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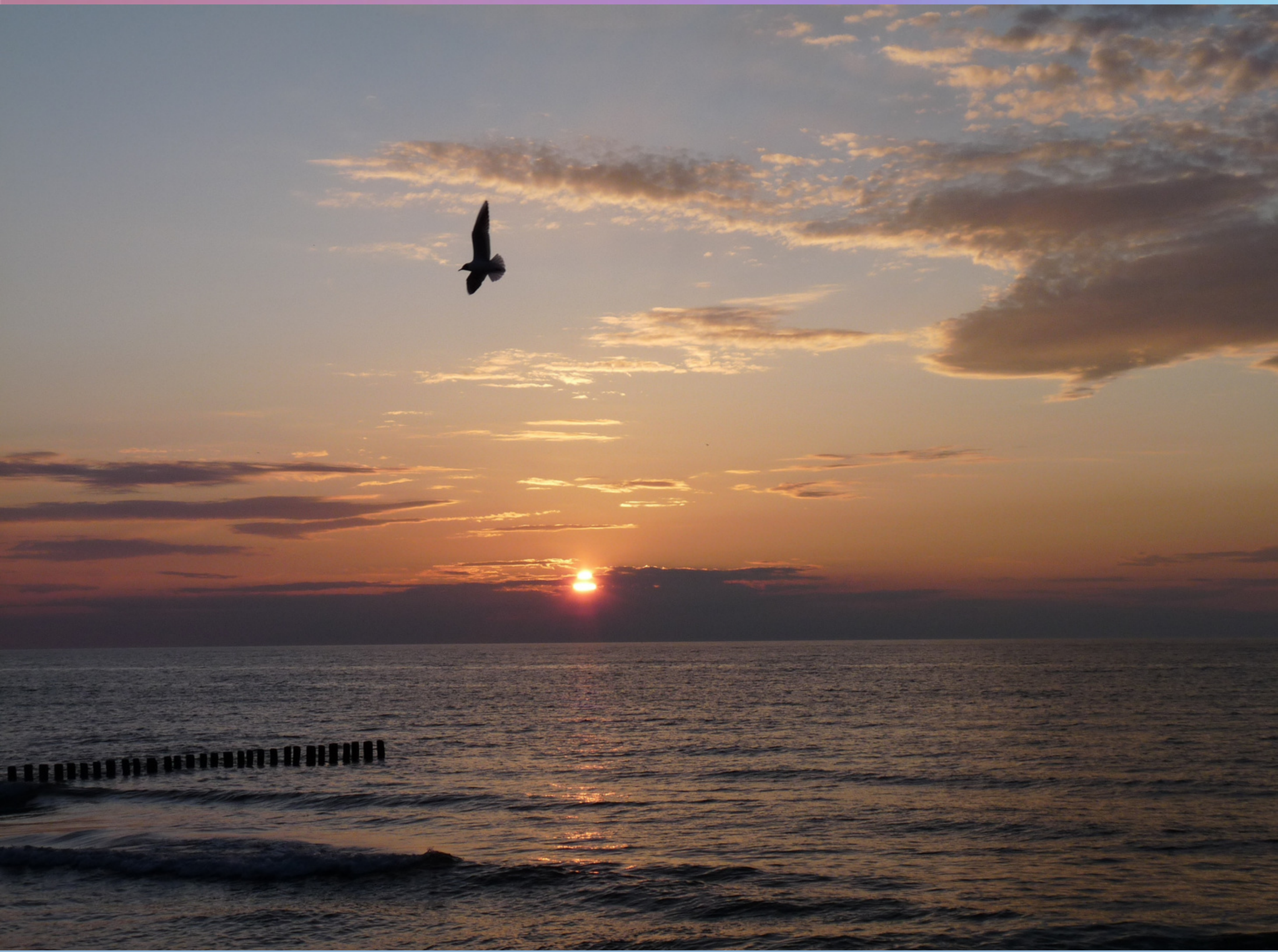


THE EDITORIAL TEAM

Mobile:
+91 93220 35920
Email:
shankar.bhagat@gmail.com
Website:
www.radiographers.org

Marie Curie (An untold story in Radiography)

J Venkat, MBA, Ireland recognized Radiographer (CORU), Teaching Faculty, Global Hospital, Chennai

Introduction:

Marie Curie was born on 7th November 1867 in Poland, for further studies she has moved to France and completed her degree in Physics. She has discovered Polonium and Radium. She has contributed her service in Physics, Chemistry and Medicine

World War One:

In early 1914, World War One started and German about to enter France. That time she was doing research on radio activity substances including Radium. She wants to hold her research during World War I to support soldiers by providing x-ray examinations. So, she kept her Radium in a lead container and deposited in a bank at Bordeaux, Which is 375 miles away from Paris. She thought, she can continue her research once war is over

Little Curies

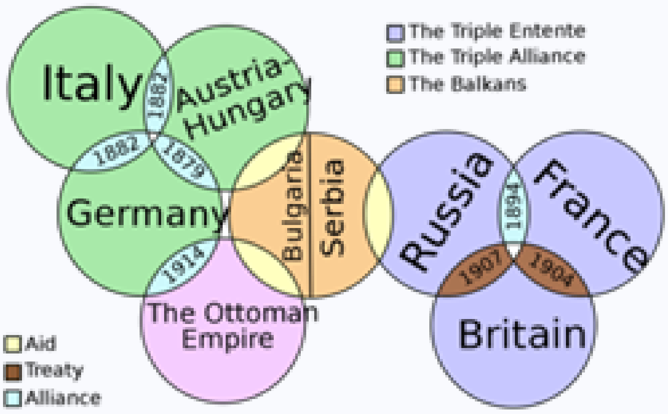
That time very few x-ray machines were available in cities and it is very difficult to do x-ray examination to the War injured soldiers. Marie Curie fitted x-ray machine in a Renault car, and it is called as little curies. She has done huge efforts to bring the cars to war-front to serve injured soldiers. Since French army delaying the funds to produce such cars, Marie Curie approached the Union of Women of France to fund it. With that fund, she has produced first radiology car which is called as “little Curies”. Since more such cars needed, she has approached rich Parisian Women to donate fund. With their support, she has developed 20 more little curies.

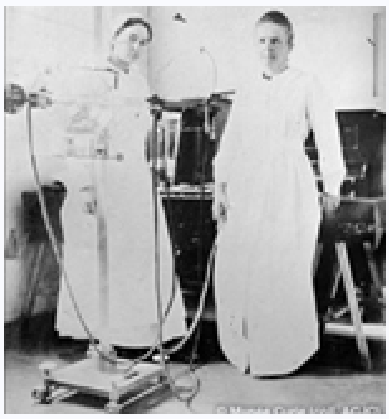
Training

After developing 20 little curies, she understood that these cars are not useful unless she develop x-ray operators. She recruited 20 women and trained them for handling x-ray machines with support her daughter Irene. Further she trained 150 women and served for 10 lakh soldiers in warfront. She also setup 200 fixed x-ray machines around war fronts.

Conclusion:

She has won two Nobel prizes in Physics and Chemistry. She is the only person to receive two Noble prizes in two different sciences. More than discovering Radium, she supported Soldiers in World War I by providing radiological services. She has Become Director of the Red Cross Radiology Service and set up France's first military Radiology Centre. Many of us thinking that, she has died because of ingestion of Radium during her research. But she has died because of x-ray exposure during her service in World War I. In 1995 her body was examined and it was no radioactivity. Her name included in the Monument to the X-ray and Radium Martyrs of All Nations (also known as the X-ray Martyrs' Memorial) is a memorial in Hamburg, Germany, commemorating those who died due to their work with the use of radiation, particularly X-rays, in medicine.





