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Radiographers' Journal

The official magazine of Society of Indian Radiographers (SIR)
Published by Radiographers' Association of Maharashtra (RAM)

May, 2023

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Radiology in Forensic Medicine

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Introduction

Forensic medicine, also known as legal medicine, is a medical specialty that involves the application of medical knowledge and techniques to legal issues. It encompasses the collection and analysis of medical evidence to aid in the investigation and resolution of criminal cases, including homicides, sexual assaults, and other violent crimes. Forensic medicine also plays a role in civil litigation, such as medical malpractice cases, and in determining the cause of death in cases of sudden or unexpected deaths. Forensic pathologists, radiologists, toxicologists, and other medical professionals are involved in the practice of forensic medicine. Radiology has become an integral part of forensic medicine and plays a crucial role in forensic investigations by providing non-invasive imaging techniques that can assist in the identification of injuries, determine the cause and manner of death, and helps in the investigation of crime scenes.

Some of the roles of radiology in forensic medicine are:

Role of radiology in Autopsies

Post-mortem radiology has emerged as an effective tool in forensic medicine for examining the human body after death. Using X-rays, CT scans, or MRI, post-mortem radiology can detect injuries that may not be visible during traditional autopsies, providing more accurate results. Post-mortem radiology can also guide the autopsy process by identifying specific areas of the body that need further examination.

The primary goal of post-mortem radiology is to establish protocols for incorporating imaging studies, such as post-mortem CT (PMCT), post-mortem magnetic resonance imaging (PMMR), and image-guided biopsy, into forensic pathology investigations. Unlike living patients, radiation dose and motion artifact are not a concern in PMCT, allowing for multiple additional acquisitions to provide more information.

Post-mortem radiology techniques have additional benefits, including long-term preservation of anatomical evidence and cultural and religious acceptance in some communities where traditional autopsy dissection is not permitted. However, PMCT may be less effective than traditional autopsy in identifying certain types of injuries. PMMR provides better anatomical detail, especially in detecting soft tissue injuries, but is less commonly used due to limited access to scanners and the complexity of image interpretation. On the other hand, conventional radiographs and post-mortem ultrasound (PMUS) remain widely available and inexpensive, with PMUS being particularly useful in evaluating fetal demise and guiding percutaneous PM biopsies.(1)

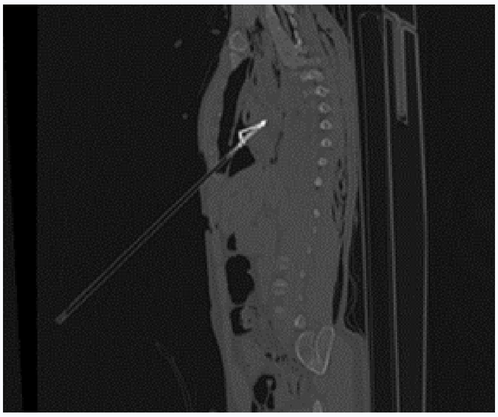

Fig. 1 PMCT showing showing self-inflicted arrow penetrating the heart

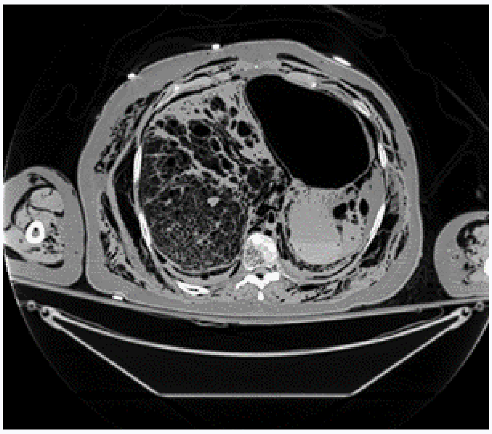

Fig. 2. PMCT shows intentional drug overdose with dense tablet material in stomach, Putrefactive decomposition is also present.

Child Abuse

Child abuse is a major problem in society, and medical imaging has become an essential tool in its diagnosis and assessment. However, with the increasing use of imaging modalities in the forensic setting, new controversies have emerged related to their interpretation and reliability. The identification of fractures and soft tissue injuries, particularly in cases of non-accidental trauma can help to suspect child abuse. While fractures are often clear indicators of abuse, their diagnosis can be difficult in certain cases, such as those involving incomplete or healing fractures. Similarly, soft tissue

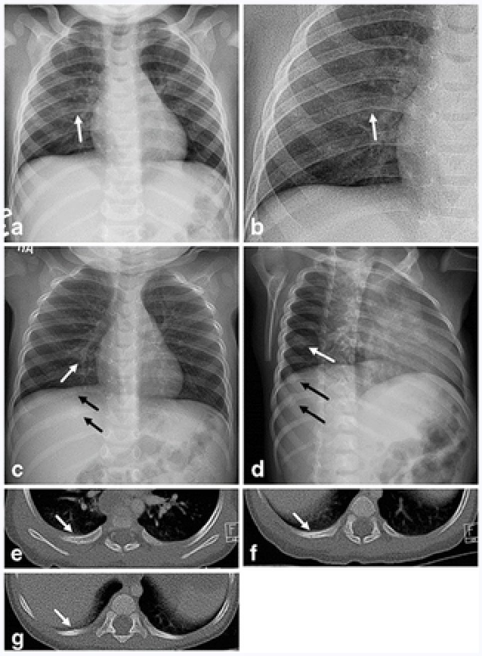

Fig 3: Image of 2 month old boy with fall and bruises found to be a victim of child abuse. **a, b** Anteroposterior (AP) showing a possible acute, nondisplaced right 7th posterior rib fracture rib fracture (arrow). **c, d** AP and oblique views from the follow up radiographic survey performed 22 days later showing subacute healing fractures of right 7th (white arrows), 9th and 10th (black arrow) posterior ribs. **e, g** Ct examination of abdomen, chest and pelvis performed the same day as initial X-ray survey demonstrates right 7th **(e)**, ninth **(f)** and tenth **(g)** posterior rib fracture (arrows) which were occult on the initial radiography

injuries, such as contusions and bruises, can be difficult to distinguish from accidental injuries or medical conditions. Another controversial issue related to using imaging for suspected abusive head trauma cases. We all know that identifying intracranial injuries in such cases is very important, but the reliability of imaging in detecting these injuries has been questioned. Fractures are the second most common physical manifestation of child abuse, after soft-tissue injuries, and can occur in up to 50% of cases. Different types of fractures that can occur in cases of suspected child abuse, including long bone fractures, rib fractures, skull fractures, and spinal fractures. Radiologists and other healthcare professionals must know how to evaluate fractures in cases of suspected child abuse. (2)

Mass victim identification:

The process of disaster victim identification (DVI) during a disaster involves fingerprinting, dental records, DNA analysis, and radiological examination. Post-mortem computed tomography (PMCT) could provide a more rapid and logistically beneficial modality for identifying victims in these situations. PMCT is non-invasive and provides detailed anatomical images that can aid in identifying individuals based on unique characteristics such as skeletal anomalies, implanted devices, or prior surgeries. PMCT can be an effective tool for mass victim identification, but it does have limitations. For example, PMCT may not be able to identify individuals with common characteristics or those who have not had prior medical procedures. (3)

Radiology in Cases of Strangulation and Suffocation:

Magnetic Resonance Imaging (MRI) can play a crucial role in identifying and evaluating the extent of injuries caused by strangulation. The use of MRI for this purpose has gained more attention due to its ability to detect soft tissue injuries that may not be visible on other imaging modalities. MRI can identify various injuries that result from strangulation, such as hemorrhages, edema, and ischemic changes in the brain, neck muscles, and ligaments. MRI can also detect laryngeal cartilage fractures and thyroid cartilage fractures, which are often difficult to visualize on other imaging techniques. MRI can provide valuable evidence in legal cases, aiding in the prosecution of strangulation. (4)

The Role of Radiology in Ballistic Trauma:

Computed tomography (CT), plays a crucial role in the initial management of patients with ballistic trauma. CT can quickly and accurately identify the location and extent of injuries, including bone fractures, soft tissue damage, and organ injuries. This information can guide the medical team in determining the appropriate treatment and prioritizing surgical interventions. Additionally, CT can detect foreign bodies such as bullets, shrapnel, or bone fragments, which may be missed on physical examination. MRI is also useful in cases where there is suspicion of vascular injuries or spinal cord compression.(5)

Conclusion

Radiology has become an indispensable tool in forensic medicine, playing a critical role in various areas and provides a non-invasive technique that can detect injuries that may not be visible during traditional autopsies. Radiology has greatly improved the accuracy and reliability of forensic investigations, and it continues to evolve with advancements in imaging technology.

Fig 4: Use of PMCT to examine victims of an aircraft incident, with emphasis on the presence of clothes/personal artefacts and osteological trauma. **(1)** The first victim **(a)** shoes and **(b)** belt; location and presence identified on PMCT for identification purposes. **(c)** and **(d)** Illustrate the numerous osteological trauma sites which can be used to consider cause of death and position in the plane. **(2)** The second victim **(a)** shoe; used for identification purposes. **(b)** and **(c)** Illustrate extensive trauma to the skull, arms and lower limbs

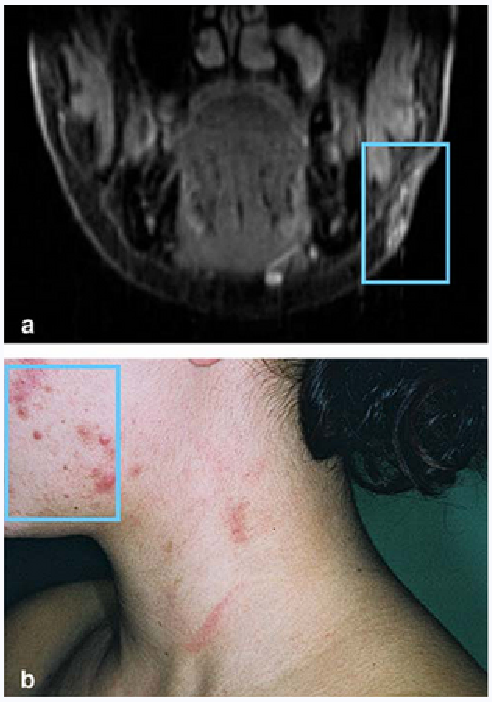

Fig 5: Case of ligature strangulation. (a) Coronal STIR-weighted MR image (TR 3000, TE 14, TI 150) depicting a hyperintense subcutaneous region above the mandible on the left side (frame). The finding corresponded to hemorrhage of the subcutaneous fatty tissue. Apart from its intracutaneous part, the hemorrhagic lesion could not be explained by acne due to its extent and depth, which was not corresponding with acne alterations. (b) Corresponding photograph of the patient showing alterations due to acne but no traumatic bruises or abrasions in the injured region.

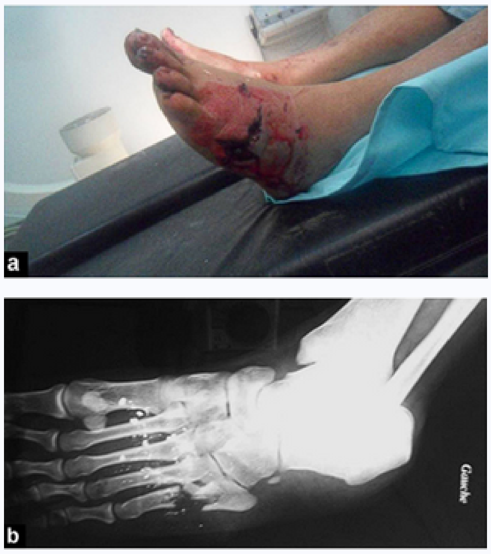

Fig 6: Bullet wound of the left foot (a) associated with a fracture of the base of the fifth metatarsal and multiple lead debris in the soft tissue (b).

References

1. Decker SJ, Braileanu M, Dey C, Lenchik L, Pickup M, Powell J, et al. Forensic Radiology: A Primer. Acad Radiol. 2019 Jun;26(6):820–30.

2. Marine MB, Forbes-Amrhein MM. Fractures of child abuse. Pediatr Radiol. 2021 May;51(6):1003–13.

3. Brough AL, Morgan B, Rutty GN. The basics of disaster victim identification. J Forensic Radiol Imaging. 2015 Mar;3(1):29–37.

4. Yen K, Vock P, Christe A, Scheurer E, Plattner T, Schön C, et al. Clinical forensic radiology in strangulation victims: forensic expertise based on magnetic resonance imaging (MRI) findings. Int J Legal Med. 2007 Feb 7;121(2):115–23.

5. Daghfous A, Bouzaïdi K, Abdelkefi M, Rebai S, Zoghlemi A, Mbarek M, et al. Contribution of imaging in the initial management of ballistic trauma. Diagn Interv Imaging. 2015 Jan;96(1):45–55.

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Metal Artifact Reduction for Orthopedic Metal Implant

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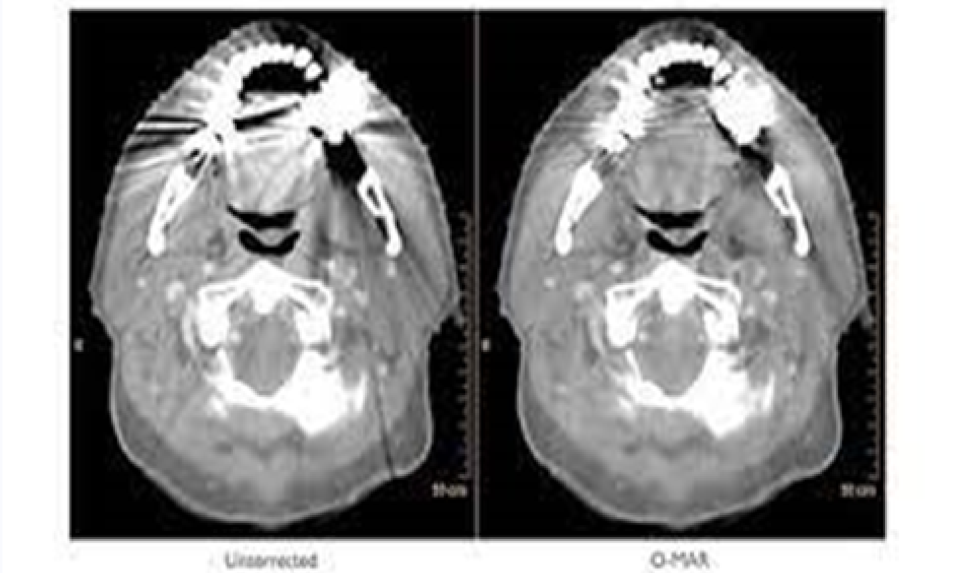
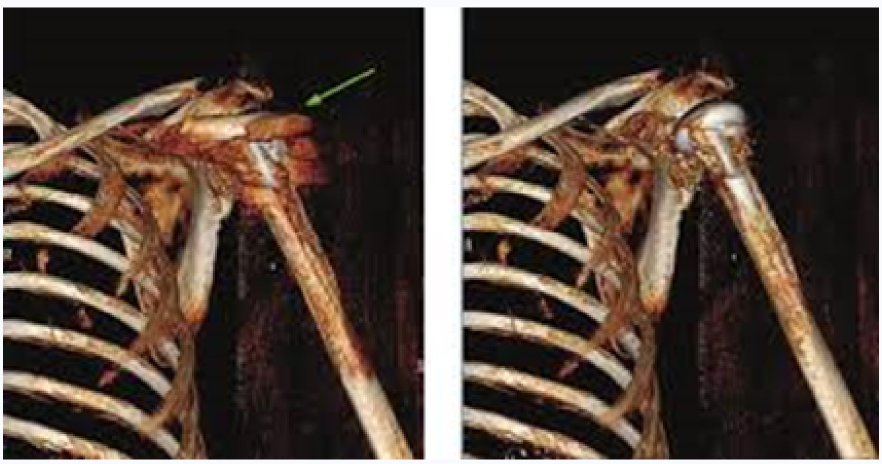
This method changed into to evolve for the discount of orthopedic metal artifact, artifacts from huge steel objects, such as orthopedic implants, create a hard and time- eating to generate contours of critical shape and place of hobby in focused volume. The metallic artifact discount set of rules for orthopedic implant (Philips, O-MAR) improves photo best and define the anatomy by using decreasing the impact of steel at the images.

This approach is helps for the planning and treatment of the orthopedic implant surgical procedure. most of the commercially to be had MAR strategies, most effective the Orthopedics steel Artifact discount (O-MAR (Philips health machine, Cleveland, united states)) algorithm changed into said. As a substitute, this systematic review article pursuits to consist of all MAR techniques that have been investigated or proposed for RT applications within the ultimate five yrs at the time of guide (2015–2020). Those methods consist of commercial MAR methods and research-primarily based MAR strategies primarily based on either conventional algorithms or deep studying. further, our assessment extensively reports now not most effective the works on dosimetric effect of the strategies but also on the ones evaluating the outcomes on organ contouring, and photo excellent and HU recuperation for RT packages.

Throughout computed tomography imaging, the presence of steel implants, which include dental clips, dental filling, hip prosthesis, and orthopedic implants, are produced the metal artifacts within the reconstructed photos. The radio-opaque cloth motive attenuation because of attenuation, beam hardening, and scatter, which produce extreme dark and vivid streak artifacts in reconstructed CT pix. Thereby degrading the picture high-quality and diagnostic overall performance. The degree of steel artifacts specifically depend upon the atomic variety, density length and shape of this metallic additives as its orientation with admire to the CT artifacts.



The main aim of O-MAR is to indentify artifacts bobbing up from orthopedic metal. it is also effective for non-orthopedic metallic like dental fillings is an example of O-MAR being carried out to a affected person with a dental crown. Now not best is smooth tissue anatomy more discernable, the skin boundary is more detectable. This is essential for Radiation remedy making plans (RTP) in which automated algorithms are frequently employed to become aware of the pores and skin contour. Without O-MAR those automatic strategies would fail, requiring the user to manually accurate the outside contour.



The O-MAR isn't always best for 2d photo formation however that is additionally have an effect on the 3-d quantity image due to steel. For example has an orthopedic humerus. In the uncorrected image the streaks from the metal object obscure the implant’s attachment to the shoulder. At the O-MAR photograph, the steel bone interface is absolutely visible.

The O-MAR correction can yield salient upgrades in image great even inside the presence of intense background noise. The usage of a higher kVp will facilitate the ability of the O-MAR set of rules to lessen metallic brought on artifacts. Each time possible, 140kVp or 120kVp need to be utilized while orthopedic metal is present. If the mAs is held constant increasing the kVp from 120 to 140 will substantially improve the photograph great of the O-MAR snap shots. Raising the kVp to 140kVp now not only decreases the impact of beam hardening, it also lessens statistical noise which benefits the O-MAR algorithm.

Conclusions

Throughout this article, we have shown multiple instances where the O-MAR algorithm is successful in minimizing metal artifacts brought on by orthopedic implants. O-MAR allows for the visualization of significant sections of occluded anatomy in addition to significantly reducing severe streaking artifacts. The clinician will be able to make a more thorough and certain diagnosis as a result of this. Additionally, O-MAR greatly speeds up contouring of tumors and important structures, which enhances the efficiency of radiation oncology applications.

O-MAR should be avoided in specific situations, as described in the contraindications section. These frequently happen when small metal objects (like stents) within iodinated contrast are in close contact to air, lung tissue, or other metal. O-MAR may have an unanticipated effect where it causes some anomalies in

Queue Management Systems in Diagnostic Centre

Amritpal Kaur, Front Desk Executive, Krshnna Diagnostic's Pvt. Ltd.

Introduction: In a diagnostic centre, the front desk or reception area is the first point of contact for patients. Patients may have to wait for their turn to see the receptionist or complete registration formalities. A queue management system helps to manage patient flow and reduces waiting time, making the patient's experience more efficient and pleasant. This paper presentation will discuss the importance of a queue management system in a diagnostic centre, the types of queue management systems available, and their benefits.

Importance of Queue Management Systems in Diagnostic Centres: A queue management system is an essential tool for managing patient flow in a diagnostic centre. A well-managed queue ensures that patients are seen promptly, reducing waiting times and improving the patient experience. Furthermore, queue management systems improve the operational efficiency of the diagnostic centre by reducing staff workload and increasing patient throughput. By optimizing patient flow, the diagnostic centre can improve the overall quality of care.

Types of Queue Management Systems Available: There are various types of queue management systems available in the market, and each has its unique features. The most commonly used queue management systems in a diagnostic centre include:

Linear Queue Management System: In this system, patients wait in a single file for their turn to be seen by the receptionist. This system is easy to set up and manage, and it is suitable for centres with a low volume of patients.

