DPT 7th

Subject: Radiology and diagnostic imaging (lab) assignment

Marks: 80

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Q1: What is the role of diagnostic imaging in physiotherapy?

Answer:

Radiology is a branch of medicine that uses imaging technology to diagnose and treat disease. Radiology is divided into two different areas, diagnostic radiology and interventional radiology.

Radiology is an older term, used when x-rays were the only testing modality using radiation available in medicine. Today diagnostic Imaging Service uses not only traditional x-rays but also ultrasound, computed tomography (CT) scans, and magnetic resonance imaging (MRI) in the diagnostic evaluation of patients.

**Diagnostic imaging** helps health care providers see structures inside your body. Doctors that specialize in the interpretation of these images are called diagnostic radiologists. Using the diagnostic images, the radiologist or other physicians can often: Diagnose the cause of your symptoms, Monitor how well your body is responding to a treatment you are receiving for your disease or condition, Screen for different illnesses, such as breast cancer, colon cancer, or heart disease.

1. The purpose/role of diagnostic imaging is to provide the with images of sufficiently high quality, for physiotherapists and doctor to assist in understanding and explaining your medical problem or symptom, and confirm either the presence or absence of disease or injury, such as pneumonia, heart failure, fractures, bone infections, arthritis, cancer, blockage of the bowel, collapsed lung and so on.
2. It is low risk;
3. It is non-invasive;
4. It is fast;
5. It is accurate;
6. It is a well established as an investigative technique.
7. It is particularly useful in emergency diagnosis and treatment as it is a faster and easy procedure.
8. Imaging is a useful resource for musculoskeletal conditions and sports related injuries.
9. The relationship between diagnostics imaging and physiotherapy practice can broadly be divided into three areas: imaging as an aid to clinical diagnosis; imaging as an aid to injury management rehabilitation and, finally, imaging as an aid to treatment accuracy, specifically ultrasound-guided injections.
10. Physiotherapists can use diagnostic imaging to check the changing size of haematoma to assess the stages of inflammation in tendinopathy.

Q2: What is stroke? Which imaging modality is gold standard for diagnosing stroke? Explain in detail

Answer:

A stroke is a very serious condition where the blood supply to part of your brain is cut off. It needs to be treated in hospital as soon as possible. Common symptoms of a stroke include your face dropping on 1 side, not being able to lift your arms and slurred speech. A stroke needs to be treated in hospital as soon as possible. Treatments include medicines to treat blood clots and sometimes brain surgery. A stroke can be caused by either a blood clot in the brain or bleeding in the brain.

An **MRI** of the head is often the first test performed. MRI can detect brain tissue that has been damaged by both an ischemic stroke and a brain haemorrhage. Also, an MRI is very sensitive and specific in distinguishing ischemic lesions and identifying pathologies that resemble stroke, known as “stroke mimics.

**MRI with diffusion** is quickly becoming the gold standard in acute stroke imaging. Once a haemorrhagic stroke has been excluded by CT, MR diffusion improves stroke detection from 50% to more than 95%. Diffusion MR noninvasively detects ischemic changes within minutes of stroke onset.

Although there are other imaging tests that can be performed to diagnose stroke and type of stroke such as:

1. Computed tomography (CT) scan. A CT scan uses X-rays to take pictures of the brain. A CT scan of the head is usually one of the first tests used for a stroke. A CT scan can show bleeding in the brain or damage to brain cells. The CT scan also can find other problems that can cause stroke symptoms.
2. CT or MR angiogram. An angiogram is an X-ray movie of the blood vessels and blood flow through them. A dye is injected into the veins to show a detailed picture of the blood vessels after a stroke. A CT angiogram is used with a CT scanner, and a MR angiogram is used with an MRI.
3. Carotid ultrasound. Carotid ultrasound is a test that uses sound waves to create pictures of your carotid arteries, which supply blood to your brain. Often used with a CT or MR angiogram, the carotid ultrasound shows whether plaque has built up in your arteries and is blocking blood flow to your brain.
4. Trans-cranial Doppler (TCD) ultrasound. Doppler ultrasound is a test that uses sound waves to measure blood flow. Also used with a CT or MR angiogram, the TCD helps your doctor find out which artery in your brain is blocked.
5. Electroencephalogram (EEG). An EEG is done less often. This test records electrical activity in the brain to be sure your stroke symptoms are not caused by a seizure. Seizures can cause symptoms like movement problems and confusion. These can be mistaken for the symptoms of stroke or transient ischemic attack (TIA). During this test, you'll have sticky electrodes placed on your head, with wires attached to a machine. The machine records the electrical signals picked up by the electrodes.
6. Electrocardiogram (ECG or EKG). This test detects and records your heart's electrical activity. It can help your doctor find out if atrial fibrillation caused the stroke. An ECG can be done during physical activity to monitor your heart when it is working hard