Advancements in Computed Radiography and Digital Radiography

Sidharth Gautam, Radiological Technologist, Tata Memorial Hospital, Varanasi (U.P.)

Introduction: -
Digital images are used throughout radiology. They appear as computed radiography, digital radiography, fluoroscopy, computed tomography, magnetic resonance, ultrasound, mammography, nuclear medicine images. Unlike film images, whose contrast, speed, and latitude are fixed during processing, the appearance of digital images can be altered after they have been recorded and stored. The advantages of digital imaging include the ability to adjust the contrast after the image has been recorded, to process the image to emphasise important features, and to transfer the images to a remote site.

Computed Radiography (CR):-
CR is a "cassette-based" system that uses a special solid-state detector plate instead of a film inside a cassette. The exterior dimensions and appearance of the CR cassette are the same as those of a conventional film cassette. The CR cassette is placed in the Bucky tray and exposed in the same manner as a conventional film cassette. The contrast resolution of CR is superior to that of conventional film/screen systems. The CR cassette contains a solid-state plate called a photostimulable storage phosphor imaging plate (PSP) that responds to radiation by trapping energy in the locations where the X-rays strike. CR plates and cassettes can be reused many thousands of times.

Computed radiography (CR) is the most established of the digital radiography technologies available, having seen more than 30 years of clinical use; yet numerous innovations are currently coming to the market. Some of the drawbacks of CR system namely cassette handling, long read out of plates, low detective quantum efficiency have been addressed by newer innovations and technological advances.

In automated CR systems with fast readout, there is no cassette handling leading to totally automatic image data acquisition. In these systems the readout time is less than 10 seconds. This can be achieved by newer phosphor for PSP plates. A needle shaped phosphor caesium bromide has been newly introduced and is considered more efficient due to its structured configuration of crystals. It reduces light diffusion because of needle shaped configuration that acts as a light guide. Newer phosphors also have increased detective quantum efficiency.

Newer mobile CR systems are easy to use and offer quick image availability in less than 25 seconds. These mobile units come with integrated CR reader.

Digital Radiography (DR): -
DR is used to describe images which are recorded on an electronically readable device that is hard-wired directly to the computer processing system. The detectors and sensors of a DR system are contained inside a rigid protective housing. DR uses an array of small solid state detectors to convert incident X-ray photons to directly form the digital image. The major advantage of the DR system is that no handling of a cassette is required as this is a "cassette-less" system. There are two forms of DR systems: one uses a linear array of detectors, which sweeps across the area to be imaged, the other has an array of detectors formed into a matrix.

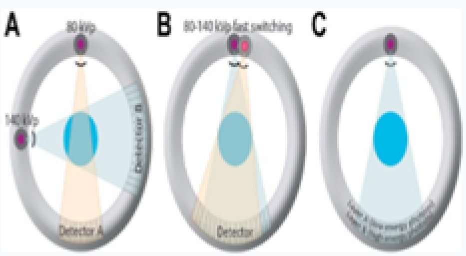
The linear array records the position of the array and the signal from each detector to form the image. In the matrix system, each detector provides data for one pixel. The linear array requires fewer detectors but a longer time to form each image.

Direct radiography flat panel detectors or imaging plates use a radiation conversion material or scintillator made of amorphous selenium (a-Se) which is a semiconductor with excellent X-ray photon detection ability and spatial resolution. A high voltage charge is applied to the top surface of the selenium layer immediately prior to the X-ray exposure. The ionisation created by the X-ray photons results in the selenium atoms releasing electrons which are absorbed by the electrodes at the bottom of the selenium layer. The electrons are transferred and stored in the thin film transistor detectors (TFT). TFT stands for a photosensitive array comprising of small pixels. Each pixel contains a photodiode that absorbs electrons and generates electrical charges. A silicon TFT separates each pixel element and sends the electrical charges to the image processor. The TFTs are positioned in a matrix which allows the charge pattern to be read pixel by pixel. This process takes place very fast where more than 1 million pixels which are capable of being read and converted into a digital image in <1 second. All this information is read with dedicated electronics that facilitate fast image acquisition and processing.

In the last two decades, digital radiography has replaced screen film radiography in many radiology departments. Today manufacturers provide variety of digital imaging solutions based on various detector and readout technologies.

Tomosynthesis: -
This is one of the important innovations in the field of digital radiography. Multiple low dose exposures are given from various angles while the X-ray tube moves in an arc and the detector remains stationary. Multiple images with different focal zones are possible to be created by addition of these low dose images. It emphasises contrast in particular layer of region of body and is considered useful in intravenous urography studies, mammography and chest radiography.

Dual energy imaging :- In this method, by using a high and low kilo voltage technique, two datasets are created and thus soft tissue and bones can be separately detected. Dual energy techniques are most effective when both images are acquired simultaneously. Similar results are obtained with two exposures within a very short period of time.



This innovation is useful in chest radiography particularly for the evaluation of partially calcified nodules and pleural plaques.

Computer aided diagnosis (CAD) software programmes:-
These programmes are important in early detection of cancer of the lung and breast. The suspicious areas are marked by the software for review by a radiologist. The efficiency of CAD software programme is related to its sensitivity and specificity profile. The main advantage of CAD is that it permits a radiologist to avoid overlooking diagnostically significant findings.

Automatic image stitching:-
This recent technique is useful in determining precise measurements in lengthy anatomical regions like spine or lower limbs. It involves multiple sequential exposures at different patient positions which are acquired in a still patient. Later in the process, automatic stitching is performed in order to reconstruct a larger composite image. This special software enables pixel shift and overlap.

Mobile DR (DIGITAL RADIOGRAPHY) :-
As medical imaging technology continues to advance, the evolution of DR has increasingly moved the modality into the mobile space. With applications from emergency departments to orthopedic clinics and more. By putting digital X-ray capability onto a mobile cart- based system, conducting imaging exams anywhere is possible. This allows for quicker exam turnaround times which in turn leads to faster diagnosis. Mobile DR in general is a 17×14 inches' flat panel detector connected to mobile X-ray system having a monitor.

The recently introduced LED status light indicator assists the technologist in confirming the status of the system while multitasking at the bedside. This indicator permits greater awareness of when the actual exposure is taking place, as an additional means of warning to the user and other clinicians also working in the same area.

Wireless flat panel detector: -
This system has no cables and does not interfere with surrounding machines. Typically, by this detector a 17×14-inch image is made available within three seconds. This allows radiography of difficult regions of body like temporomandibular joint, flexed knee and enables radiography in unusual positions.

In future with more data, the capability to learn more and possibility of adoption of new technologies like artificial intelligence, it will change the way mobile DRs get used and more importantly, the role they will play in patient care. Just as the consumer electronics industry is making smaller, lighter, and more durable phones, laptops, and tablets each year, manufacturers of DR technology will definitely try to do the same for detectors and mobile units.

While for the next years, it is likely that DR and CR systems will coexist wherein the long term perspective of CR will be based on further innovations in consideration with the dose efficiency and signal-to-noise characteristics while for DR, economical aspects and broader availability of mobile systems will play a significant role. The future is exciting!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Abdomen And Pelvis Prone Cross-Table Lateral X-Ray Projection For Anorectal Malformation

C. Marimuthu, Institute of Radio-diagnosis, Government Kilpauk Medical College, Chennai

Anorectal malformation is a condition where the anus, which opens into the rectum the end of the large intestine, is missing, is malformed, or has a blockage that doesn't allow feces to pass from the body. The condition is also called imperforate anus and is diagnosed at birth. One out of 5,000 babies are born with the condition, and as of now there's no way to prevent it. The complete lack of an anus in the baby is considered a medical emergency.