Virtual Queue Management System: In this system, patients receive a ticket number or token upon arrival. Patients can then wait in a designated waiting area until their number is called. This system is efficient and can manage a high volume of patients.

Appointment Based Queue Management System: In this system, patients schedule an appointment for their visit. The receptionist manages the queue based on the scheduled appointments, and patients are seen promptly. This system is suitable for centres that handle specialized services or procedures.

Benefits of Queue Management Systems: A queue management system offers numerous benefits to a diagnostic centre. These include:

Improved Patient Experience: A queue management system reduces waiting times, making the patient experience more efficient and pleasant.

Enhanced Operational Efficiency: A queue management system optimizes patient flow and reduces staff workload, increasing patient throughput and enhancing operational efficiency.

Better Resource Utilization: A queue management system ensures that resources, such as staff and equipment, are utilized efficiently.

Enhanced Data Collection: Queue management systems collect data on patient waiting times, patient flow, and staff workload, which can be used to identify areas for improvement.

Conclusion: In conclusion, a queue management system is a critical tool for managing patient flow in a diagnostic centre. The most commonly used queue management systems include linear queue management systems, virtual queue management systems, and appointment-based queue management systems. The benefits of using a queue management system include improved patient experience, enhanced operational efficiency, better resource utilization, and enhanced data collection. Diagnostic centres should consider implementing a queue management system to optimize patient flow and improve the overall quality of care.

MR Enterography A Case Review

Santhosh Bhaskar, Lead Radiographer, Padmashree Advanced Imaging Services, Vijaynagar, Bengaluru

MR Enterography in an analogous way to CT enterography, is most commonly used to evaluate patients with Crohn's disease where it is used for assessment of the primary disease and any complications. Other indications include celiac disease, postoperative adhesions, radiation enteritis, scleroderma, small bowel malignancies, and polyposis syndromes. 26 Years Young lady known case of crohn's disease on medication since 3 months adviced MR Enterography as folloup Study Avoiding Computed tomography Considering young age

Benefits:

- MRI is a noninvasive imaging technique that does not involve exposure to radiation.
- MRI can detect abnormalities that might be obscured by bone with other imaging methods.

The MRI gadolinium contrast material is less likely to cause an allergic reaction than the iodine-based contrast materials used for x-rays and CT scanning.

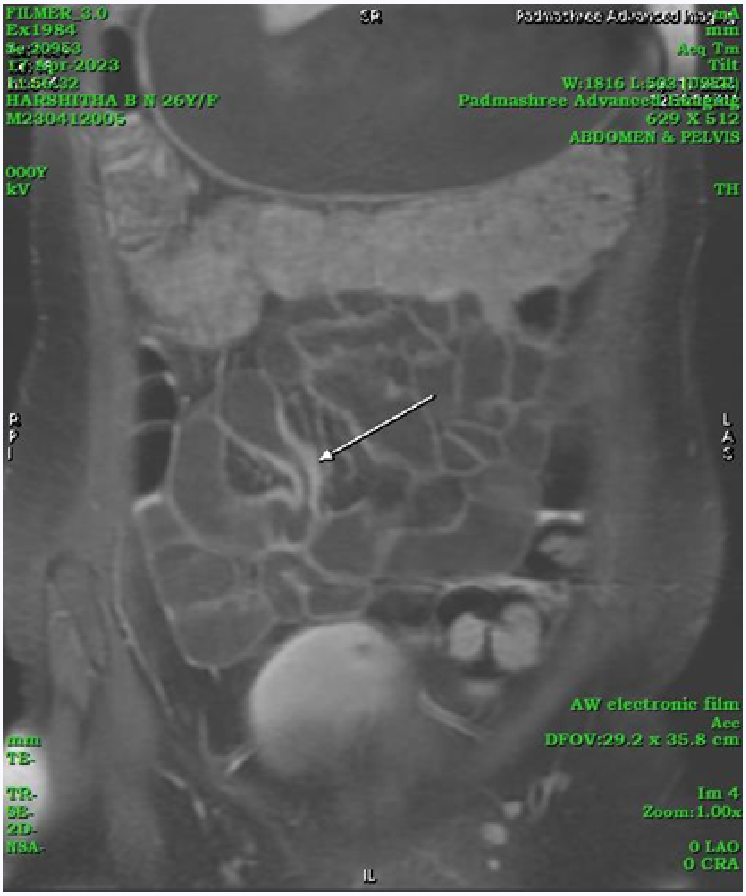
- MR enterography is a complementary imaging examination that helps identify areas of bowel inflammation due to such diseases as Crohn's.
- Because MR enterography does not involve ionizing radiation, the procedure may be preferred for the evaluation of young patients with inflammatory bowel disease who may undergo multiple exams throughout their life.

Patient preparation: 75 Gms Polyethylene Glycol (PEGLEG) with 50 ml of **Mannitol solution 20% W/V** Diluted in **1800** ml of water and instructed the Patient to drink over a period of **40 minutes** with 10 minutes interval after every 400 ml. 200 ml of oral solution given on table just before the start of procedure. To reduce bowel movement 1:3 ratio diluted Buscopan injection given 2ml just before start of procedure another 2 ml given before Injection of MRI Contrast

SEQUENCES DONE :
AXIAL: 2d fiesta , SSFSE,STIR ,DWI
CORONAL: Fiesta, SSFSE, THICK SLAB, Fiesta CINE followed by Multiphasic dynamic Contrast Coronal Lava after Injection of vivobutrol contrast 0.1mMOl/kg body weight. Imaging Performed on 1.5 Tesla GE Optima scanner with 8 channel Body array coil in supine position.

Report showed: Persistent mild thickening of distal ileal loop with single fistulous tract

Conclusion:
Enterography has the advantage of enhanced tissue contrast, multiple different sequence options, and the ability to perform functional imaging. A structured imaging protocol and reporting template is excellent modality in diagnosis and management of patients with Crohn's disease.



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Role of Artificial Intelligence(AI) in Medical Radiology & Imaging

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Introduction

Recent developments in artificial intelligence (AI), such as the creation of effective artificial neural networks, reliable machine learning (ML) algorithms, and potent cloud-based computing capabilities, are being applied to the vast amounts of machine-readable digital data produced by radiology imaging. In addition to the enormous amount of imaging data that radiologists must review every day, they are now overburdened by the amount of time it takes them to seek for and locate relevant clinical information about the imaging studies they read. According to estimates, each of the approximately 32,000 practising radiologists in the United States examines an image every three seconds throughout each working day for the duration of the full year due to the high volume of multi slice imaging exams carried out annually.

What is AI?

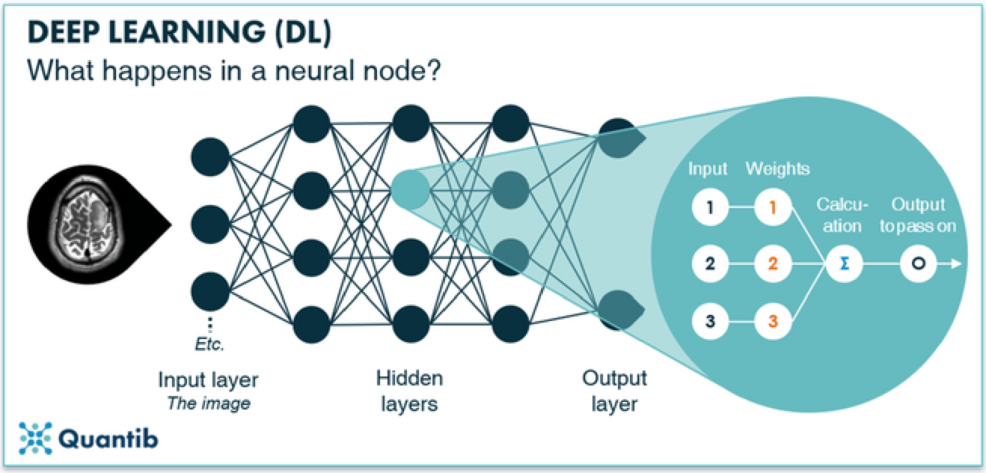
The replication of human intelligence functions by machines, particularly computer systems, is known as artificial intelligence. Expert systems, natural language processing, speech recognition, and machine vision are some specific applications of AI. Includes:

Using symbols to manipulate "Perception" and computer "vision" are the processes of extracting information from sensors (such as cameras, microphones, MRI scanners, and other electronic devices) and processing that information to find patterns, identify things, and establish relationships between those items.

Types of AI

Artificial neural networks (ANNs)

An ANN is a machine learning model that is modelled after the human brain, It is artificial neuron, also known as a node, unit, or perceptron, is its essential building block.



Machine learning

Large data, experience, and self-modifiable algorithms are used by machine learning, a subtype of artificial intelligence, to enhance its performance over time. Learning may be reinforced, semi-supervised, unsupervised, or under supervision. Deep learning (DL) is the most significant sort of machine learning that is pertinent to MRI.

Types of machine learning

- Shallow machine learning
- Deep machine learning

Shallow ML- Relatively straight forward structure with a small number of layers Regression, SVM, Random Forest, and Cluster Analysis.

Deep ML:

Complex designs with numerous (hidden) layers: Deep ML - Suitable for difficult tasks but require a lot of training time - Examples include CNNs, GANS, RNNs.

TYPES OF DEEP LEARNING:

1. CNNs
2. Encoder-Decoder Networks
3. Generative Adverarial Network
4. Recurrent Neural Networks

CNNs (convolutional neural networks)

The most used configuration for MRI and other image processing applications is CNN. Typically, data is entered as 2D or 3D arrays of pixels, and the first stages of computation are limited to actions on nearby pixels.

Encoder-Decoder Networks (EDNs) are a particular type of CNN that are frequently used for image segmentation, co-registration, and artifact removal.

They often have a "U-configuration" with an initial contracting path (the encoder) followed by an expansion path (the decoder).

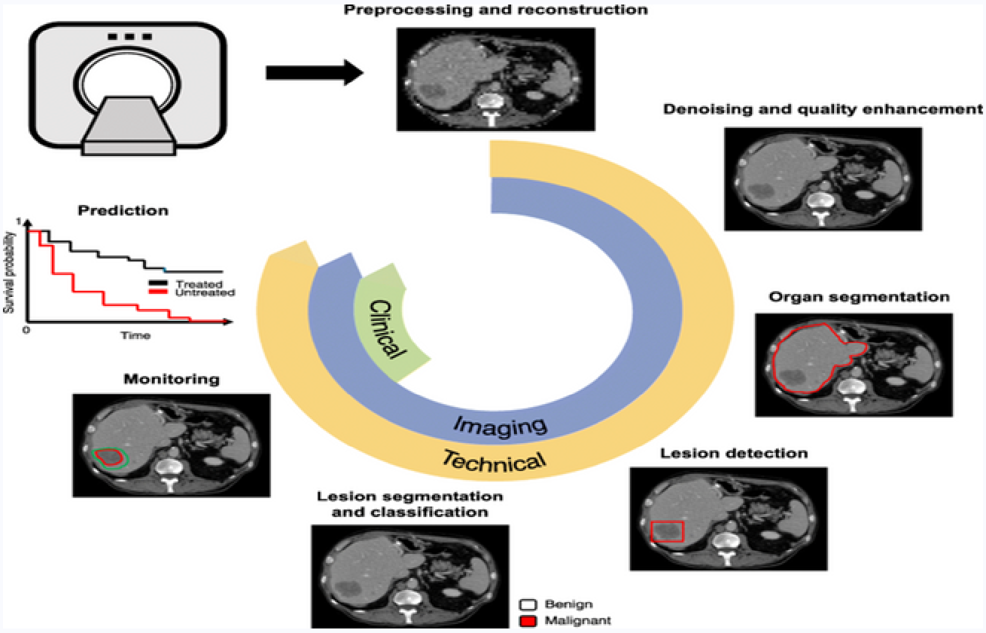
GANS (Generative Adversarial Network) are made up of two competing parts: (1) the Generator, a deconvolutional network that creates "fake" but realistic-looking images using random noise and interpolation, and (2) the Discriminator, a conventional CNN that was previously trained using supervised learning to accurately identify real images.

RNNs (Recurrent Neural Networks): RNNs are a type of "feed forward" neural network, but they also include data feedback loops. They are able to use recent results as updated inputs for upcoming calculations because to this feedback, which acts as a kind of "memory".

Concept of AI
Overall, even though AI has the potential to completely transform the field of medical radiology, there are still major obstacles that need to be overcome. There are two types of AI:

- **Specific or Weak AI**
- **Global or Strong AI.**

Narrow AI systems are trained on a big dataset of instances and are created to carry out specified tasks. Speech recognition, natural language processing, and image recognition are a few examples of restricted AI systems. General AI systems, on the other hand, are intended to be able to carry out any intellectual work that a human can.The creation of algorithms that can learn from data and make predictions about it is the focus of the branch of AI known as machine learning. Depending on the type of data they use and the learning approach used, machine learning algorithms are often categorised as supervised, unsupervised, or reinforcement learning. Artificial neural networks, modelled after the structure and operation of the human brain, are used in deep learning, a type of machine learning. Deep learning methods can be applied to a variety of tasks, such as natural language processing, speech recognition, and image and image recognition. The creation of computer systems that are capable of doing tasks that traditionally require human intelligence, such as problem-solving, decision-making, and perception, is the fundamental idea behind artificial intelligence



Clinical application & importance of AI
AI techniques are currently being offered as commercial products to shorten imaging times and enhance image quality. The radiography has benefited greatly from advances in artificial intelligence (AI), which have completely changed how medical pictures are analysed and interpreted. Following are some recent developments:

Automated Detection and Diagnosis: Using medical pictures from X-rays, CT scans, and MRI scans, AI can identify and classify diseases. For instance, AI systems are highly accurate in spotting brain tumours, breast cancer, and lung nodules.

Image Segmentation: AI can segment medical images to identify particular organs and structures, making it simpler for clinicians to examine the images. This is particularly useful for locating anomalies and lesions

Computer-Aided Diagnosis (CAD): By offering a second opinion, AI can help radiologists make correct diagnoses. To analyse medical photos and spot anomalies, CAD systems use machine learning algorithms, giving radiologists with possible conclusions.

Workflow Optimisation: By automating repetitive tasks like image annotation and report preparation, AI can sped up radiology workflows. This can speed up the work of radiologists and save them time.

In general, AI is revolutionising the field of radiology and has the potential to enhance patient outcomes by delivering quicker and more precise diagnosis.

Future of AI in radiology
The application of artificial intelligence (AI) in radiology has the potential to completely transform the profession, with several advantages for both patients and medical professionals. The future of AI in radiology is anticipated to provide even more advanced capabilities and more integration with other technologies, even if it already helps radiologists with image interpretation and diagnosis.AI is anticipated to have a big impact on the advancement of personalised treatment, for example. Large amounts of patient data and medical picture data can be analysed by AI algorithms to find trends and generate predictions that can help with the creation of individualised treatment regimens. By reducing pointless treatments and procedures, this can improve patient outcomes and lower healthcare expenditures. AI can be used, for instance, to identify patients who are at risk for specific disorders and provide early intervention strategies or personalised treatment regimens based on the patient's unique traits. The potential for AI in radiology to improve patient outcomes, lower healthcare costs, and increase the

speed and precision of medical image interpretation makes the field's future very hopeful. Healthcare professionals should keep up with the latest breakthroughs in AI as it develops and improves, and they should thoroughly assess and validate AI algorithms to assure their accuracy and dependability. Radiologists may continue to give their patients the finest care possible while also advancing the discipline of radiology for years to come by collaborating with AI.

Challenges of AI: By enhancing diagnostic accuracy, speed, and efficiency, artificial intelligence (AI) has the potential to revolutionise the field of medical radiology. The application of AI in radiography, however, is not without difficulties. The following are some of the major issues with AI in medical radiology:

Data Quality: The accuracy and efficiency of AI models depend heavily on the quality of the data used to train them. It can be difficult to get enough high-quality data for AI training, despite the fact that high-quality data are crucial in medical imaging.

Interpretability: Radiologists must comprehend how a given diagnostic or recommendation was reached by an AI algorithm. However, a lot of AI models are referred to as "black boxes" because radiologists find it challenging to comprehend how they operate due to the opaqueness of their decision-making processes.

Integration with current workflows: For AI solutions to be effective, they must symbiotically work alongside current radiology workflows. However, incorporating AI into current workflows can be difficult and requires significant adjustments to how radiologists perform their jobs.

Legal and ethical issues: Using AI in medical radiography raises a number of legal and ethical issues. Who is responsible, for instance, if a diagnostic error is made by an AI algorithm? Concerns have also been raised regarding the security and privacy of patient data while employing AI.

Training and education are essential for radiologists and other healthcare workers to use AI in radiology effectively. However, there are currently not enough experts in medical radiology who have the abilities and knowledge required to create and implement AI solutions. Overall, even though AI has the potential to completely transform the field of medical radiology, there are still major obstacles that need to be overcome.

Conclusion

AI in radiology has a very bright future. AI has the potential to completely change the field of radiology in light of the growing need for more precise and effective diagnostic tools. Radiology activities including image interpretation, abnormality identification, and organ segmentation have already demonstrated encouraging outcomes when automated using machine learning algorithms and deep learning approaches. We may anticipate more developments in AI technology in the years to come, such as the creation of hybrid AI-human systems that incorporate the best aspects of both systems. Better patient outcomes may result as a result of quicker and more accurate diagnoses. However, there are additional potential difficulties and ethical issues that must be addressed, such as ensuring the accuracy and dependability of the data. ensuring that AI is utilised as a tool to supplement, rather than replace, human knowledge, the privacy of patient information, and the development of AI algorithms. Overall, AI in radiology has a bright future and will continue to influence this profession in the years to come.

References

1-Albawi, S., Mohammed, T. A., & Al-Zawi, S. (2017). 2017 International Conference on Engineering and Technology (ICET).

2- Collado-Mesa, F., Alvarez, E., &Arheart, K. (2018). The role of artificial intelligence in diagnostic radiology: A survey at a single radiology residency training program. Journal of the American College of Radiology: JACR, 15(12), 1753–1757.

3- Davenport, M. S. (2020). Artificial Intelligence and the Future of Radiology: A Summary of the Joint European and North American Multisociety Statement. Radiology, 294, 450–457.

4- Wang, D. (2018). Artificial intelligence in medical imaging: Opportunities, applications and risks. Radiology of Infectious Diseases, 5, 102–109.

5- Lee, J., Yoon, H.-J., Kim, J.-H., Kim, D.-J., Kim, K.-H., Kim, D.-W., & Cho, Y. (2018). Artificial intelligence in medical imaging: Training a convolutional neural network for pneumonia detection on chest radiographs. Korean Journal of Radiology, 19(4), 775–785. https://doi.org/10.3348/kjr.2018.19.4.775

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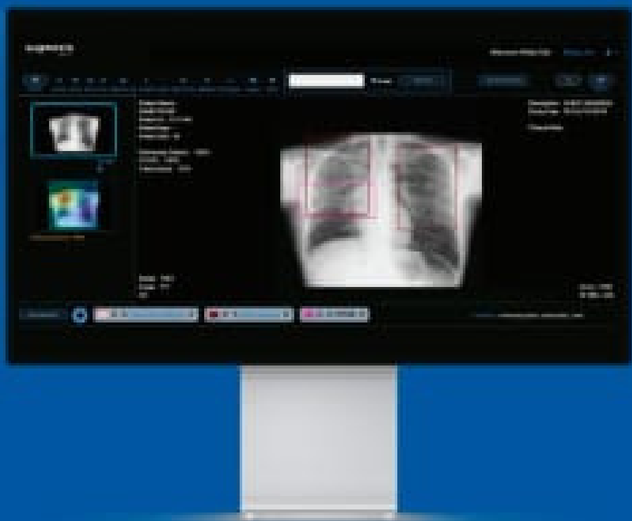

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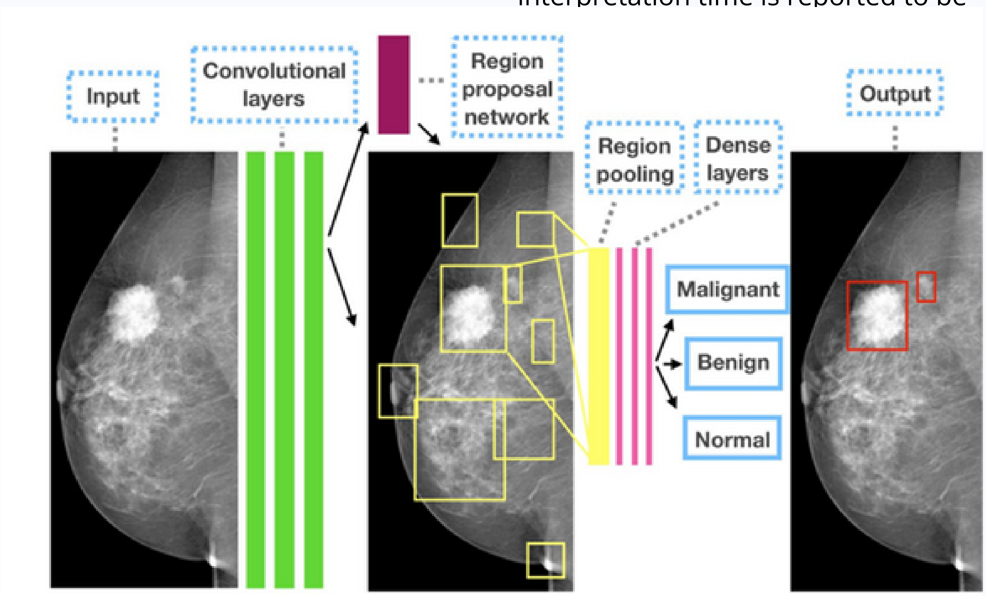
Artificial Intelligence for Mammography-Deep learning

Aswathi. P, MSc MIT, K S Hegde Medical Academy, NITTE Deemed to be university, Mangalore

During the past decade, researchers have investigated the use of computer-aided mammography interpretation. With the application of deep learning technology, artificial intelligence (AI)-based algorithms for mammography have shown promising results in the quantitative assessment of parenchymal density, detection and diagnosis of breast cancer, and prediction of breast cancer risk, enabling more precise patient management. AI-based algorithms may also enhance the efficiency of the interpretation workflow by reducing both the workload and interpretation time.