Q3: Which radiological modality is commonly used for diagnosis of neurological disorders and Why? /10

Answer:

Magnetic resonance imaging (MRI) uses computer-generated radio waves and a powerful magnetic field to produce detailed images of body tissues. Using different sequences of magnetic pulses, MRI can show anatomical images of the brain or spinal cord, measure blood flow, or reveal deposits of minerals such as iron. MRI is used to diagnose stroke, traumatic brain injury, brain and spinal cord tumors, inflammation, infection, vascular irregularities, brain damage associated with epilepsy, abnormally developed brain regions, and some neurodegenerative disorders. MRI is also used to diagnose and monitor disorders such as multiple sclerosis. A contrast dye may be injected into the vein to enhance visibility of certain areas or tissues.

Computed tomography (CT) and magnetic resonance imaging (MRI) have revolutionized the study of the brain by allowing doctors and researchers to look at the brain noninvasively. These diagnostic imaging techniques have allowed for the first time the non-invasive evaluation of brain structure, allowing doctors to infer causes of abnormal function due to different diseases.

The answer to which imaging modality is better for imaging the brain is dependent on the purpose of the examination. CT and MRI are complementary techniques, each with its own strengths and weaknesses. The choice of which examination is appropriate depends upon how quickly it is necessary to obtain the scan, what part of the head is being examined, and the age of the patient, among other considerations.

MRI is better as MRI scans usually provide a far more detailed image of the soft tissues and internal organs such as the brain, skeletal system, reproductive system and other organ systems than that provided by a CT scan.

Advantages of head CT

* CT is much faster than MRI, making it the study of choice in cases of trauma and other acute neurological emergencies
* CT can be obtained at considerably less cost than MRI, and is sufficient to exclude many neurological disorders
* CT is less sensitive to patient motion during the examination. because the imaging can be performed much more rapidly
* CT may be easier to perform in claustrophobic or very heavy patients
* CT provides detailed evaluation of cortical bone
* CT allows accurate detection of calcification and metal foreign bodies
* CT can be performed at no risk to the patient with implantable medical devices, such as cardiac pacemakers, ferromagnetic vascular clips, and nerve stimulators

Advantages of head MRI

* MRI does not use ionizing radiation, and is thus preferred over CT in children and patients requiring multiple imaging examinations
* MRI has a much greater range of available soft tissue contrast, depicts anatomy in greater detail, and is more sensitive and specific for abnormalities within the brain itself
* MRI scanning can be performed in any imaging plane without having to physically move the patient
* MRI contrast agents have a considerably smaller risk of causing potentially lethal allergic reaction
* MRI allows the evaluation of structures that may be obscured by artifacts from bone in CT images

Q4: How fluoroscopy is helpful in the field of physiotherapy? /20

Answer

Fluoroscopy allows your doctor to see your organs and tissues working on a video screen, similar to watching a movie. Fluoroscopy helps diagnose and treat many conditions of the blood vessels, bones, joints, and digestive, urinary, respiratory and reproductive systems.

real-time radiographic visualization of moving anatomic structures. Fluoroscopy is extremely useful to evaluate motion such as GI peristalsis, movement of the diaphragm with respiration, and cardiac action. Fluoroscopy is also used to perform and monitor continuously radiographic procedures, such as barium studies and catheter placements.

As an imaging tool, fluoroscopy enables physiotherapist and physicians to evaluate specific body areas, such as bones, muscles, and joints as well as major organs, like the heart, lungs, and kidneys. It may be used as a diagnostic test or along with other treatments or therapeutic procedures. Fluoroscopy is used for a variety of things, such as the following:

1. Barium X-rays
2. Catheter insertion and manipulation
3. Arthrography and orthopedic surgery
4. Percutaneous vertebroplasty
5. Angiogram
6. Biopsies
7. To guide injections into joints or the spine
8. To locate foreign bodies
9. A radiologist can use barium to check the functions of the stomach, the small and large intestines, colon and rectum. Since X‑rays often shoot completely through these soft tissues, barium adds density to these anatomies so that they can be monitored.
10. During a swallow study, a speech language pathologist can use fluoroscopy to see if food is going to the right place when swallowed. They can also check to see if parts of the patients mouth and throat are working properly.
11. In cardiac procedures, dye can be injected into the coronary arteries to show blood flow or to investigate potential blockages. Catheters may be placed more easily due to fluoroscopic guidance.
12. Several spine and joint injections can accurately be made using fluoroscopy after dye is injected. These injections can be both diagnostic, to see if there is a greater underlying pathology, or therapeutic, sometimes providing full relief for an extended period of time.
13. Ankle Injection: Therapeutic ankle injections can be challenging in patients with post-traumatic deformities or advanced osteoarthritis. The injection can be performed in various ways. Common approaches include the lateral mortise or anterior approach, depending on the degree and location of joint space narrowing. With the lateral mortise approach, the patient is placed supine on the fluoroscopy table with the foot relaxed or in mild plantar flexion and internally rotated. A short 22-gauge spinal needle is then advanced into the lateral clear space. If the injection is intra-articular, contrast will flow freely over the talar dome and lateral clear space. More commonly, the anterior approach is performed secondary to underlying post-traumatic deformities. In this approach, the patient is placed in the lateral decubitus position. The foot is elevated on a foam block or other material, plantar flexed, and kept parallel to the fluoroscopy table with a small weight such as a sandbag. The anterior tibialis tendon is then palpated and a skin entry site lateral to this is chosen. Under real-time fluoroscopic guidance, a short 22-gauge spinal needle is advanced along the dorsal talus until its tip is in the tibiotalar joint. Real-time fluoroscopic guidance is critical in “sneaking” the needle tip beyond anterior ankle joint osteophytes. Intra-articular contrast confirms needle tip positioning, with contrast flowing freely over the talar dome, and 1 mL of steroid and up to 4 mL of aesthetic are injected.
14. Epidural Steroid Injection: Epidural steroid injections are effective procedures for relieving low back pain and are safest when performed under fluoroscopic guidance.
15. Nerve Root Injection: When a patient’s symptoms are isolated to a particular nerve distribution, a selective nerve root injection may be useful. This is done under fluoroscopic guidance.
16. Facet Joint Injection: Degenerative facet disease can result in painful radiculopathy secondary to foraminal narrowing and synovial cyst formation. Steroid injections around the facet joints are an effective form of treatment. This treatment is done under fluoroscopic procedures.
17. knee injections can be performed in the clinic setting. However, patient body habitus or patellofemoral degenerative disease may preclude this and necessitate the use of fluoroscopic guidance.
18. Radiologists are occasionally asked to perform a fluoroscopic arthrogram in patients with a shoulder prosthesis who are suspected of having a full thickness rotator cuff tear.

Q5: Explain the role of mammography in diagnosis of breast cancer? /20

Role of mammography

Mammograms are used as a screening tool to detect early breast cancer in women experiencing no symptoms. They can also be used to detect and diagnose breast disease in women experiencing symptoms such as a lump, pain, skin dimpling or nipple discharge.

Mammography is a special type of low-dose x-ray imaging used to create detailed images of the breast. Mammography is currently the best available population-based method to detect breast cancer at an early stage, when treatment is most effective. Mammography can demonstrate microcalcifications smaller than 100 µm; it often reveals lesions before they become palpable by clinical breast examination (CBE) and, on average, 1-2 years before being found by breast self-examination (BSE)

Two major types of mammography are:

1. Screening mammography

Screening mammography is a low-dose X-ray examination of a woman’s breasts used to detect breast cancer when that cancer is too small to be felt as a lump. Screening mammography is carried out on women who do not have any symptoms of breast disease.

1. Diagnostic mammography

A diagnostic mammogram is an X-ray examination of the breasts. This is carried out when a person, their doctor or another health professional discovers unusual signs or symptoms in one or both breasts; that is, a lump, tenderness, nipple discharge or skin changes. The mammogram confirms whether the changes are benign (non-cancerous) and no treatment is needed, or whether the changes indicate possible breast cancer and further tests and treatment may be required.

Benefits

Benefits of mammography reduces the risk of death due to breast cancer. It is useful for detecting all types of breast cancer, including invasive ductal and invasive lobular cancer. Screening mammography improves a physician's ability to detect small tumors. When cancers are small, the woman has more treatment options. The use of screening mammography increases the detection of small abnormal tissue growths confined to the milk ducts in the breast, called ductal carcinoma in situ (DCIS).