Four types of anorectal malformations have been created to help assist with the diagnosis and treatment of each individually.

1. Anal stenosis is the most common anorectal malformation and is an abnormally narrow anal opening. Atresia is a congenital condition in which any bodily opening is nonexistent or closed.

2. Membranous anal Atresia is the second type and also called as a low ARM where a thin tissue membrane covers the anal opening.

3. Anal agenesia/Atresia is the third type of ARM (intermediate ARM) more common in female newborns. The anal entrance is partially covered by a piece of skin leaving a very tiny slit for an opening.

4. Anorectal Agenesis/ Atresia (high ARM) affects both the anal and rectal tract in which the opening is entirely sealed up so they cannot poop at all. Fecal matter backs up into the large intestine causing bodily failure.

Surgical treatment varies based on the severity of the anorectal malformation. Plastic surgery called anoplasty can create a new anal opening if one does not already exist, can widen a narrow opening, or remove a membrane covering an anal entryway.

Complete rectal reconstruction is required where the anorectal system is linked by an internal opening into the urinary tract. Sometimes surgical treatment involves relocating the anal and rectal area into their normal position.

Investigation
If clinical signs are unclear than radiological investigations may be useful. Invertogram or Prone Cross table lateral x rays are very useful to see the gas shadow in the rectum. If a colostomy is fashioned, distal colonography, MCU may demonstrate a fistula to the urinary tract. Ultrasound may show feature of co-existent obstructive uropathy Whole body Plain x-ray (Baby gram) of the baby may show associated abnormalities, Echocardiography, CT and MRI are optional.

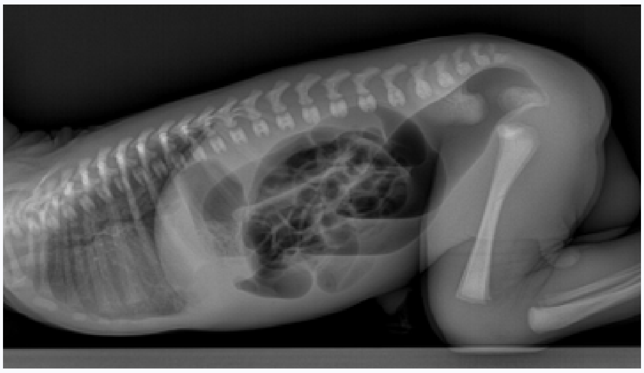
Preparation
Invertogram or Prone Cross table lateral x-rays procedure Should be done after 18 hours after birth because at birth gas shadow will be seen only in stomach and it will take 6-8 hrs to reach ileocaecal junction and reach the rectum only 18 hours after birth.

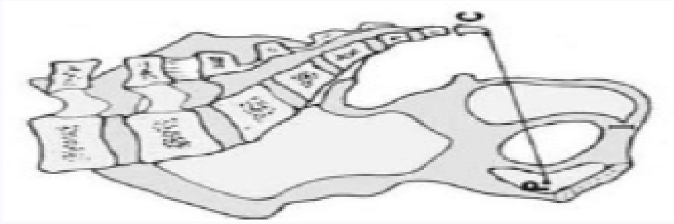
Invertogram
The well-known precautions of allowing enough time after birth for the air to reach the rectum and 3-5 minutes in the inverted position were followed routinely for the Invertogram.

Prone Cross-table lateral x-ray view
This x-ray view with a marker on the perineum is useful initial study. The prone cross-table lateral radiograph provides equal or sometimes better information, compared to the Invertogram, for demonstration of the level of rectal atresia in neonates.

Positioning
The infant should be placed in the prone position, with the pelvis and buttocks raised on a triangular covered foam pad or rolled-up nappy or Face down with their hips flexed and were kept in this genupectoral position and infant should be kept in this position for approximately 10 minutes. A lead marker is taped to the skin in the anatomical area where the anus would normally be sited.

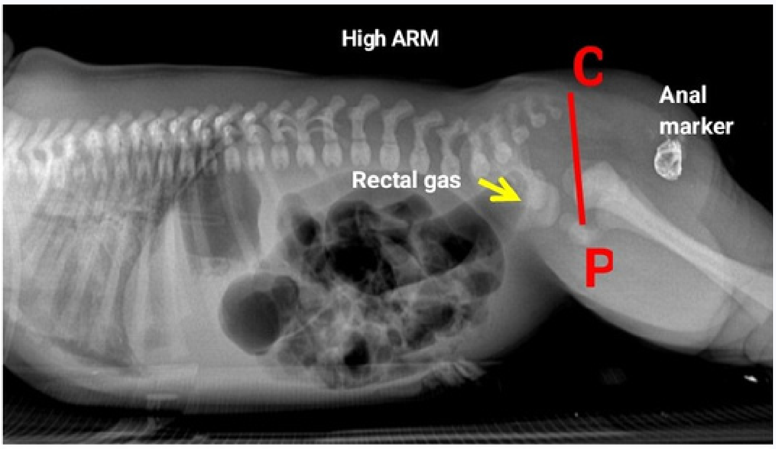
The Image receptor is supported vertically against the lateral aspect of the infant's pelvis, and adjusted parallel to the median sagittal plane. The horizontal central ray is directed over the to greater trochanters like in the Invertogram.Easy positioning, better cooperation of the patient, elimination of the effect of gravity, and better delineation of the rectal gas shadow are the advantages of the prone lateral view.



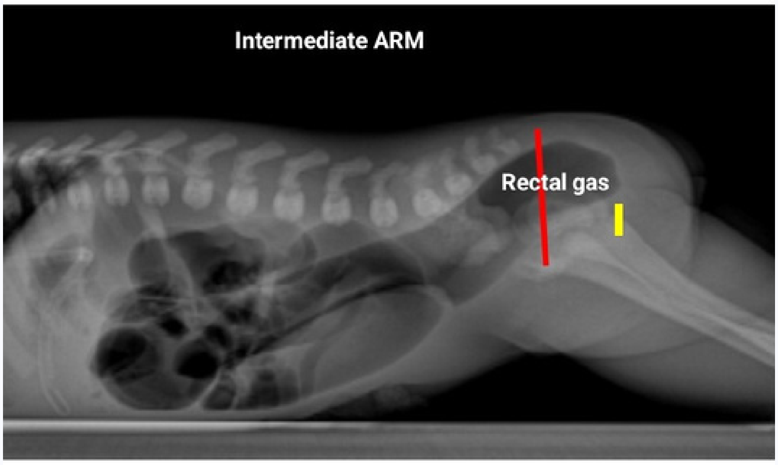


Evaluation

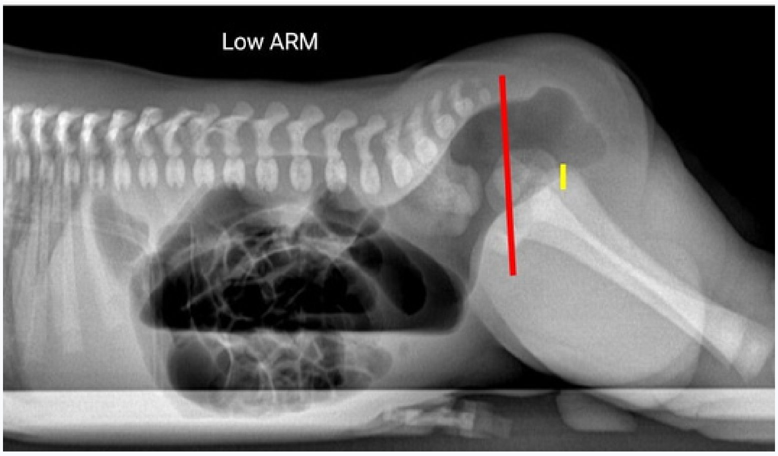
The rectal gas shadow was evaluated according to the bony landmarks of the pubococcygeal line and the ischial point. The distance of the rectal gas shadow from the pubococcygeal line was also measured. In high and intermediate anomalies, the ultimate proof of the level of the rectal gas shadow was the barium examination of the distal loop of the colon, after the neonatal colostomy. The presence of air in the distal rectum within 1 cm of the perineum suggests primary repair may be possible.