Why Deep Learning?



The outline of the Faster R-CNN model for CAD in mammography

AI, powered by recent advances in machine learning, may make CAD for mammography more valuable in clinical practice. Deep learning is a family of machine learning methods focusing on developing multi-layered neural networks. Logistic regression, decision trees, and support vector machines are examples of supervised learning models not based on neural networks. However, neural networks are capable of learning intermediate representations of the data before classifying the entire image. convolutional neural networks (CNNs)only combine information from voxels that are spatially close to each other, making them especially suited for image evaluation.

Deep learning applied to digital breast Tomosynthesis

DBT provides multiple low-dose projection images of the breast that can be used to reconstruct a three-dimensional dataset of mammography images. This in turn reduces the negative effect of overlapping breast tissues. Studies have proven the efficacy of DBT over full-field DM when used for breast cancer screening, with several reports of increased cancer detection rates and decreased recall rates. Although DBT may show superior performance, its acquisition time is longer and its interpretation time is reported to be almost twice the time needed for DM, a factor that may critically impact the workload of radiologists.

Even with the superior performance of DBT over DM, perception or interpretation errors still occur. Compared to the single images used to interpret each plane in DM, for DBT interpretation, radiologists have to scroll through stacked images for each mammographic projection, where the number of images per stack is proportional to the breast thickness under compression. More images mean a heavier workload, and this is the main reason for longer interpretation time and radiologists' fatigue with DBT. Automated detection of abnormalities among multiple projection images could help clinicians localize and assess the clinical significance of a detected abnormality. Commercial or in-house software has been developed to assist DBT interpretation, for which initial studies commonly report a reduction in reading time while maintaining reader performance.

Assessment of mammographic parenchymal density using deep learning

Breast parenchymal density is important for two reasons: an increased proportion of fibro glandular tissues has been associated with a four-to-six-fold increased risk for breast cancer, and the detection sensitivity of mammography can be severely affected by increased parenchymal density. Legislation on breast density notification was passed in Connecticut, USA in 2009, and radiologists are now required to notify women of their breast density after they are screened with mammography. However, the qualitative four-tiered density categories of the American College of Radiology Breast Imaging Reporting and Data System (ACR BI-RADS) depend solely on the radiologist's subjective interpretation and vary widely. Currently, several commercially-available automated volumetric density measurement programs enable the quantification of parenchymal data by calculating the ratio of fibro glandular tissue to the total breast volume in percentages. Studies have reported differences between radiologists and commercially-available software in density classification. To narrow the gap between computers and radiologists, DL algorithms have been constructed and applied in several recent studies. In experimental settings, DL models showed strong similarity or agreement with the BI-RADS density assessments made by radiologists. When implemented in routine clinical practice, a DL algorithm showed excellent agreement with radiologists' assessments made by the DL algorithm that were accepted by the radiologists in binary categorization of non-dense or dense breasts. DL algorithms show the potential for providing consistent and reliable data for breast density, which is important to predict breast cancer risk and discuss the need for supplementary studies and future management plans with the patient.

Assessment of breast cancer risk using deep learning

Mammographic breast density is now a well-accepted risk factor, and DL models have been introduced to enable more objective and quantitative density assessment. Recent studies have shown that computer-analysed imaging data (DL models) can be used to predict breast cancer risk with promising results. A hybrid DL model using both traditional risk factors and mammograms showed the highest diagnostic performance compared to a clinical risk-factor-based model or image-only DL model. A DL model with a broader range of input data extracted from electronic health records linked to mammographic data showed the potential to assess breast cancers at levels comparable to and detected 48% of false-negative mammography interpretations. Recent studies indicate that image-based DL models show promise for more accurate breast cancer risk prediction and that we can expect more from these models in the future including personalized management for women. The applications of DL algorithms for breast cancer risk prediction are still in the early stages of development.

Reference

1. Le, E. P. V., Wang, Y., Huang, Y., Hickman, S., & Gilbert, F. J. (2019). Artificial intelligence in breast imaging. Clinical radiology, 74(5), 357–366. https://doi.org/10.1016/j.crad.2019.02.006
2. Yoon, J. H., & Kim, E. K. (2021). Deep Learning-Based Artificial Intelligence for Mammography. Korean journal of radiology, 22(8), 1225–1239. https://doi.org/10.3348/kjr.2020.1210
3. Jairam, M. P., & Ha, R. (2022). A review of artificial intelligence in mammography. Clinical imaging, 88, 36–44. https://doi.org/10.1016/j.clinimag.2022.05.005

Root Cause Analysis in Radiology

Sanjeev Kumar, District Hospital, Bathinda.

Introduction: Root Cause Analysis (RCA) is a systematic process used to identify the underlying causes of a problem. In radiology, RCA is an essential tool used to identify and address the root cause of problems that affect the quality of the imaging process. This paper presentation will discuss the importance of RCA in radiology, the steps involved in RCA, and provide examples of RCA in radiology.

Importance of Root Cause Analysis in Radiology: The importance of RCA in radiology cannot be overstated. RCA helps to identify the root cause of problems, which enables radiologists to develop effective solutions that address the problem's underlying cause. RCA also helps to prevent the problem from recurring, which is critical to maintaining the quality of radiology services.

Steps Involved in Root Cause Analysis in Radiology: The steps involved in RCA in radiology are as follows:

Define the problem: The first step is to define the problem that needs to be addressed. The problem could be anything that affects the quality of the imaging process, such as errors in the imaging report or delays in the imaging process.

Gather data: The next step is to gather data related to the problem. This may involve reviewing imaging reports, examining equipment, and interviewing radiologists and other staff involved in the imaging process.

Identify contributing factors: Once data has been gathered, the next step is to identify the contributing factors that led to the problem. Contributing factors may include inadequate training, faulty equipment, or a lack of communication between radiologists and referring physicians.

Analyze the data: The radiology team should analyze the data to determine the root cause of the problem. This may involve reviewing the data to identify patterns or trends that may have contributed to the problem.

Develop a plan of action: Once the root cause has been identified, the radiology team should develop a plan of action to address the problem. This may involve making changes to processes, providing additional training, or upgrading equipment.

Examples of Root Cause Analysis in Radiology: RCA is commonly used in radiology to identify the root cause of problems that affect the quality of the imaging process. One example is the use of RCA to identify the root cause of equipment failure. By analyzing data related to the failure, radiology teams may discover that the root cause was inadequate maintenance. Once the root cause is identified, the radiology team can develop a plan of action to ensure that the equipment is properly maintained, thereby preventing future failures.

Conclusion: RCA is a critical tool in radiology that helps to identify the root cause of problems that affect the quality of the imaging process. By identifying the root cause, radiologists can develop effective solutions that address the underlying cause of the problem. RCA should be an integral part of any quality improvement initiative in radiology.

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Faraday's Cage- The Keeper Of Magnetism

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Since the dawn of Magnetic Resonance Imaging technology, we have made some fascinating inventions & findings today we use MRI for most crucial medical diagnosis and even in research purposes, Initially we knew very little about magnetic field applications but later on as research progressed we have found a bundle of crucial data of how magnetism affects each molecule and atoms of human body & it's surroundings. Till today 11.7 Tesla's MRI Scanner has been developed for clinical research matters installed at CEA Paris-Sanclay, while we can use only up to 7 Tesla MR for diagnostic purposes.

We can very well say that MRI is one of the most captivating inventions by human beings, from the past few centuries it is very well known fact that magnetism cannot be stored or altered without any external force. Till 18th century it was very uncertain that how and why magnetism was produced & the conditions required to alter it were uncertain, finally in year 1831 Sir Michael Faraday made a breakthrough in field of electromagnetism when he gave the direct relation between generation of magnetic field in the presence of electric field by performing a series of experiments. He reached into a final conclusion that by changing current (I) in a closed loop magnetic field (Bo) can be induced & also that on changing the Bo electric field can be induced this was called Faraday's law & also the Faraday's Cage works upon the same law, invention of this cage also had a key contribution of renowned scientist Benjamin Franklin along with Sir Michael Faraday.

Now the question arises What is faraday's cage? Why is it crucial & why it is required for installation for any MR scanner? This article will give answer to all these questions. Firstly, A Faraday Cage (Shield) can be described as an enclosure created by conducting materials that blocks external electric fields (both static and non-static).

These shields – cages can be used to protect different kinds of electronic equipment i.e., MRI scanner from electrostatic discharges. They can't block magnetic fields like Earth's as well as external magnetic field to enter into the MR room, but they can protect the interior from electromagnetic radiation coming from the outside.

The Invention of Faraday Cage:

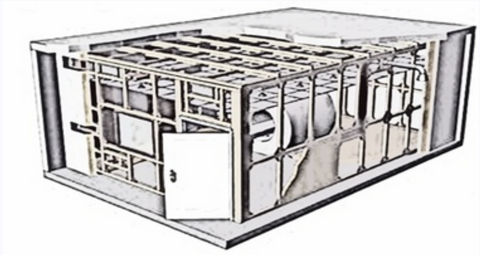
Michael Faraday invented the "cages" in 1836, and they were named after him, but Benjamin Franklin also made a great contribution to "Faraday Cage" development and application.

Faraday noticed that the conductor charge (on a charged conductor) did not influence anything that was enclosed within; the charge resided only on the exterior. Faraday constructed a room, coated the entire room with metal foil, and used an electrostatic generator to create high-voltage discharges that stroke the outside of his metal foil-coated room. He found no electric charge on the inside walls. Faraday used an electroscope to prove this.

How Does It Work?

An external electrical field leads to rearrangement of the charges, and this cancels the filed inside. Electric fields (applied externally) create forces on electrons in the conductor, creating a current, which will further result in charge rearrangement. The current will cease when the charges rearrange and the applied field inside is cancelled.

In MR scanner rooms to prevent external radiofrequency signals from causing any distortion to the image signals coming from patient while keeping the RF pulses from the machine within the scanning area. To function properly, an MRI scanner needs to sit in a specialised room or chamber shielded against RF interference. When creating an RF shielded room, Faraday Cage is made using mainly copper clad panels. Acoustic insulation is fitted and the necessary electrical power, cryogen supply and data cabling is installed along with various services, all of which are shielded using suitable filters. The metal cage can even be seen running through the special glass of the window completely separating the the control room from the scanner itself.



Layout for construction of Faraday's Cage

RF Shielded MR room

Conclusion

Faraday cages or RF Shielding are vital parts of preparing the an MRI machine for medical use, this simple conductive element is so essential that without it high magnetic field cannot be kept at one place with such uniformity. So ensure that each medicinal facility is equipped with proper and well constructed Faraday's cage cause no matter what the quality and built of MR scanner is if the Magnetic field is inhomogeneous, image quality would always be degraded.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X-ray crystallography

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P.G Medical Imaging Technology, Department of Allied Health Science,
Martin Luther Christian University, Shillong, Meghalaya

Introduction:

X-ray crystallography uses X-rays to determine the atomic and molecular structure of a crystal with a technique that relies on the interaction of electromagnetic radiation in the range of 0.01–10 nm (though typically 0.05–0.3 nm) with matter in crystalline form, so that structures of crystallized molecules can be determined with resolution to their individual atoms. The resultant of crystallographic structure determination is an electron density map which is essentially a contour plot indicating positions in the crystal structure where electrons are most likely to be found. By measuring the angles and intensities of these diffracted beams, a crystallographer can produce a 3D picture of the density of electrons within the crystal. From this electron density image, the mean positions of the atoms in the crystal can be determined, as well as their chemical bonds, their disorder, and various other information. The method revealed the structure and function of many biological molecules, including vitamins, drugs, proteins, and nucleic acids, such as DNA. The double helix structure of DNA discovered by James Watson and Francis Crick was revealed by X-ray crystallography later in 1962 won the Nobel Prize in Physiology or Medicine.

The technique was developed in 1912 by William Henry Bragg and William Lawrence Bragg (a father and son duo won the Nobel Prize in 1915 in Physics), who built upon earlier work by Max von Laue. Von Laue discovered that by shining X-rays through a copper sulfate crystal onto a photographic plate, diffraction spots that related to the crystalline structure of the sample were produced. The early applications were mainly for determining the size of atoms, lengths and types of chemical bonds, atomic-scale differences among various materials, as well as the crystalline integrity, grain orientation, grain size, film thickness and interface roughness of the related materials, especially minerals and alloys. The structure and function of many biological molecules like vitamins, drugs, proteins, and nucleic acids were also studied. Up to date, it is still the chief method for characterizing the atomic structure of new materials and in discerning materials that appear similar by other experiments. Many different fields of study including biology, chemistry, and geology have found uses for this powerful yet simple technique.

Bernal and Dorothy Crowfoot in 1934, recorded the first X-ray diffraction image on a crystallized protein after exposing pepsin crystals. Crowfoot (later Hodgkin) wone the 1964 Nobel Prize in Chemistry for determining the structure of vitamin B12 by X-ray crystallography. The first biological macromolecule structures bovine hemoglobin by Max F. Perutz and sperm whale myoglobin by John Kendrew, were determined by X-ray crystallography in 1959, and later in 1962 they later received the Nobel Prize in Chemistry.

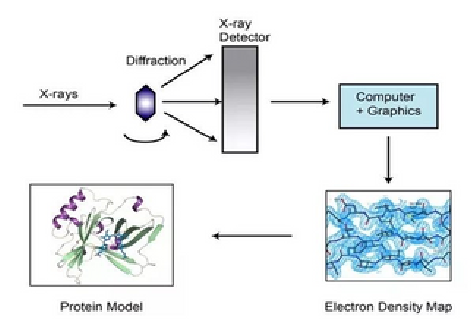


Fig. Principle of X-ray crystallography

Principles:

A crystal is mounted on a goniometer, the crystal is positioned at selected orientations. The crystal is exposed to a finely focused monochromatic X-rays, which will lead to diffraction pattern of regularly spaced spots. It works in a manner of elastic scattering with the outgoing rays having the same energy and wavelength as the incoming X-rays, which get an altered direction after diffraction. A crystallographer will then produce a 3D picture of the density of electrons within the crystal by measuring the angles and intensities of these diffracted beams by mathematical calculation method called Fourier transforms. From this electron density, the mean positions of the atoms, chemical bonds, crystallographic disorder, and some other information in the crystal can be determined.

Equipment: X-ray sources: rotating anode; synchrotron; free electron laser

Methodology or Workflow: An X-ray crystallography machine works by utilizing a four-circle diffractometer. The diffractometer rotates the crystal and the deflector between the X-ray source and the screen. Where the screen receives the X-rays which have passed through the crystal. X-Ray crystallography experiments are broken down into four steps:

1. Protein crystallization
2. Production of a diffraction pattern
3. Analysis of the diffraction pattern to produce an electron density map
4. Determination of the protein structure.

A perfect crystal structure is required for analysis, as position of electrons must be mapped accurately, it is important that the structure be flawless. Diffraction pattern is formed on the screen by the X-rays which have been absorbed by the atoms in the crystal, which leave behind dark diffraction spots. The densities vary with the amount of interference between the diffracted electrons at each point. These spots represent accurately the electron density, that can be mapped. Once the electron density is mapped, complex

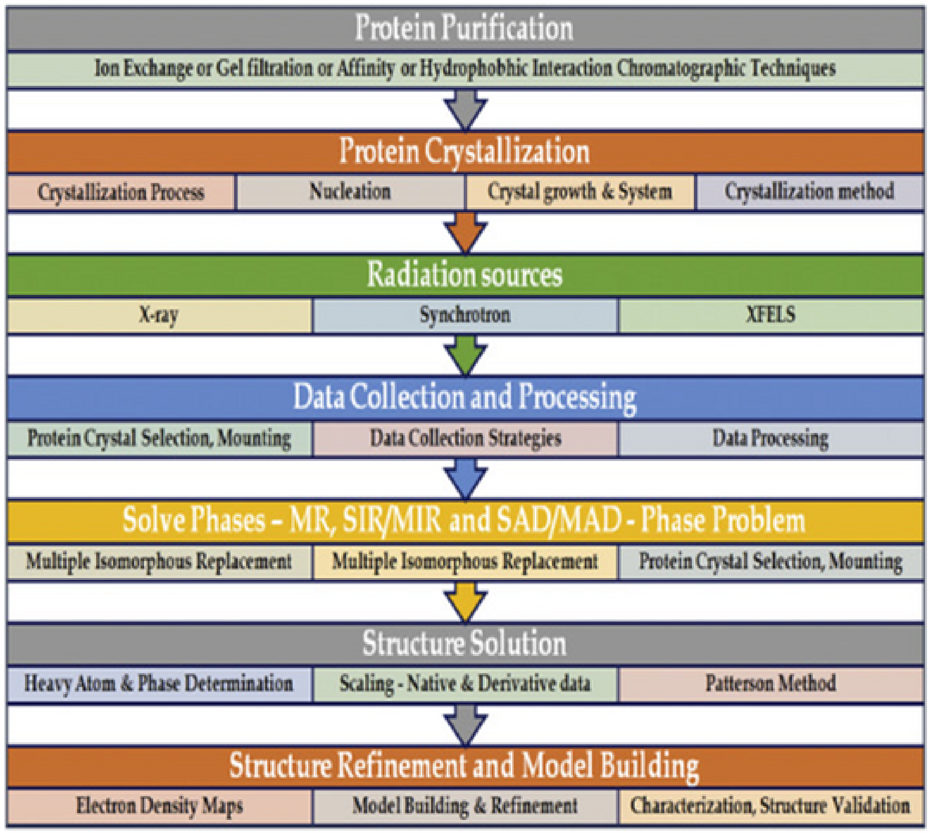
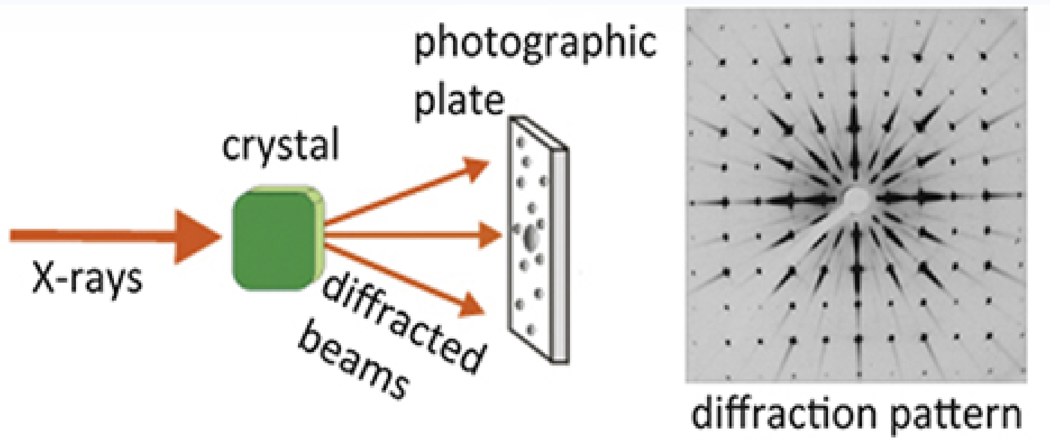


Figure: Steps involved in macromolecular X-ray crystallography.

mathematical calculations called the Fourier transformation are performed to make sense of the information. This calculation transforms the data into a 3D representation of the atomic or molecular structure of the sample molecule or material. Now computers perform this task but, in the early days, these calculations were done by hand.



