severe right upper quadrante pain after fatty meals suggested gallbladder, liver and pancreas pathologies. While performing abdominal ultrasound scanning, the technologist has identified a hyperechogenic and movable structure with posterior acoustic shadow within the gallbladder lumen which is the ultrasound feature of Cholelithiasis (Option D). Choledocholithias (Option A) is a stone that also has posterior acoustic shadow; however, it is located in the common bile duct. Adenomyomatosis (Option B) is a non-inflammatory process which has thickened GB wall with Rokitansky-Aschoff sinus. Cholesterolosis (Option C), is known as strawberry gallbladder, is the presence of multiple tiny nodules on the surface of the gallbladder mucosal lining resulting from the build-up of lipids.

13. A patient, who has a colostomy bag, comes to an MRI center for pelvic MR examination with his family member. The patient and his family member are cooperative and follow instruction of the radiographers. When radiographers asked to expose the patient's private body part, they altogether said, "we are here to get your service, and we feel health professionals are like our family member and thrive for our full recovery."

What type of family and patient behavior is exhibited in this scenario that would help the family to cope-up the situation?

- (A) Tolerance
- (B) Adaptation
- (C) Rationalization
- (D) Taking initiative to build relationship

Answer Key: The answer is **C**

Explanation: Adaptation, rationalization and taking of further action to build relationship are among commonly mentioned patient and family related factors of respectful care. In rationalization, patient and family rationalize health professionals act towards betterment of health and good health outcome and cooperate fully. In the scenario, the patient rationalizes the bodily exposure is part of professional act and not complains about it. Therefore, C is the answer for the question.

14. A Head of radiology department has planned to develop performance indicators for controlling a new project. The project is required performance indicators which will be collected daily and regularly to describe the change in performance, to identify problems, and to take immediate corrective actions.

What is the most appropriate performance indicator that the Head should develop to gather information for this purpose?

- (A) Evaluation
- (B) Monitoring
- (C) Inspection
- (D) Supervision

Answer Key: The answer is **A**

Explanation: Monitoring is conducted continuously since it is the main activity of different programs and projects. It involves continuous data collection, analysis, interpretation and utilization to answer project related questions. Monitoring is a day-to-day, or continuous follow-up of an ongoing activities. It is can be done through observation of workers and materials, discussion with workers, supervisors and beneficiaries, and review of reports or statistical data. Furthermore, monitoring is one of the tools for evaluation.

15. A medical radiologic technologist measured the amount of scatter radiation (mSv) from different X-ray examinations. The data were asymmetric with high variability.

What is the most appropriate measure of central tendency and dispersion for this scenario?

(A) Mean and SD

(C) Median and SD

(B) Mean and IQR

(D) Median and IQR

Answer Key: The answer is **D**

Explanation: Median is one measure of central tendency that divides the dataset into two equal parts which cannot be affected by the outliers. Interquartile range (IQR) is also the measure of dispersion/variability of the dataset in the middle 50 percent, and it is not affected by the outliers. In the above scenario, the medical radiologic technologist observed an asymmetric X-ray examination result, which means it has an outlier value. Thus, in this scenario median and IQR are the best measure of central tendency and dispersion respectively. The other mean and SD are highly affected by the outlier measure of central tendency and dispersion respectively.

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