Prone cross table x-ray of abdomen and pelvis showing tip of the rectal gas is quite away from the pubococcygeal line. It is a case of high ARM.



Prone cross table x-ray of abdomen and pelvis showing tip of the rectal gas crossed the pubococcygeal line and touching the ischial point. It is a case of Intermediate ARM.



Prone cross table x-ray of abdomen and pelvis showing tip of the rectal gas crossed the pubococcygeal line and ischial point. It is a case of Low ARM.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Zero Echo Time (ZTE) MRI Imaging

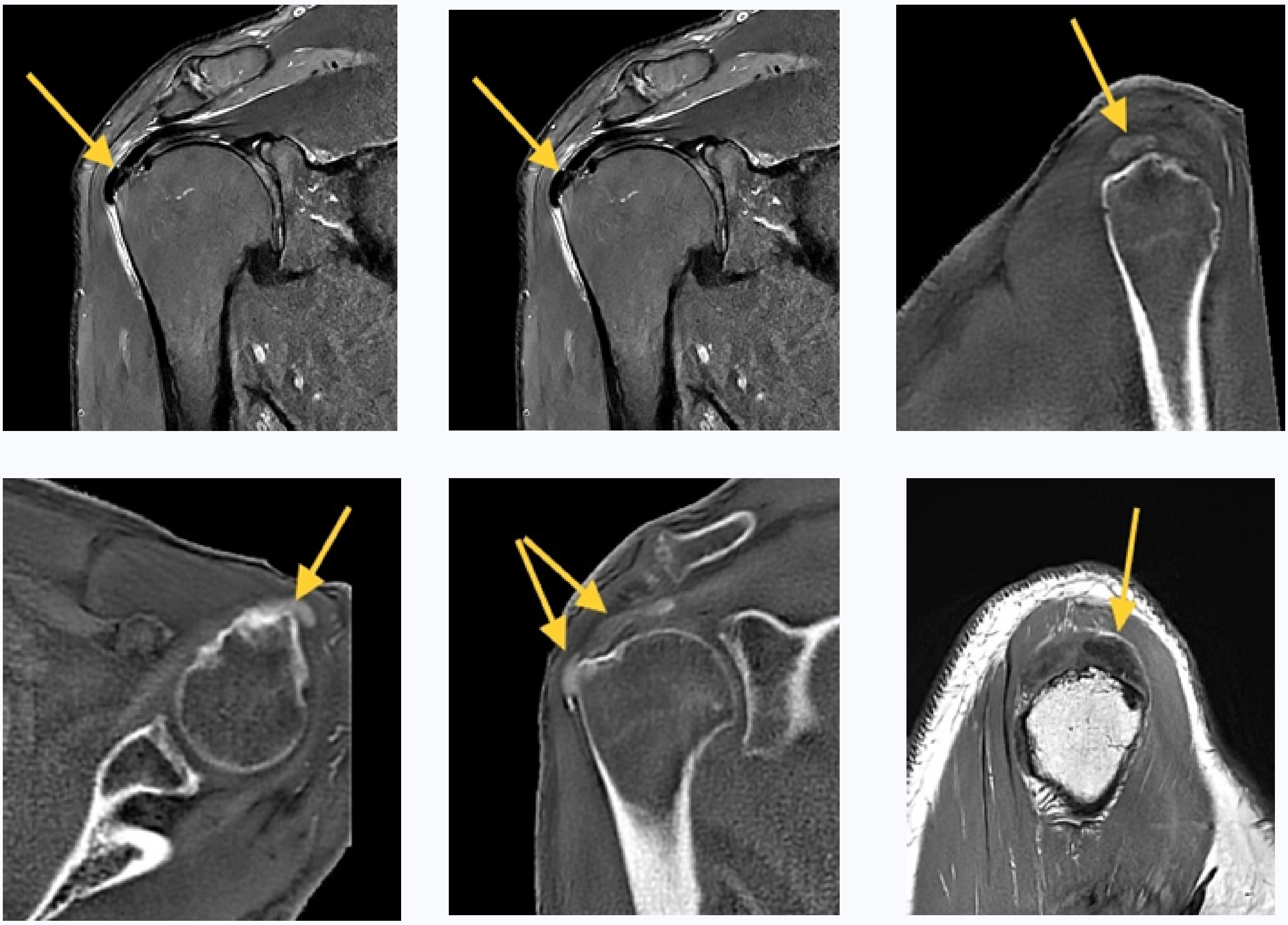
Chetan Shende. Clinical Application Specialist, RSO. Pacific Diagnostics ltd. Siemens Healthineers.
Bachelor's degree in Radiology. India. CT & MRI Trainings in Germany.
SHS.International certificate in Radiology from UBC University Canada.

Physics:

Zero echo time (ZTE) imaging is an MRI technique that produces images similar to those obtained with radiography or CT. In ZTE MRI, the very short T2 signal from the mineralized trabecular bone matrix and especially cortical bone-both of which have a low proton density (PD)-is sampled in a unique sequence setup. In ZTE, the signal is acquired immediately after applying the radiofrequency pulse resulting in near-zero echo times. After initial data readout gradient spoiling, adjustment and settling is rapidly performed, followed by the next radiofrequency pulse with very short repetition times.

Practical points:

ZTE is currently primarily used in some musculoskeletal imaging protocols such as those of the shoulder, and in some cases may obviate the need for e.g., CT imaging for detailed depiction of bony anatomy. Preliminary results also show superior depiction of lung tissue compared to standard MRI sequences. Note, however, that despite recent improvements, the spatial resolution of ZTE is still inferior to CT.Additionally, the PD weighting of the ZTE sequence results in less contrast between soft tissues. Therefore, along with Gray-scale inversion from black to white and vice versa, ZTE imaging provides excellent contrast between cortical bone and soft tissues similar to that of radiography and CT. However, despite isotropic or near-isotropic three-dimensional (3D) imaging capabilities of the ZTE sequence, spatial resolution in this technique is still inferior to that of radiography and CT, and 3D volume renderings are currently time-consuming and require post processing software that features segmentation and manual contouring. Optimization of ZTE MRI mostly entails adjustments of bandwidth, flip angle, field of view, and image matrix. A wide range of structural abnormalities and disease or healing processes in the musculoskeletal system are well delineated with ZTE MRI, including conditions that involve bone-based morphometric analyses (which aid diagnosis, help prognostication, and guide surgery), impaction, avulsion and stress fractures, loose bodies, or erosions in and around joints, soft-tissue calcifications and ossifications, and bone tumour's (including treatment response).