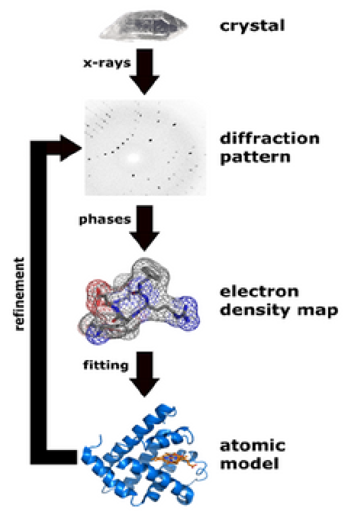


Figure: Workflow for solving the molecular structure by X-ray crystallography.

Applications:

Some of the specific areas that can be probed with X-ray crystallography include measuring the thickness of films, identifying specific crystal phases and orientations that can help to determine the catalytic activity of materials, determining the purity of a sample, determining how a drug might interact with specific proteins and how the drug can be improved, analyzing how proteins interact with other proteins, for investigating microstructures, and for analyzing what amino acids are present in a protein which can help with determining how catalytically active an enzyme is. It is now often used to identify the structure of various biological materials, vitamins, pharmaceutical drugs, thin-film materials and multi-layered materials.

X-ray crystallography has led to a better understanding of chemical bonds and non-covalent interactions. The initial studies revealed the typical radii of atoms, and confirmed many theoretical models of chemical bonding, such as the tetrahedral bonding of carbon in the diamond structure, the octahedral bonding of metals observed in ammonium hexachloroplatinate (IV), and the resonance observed in the planar carbonate group and in aromatic molecules. X-ray crystallographic studies have led to the discovery of even more exotic types of bonding in inorganic chemistry, such as metal-metal double bonds, metal-metal quadruple bonds, and three-center, two-electron bonds. Since the 1920s, it was used for determining the arrangement of atoms in minerals and metals. The application of this principle to mineralogy began with the structure of garnet, which was determined in 1924 by Menzer. Recent advances in image reconstruction technology have made X-ray crystallography amenable to the structural analysis of much larger complexes, such as virus particles.

Challenges:

Growing a perfect crystal is a challange, as this is needed to provide accurate information about the sample. Especially some macromolecules those with a high atomic weight such as membrane proteins, can be difficult to crystallize. It is also difficult to obtain a crystal of virus particles, which is a prerequisite, and requires placing the samples in nonphysiological environments, which can occasionally lead to functionally irrelevant conformational changes. High-resolution capsid structure can be obtained from the diffraction pattern generated by crystals of the virus particles (eg, human rhinovirus 14).

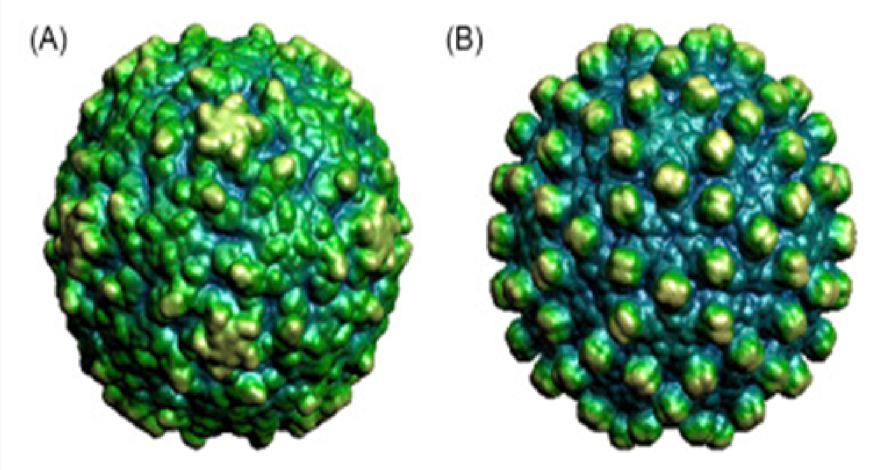


Figure: Viral capsid structure obtained by X-ray crystallography. (A) Poliovirus capsid with T=3 symmetry. (B) Hepatitis B virus capsid with T=4 symmetry (http://viperdb.scripps.edu/).

References:

- Smyth, MS, and Martin, JHJ (2000) X-ray crystallography. Molecular Pathology https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1186895/
- Blundell, TL and Johnson, LN (1976). Protein crystallography. London: Academic Press
- https://www.creativebiomart.net/resource/principle-protocol-x-ray-crystallography-393.htm
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Pituitary Macroadenoma

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Dr. Vasantrao Pawar Medical College Hospital & Research Centre, Adgaon, Nashik

Pituitary gland – overview

The pituitary gland, also known as the hypophysis, is a small, pea-sized gland located at the base of the brain. Despite its small size, it plays a crucial role in regulating various bodily functions by producing and secreting hormones into the bloodstream.

The pituitary gland is divided into two parts: the anterior pituitary and the posterior pituitary. The anterior pituitary is responsible for producing and secreting several hormones, including growth hormone, prolactin, thyroid-stimulating hormone, adrenocorticotropic hormone, follicle-stimulating hormone, and luteinizing hormone. These hormones regulate growth, metabolism, lactation, stress response, and reproductive functions.

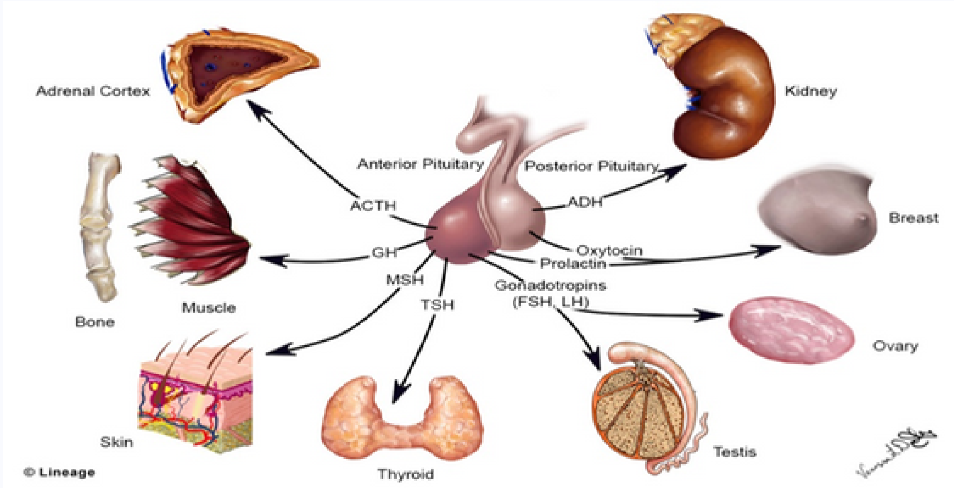
The posterior pituitary, on the other hand, does not produce hormones but stores and releases two hormones made by the hypothalamus: oxytocin and vasopressin. Oxytocin regulates social behavior, while vasopressin regulates water balance in the body.

The pituitary gland is regulated by the hypothalamus, a small area of the brain that controls the release of hormones from the pituitary gland. The hypothalamus releases hormones that either stimulate or inhibit the production and release of hormones from the pituitary gland.

In conclusion, the pituitary gland is a small but vital gland that plays a crucial role in regulating various bodily functions. Its proper functioning is essential for maintaining overall health and well-being.

Pituitary macroadenoma

A pituitary macroadenoma is a type of pituitary tumour that is larger than 1 centimeter in size. These tumours are usually benign, but they can cause problems by compressing the surrounding tissues and affecting



hormone production.

Causes

The exact cause of pituitary macroadenomas is unknown, but they are thought to be caused by genetic mutations that result in uncontrolled growth of the pituitary cells. Certain genetic syndromes, such as multiple endocrine neoplasia type 1 (MEN-1) and Carney complex, are also associated with an increased risk of developing pituitary macroadenomas.

Symptoms

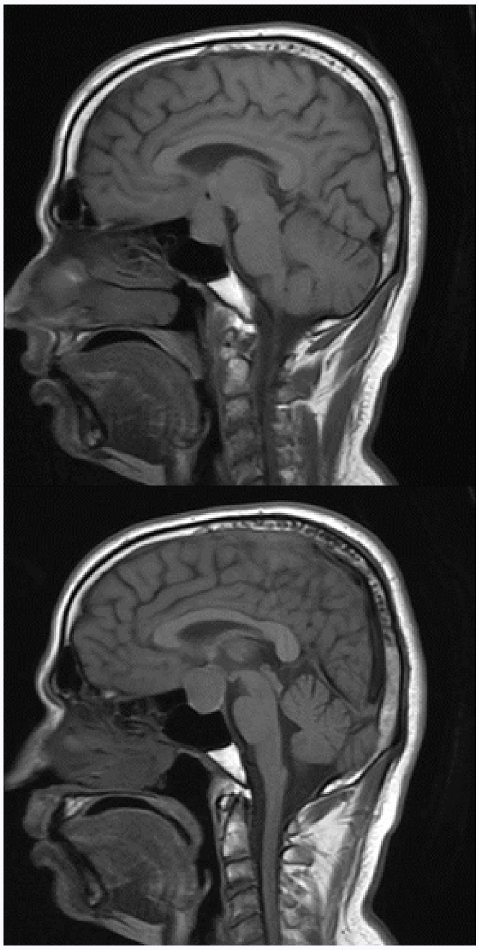
The symptoms of pituitary macroadenomas depend on the size and location of the tumour, as well as the hormones that are affected. Some common symptoms include:

1. Headaches
2. Vision problems, such as double vision or loss of peripheral vision
3. Fatigue
4. Weight gain
5. Mood changes
6. Irregular menstrual periods or loss of menstrual periods in women
7. Erectile dysfunction or loss of sex drive in men
8. Increased thirst and urination
9. Growth of hands

Diagnosis

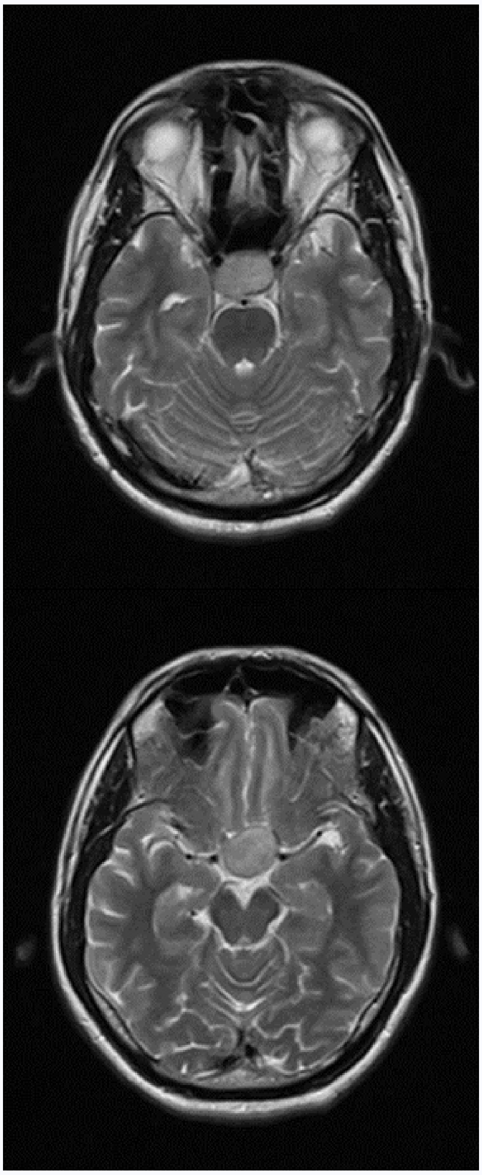
Pituitary macroadenomas are usually diagnosed through a combination of medical history, physical examination, and imaging tests. Blood tests may also be ordered to check for hormone imbalances. Imaging tests, such as magnetic resonance imaging (MRI) and computed tomography (CT) scans, can help to determine the size and location of the tumour.

Signal characteristics on MRI T1W sagittal -



1. Typically isointense to grey matter.
2. Larger lesions are often heterogeneous and vary in signal due to areas of cystic change/necrosis/hemorrhage.

T2W Axial -

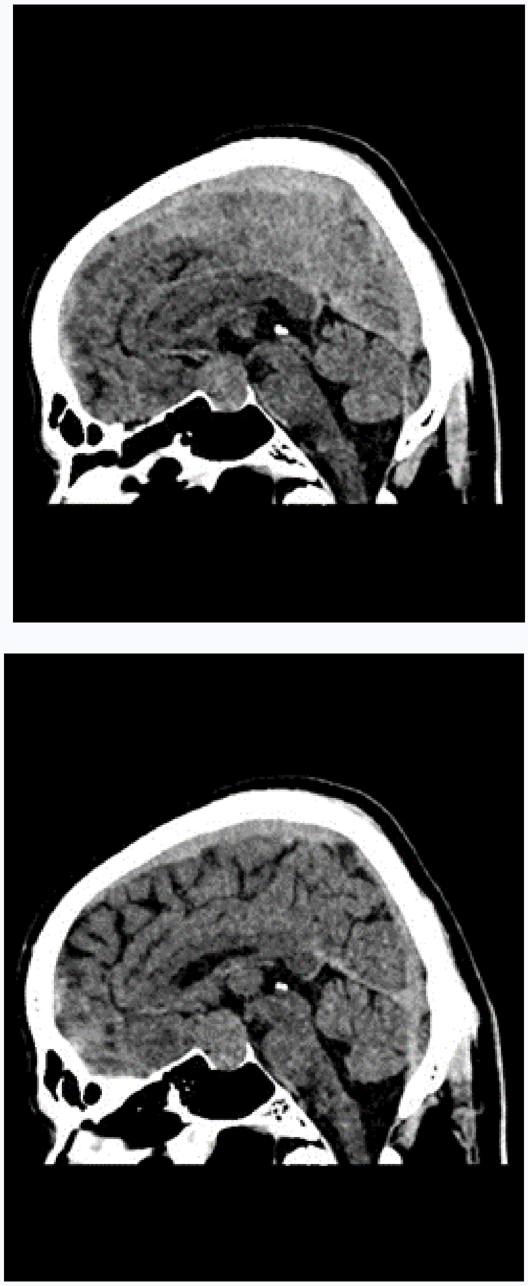


1. Typically isointense to grey matter
2. Larger lesions are often heterogeneous and vary in signal due to areas of cystic change/necrosis/hemorrhage.
3. A hypo intense rim is often present (75%).

Post Contrast – T1W Fat Sat

Solid components demonstrate moderate to bright enhancement

CT-Scan images



Non-contrast attenuation can vary depending on cystic and necrotic components.

Treatment

The treatment for pituitary macroadenomas depends on the size and location of the tumour, as well as the hormones that are affected. Some common treatment options include:

1. Medications to reduce hormone levels and shrink the tumour
2. Surgery to remove the tumour.
3. Radiation therapy to destroy the tumour cells
4. In some cases, a combination of these treatments may be used to effectively manage the tumour and its symptoms.

Conclusion

Pituitary macroadenomas are a type of pituitary tumour that can cause a range of symptoms, depending on the size and location of the tumour. Diagnosis typically involves a combination of medical history, physical examination, and imaging tests. Treatment options include medication, surgery, and radiation therapy, and the choice of treatment depends on the individual case. If you experience any of the symptoms associated with pituitary macroadenomas, it's important to seek medical attention promptly.

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MR Imaging of acute Penile Injury utilizing Cardiac-phased array coil

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Introduction:

A 17-years old boy with suspected penile injury caused by masturbation referred to our department to undergo MRI of Penis. We have tried the Cardiac Phased-Array coil instead of routine abdomen and pelvis Phased-Array coil for the better resolution with smaller field of view. This study reveals the advantages of Cardiac Phased-Array coil in MR imaging of Penis.

Material and Methods:

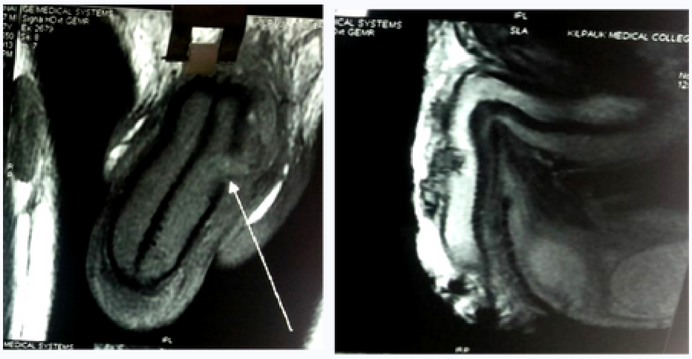
- This study was done in GE MRI 1.5 T with 4-channel Cardiac Phased-Array coil. MR imaging of the penis is facilitated by appropriate positioning of the patient.
- With the patient supine, adequate padding is placed between the patient's legs inferior to the perineum, to elevate the scrotum and penis.
- The penis is taped to anatomic midline to reduce motion during the examination. A cardiac Phased-Array Surface coil is placed around the pelvis and scrotum.
- The protocol includes 3 plane localizer, FSE T2 in all three planes, Axial SE T1and fat-suppressed FSE or STIR T2-weighted sequence in any one plane. Dual echo, Post contrast SPGR are optional sequences.

Result:

Placement of small size Cardiac Phased-Array coil was comfortable to the patient.

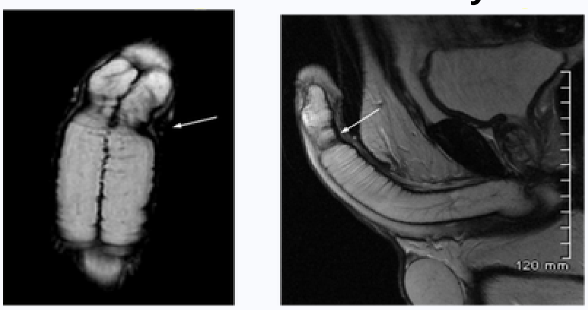
This 4 -channel Cardiac Phased-Array coil facilitate to maximize signal-to-noise ratio at small fields of view and clearly demonstrate small anatomic structures, such as the tunica albuginea, thereby aiding in the evaluation of patients with trauma and suspected penile fracture.MR imaging demonstrates focal disruption of the T1- and T2-hypointense tunica albuginea with an adjacent T2- hypointense hematoma

4-CHANNEL CARDIAC PHASED-ARRAY COIL

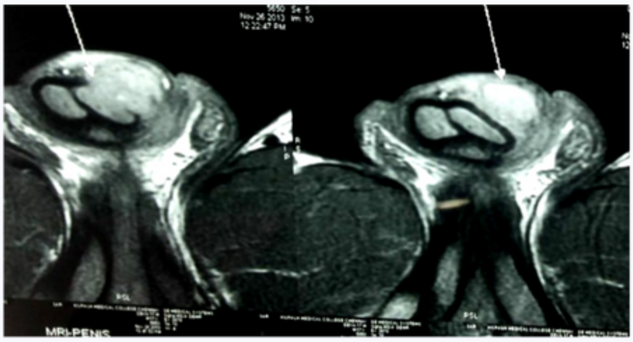


Focal discontinuity in tunica albuginea of corpus cavernosum with focal T1 and T2 hypointense collection

"Hour Glass" Deformity



T2- Hypointense lateral plaque in the left corpus cavernosum, with waisting and angulation of the distal penis.



Focal discontinuity in tunica albuginea (penile fracture) and heamatoma.

Conclusion:

MR imaging of penis with Cardiac phased-Array coil helps making the high resolution imaging with small field of view and suggests the exact site of surgical incision. A 12mm sized transverse tear in dorso lateral aspect of tunica albuginea with partial cavernosa tear on left side with heamatoma of size 27 x 16 mm along the subcutaneous plane was clearly demonstrated.

Reference:

Hricak H, Marotti M, Gilbert TJ, et al. Normal penile anatomy and abnormal penile conditions: evaluation with MR imaging.

Satragno L, Martinoli C, Cittadini G. Magnetic resonance imaging of the penis: normal anatomy.

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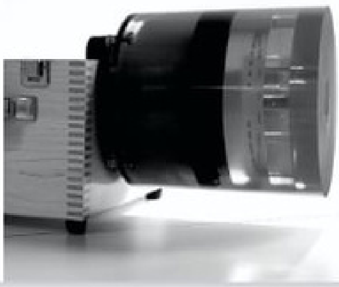

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MRI Brain: Epilepsy Protocol

J Venkat, MBA, Ireland recognized Radiographer (CORU), Asst. Professor, Global Hospital, Chennai

Introduction:

An MRI provides an accurate picture of the structures of the brain using magnetic technology. An epilepsy protocol MRI is different from a standard brain MRI because the pictures are focused to look in the structures of the brain that are most likely to cause seizures. MRI protocol for epilepsy is a group of MRI sequences put together to improve sensitivity and specificity in identifying possible structural abnormalities that underlie seizure disorders (e.g. mesial temporal sclerosis and malformation of cortical development). MRI is the imaging modality of choice for epilepsy investigation

Routine Brain sequences

Before starting Epilepsy protocol, a routine MRI Brain scan should be completed. These sequences should include T1, T2, FLAIR, DWI and SWI with Axial sagittal and Coronal Plane accordingly.

Importance of Hippocampus

The hippocampus is a small, seahorse-shaped structure located deep within the temporal lobe of the brain. It plays an important role in the formation and retrieval of memories, as well as spatial navigation. In epilepsy, the hippocampus is often affected, and a decrease in the volume of the hippocampus is a common finding in patients with temporal lobe epilepsy.

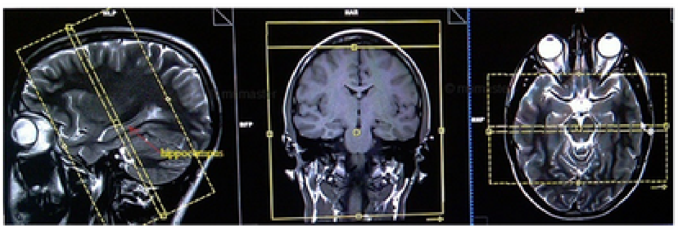
The reduction in hippocampal volume is thought to be due to a process called hippocampal sclerosis, which involves the loss of neurons and the formation of abnormal tissue within the hippocampus. This process can be detected on MRI scans, and is often found in patients with temporal lobe epilepsy.

Epilepsy sequences

Once routine sequences completed, following sequences should be completed (Yellow highlighted)

Epilepsy Protocol	Philips	SIEMENS	GE
Localizer	Survey	Localize_3PLANE	3-plT2 FGRE
	T2W TRA	T2_TSE_TRA	Ax FRFSE T2
	3D Brain VIEW	T2_flair_TRA	COR T2 FLAIR
	T1W 3D TFE SG	T1_se_cor	SAG T2 FRFSE
	T2W_TRA	T2_tse_sag	DWI
	DWI SENSE	DWI	Ax T1 FLAIR
Coronal Oblique plans- perpendicular to Hippocampus	T2w-TSE COR OBL	T2_TSE_COR_OBL_2mm	COR 3D Ir prep
	FLAIR COR OBL	T1_TSE_COR_OBL_2mm	COR T2 FRFSE
	T1W_IR COR OBL	T1_TIRM_COR_OBL_2mm	COR T2 FLAIR

Coronal Oblique Planning should be perpendicular to Hippocampus



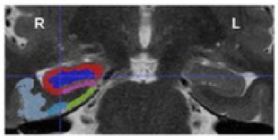
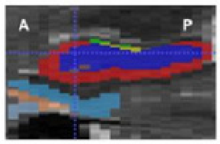
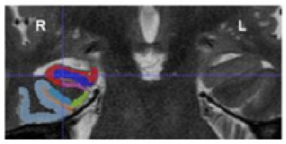
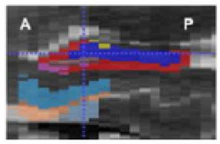
Planning Hippocampus

When planning an MRI scan to assess hippocampal volume in epilepsy, there are several important factors to consider:

Protocol: There are different MRI protocols that can be used to assess the hippocampus, including high-resolution T1-weighted imaging and T2-weighted imaging. The specific protocol used for epilepsy evaluation may vary depending on the individual patient's needs and the clinical questions being asked by the treating physician.

MRI machine: The strength of the MRI machine can affect the image quality and resolution. A higher-field MRI machine (e.g. 3T or higher) may be preferred for imaging the hippocampus.

Patient positioning: The patient should be positioned in the MRI scanner in a way that allows for optimal visualization of the hippocampus. This typically involves lying on their back with their head secured in a coil, and the head tilted slightly forward to reduce motion artifacts.

Hippocampus	Coronal view	Sagittal view
Normal		
Abnormal (reduced Volume)		

Significance of the study:

The range of volume of Hippocampus varies between 1.73-5.68 cm3. Average volume of hippocampus is 2.21cc, Right-left difference 0.3cc. In vivo MRI volumetry consistently shows that the right hippocampus is larger than the left.This measurement can be performed manually in MRI Work station. However, nowadays advance software are available to calculate the volume of the hippocampus. In summary, the volume of the hippocampus is an important factor to consider in epilepsy, as it is closely linked to the development of seizures and the difficulty in controlling them.

Magnetic resonance spectroscopy (MRS): This technique allows for the detection of chemical changes in the brain, which can help identify abnormalities related to epilepsy, such as changes in the concentration of certain neurotransmitters or metabolic markers.

Functional MRI (fMRI): This type of imaging is used to evaluate brain function, including the areas of the brain that are activated during certain tasks or activities. fMRI can be used to identify areas of abnormal brain activity that may be associated with seizures.

Electroencephalography (EEG): This is not an imaging technique, but it is often performed in conjunction with a brain MRI to record the electrical activity of the brain and identify areas of abnormal brain activity that may be associated with seizures.

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CT Tube Warm Ups

Hemant Prakash Joshi, Radiographer. ESIC MC & Hospital, Gulbarga, Karnataka.

Like any equipment, CT scanners are incredibly expensive pieces of machinery and are essential components in various medical establishments. Since they are valuable, even repairing and replacing some of its elements may be costly. For this reason, you must operate your CT scanner properly to avoid damage and mishandling. One of the most expensive and essential parts of a CT scanner is the X-ray Tube. And seeing that it plays a vital role in the operations of a scanner, you need to prolong its life and allow it to warm up before use. When you don't allow it to warm up properly, you could increase its wear and tear and ultimately shorten its lifespan.

X-ray tubes convert electrical input power into X-rays, making them an extremely vital element that allows your CT scanner to capture diagnostic images. Because of this process, your CT scanner may require more energy to function and produce heat. When the X-ray tube's anode is cold, heat production may require a lot of effort, which could cause damage to your machine. For this reason, you must prevent this sudden change of temperature from damaging your tubes by having a warm-up sequence, allowing your CT scanner to gradually warm-up.

But why do you need to do this?
Increase the Life of Your X-Ray Tubes
Generally, X-ray tubes can last up to three years, depending on the war and tear they sustain. Without proper warm-up procedures, they'll most likely fail to operate much earlier in the timeline. In fact, you should know that one of the reasons X-ray tubes breakdown is due to overheating.

Reduces Premature Failing
When your X-ray tubes overheat, they're more susceptible to failure prematurely, which could also cause other operating errors. Sadly, when you don't warm up your CT scanners, it may go into overdrive really quickly and cause the system to shut down unexpectedly, damaging other parts of your scanner.

Reduces Downtime
Seeing as CT Scanner warm-up procedures don't take much time to complete, it's best to put in a bit of time to warm up your device rather than suffer the consequences and be out of commission due to scanner failure. When your CT scanner is broken, you'll most likely experience downtime in your facility, which could lead to havoc. Once you know your CT scanner parts need replacements, it's critical to get high-quality parts to have your machine repaired and go through replacements right away.

What you can do to extend ct tube life

Tube Warm Ups
A premature exposure to high power levels creates a sudden influx of heat in a tube. This sudden heat can damage a tube or accelerate wear and tear on it.

Before beginning your CT's daily schedule of patient scans or running a QA test on your system, it's important to perform the manufacturer-recommended warm up procedure. This will gradually increase the temperature in the tube and prevent damage from temperature shock. If your CT isn't in regular use, it's still recommended you warm it up and run a QA test at least once a week.

It's worth noting that too many warm ups can be as bad as too few. Generally speaking, a warm up is only necessary at the start of a scanning day. After warm up, a tube will stay warm for about 30-60 minutes.

Shutting Down
Tube life can also be preserved by following proper shutdown procedures. Do not shut down power to your gantry until the tube has had time to cool down.

Preventative Maintenance
Make sure that your system is getting preventative maintenance (PM) at least twice a year. When your system is kept in good operating condition by a qualified service provider, it powers your tube and manages its temperature according to the original specifications. A scanner that is maintained haphazardly puts the tube at a higher risk for damage.

Please note: on the first PM after a tube is installed, the engineer should check the tube's heat exchanger loop for air bubbles and a proper pump flow rate.

"Listen" to Your System"
In many cases, if you're about to do something that will affect your tube, the operator's workstation will warn you and recommend what you should do before proceeding. For example, if your system detects that the tube is cold, a message will come up recommending a warm up. Your tube life will benefit if you follow on-screen recommendations as often as possible.

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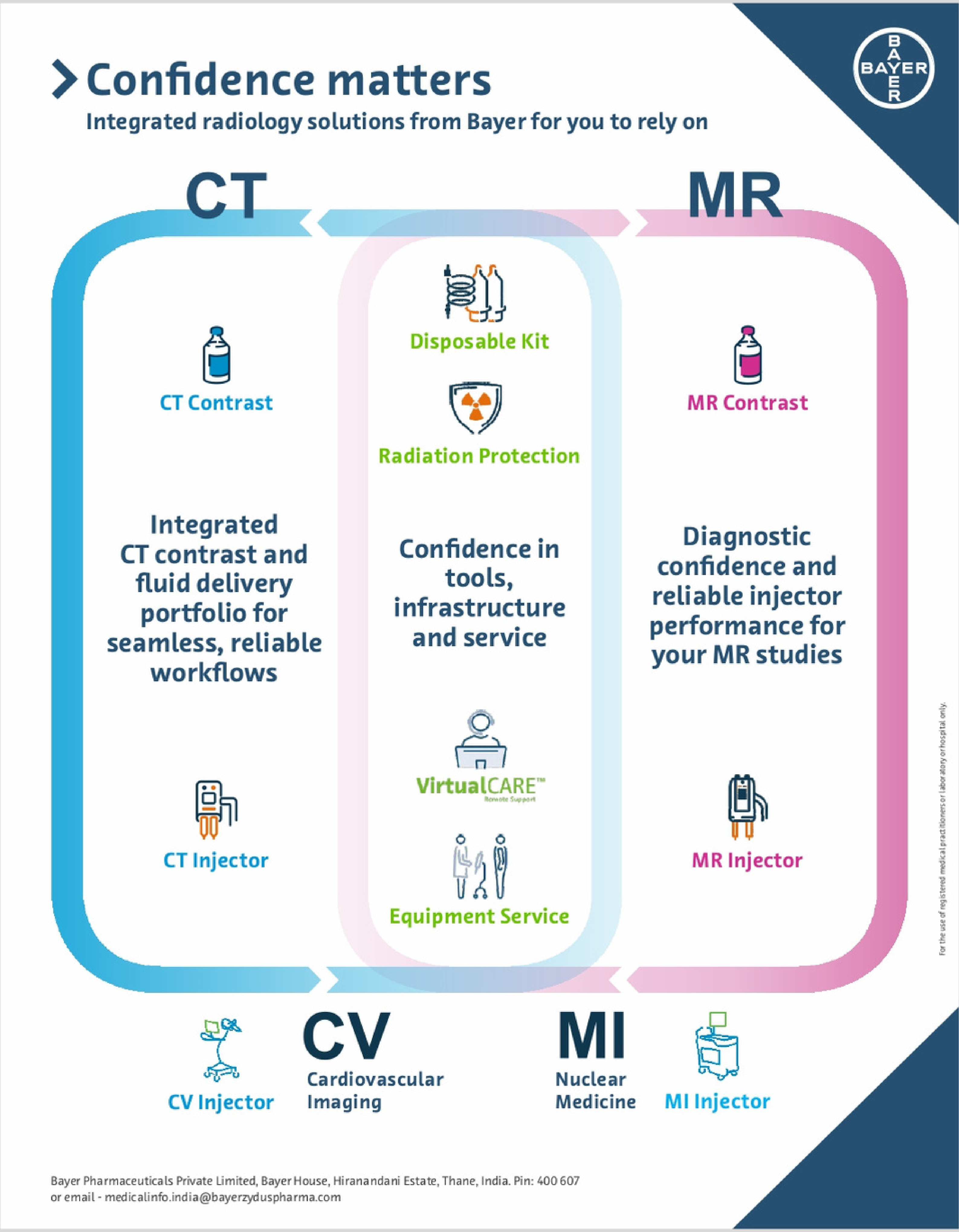
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CT Scan Detectors

Ramesh Sharma, Rtd. Chief Technical Officer Radiology, NCI-AIIMS

"Detector" refers to a single element or type of detector used in a CT Scan system. It describes the entire collection of detectors that are situated in an arc or a ring in a system. Each measures the intensity of transmitted x-ray radiation along a beam that's projected from the x-ray source to a particular detector element. There are also reference detectors within the array that help calibrate data and reduce artifacts

The efficiency of a CT Scan system detector depends on:
1) The stopping power of the detector material
2) The scintillator efficiency (in solid state types of detectors)
3) The change collection efficiency (in Xenon types of detectors)
4) The geometric efficiency, which is the amount of space occupied by the detector
collimator plated relative to the detector's surface area
5) The scatter rejection

There are several terms that describe elements of detector efficiency:
A) Capture efficiency refers to the ability with which the detector obtains photons that pass through the patient
B) Absorption efficiency refers to the number of photons absorbed by the detector and are dependent on the physical properties of the detector face, including thickness and material.
C) Response time refers to the time required for the detector signal to return to zero after the detector is stimulated by x-ray radiation and is able to detect another x-ray event.
D) Dynamic range is the ratio of the maximum detector signal measured to the minimum signal they can measure.

Two Types of Detectors:
- Xenon Gas
- Solid State Crystal

Xenon Gas Detectors use pressurized xenon gas to fill the hollow chamber to produce detectors that absorb 60-87% of the photons that reach them. Xenon gas is used because it can remain stable under pressure and is significantly less expensive when compared to the solid-state variety. It's also easier to calibrate and is highly stable. A Xenon Detector Channel consists of three tungsten plates. The xenon gas is ionized when a photon enters the channel. These ions are accelerated and amplified by the electric field between the three plates. This collection charge produces and electric current, which is then processed as raw data. The downside of xenon gas is that it must be kept under pressure The major factors hampering detector efficiency are the loss of x-ray photons in the casing window and the space taken up by the plates.

Solid State Crystal Detectors are also called scintillation detectors because they use a crystal that fluoresces when struck by an x-ray photon. The photodiode is attached to the crystal and transforms the light energy into electrical (analog) energy. Individual detector elements are affixed to a circuit board .Solid state crystal detectors are made from a variety of materials, like cadmium tungstate, cesium iodide, bismuth germinate and ceramic rare earth compounds like gadolinium of yttrius. Solid state detectors have higher absorption coefficients because these solids have high atomic numbers and high density in comparison to gases. They absorb close to 100% of all photons that reach them.

All of the scanners mentioned above are build in solid state i.e., there are no gas detectors which are used mainly GE scanners used highlight lumex, image reconstruction with the 4th generation, all Siemens scanners used ultra-fast ceramic as detector material while GE scanners used highlight lumex, image reconstruction time display per seconds is ranged from 1 slice/s up to 40/s for Siemens 64 slices, Toshiba has the large number of detectors along the (z) axis and so large number of detection channels per row between the scanners, minimum slice thickness of scanners in the region are ranged from 0.5 to 1.5.

Table 6 Technical Specifications Comparison (Detection System)

Detection System	GE Hi Speed Nxi/pro	Siemens Somatom Definition	GE LightSpeed	GE BrightSpeed	GE LightSpeed	Siemens somatom Emotion	Toshiba Aquillion	GE BrightSpeed 8 slice	Siemens somatom 20 slices	Siemens emotion 1 slice	Cere Tom Portable CT
Detector Type	Solid state array	Solid state array	Solid state array	Solid state array	Solid state array	Solid state array	Solid state array	Solid state array	Solid state array	Solid state array	Solid state array
Detector Material	(HiLight-Lumex)	Siemens UFC	GE HiLight matrix II Lumex	GE HiLight Matrix Lumex	GE HiLight Matrix II Lumex	Siemens UFC	Gadolinium oxysulphide GOS	GE HiLight Matrix lumex	Siemens UFC	Siemens UFC	NA
Number Of Detectors	16	32	24	24	24	24	40	24	24	12	20
Number Of Detection Channels/ Row	16×816 total 13,056	736×32 total 23552	24×888 total 21,312	24×880 total 21,120	24×888 total 21,312	24×736 total 17663	40×896 total 35840	24×880 total 21,120	24×888 total 21,312	12×816 total 6528	408×20 total 8160
Effective Length Of Detector Elements	20	38.4	20	20	20	20	32	20	20	12	20
Image Reconstruction Time Display	6 frames/ second	40 slices/sec	6 slices/sec	3 frames/ second	6 slices/sec	6 images/s	10 images/s	3 frames/ second	40 images/s	1 slices/sec	4-8 image/s
Min Slice Thickness (mm)	0.5	0.6	0.625	0.63	0.625	0.63	0.5	0.63	0.5	0.5	1.5

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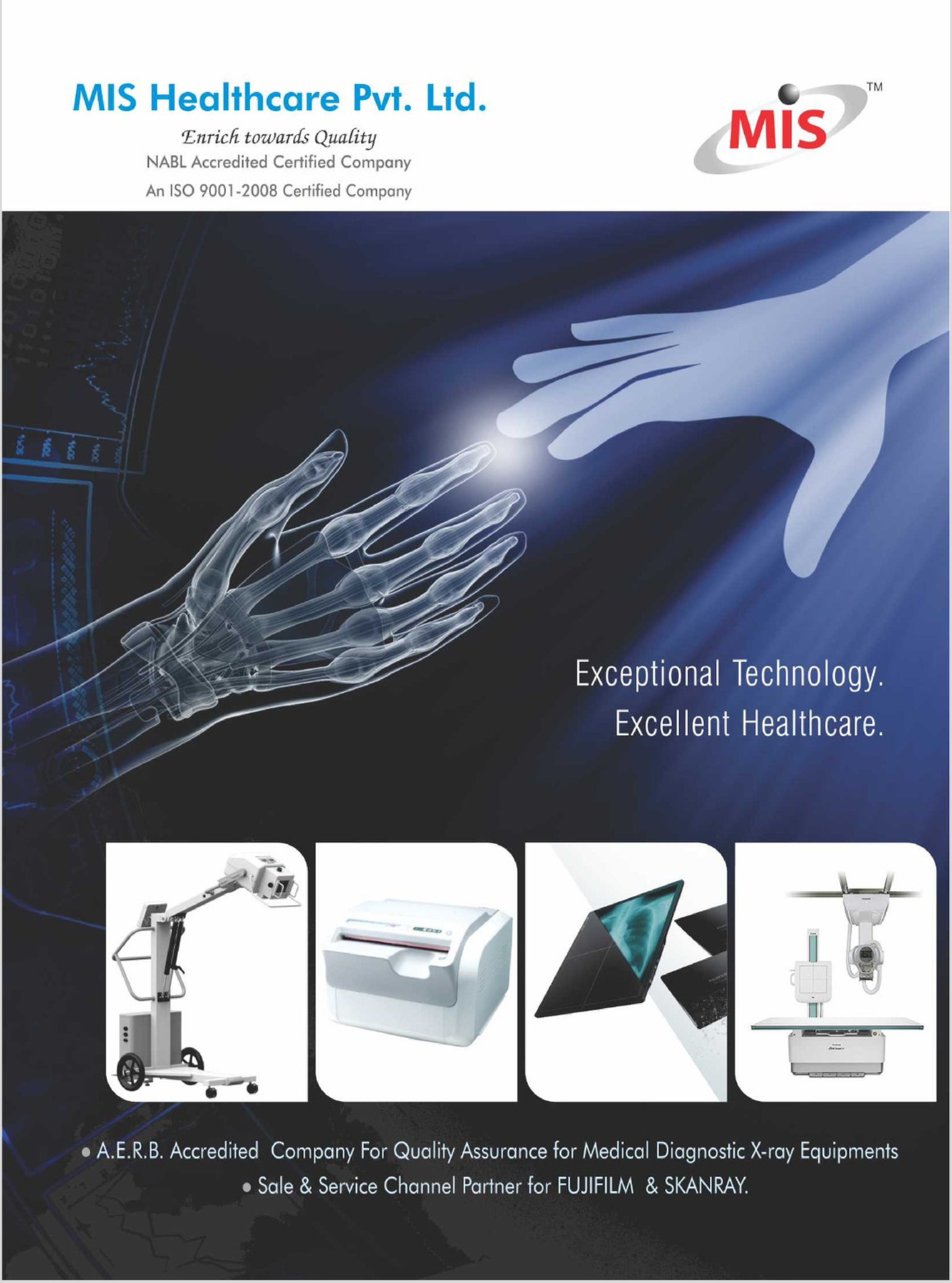
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Dual Energy X-Ray Absorptiometry

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School of Allied Health Sciences, SMVMCH & SMVEC, Pondicherry.