MRI Shoulder ZTE shows calcification/ossification

Overview of Contrast Media in Radiology

Tejas Dhepe, BPMT Student, **Ganesh Ashok Khalkar** (Senior Radiographer)
Dr.Vasantrao Pawar Medical College Hospital & Research Center Adgaon, Nashik

Contrast media are used in imaging techniques to enhance the differences between normal body tissue and abnormal body tissue on images in Radiological Investigation.(X-ray, C.T.Scan & MRI)

PREPARTAION OF CONTRAST STUDY

- Patient should be NBM (Neal by mouth)
- Serum Creatinine should be normal.
- Normal range between (0.8mg/dL to 1.2mg/dL).

ADVANTAGE & PURPOSE OF CONTRAST MEDIA

- Contrast media also called contrast agents are used to improve pictures of the inside of the body produced by X-RAY, CT-SCAN, MRI& ULTRASOUND.
- Contrast media is allows to distinguish normal from abnormal conditions and help to diagnose the study.
- The use of contrast media highlights the difference between normal and abnormal various parts of organs.

X-ray

X- Ray Contrast media are used for evaluate structures that are not clearly evident on conventional X-ray exams.

Types of contrast studies:

- IV Contrast study
- Oral Contrast study

IV CONTRAST STUDY

In X-ray we commonly use Urografin 76 or 60 %. Urografin 76 % or 60% Injection is an injectable contrast medium or dye which contains iodine. It is used prior to x-rays to better visualize the areas of your body that doctors want to investigate. It is used alone or in a combination with other agents for a wide variety of diagnostic imaging methods, including angiography, urography, computed tomography, etc.

It may also be used for imaging the gastrointestinal tract in patients allergic to barium.

Plain KUB X-ray

After giving Contrast
(IVP X-ray)

Oral Contrast study

Barium sulfate is used to help diagnose or find problems in the esophagus, stomach, and bowels. It is a radiographic contrast agent. Contrast agents are used to create a clear picture of the different parts of the body

Plain X-ray

After giving Contrast
(Barium Swallow)

CT- SCAN

A special injection of (iodine) dye called contrast. Contrast material is needed for some CT scans to help highlight the areas of your body being examined.The contrast material blocks X-rays and appears white on images, which can help emphasize blood vessels, intestines or other structures. Contrast material might be given to you: By mouth and IV.

TYPES OF CONTRAST MEDIA IN CT-SCAN

- Oral Contrast
- IV Contrast
- Rectal contrast

C.T.Scan contrasts commonly used:

- Inj.Iohexol370
- Inj.Iomeprol 350
- Inj.Iomeprol 400

MRI

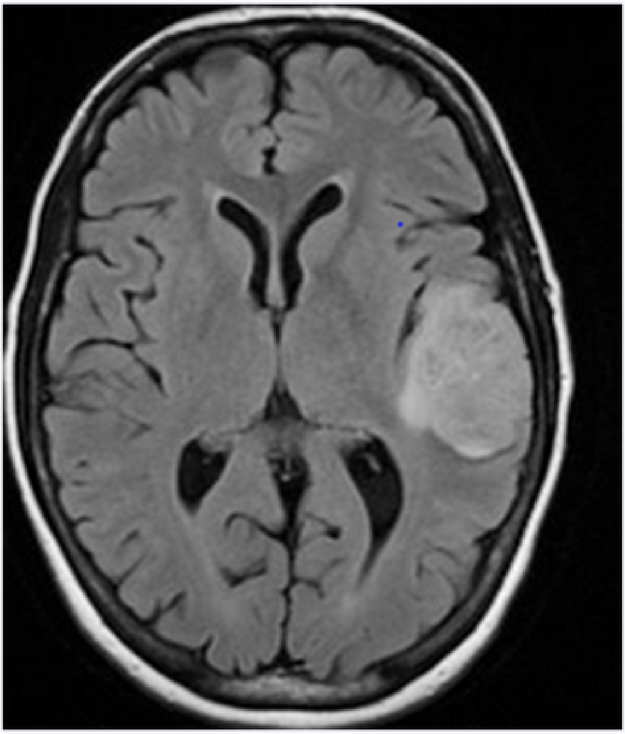
MRI with contrast is an imaging test that combines magnetic and radio wave imaging with an injection of Gadopentetate Dimeglumine .

The dye highlights blood vessels, organs, and specific soft tissues so they show up more clearly and help your diagnosis.

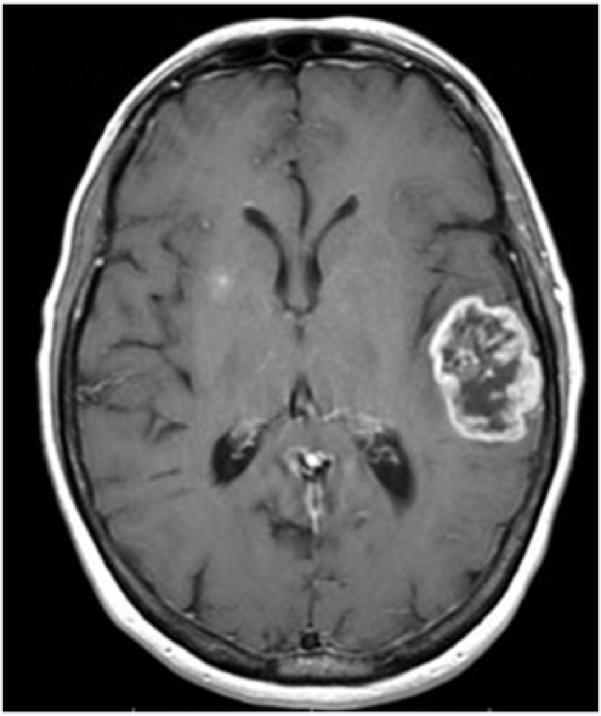
In MRI contrast study Inj. Gadolinium commonly used

Plain study of CT-Abdomen

Oral Contrast study of CT-Abdomen



Plain study of MRI Brain



Contrast Study of MRI brain

आप भी अपना पाठक धर्म निभाएँ

पत्रिका का अंक मिला, डाउन लोड किया, पढा और डिलीट कर दिया. केवल इससे पाठक धर्म नहीं निभ जाता. पत्रिका में प्रकाशित सामग्री से आप सहमत हो सकते हैं या उसमें आप कुछ और जोड़ सकते हैं, तो ऐसे मामलों में अपनी टिप्पणी अथवा प्रतिक्रिया हमें अवश्य लिख भेंजे. इसी प्रकार पत्रिका में जो मुद्दे उठाए गए हों, जो प्रश्न खड़े किए गए हों, उन पर भी खुल कर बहस करें और हमें लिख भेंजे. तात्पर्य यह है कि आप केवल पाठक ही न बने रहें, पाठक धर्म भी साथ में निभाते रहें इससे जहां अन्य पाठक बंधु लाभान्वित होंगे वहीं हमें भी विभिन्न रूपों से मार्गदर्शन मिलेगा. हाँ तो, जब भी समय की मांग हो, कलम उठाना न भूलें.

और एक बात, ये अंक हमने आप तक पहुंचाया, एक प्रबुद्ध रेडियोग्राफर के नाते अब ये आप की ज़िम्मेदारी बनती है कि इस अंक को आप भी और रडीओग्राफेर्स तक पहुंचाए यानि फॉरवर्ड करें.

अग्रिम धन्यवाद.
संपादक

Radiographers' Journal invites concerned articles.