Introduction

Dual energy x-ray absorptiometry (DEXA), is used for measuring the bone mineral density (BMD) of the body. A decrease in the BMD is one of the common signs in the process of aging. In 1994, the World Health Organization (WHO) coined the densitometric evaluation of BMD.

Instrumentation & working mechanism

DEXA is based on absorption of x- rays by different components, using high and low energy X-ray photons. Depends on equipment, x-ray energy difference can be of two mechanisms.

1. The generator emits alternating radiation of high (140KVp) and low (70-100 KVp) kilovoltage while moving across the surface of the body
2. The generator emits a constant beam while a rare-earth filter separates high energy (70 Kev) from low energy (40 Kev) photons.

- DEXA, system include different types of hardware (filters and detectors) & software (analysis algorithm). The X-ray source can emit a pencil beam (pinhole collimator), which is registered by single detector, or a fan beam (slit collimator), which is registered by a multiple detector.
- The latter system reduces the acquisition time and image quality. At the same time, the analysis algorithm discriminate bone from soft tissue depending on the energy differences.
- Peripheral DEXA performed with portable units such as (Accu DEXA) focus on study of phalanxes. It is not very accurate, but its cost is low.
- Axial DEXA of the lumbar spine and femur (Central DEXA) is the preferred technique to measure BMD with a good resolution and low radiation.

Indications

- Low trauma fracture
- Osteoporosis
- Long term/high dose Steroids

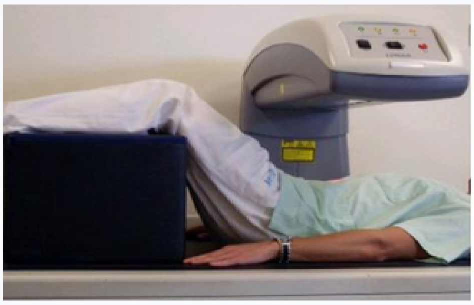
Patient preparation

The patient is advised to change to the hospital gown with removal of any metallic objects away from the body especially in the region of lumbar spine and hip joint. The patient's condition and history is assessed and the scan is performed.

Patient positioning

Lumbar spine

The patient lies supine with the legs flexed over a support pad that reduces a lumbar lordosis.
Lateral spine is not taken in routine Osteoporosis study, but it is used in vertebral morphometry.



Hip joint

The patient lies supine with legs slightly in abduction in order to maintain the femoral axis straight, an internal rotation (15-300) is given and held in the position by a immobilizer stand.

Image acquisition

The scan is initially with the appropriate patient age and ethnicity entered in the computer with relevant details. Then, Lumbar spine PA examination is done first followed by bilateral or unilateral hip joint acquisition. For patients with age less than 20 years of age, Lumbar spine examination is only done due to the variability in femoral maturation that could affect the results. The forearm is examined in a condition where either spine or hip data is insufficient for final diagnosis. The Bone Mineral Density is calculated in g/cm2. The FOV of all the scans ranges from 1 – 2cm extending superior and inferior to the original anatomy. As a common point, the bone's axis must be centered and straight. The main cause of error in reports is predominantly due to the following two reasons,

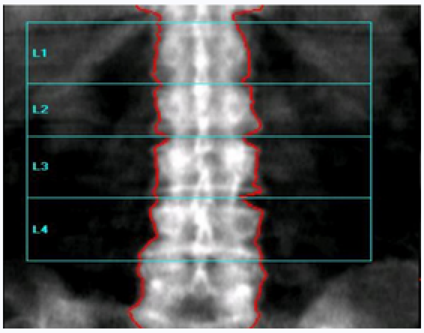
- Incorrect Positioning
- Artifact in area of scanning

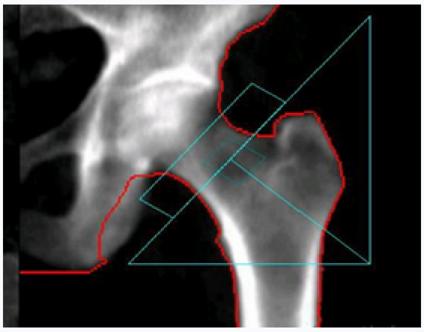
Post processing

Once the acquisition is complete, the acquired images are loaded in the post processing software for end result analysis. Most of the DEXA machines has inbuilt ROI placement after the acquisition is done which has to be verified once the examination is done before generating the reports. The ROI positioning for post processing is as shown in the below given figure.

Lumbar spine - Correct labelling of the vertebrae is the primary goal which can be done by keeping in mind the anatomical landmark (i.e. 12th rib appears at T12). The BMD values increases with increasing number of vertebras from L1 – L4. In case of any artifact in the spine, the specific vertebral level can be skipped.

Hip Joint – Correct positioning of the ROI in femoral neck which is placed in the greater trochanter notch.

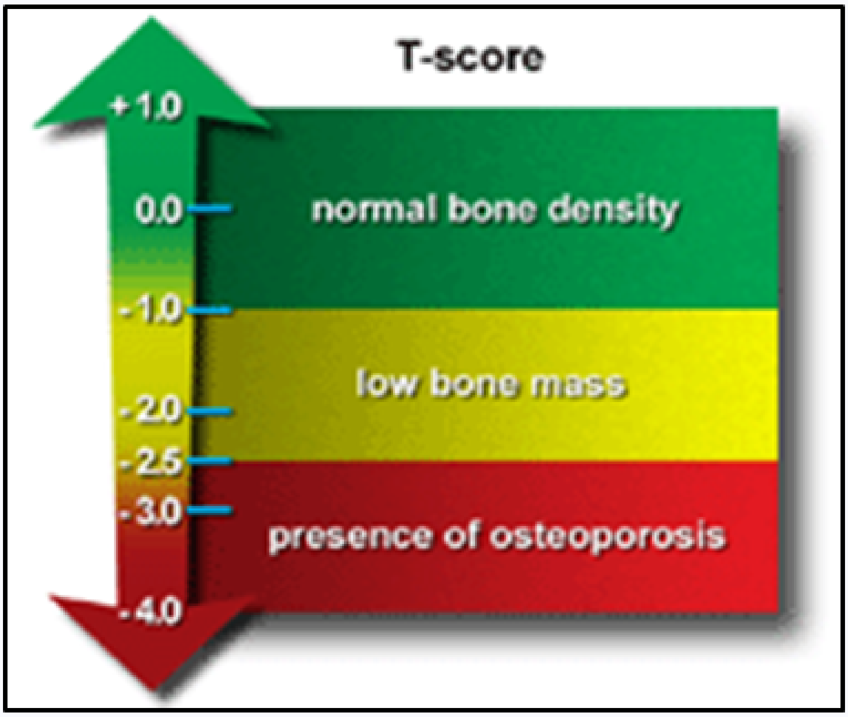




Report analysis

T-score - It is a number of standard Deviations the patient BMD above or below the mean for young adult reference population at same sex and Ethnicity. Used to diagnose osteoporosis in postmenopausal women and in men aged 50 and over.

Z-score - It is a number of standard Deviations the patient BMD above or below healthy population of the same sex, ethnicity, and age. Used in premenopausal women, in men younger than 50 years then in children and adolescents (before 20 years).



Current perspectives

Apart from BMD analysis, the raw data is used for fat quantification by estimating the total body fat mass, total body mineral content, total body lean mass, etc.

Conclusion

To conclude, DEXA is one of the emerging technique which is quick, accurate, and cost effective imaging technique for diagnose and monitor the osteoporosis with lower level of radiation. It has also extended its leap in estimation of fat quantification.

References & Image Courtesy

1. Bone Densitometry | Johns Hopkins Medicine (no date). Available at: https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/bone-densitometry (Accessed: 21 April 2023).
2. Choplin, R. H., Lenchik, L. and Wuertzer, S. (2014) 'A Practical Approach to Interpretation of Dual-Energy X-ray Absorptiometry (DXA) for Assessment of Bone Density', Current Radiology Reports, 2(6). doi: 10.1007/s40134-014-0048-x.
3. DAPA Measurement Toolkit (no date). Available at: https://www.measurement-toolkit.org/anthropometry/objective-methods/whole-body-dexa-scan (Accessed: 21 April 2023).
4. Khandpur, R. S. (2020) ' Bone Density Measurement: Dual Energy X -ray Technique ', Compendium of Biomedical Instrumentation, 1, pp. 295–298. doi: 10.1002/9781119288190.ch55.
5.Lorente-Ramos, R. et al. (2011) 'Dual-energy x-ray absorptiometry in the diagnosis of osteoporosis: A practical guide', American Journal of Roentgenology, 196(4), pp. 897–904. doi: 10.2214/AJR.10.5416.

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- J. S. University, Faizabad, Utter Pradesh
- Kovai Medical Center & Hospital, Coimbatore, Tamilnadu
- Manipal Academy of Higher Education, Jaipur, Rajasthan
- Manipal Academy of Higher Education, Manipal, Karnataka
- Martin Luther Christian University, Shillong, Meghalaya
- MGM Institute of Health Sciences, MGM University, Navi Mumbai, Maharashtra
- NITTE University's - K. S. Hegde Medical Academy, Mangalore, Karnataka
- Pushpagiri College of Allied Health Sciences, Tiruvalla, Kerala
- Sri Ramachandra University, Chennaai, Tamilnadu
- Srinivas University, Surathkal, Mangalore, Karnataka
- SRM University, Chennai, Tamilnadu
- Swami Vivekanand Subharati University, Meerut, Utter Pradesh
- The Tamilnadu Dr. MGR Medical University, Chennai, Tamilnadu
- Vinayaka Mission, Salem, Tamilnadu
- Rayat Bahra University (UGC) Mohali, Punjab

Phd in Medical Radiology and Imaging Technology

- Rayat Bahra University (UGC) Mohali, Punjab

NITTE University's - K. S. Hegde Medical Academy, Mangalore, Karnataka

- 1 Year PG Diploma in Computed Tomography (CT) Technology.
- 1 Year PG Diploma in Magnetic Resonance Imaging (MRI) Technology.
- Medical Imaging Fellowship (CT & MRI) For Technologist
- Fellowship in Cardiac CT & MRI for 1 year.
- Fellowship in Body/MSK & Neuro Imaging for 1 year.

Tata Memorial Hospital, Mumbai, Maharashtra

- Six Months Advanced Mammography Imaging Training
- Six Months Advanced CT Scan Imaging Training
- Six Months Advanced MRI Imaging Training
- Six Months Advanced Interventional Radiology Imaging Training

Homi Bhabha Cancer Hospital, Tata Memorial Centre, Varanasi, Utter Pradesh

- Advanced CT Scan Imaging Training
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Personnel Radiation Monitoring Services (PRMS)

- Personnel Radiation Monitoring Service (TLD Badge) is compulsory for Medical Diagnostic Installations as per Atomic Energy Regulatory Board (AERB) safety code no: #AERB/SC/MED-2 (Rev-1), dated: 05/10/2021
- Renentech Laboratories Pvt. Ltd., is accredited by Bhabha Atomic Research Centre (BARC) to provide PMS Services in states: Maharashtra, Gujarat, Rajasthan & Goa.

Personnel Monitoring Service is required on Quarterly basis for the persons working in the facilities namely:

- Medical Diagnostic X-Ray Centers
- Mammography Clinics
- CT Scan Centers
- Cath Labs
- Radiology and Radiotherapy Centers
- Orthopedic X-Ray Units and Dental X-Ray Units
- Nuclear Medicine Centers

Please Kindly Note:

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- TLD Badges only monitors radiation dose received by a person and does not protect you from Radiation.

Quality Assurance (QA) of Medical Diagnostic Installations

- Quality Assurance of diagnostic X-Ray equipment means systematic actions Necessary to provide adequate confidence that diagnostic X-Ray equipment will perform satisfactorily in compliance with safety standards specified by**Atomic Energy Regulatory Board (AERB)**
- **Atomic Energy Regulatory Board (AERB)** authorized agency for Quality Assurance Services (QA) of Medical Diagnostic X-Ray Equipment.

Why Quality Assurance of Diagnostic Machines is required?

It Helps:

- Reduces the down time of the machine
- Accurate & Timely diagnosis
- Minimize radiation dose levels to patients, technicians & general public
- Cost effective
- Complies to regulatory requirements

Compulsory Requirements as per:

- AERB & NABH Regulations (Every Two Years)

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Planning of Radiology Department

Yadav Manisha Murugan, 3rd Year B.Sc., Radiography and Imaging Technology Student, School of Allied Health Sciences, SMVMCH & SMVEC, Pondicherry.

Introduction

Radiology is a branch of medicine that uses imaging technology to diagnose and treat the diseases. This imaging technology uses radiation which is either in ionizing energy or in non-ionization energy. As the exposure has the potential to cause side effects on living tissue, it is very important to plan the department with adequate safety to safeguard the radiation occupancy, members of public, and patients.

Planning of the Department

Location of the Department in a Hospital - Mostly the department are situated in the ground floor and must be as far as possible from the common patient's waiting area. The location must be situated near the emergency department as well as it must have easier access to the wards and outpatient departments. The entire departmental construction area varies with the respective institutions but the layout measurements of a specific modality must be constant everywhere prescribed by the radiation regulatory body.

Divisible areas – The department is initially divided into modality (imaging) area and occupancy area. The occupancy area is where the reporting room and patient waiting area is constructed. In the reporting room the radiologist make report. The walls and doors should be painted with good quality washable paints. Minimum furniture should to be kept and cleaned periodically. Under the imaging area, the radiation emitting radio-diagnostic modalities were erected. The two types of radiation used for medical imaging purposes were, **Ionizing radiation modalities** - X-ray, Mammography, Fluoroscopy, Bone Mineral Densitometry, C-arm, Computed Tomography (CT) and **Non-Ionizing radiation modalities –** Ultrasonography (USG) and Magnetic Resonance Imaging (MRI). Compared to the non-ionizing modalities, ionizing radiation modalities needs precise and optimal shielding and layouts as it has the tendency to cause higher risk to the occupancies.

Construction & operation of Ionizing Radiation Modalities

No radio-diagnostic modality is allowed to be operated unless adequate License of Operation is obtained from the competent authority (Radiation Regulatory Body).

For obtaining license from AERB, initially the institute must have registered ID in e-LORA portal of AERB.

After registration, the equipment procurement permission is requested by the institute to AERB in the portal. Once the supplier of the equipment successfully erects the equipment and feeds the erection report in the portal, the license for operation can be obtained for the instrument by submitting the following documents.

1)Layout - A layout which should be planned based on the requirements proposed by the competent authority as mentioned below.

2)NOC - A Valid NOC / Type approval certificate of the X-ray equipment from the authorized manufacturer.

3)RSO - Approval - The Radiation Safety Officer approved by the competent authority.

4)Radiation Protection - List of available Radiation protective apparels, Radiation workers with personnel monitoring services.

5)QA Report - The final Quality Assurance report conducted after procurement of the equipment with results under the tolerance values.

Common Construction Guidelines as per AERB

- The walls must be made up of brick with 23cm thickness.
- The roofing and flooring should constructed in concrete with 6 – 8 inch thickness.
- In case of lead glass present, it must have 2mm lead equivalence.
- The radiation protection barrier must be large enough to accommodate at least two persons behind it.
- The doors must have hydraulic mechanism and overlapping joints in the center to avoid scattered radiation streaming.
- The safe light should be on outside the x ray room to give alert during the exposure. The radiation warning sign and instructions should paste outside the doors to alert to the pregnant ladies.
- A radiation warning symbol with adequate instructions must be displayed in outside the modality in national and local languages.

X-ray - The room should be large enough space to accommodate the beds and trolleys. The chest stand should front of the x ray source. Every x ray room should be attach to dark room it should maintain with proper with proper wall painting and proper flooring. It should be constructed with cassette loading and unloading area, safe light, developing and film processing area, drying room, the pass boxshould be attach to x ray room and dark room. The doors of the dark room should be tight close enough to avoid the white light to interact with the film.

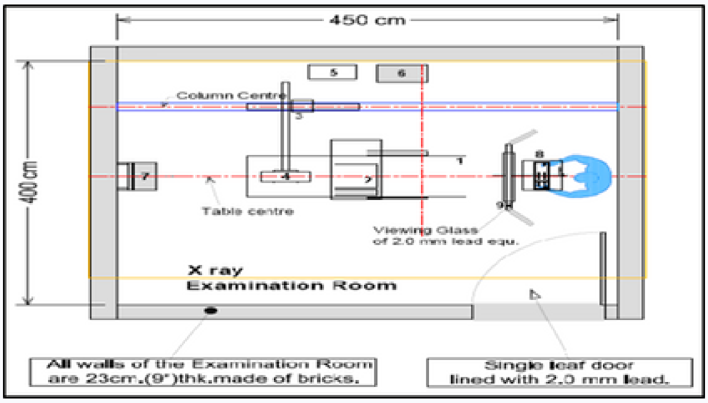
CT & Fluoroscopy - The CT room consist of two doors one for the entry of the patient to the gantry and the door entry to the console room. There should be separate console room in the CT. The speaker should be fixed in the console room to interact with the patient from the console room to the gantry. The patient dressing room should be constructed in the gantry with proper shielding.

Mammography – The specifications is same as all radio-diagnostic modality. The equipment must be erected as far as possible from the door and control console.

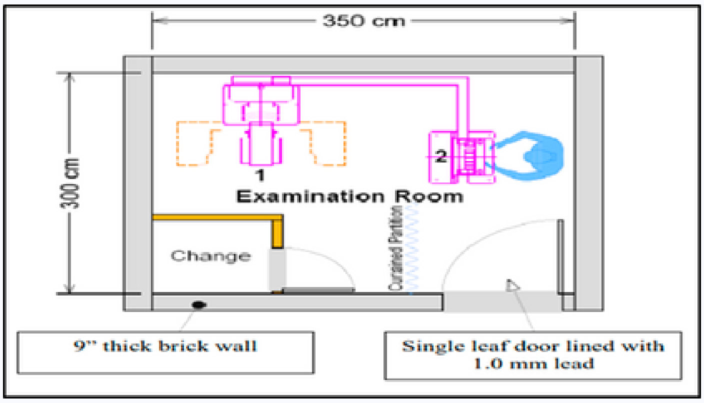
Mobile radiography – The mobile radiography equipment when used as a fixed radiography instrument must have all the criteria's of normal x-ray machine erection.