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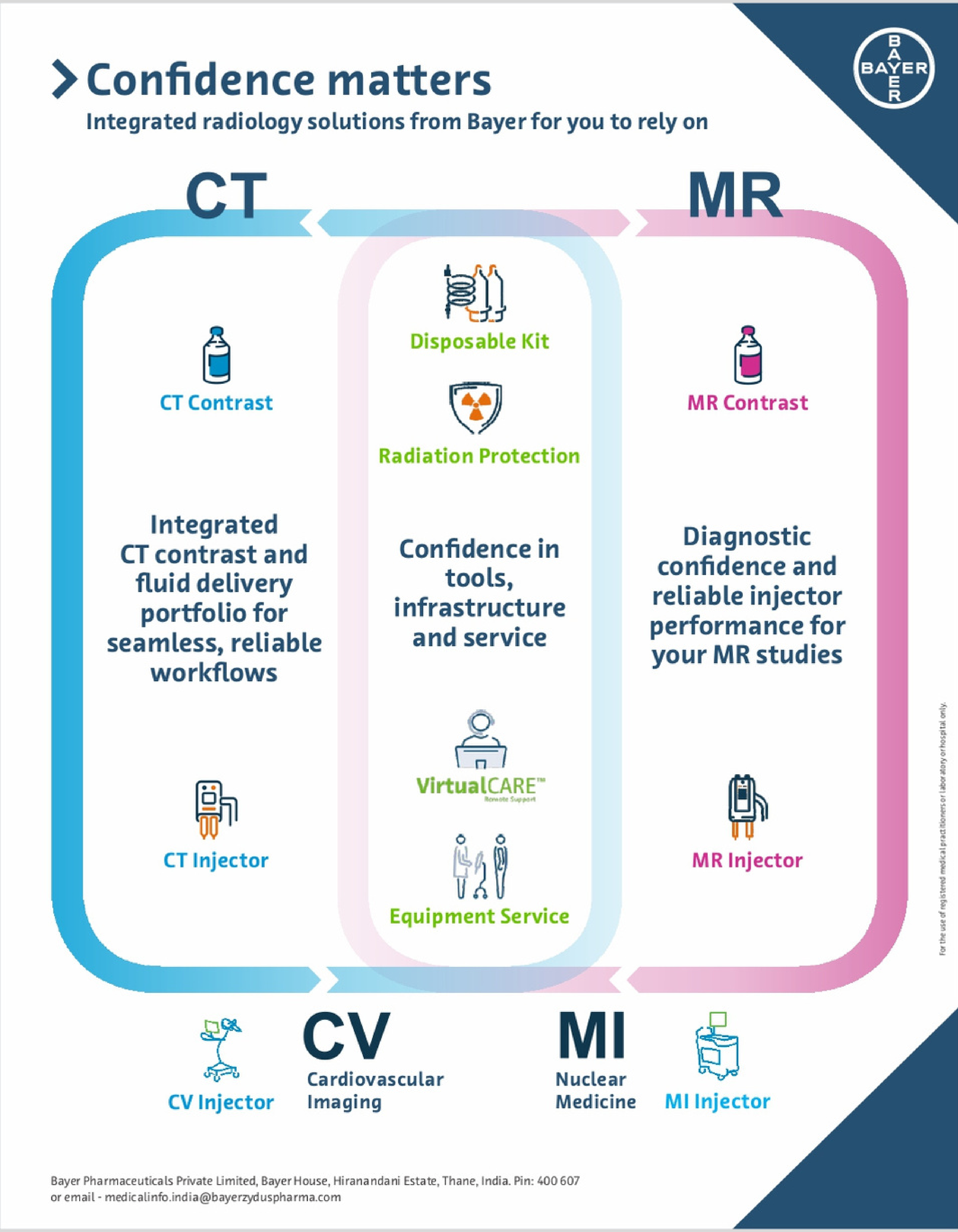
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CSF Flow Study- An Useful Clinical Tool

Manisha Pradhan, Student, M. Sc. Nuclear Medicine, Dr. Ram Manohar Lohia, Institute of Medical Science, Lucknow.

INTRODUCTION-
CSF is the clear fluid that cushions and delivers nutrients to your Central Nervous System. Produced from choroid plexus of 4th ventricles and additionally by ependymal cells. Alternations in CSF movement can be rule out by CSF Flow study in clinical scenarios of various pathophysiology.

BASIC PRINCIPLE-
- CSF circulation is related to the cardiac cycle .
- During systole as blood flow into the brain, CSF flows down the aqueduct of sylvius
- During diastole the reverse occur

INDICATIONS
- NPH
- Cerebral atrophy
- Communicating and non communicating hydrocephalus
- Chiari malformation
- Arachnoid and syringomyelia cyst
- Follow up patient with 3rd ventriculostomy and VP Shunt

TECHNIQUE
To visualize CSF movement

1)Phase – contrast (PC) MR imaging
2)Time – spatial labeling inversion pulse (TIME-SLIP)

Phase – contrast (PC) MR imaging
1)PC MR imaging generates signal contrast between flowing and stationary nuclei by sensitizing the phase of the transverse magnetization to the velocity of motion
- Standard velocity encoding (VENC) value- 5 to 8 cm/s
- Low VENC value – 2 to 4 cm/s
- High VENC value – 20 to 25 cm/s

2 series of PC imaging technique are applied:
a)Qualitative assessment:
- Through plane is performed in axial oblique plane perpendicular to the aqueduct
- In plane is performed in SAG plane parallel to the aqueduct

b)Flow quantification:
- In axial ,phase images are obtained from through plane
- An ROI at the level of aqueduct ,so that CSF flow velocity is obtained as acurve.

Time – spatial labeling inversion pulse (TIME-SLIP)
TIME-SLIP : based on Arterial Spin Labelling technique. Here acquisitions are incremental, allowing the bulk flow using FASE sequence

CONCLUSION
- The only MR technique to visualize CSF movement is Phase Contrast MR imaging.
- TIME SLIP is another option, which makes it possible to non invasively select CSF at any region in the CSN and visualize its movement up to 5 sec.
- Various parameters can be calculated from CSF flow study such as Systolic stroke volume, duration of CSF systole ,mean systolic flux ,etc.

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And one more thing, we have conveyed this issue to you, as an enlightened Radiographer, now it is your responsibility to forward this issue to other Radiographers.

Thanks in advance,
Editor

Role of Dual-energy CT in Gastrointestinal Bleeding

Pratap Singh, Intern, Zydus Hospitals, Anand, Gujarat

Gastrointestinal bleeding is a life-threatening medical emergency that can be a cause of morbidity and mortality. In the case of gastrointestinal bleeding, the first choice for diagnosis is endoscopy. But upper endoscopy has the limitation of detecting the source of bleeding in the small intestine. So CECT can be performed as the first choice. However, it can be difficult for the conventional CT scanner to identify active gastrointestinal bleeding because of high attenuating bowel contents. In addition, non-enhanced and several contrast-enhanced images are needed as multiple-phase scans to identify and diagnose gastrointestinal bleeding.

In a single energy source computed tomography, every different material have their identical pixel values in a CT image i.e. CT numbers. CT numbers depend on the mass density of the materials. It can be very difficult to differentiate between two materials having the same or very similar CT numbers. This issue can be overcome by the use of Dual-Energy CT, which can acquire the changes in attenuation measurement by using two different spectra. As a result, it can be easy to differentiate between two material compositions.

This article will outline the importance of DECT and modified standard CT protocols to diagnose gastrointestinal bleeding.

The standard protocol of CT: The standard protocol of CT includes multi-phase imaging, pre-contrast CT, and post-contrast two phases (arterial and delay).In multiphasic scans, both arterial and venous sources of bleeding can be detected.The purpose of pre-contrast images is to evaluate the coagulated and uncoagulated blood. The arterial phase is taken to confirm the extravasation of contrast media into intraluminal space and the responsible vessels. Whereas the delayed phase confirms the increase in extravasation spread into the lumen. The main problem that exists with the standard protocols is the dislocation of organs due to respiration and bowel movement, so interpretation can be difficult. Another demerit is difficult to diagnose in cases of minor bleeding.