Non - ionizing radiation modalities construction

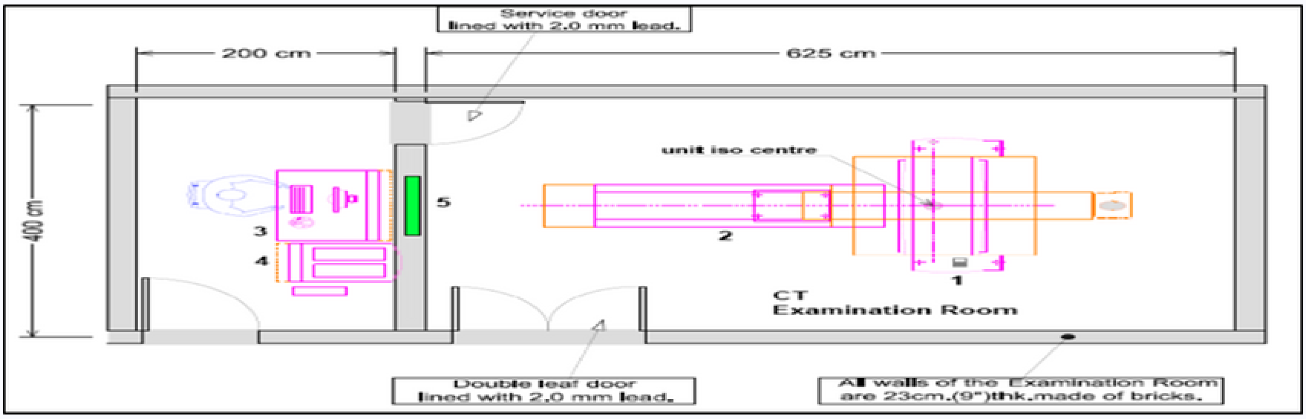
Ultrasound room construction: The room should be size of 120 square feet with minimum clear floors and proper dress changing room. The rooms must have attached restroom and waiting area.



Layout of X-ray



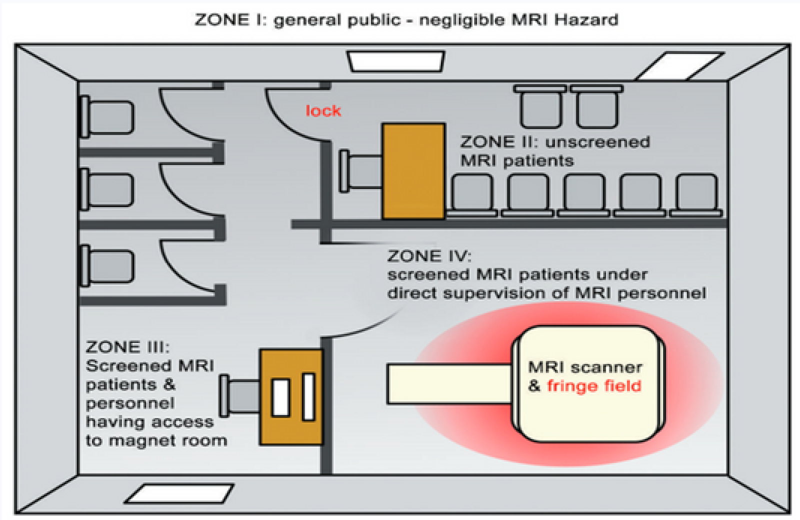
Layout of Manmmography



Layout of CT Scan

MRI room construction: The room must have appropriate power source, air conditioning, shielding for the static and RF field, room venting, etc. The viewing glass must have copper mesh covered to avoid external RF interaction to the main magnetic field. There are four zones for a MRI construction as per American College of Radiology criteria. The Zones are,

- **Zone I** include all areas that are freely accessible to the general public including parking lot, etc.
- **Zone II** patients referred to MRI will have initial contact with the MRI atmosphere in this zone. This include the interface between the publicly accessible uncontrolled Zone1 and the strictly controlled 3.
- **Zone III** This zone is strictly restricted to the screened MRI patients ready for MRI examination.
- **Zone IV** is only restricted to screened patients under direct constant supervision of MRI staff as there is a risk of patient heating, RF antenna effects, missile effects and anoxia due to quench pipe failure. The scan acquisition takes place here.



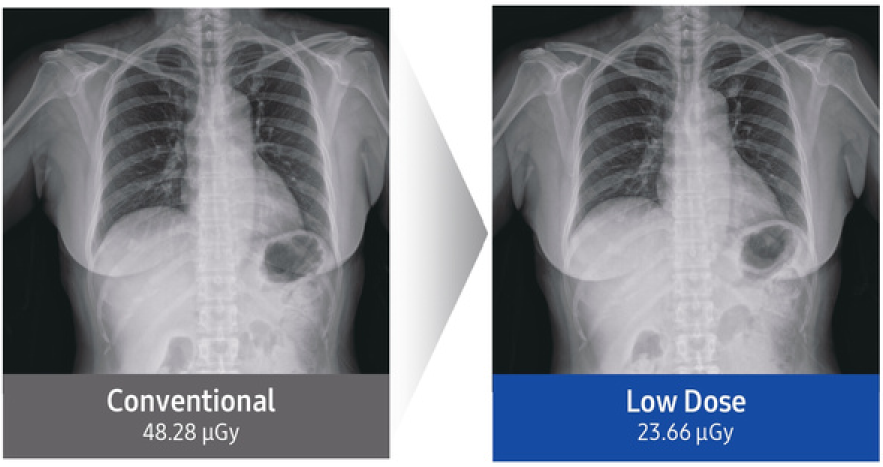
Quality Assurance Tests

Periodic quality assurance tests must be conducted for the instruments to ensure that it works under adequate condition without causing harm to the patient and occupancies. According to AERB, the QA tests has to be conducted once in two years.

Conclusion

The planning of radiology department needs precise knowledge related to radiation protection. All the ceiling, wall and layouts must be constructed under the reference value prescribed by the competent authority. Additionally the warning placards relevant to the respective modalities must be placed outside the modalities for awareness. TO conclude, apart from safety operation of the equipment, the operational built-in safety ensures higher quality radiation protection standards.

Case. Adult Chest PA*



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* The claim concerning Samsung DR is based on limited phantom and clinical study results conducted at one medical site with a specific x-ray imaging system and specific technique factors. Only routine PA chest radiography and abdominal radiography for average adults and pediatric abdominal, chest, skull radiography were studied, excluding pediatric patients under 1 month old.(FDA cleared - K172229, K182183). In practice, the values of dose reduction may vary accordingly. The clinical site is responsible for determining whether the particular radiographic imaging needs are not impacted by such x-ray dose reduction.

Non Contrast Magnetic Resonance Angiography Techniques

S. Mehalakshmi, 3rd Year B.Sc., Radiography and Imaging Technology Student,
School of Allied Health Sciences, SMVMCH & SMVEC, Pondicherry.

Introduction

Magnetic Resonance Angiography (MRA) is the radiological technique applied in Magnetic Resonance Imaging (MRI) for the visualization of the arterial blood vessel either by the administration of contrast media or not by its administration. But the interest on non-contrast enhanced MRA application has been increased in the last few years due to increased number of incidence on nephrogenic systemic fibrosis (NSF) (MR contrast induced side effect). At the same time development in new technique increased the quality of MRI images with less contrast media usage. Several vascular applications will be covered with a brief explanation on physics of Non-contrast MRI.

Classification of MRA

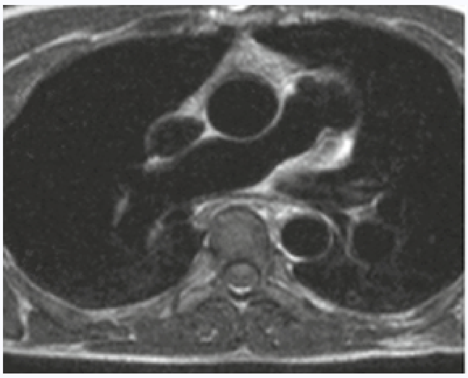
Contrast Enhanced MRA - It is the MRI procedure that enhances the blood vessels by the administration of a contrast or dye. (Gadolinium)

Non-Contrast MRA (NCMRA) - It is a MRI procedure which enhances the blood vessels without administration of contrast agent that can be further classified into

- Black Blood Imaging
- Bright Blood Imaging

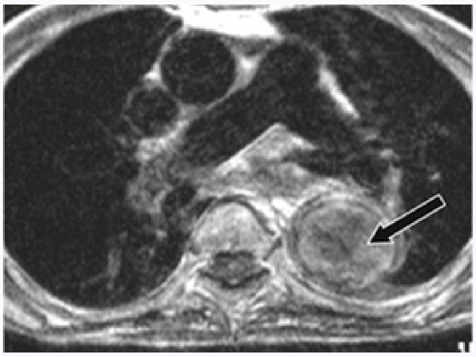
Black Blood Imaging

It is Spin echo technique where stationary photons receive both 90 &180-degree pulse to produce signal whereas protons in flowing blood does not receive either of these pulses and does not produce signal and appear dark.



Bright Blood Imaging

It is a Gradient echo technique where rephasing is done by gradient and a short TR is used resulting in saturation of protons in stationary tissues which increased contrast between stationary and moving blood.



Non-contrast MRA Technique

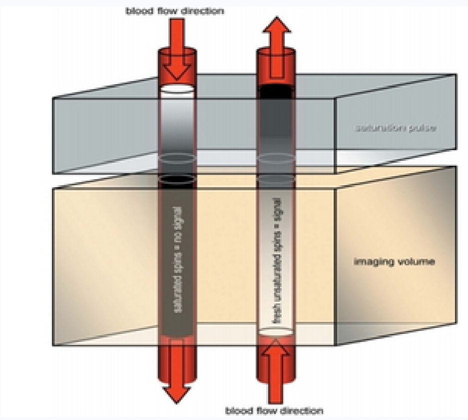
Types of NCMRA used in routine clinical practices are,

- Time of Flight (TOF)
- Phase Contrast MRA (PCMRA)
- NCMRA (Balanced GRE based)
- Quiescent Interval Single Shot (QISS)

TOF

In this technique protons in the slice which is stationary gets saturated because of repeated RF saturation pulses and does not produce signal. When new protons entering into the imaging slice are not saturated and produce good signal. This enhances the contrast difference between blood vessels and stationary tissue. This phenomenon is called inflow enhancement. The base sequence used is spoiled GRE sequence where rephasing is done by gradients here TR is kept less than T1 in stationary tissue to saturate signal.

Clinical Application: Head and Neck Angiography



Types of TOF MRA:

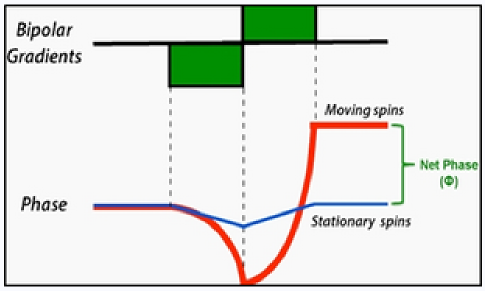
- **2D TOF -** Sensitive to slow flow, larger area coverage (i.e.) can be used for peripheral arteries and venography.
- **3D TOF -** Gives high resolution and high velocity.
- **MOTSA** (Multiple overlapping thin slab acquisition) - Advantage of both 2D, 3D TOF and thin slabs are combined to form a single volume data.

PCMRA

If an equal but opposite gradient is applied the protons that are stationary have no shift hence the protons that are moving will undergo varying degree of changes that is phase shift because their location along the gradient constantly changes due to their movement. This concept is used to interpret protons that are moving through the plane. This results in net phase shift this information can be used directly to determine the velocity of the spins.

Clinical Application:

- Flow quantification.
- MR venography.
- CSF flow studies.

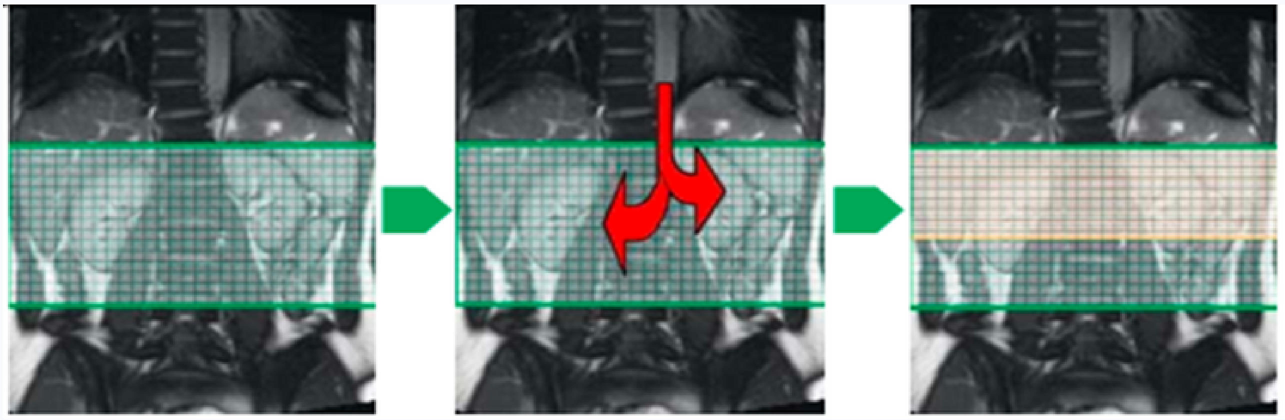


NCMRA balanced GRE technique: (Body Angiography)

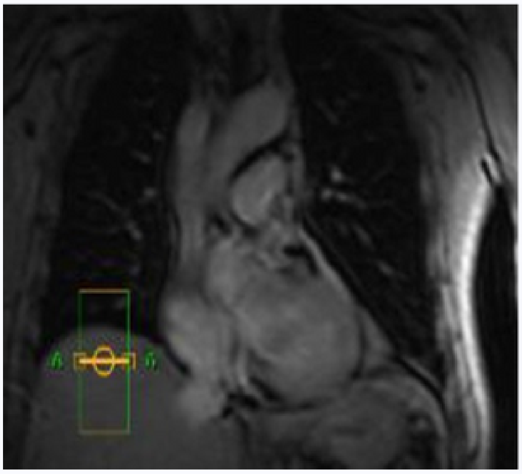
This acquisition can also be done in synchronization with 2D respiratory gated navigator that is placed at the level of the hepatic dome as shown in QISS or conventional respiratory bellow can also be used.

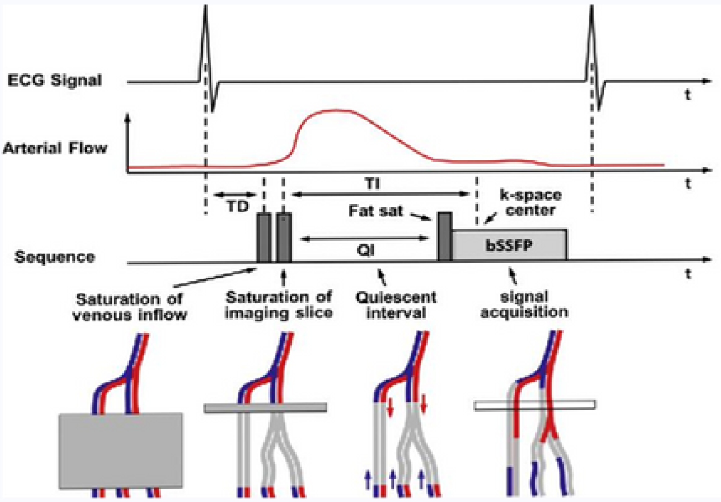
It works under the basis of balanced gradient echo. The first planning box (Inversion slab) is placed to cover the entire field of view which inverts the spin and suppresses signal from the entire stationary tissues whereas the second planning box which is smaller

and limited to the renal vessels is placed within the saturation pulse box which collect signal from the moving spins.
Clinical Application - Renal Angiography.



QISS
Image acquisition in QISS was done in synchronization with Electro cardiogram as well as 3D navigator (First Image). Using ECG gating the first 180 degree RF saturation pulse was applied with the delay time of 100ms after the R-wave to nullify the longitudinal magnetization within the slice followed by a quiescent interval of 228ms during which no excitation takes place. Now a fat suppression sequence is applied followed by balanced gradient echo acquisition. This pulse sequence is dedicatedly developed by Siemens Healthineers.
Clinical Application - Peripheral Angiography.





Advantages of MRA over other modalities:

- **MRA vs DSA:** MRA is less invasive, less expensive and fast to perform, and eliminates the invasive nature of the procedure. (Greatest advantage in diagnostic purposes)
- **MRA vs CT Angiography:** NCMRA does not involve exposure to ionizing radiation and can produce high quality images of blood vessels without using contrast agent whereas CT Angiography requires high Amount of contrast which may result in potential reactions.
- **MRA vs Doppler:** MRA is more accurate than Doppler ultrasound in defining surgical lesions. The sensitivity and specificity of MRA is great compared to Doppler ultrasound.

Conclusion:
In summary, NCMRA is an angiographic technique to visualize blood vessels without contrast agent. This type of imaging techniques were discrete for various parts of the body. Each type of techniques has relevant post processing skills that is required for the effective usage of the technique clinically. Hence to conclude, NCMRA

References & Image Courtesy
1.Questions and Answers in MRI - MRI Questions & Answers; MR imaging physics & technology (no date). Available at: https://www.mriquestions.com/index.html (Accessed: 19 April 2023).
2.Ridgway, J. P. (2015) 'Black Blood Versus Bright Blood Imaging', Cardiovascular MR Manual. Springer, Cham, pp. 97–104. doi: 10.1007/978-3-319-20940-1_12.
3.Siemens Healthineers | Corporate Home (no date). Available at: https://www.siemens-healthineers.com/ (Accessed: 19 April 2023).
4.Westbrook, C. and Talbot, J. (2018) 'MRI in C. Westbrook, "MRI in Practice," 2019.Practice'. John Wiley & Sons. Available at: https://books.google.com/books/about/MRI_in_Practice.html?id=HrBlDwAAQBAJ (Accessed: 19 April 2023).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Magnetic Resonance Spectroscopy

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Introduction

Magnetic Resonance Spectroscopy (MRS) made a guideline for examining the metabolites present in a component. It is process which is done non- invasively to verify the various metabolites or biochemical from the body tissues. MRS can be done by either Hydrogen (1H) or Phosphorus (51P) spectroscopy clinically.

Principle and Necessary Components for MRS

Chemical Shift

- The principle of spectroscopy is the assessment of the frequency of protons in a metabolite which is called as Chemical shift which is expressed as Parts per Million (ppm). Where ppm will be same for particular metabolite at different field strengths.
- For optimal identification of different metabolite peaks, the MRS needs basically a field strength of 1.5 Tesla.

Magnetic Field Strength

- Due to the weak signal from the metabolites, it demands higher field strengths. Hence 1.5T or 3T scanners were preferred. The advantage of 3T is higher SNR with precise spectral generation even from smaller voxels.

Homogeneity of Magnetic Field

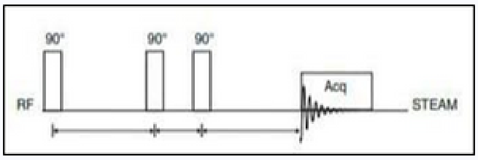
- Magnetic field should be homogeneous for normal MRI but in the case of MRS it should be even more homogeneous to detect the smaller chemical shift.
- Hence the process of making the magnetic field homogeneous is called shimming.

Choice of TE

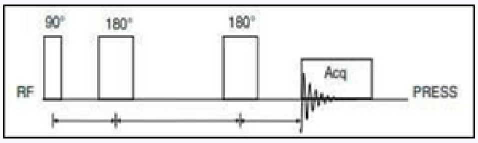
- **Short TE (18 – 45 ms) -** is used for evaluation of tissues with shorter T2 relaxation time but has the potential disadvantage of overlapping peaks due to background noise of lipid and water contamination, etc. leading to artefactual elevation of some peaks and irregular baseline. But the SNR is relatively higher in short TE and hence it is clinically applied for brain tumor evaluation.
- **Long (120 – 288 ms) –** is used for the evaluation of tissues with longer T2 relaxation time but has potential disadvantage of missing low / shorter T2 metabolites making it less informative. But the advantages includes, undistorted baseline acquisition and estimation of NAA, Choline, Creatinine, and lipid lactate peaks are acquired separately which is overlapped usually.
- For some quantitative spectroscopic analysis, two separate acquisitions in a specific region voxel is performed with both short TE and long TE.

Pulse Sequence of MRS

- **STEAM:** (Stimulated Echo Acquisition Method) It is the simplest technique by applying three 90 degree pulses. Since the echo is stimulated signal is weak. STEAM is used for short TE spectroscopy.



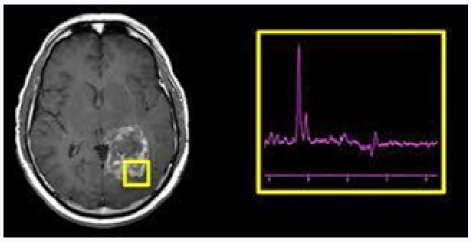
- **PRESS:** (Point Resolved Spectroscopy). It is a technique where one 90 degree and two 180 degree pulses are applied in the planes. Since the signal is strong with better SNR, it is used for longer TE spectroscopy.