DECT protocol: Dual Energy CT can easily differentiate between two material compositions. In the DECT protocol, biphasic scans are included (arterial and venous) without pre-contrast scan and oral contrast agent. DECT allows virtual non-contrast images (VNC), Virtual Monochromatic Images (VMI)and iodine maps as post-processing tools which can be useful in gastrointestinal bleeding.

Replacing pre-contrast images with VNC images

VNC images are the reconstructed images by subtracting the iodine content from contrast-enhanced images. It can virtually create pre-contrast images. Another advantage of VNC is that the comparison of positional information of organs remains the same without being affected by respiration and bowel movement. Therefore, it is possible to omit pre-contrast CT with VNC. As a result, post-contrast two phases with VNC can reduce radiation exposure by approximately 30%.

Use of Virtual Monochromatic Image and iodine map

A VMI is a virtual image obtained at different energies i.e. 40-200 keV. Different chemical compositions can be differentiated by characteristics of the spectral attenuation curve. Low keV images have increased contrast enhancement due to the increased attenuation of the contrast agent. At lower keV levels, which are closer to the K-edge energy level of the iodine (33.2 keV), the contrast of the iodine increases.Visualization of iodine improves and contrast differences between the tissues increase. It can provide information regarding the bleeding area in the case of gastrointestinal bleeding **[Figure 1]**.

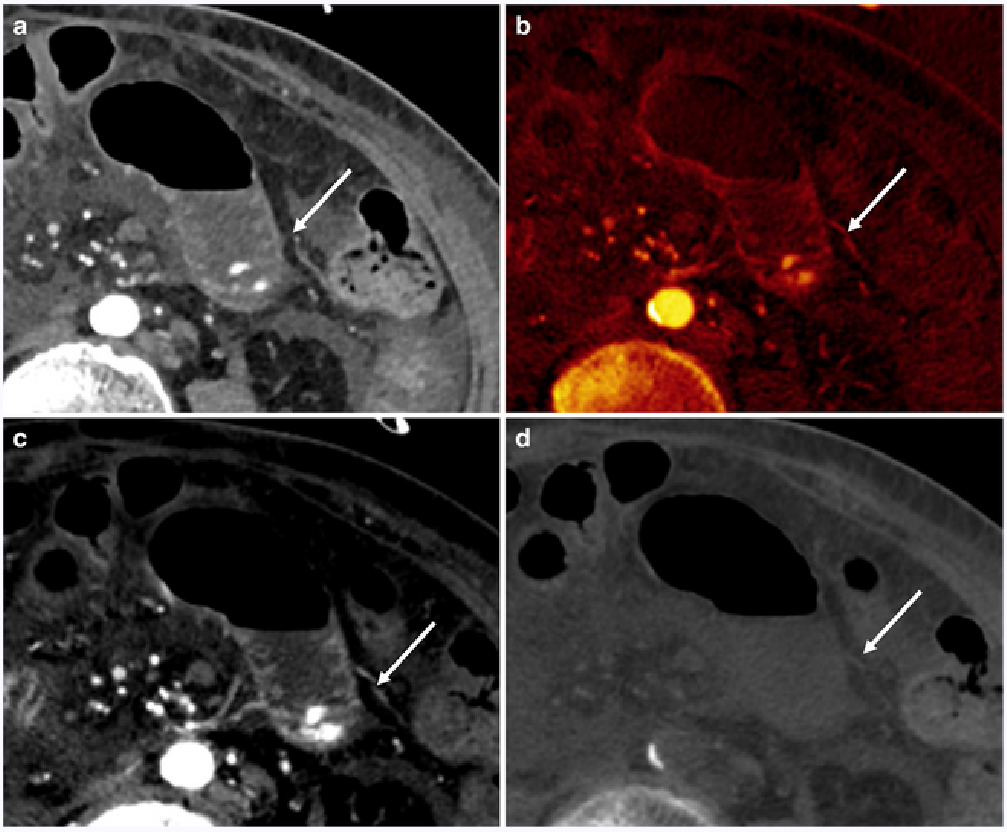

Figure 1:a. Enhanced image at 120 kVp **b.** Iodine mapping **c.**VMI at 40 keV **d.** VNC image

By using the unique linear attenuation coefficient of substances, specific materials such as iodine can be distinguished from other materials.Iodine mapping provides images in which pixel numbers are expressed in mg/ml iodine density instead of CT numbers. Therefore, we can easily differentiate between extravasation and intestinal content. As a result, the use of VMI and iodine mapping increases reliability and provides a more confident diagnosis.

If the hyper-attenuation observed within the bowel lumen in the enhanced images shows no iodine content on iodine maps and does not disappear on virtual non-contrast images, it does not reflect active bleeding **[Figure 2]**.

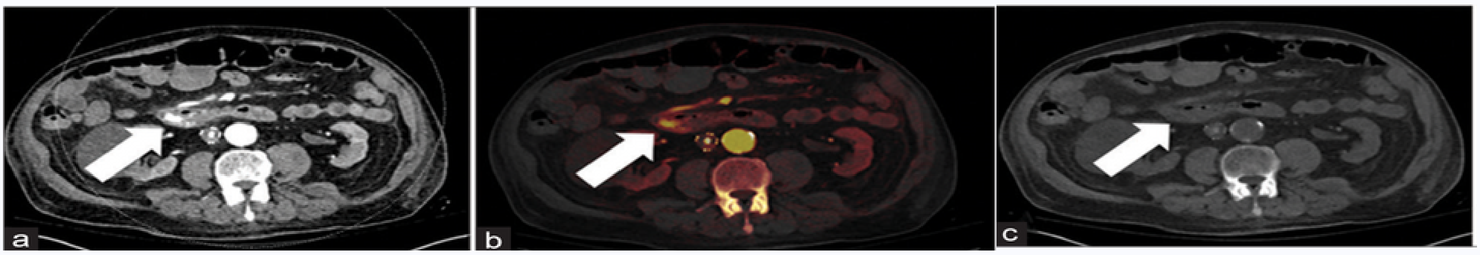

Figure 2: a. Contrast enhanced image **b.** iodine overlay image **c.** Virtual non-contrast image

Conclusion

This article reviews the advantages of functional analysis by DECT, whichcan reduce radiation exposure by using VNC as a replacement fortrue unenhanced images and improved visualization of extravasation by iodine mapping and VNC. The positional information remains same. If we use DECT as the first choice imaging modality, it can be a greatadvantage due to improved reliability and increased confident diagnosis in the case of iodinated contrast media extravasation as compared to conventional CT.In conclusion, DECT can solve the problems of conventional protocols and considered useful in the imaging diagnosis of gastrointestinal bleeding.