Types of Spectroscopy

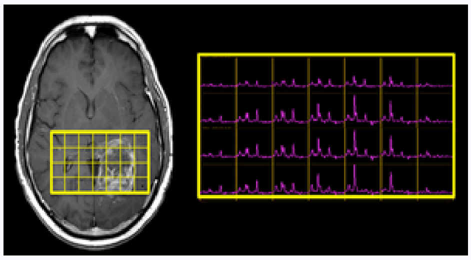
Single Voxel Spectroscopy (SVS)

- SVS is done by planning a single voxel and acquire data from it for imaging that takes about 3-5 minutes for data acquisition on modern scanners.
- The advantage includes, good shimming as lesser area is covered which results in high quality spectra and excellent peak separation.
- The concern about this technique is that in case of larger pathological extent, it has limited application. Also two separate acquisition must be performed, one in pathological site and another in normal healthy tissue for comparison which increases scan time.



Multi Voxel Spectroscopy (MVS)

- MVS is done by planning a multiple voxels placed symmetrically like a grid and acquire data from it for imaging that takes about 5 - 8 minutes for data acquisition on modern scanners.
- This is also called as Chemical Shift Imaging which is used for better assessment of entire larger pathological extent and eliminates separate acquisition for a healthy and pathological tissue as the voxels covers the entire region.
- The concern includes, improper fat and water suppression due to insufficient shimming leading to lesser quality spectrum.



Steps to MRS acquisition

1.Acquisition of MR images for localization – The normal routine imaging planes are used for localization when if the patient is not moved.

2. Planning - The planning voxel should not be overlapped with neighboring anatomy other than the respective anatomy. Once the planning is done, multiple overlapping saturation bands are placed around the voxel parallel and diagonally.

3.Selection of MRS measurement and parameter – The most important parameter used in MRS is type of voxel and TE. The choice of TE determines the metabolites that is visualized.

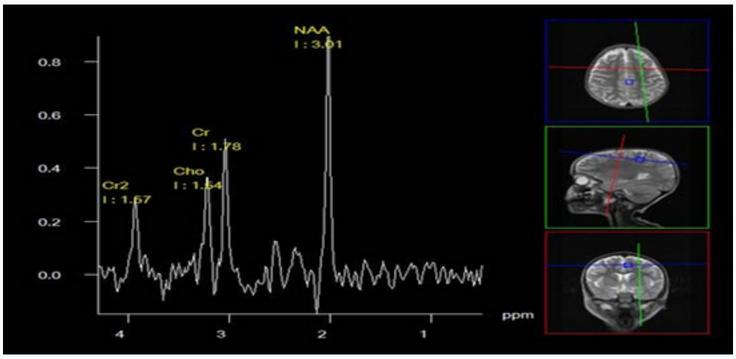
4.Selection of volume of interest – The volume of interest is selected from the SVS and CSI. Where SVS can be used for local or diffuse diseases and CSI is used in the case of irregular shaped lesions.

5.Shimming – The one which provides the starting value for local shimming is known as Global shimming. Good local shim gives better resolution, good SNR and narrow metabolite peaks.

6.Water suppression – Water peak suppression is done by Chemical shift selective saturation (CHESS). In addition to CHESS, gradients are also combined which is called as Water Suppression by Gradient Tailored Acquisition (WATERGATE) for selective dephasing of bulk water signals.

7.MRS Data processing and display – The acquired data from is processed to get spectrum and spectral maps. The Hunter's angle is used to initially diagnose any abnormality.

Common metabolites and its relevant peaks



Future direction

Now a days the magnetic resonance spectroscopy is done for brain, breast and in Prostate. But the current perspectives of spectroscopy has extended its application in spine, cardiac, uterus, etc. Hence it is evolving as one of the necessary protocol to be applied in many parts of body.

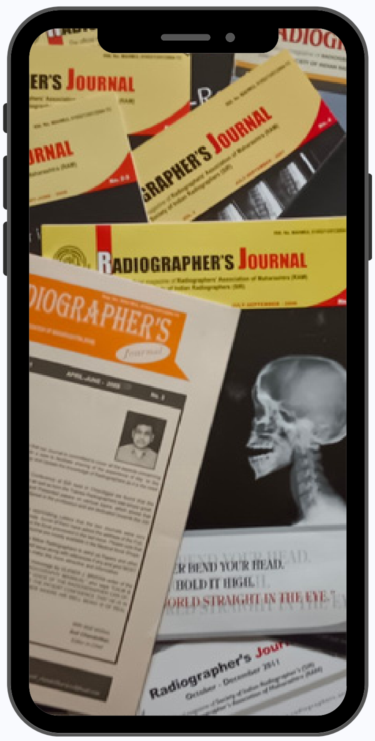
Conclusion

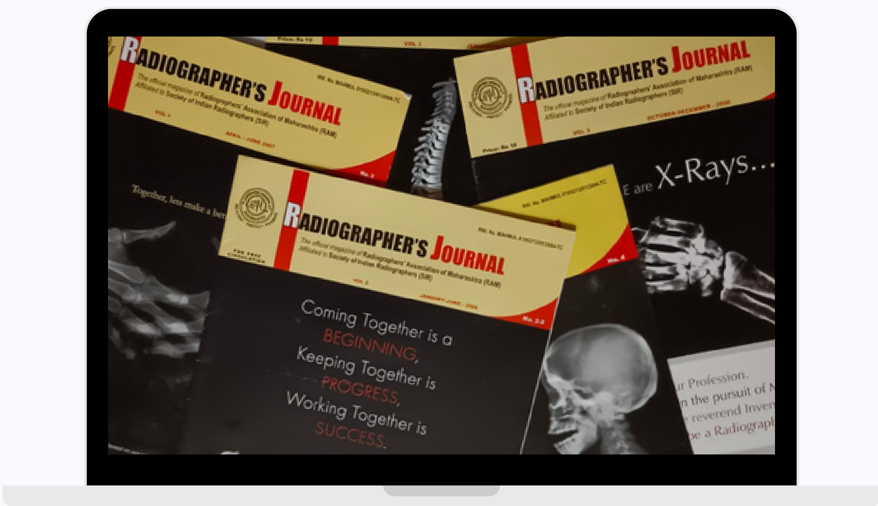
The MRS is used for aiding in accurate diagnosis of a pathology depending upon its biochemical composition which leads to precise treatment planning either by medication or by surgery. The technique needs expertise operation as which type of spectroscopy and choice of TE plays a major role in adequate results.

References & Image courtesy

- Magnetic resonance spectroscopy (MRS) | Britannica (no date). Available at: https://www.britannica.com/science/magnetic-resonance-spectroscopy (Accessed: 19 April 2023).
- Saber, M. and Gaillard, F. (2008) 'MR spectroscopy', Radiopaedia.org. Radiopaedia.org. doi: 10.53347/RID-1630.
- Adityan, R. and Selvaganesan, S. (2021) "'ROLE OF SPECTROSCOPY IN MAGNETIC RESONANCE IMAGING: A CLINICAL REVIEW"', INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH. World Wide Journals, pp. 20–23. doi: 10.36106/IJSR/3129141.

METABOLITE	PEAK POSITION (in ppm)	PATHOLOGICAL MARKER
N-Acetyl Aspartate (NAA)	2.01	Elevated peak in Canavan's disease etc.
Creatinine (Cr)	3.0 – 3.9	Decreased peak in glial tumor and brain metastases.
Choline (Cho)	3.2	Elevated peak indicates presence of multiple sclerosis, necrosis, glial tumor, etc.
Myo-Inositol (mI)	3.5 – 3.6	Elevated peak is present in Low grade tumor and decreased peak is present in high grade tumor.
Lactate (Lac)	1.33	Elevated peak indicates presence of high grade tumor or multiple sclerosis.
Glutamate (Glx)	2.2 - 2.4	Elevated peak indicates the presence of Meningioma and helps in differentiating Oligodendroglioma and astrocytoma.
Lipid	0.9 – 1.2	Elevated peak indicates the presence of Necrosis or Inflammation.





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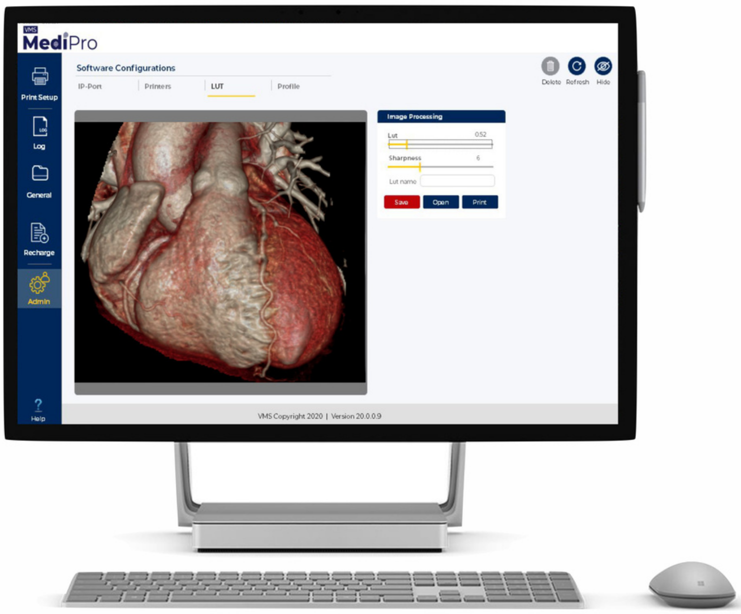

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CT Guided Biopsy

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Introduction

The Biopsy is a procedure in which a small sample of the pathological tissue is obtained from the body with a less invasive technique to rule out the type of disease and to make final diagnosis. The biopsy is usually conducted under the guidance of an imaging modality. Common imaging modalities includes Ultrasonography (USG), Computed tomography (CT), and Magnetic Resonance Imaging (MRI).

Biopsy protocols and acquisition

Patient Preparation

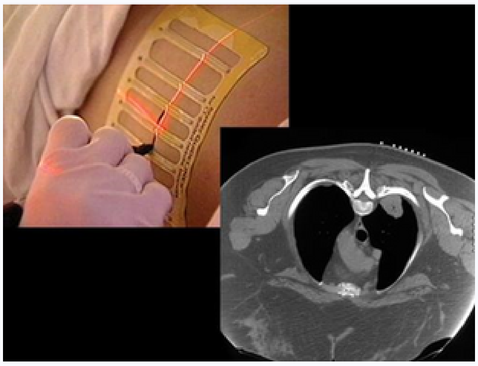
The patient is presented for the biopsy procedure is initially justified with the necessity of the examination and clinical outcome. Then necessary blood tests like bleeding time, and clotting time tests, etc. must be obtained prior to the procedure. In many instances, fasting of maximum 8 hours prior to the procedure is advised and an accompanying patient attender should be presented with the patient during the examination day. After successful screening of the patient, it is advised to change to the hospital gown with opening of the gown facing anterior, posterior, or in sides depending upon the pathological site. Then the patient can be positioned depending on the location of the lesion, patient comfort, past scan and their respiratory function. The common positions for biopsy are, lateral, supine, prone, and oblique.

Materials required

- A radiopaque grid or skin marker with a pen.
- Gauze and Gally pot.
- Betadine solution and Lidocaine.
- Biopsy Needle

Image Acquisition and Procedure

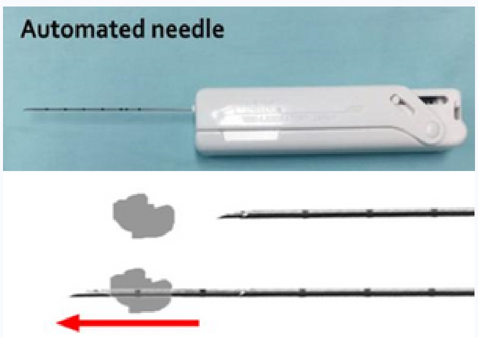
In CT guided biopsy, a **Topogram** is acquired prior the procedure and a plain CT is performed for the part being examined. Now, the puncture sight is chosen based on CT table landmark of the lesion and metallic markings were placed on the skin for the correct orientation of the puncture site. The slice is selected and the exact puncture spot was chosen on the skin using the metallic marker. The area of puncture site is cleaned under aseptic condition and locally anesthetized using xylocaine. The needle is introduced by successive repositioning's under CT guidance with **single slice scan**. After the needle reached the lesion, the biopsy gun is inserted using its outer cannula as an introducer. Usually the samples were collected and stored in formalin or saline.



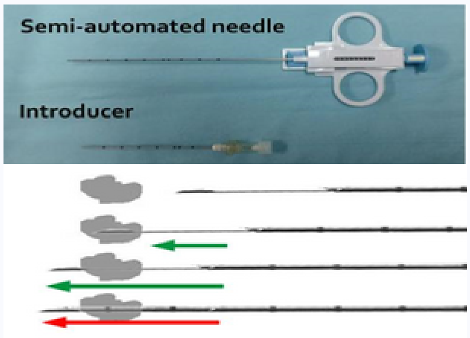
Biopsy Gun

The biopsy gun is an instrument used to collect tissue samples during biopsy procedures. The biopsy guns available clinically that is used commonly are listed below.

Automatic Biopsy Gun - The gun has lighter construction with 2 triggers front and back (to use in various positions). Most importantly, simple extraction of sample without removing the needle from biopsy instrument.



Semi-automatic Biopsy Gun - More control and precision then automatic design. Full notch exposure provides accessories to sample. Penetration depth of 10mm and 20mm which are available in 14G,16G,18G and 20G.



Bone Biopsy Needle - The bone biopsy needles are available in 8, 10, &11 gauge. This needles are used to collect samples within the vertebral body. Features includes the coaxial biopsy needle, with a plunging stylet and a 3cc syringe. Bone biopsy kits for the iVAS system features a rotating handle and increases biopsy protrusion.

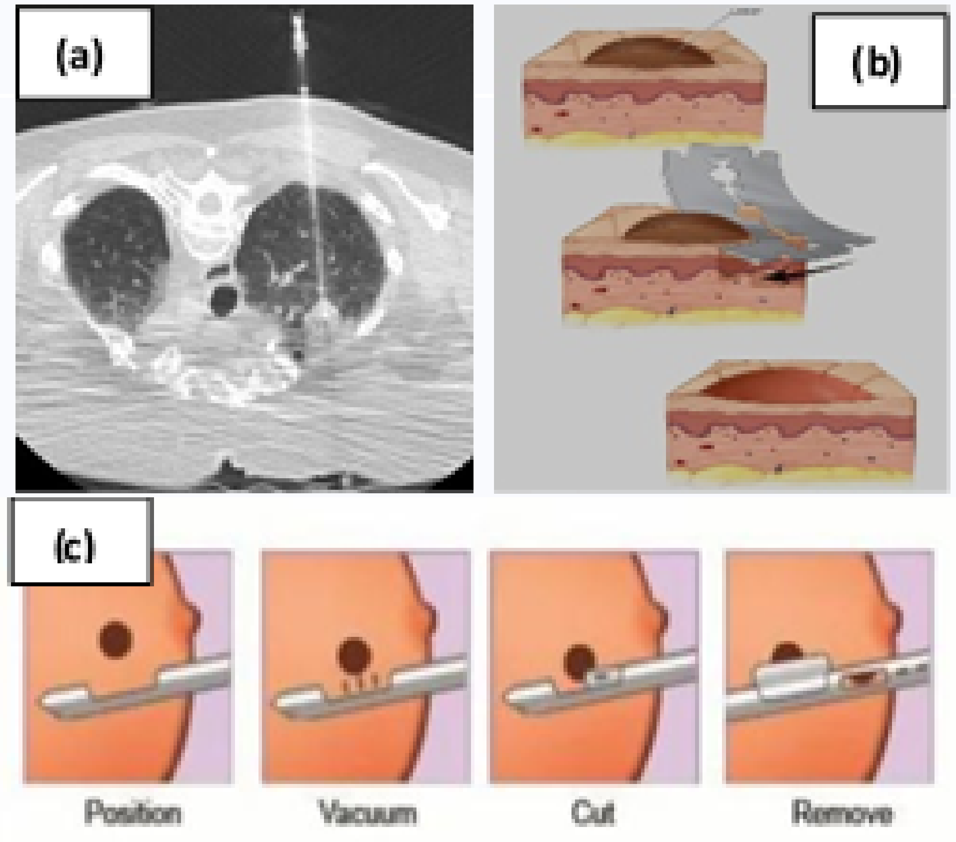
Most Common Percutaneous Biopsies - Lung biopsy, Liver biopsy, renal biopsy, Breast biopsy, and Bone biopsy

Types of Biopsy

a) Core Needle Biopsy - A core needle biopsy uses a long, hollow tube to obtain a sample of tissue. Often preferred for suspected breast cancer.

b) Shave Biopsy - During a shave biopsy, a tool like a razor is used to scrap surface of a skin. The goal is to remove irregular tissue to send to the lab. Strictures usually aren't needed after this procedure.

c) Vacuum Biopsy - A vacuum assisted biopsy (VAS) of the breast is a way of taking sample from breasts. The test is also called as mammotome biopsy, adapted minimally invasive breast biopsy.



Methods of Sample Preservation:

The collected samples are stored either in saline or formalin and sent for tissue processing.

- **Formalin:** Most commonly dry collections and skinned specimens (organs and soft tissue) are stored. Rapid fixation of urgent biopsy specimens, Formalin at 60°C is used commonly. Formaldehyde at 100° is used to fix tissue infected with TB and hollow specimens.
- **Saline:** Normal saline is used to seal the needle tract that reduces the incidence of pneumothorax and prevents subsequent chest tube placement after CT guided biopsy

Fine Needle Aspiration Cytology (FNAC) - a less invasive diagnostic procedure done to extract cells from the target site, used in the cytological evaluation of the mass lesions.

Patient Management

After the biopsy is done, the puncture site is sealed with tight bandage coverage to aid in stopping bleed from the site. Then a final check CT is taken to rule out any procedure related complications in the part being examined. The post procedural care includes rest, limited movement in biopsy site, avoiding vigorous exercise and lifting heavy objects, keeping the wound dry for around one week to 10 days and cover the wound while shower or bath.

Complications

The common complications presented by patients are listed below.

- Haemorrhage
- Infection
- Puncture damage to nearby tissue or organs
- Skin numbness around the biopsy site
- Lung: Haemoptysis, pneumothorax
- Liver: flank pain
- Renal: bleed and pain, abnormal connection between two blood vessels.

Conclusion

A biopsy is a gold standard diagnostic tool for lesions ranging from simple periapical lesions to malignancies and very useful in treatment planning and gives adequate knowledge about the lesion characteristics which is mandatory for planning treatment that aid to good therapeutic response.

References & Image Courtesy

1.Fine Needle.png (375×225) [Internet]. [cited 2023 Apr 18]. Available from: https://penangbreastcare.com/PBCH Images/Fine Needle.png?hl=en_IN

2.Differences-between-the-standard-full-automatic-approach-and-the-introduced.png (850×397) [Internet]. [cited 2023 Apr 18]. Available from: https://www.researchgate.net/profile/Claus-Peter-Wallner/publication/285322562/figure/fig4/AS:391754726559752@1470413013501/Differences-between-the-standard-full-automatic-approach-and-the-introduced.png

3.static.radiopaedia.org/images/18679427/3311dd6153bbb1b59fbfa0537f9cc2_gallery.jpeg

4.guidelines117-in-use-3.png (500×365) [Internet]. [cited 2023 Apr 18]. Available from: https://beekley.com/Portals/0/ImageCache/Category_FeaturedProduct_Desktop/guidelines117-in-use-3.png

5.ROMAN A, ACHIMAS-CADARIU P, FETICA B, GATA V, SEICEAN A. CT-guided procedures: an initial experience. Clujul Med [Internet]. 2018 Oct 30 [cited 2023 Apr 18];91(4):427. Available from: /pmc/articles/PMC6296730/

6.Needle biopsy - Mayo Clinic [Internet]. [cited 2023 Apr 18]. Available from: https://www.mayoclinic.org/tests-procedures/needle-biopsy/about/pac-20394749

7.Needle Biopsy [Internet]. [cited 2023 Apr 18]. Available from: https://my.clevelandclinic.org/health/diagnostics/17872-needle-biopsy

8.Biopsy - Better Health Channel [Internet]. [cited 2023 Apr 18]. Available from: https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/biopsy

9.Jain N. Essentials Before Sending Biopsy Specimens: A Surgeon's Prespective and Pathologists Concern. J Maxillofac Oral Surg [Internet]. 2011 Dec 1 [cited 2023 Apr 18];10(4):361. Available from: /pmc/articles/PMC3267913/

10.Bickle I. CT guided biopsy. Radiopaedia.org. 2013 Jan 27;

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