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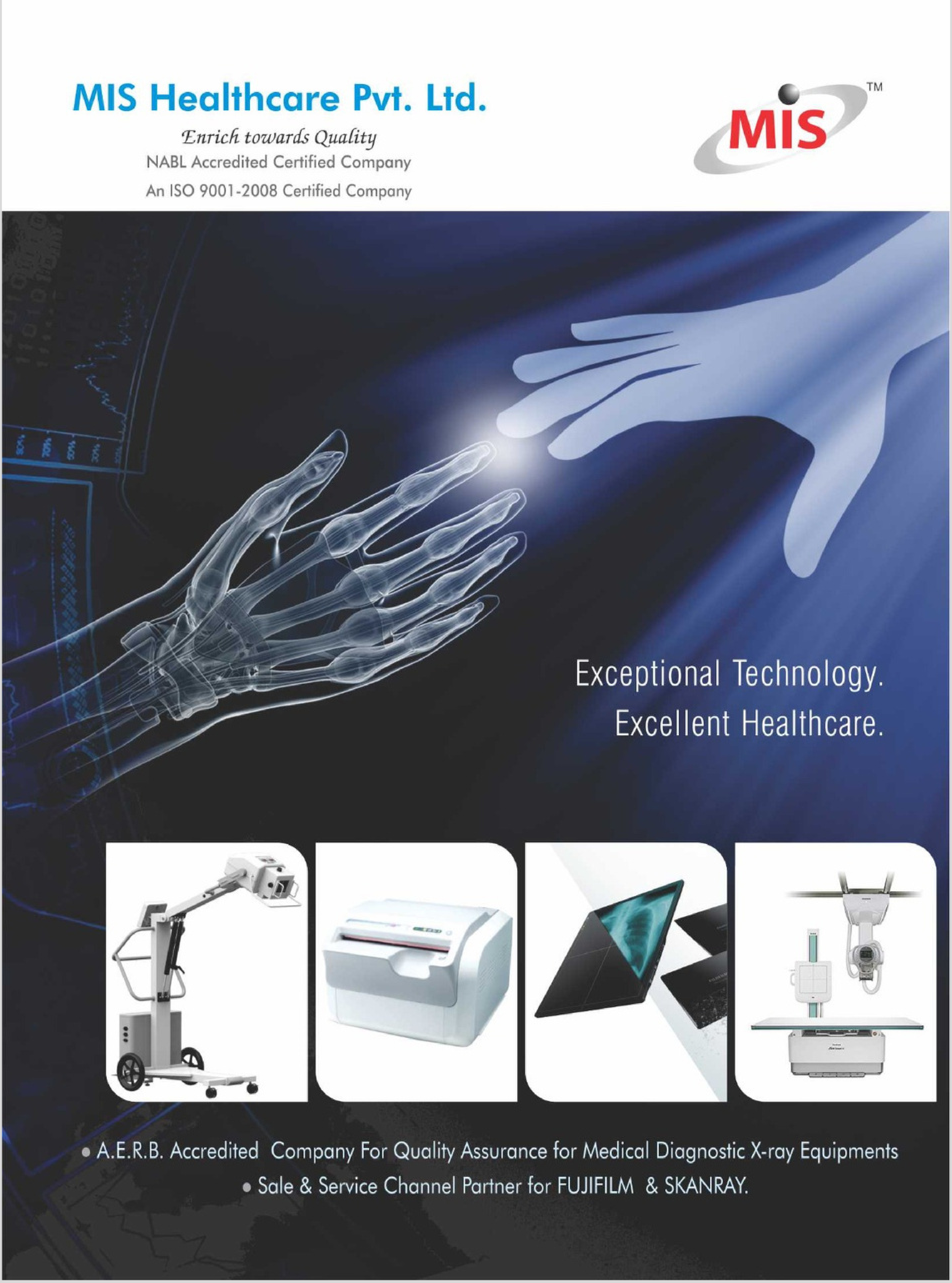
Glimpses of RITE 2023

Organised by: Ramachandra Imaging Technology Education, Chennai, on 18-19, March 2023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Claustrophobia and MRI Scan

Muhammed Rashid M K, Radiology Technologist

The Magnetic Resonance Imaging has a strong magnet field which produces high quality images of the internal structure of human body.It contains a large magnet that produces radio waves which enters the human body and helps diagnose the patient`s condition.The center of the magnet is a hollow tunnel which is called as “magnetic bore”. The patient lies inside the magnetic bore and the body part to be scanned lies at the center of the magnetic bore.As the MRI scan begins, there is continuous meticulous sound that comes from the scanner because of the coils vibrating inside the magnetic bore. Claustrophobia is a form of anxiety disorder, in which an irrational fear of having no escape or being closed-in can lead to a panic attack. Claustrophobia is characterized as a fear of dark or confined spaces but people also describe this as a fear of being trapped without a way out. Sometimes an MRI is unavoidable if you need answers, but the thoughts of lying in a tube for an extended amount of time however, is almost too much to bear if you have claustrophobia. In a study involvingMRI procedures and those diagnosed with claustrophobia, 13% suffered from a full blown anxiety attack.

Before your MRI, you should also know that some of the MRI-claustrophobia-related stories you may have heard are likely no longer accurate. Modern MRI machines are not dark, closed off tunnels. They are well-lit, open on both sides of the tunnel, and they are wider than they once were. We also have an MRI machine that isn’t a tunnel at all, but has open sides so that you can see the examination room. The more educated and informed you are on the specifics of the test, the less likely you are to be surprised by something. Ask your doctor to explain the details of the whole MRI procedure and know exactly what to expect.

Claustrophobic patients have a fear and experience a feeling of confinement or being closed in.In magnetic resonance imaging system, as the table goes inside the magnetic bore the patient develops a fear due to the closely packed environment. Moreover, the continuous rigorous sound of the machine makes the patient`s condition worse.

Open MRI’s have more room and feel less confining that more traditional MRI machines. Open, high field MRI’s are also extremely effective with high speed scanning and extremely details imaging capabilities. One of the best ways to overcome the claustrophobic problems is by entertaining the patients.Most of the MRI centers provide with music on the ears to help reduce the noise fromthe machine which can help distract and keep you calm. Nowadays, MRI centershavecome up with the In-bore MRI Entertainment system that gives cinema like experience to the patients. An In-bore MRI Cinema provides a big win in pediatric and small kids where earlier sedation was needed. The latest technology of In-bore MRI Cinema along with the MRI Ambience helps the patient not only remove the anxiety problems but also takes the patient into a different world of MRI system.

National Curriculum Review Task force Meeting to review the curriculum of Medical Radiology & Imaging Technology

Organised by: Interim Commission for Allied & Healthcare Professionals, Ministry of Health and Family Welfare, Govt. of India at Institute of Health and Family Welfare, New Delhi on 25.03.2023

Task Force Members:

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- **Dr. P. K. Hota**, Regional Cancer Centre, Cuttack.
- **Dr. Timothy Peace**, Christian Medical College Vellore.
- **Dr. Rashmi Shukla**, AIIMS New Delhi.
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- **Dolly Sharma,** Charotar University of Science and Technology, Anand, Gujarat
- **Abhishek Sheharawat,** AIIMS, Bhoopal.
- **Subarna Debnath,** Tripura Institute of Medical Sciences, Tripura

The role of immediate Whole body CT scanning in severely injured patients

Ramesh Sharma, Chief Technical Officer (Rtd)., NCI –AIIMS.

Computed tomography (CT) scanning has become essential in the early diagnostic phase of trauma care. It is a fast and highly accurate modality for the identification of various injuries and it enables a rapid response to life-threatening problems. Especially total-body CT (TBCT) scanning is increasingly used. The TBCT scan can be used as a supplement to conventional imaging (i.e. chest and pelvic x-rays, FAST and selective CT scanning), but also as a total replacement.

Ongoing developments in the field of diagnostic imaging in trauma patients propose a major challenge to physicians. The TBCT scan provides a rapid and complete overview of possible lifethreatening injuries that trauma patients can sustain, particularly internal bleeding. This totalbody imaging concept is theoretically so promising that numerous trauma centres worldwide incorporated the TBCT scan in their daily practice, without Level 1 evidence. On the other side, TBCT scanning is associated with a considerable amount of radiation exposure and health care costs. Point of interest is whether it is safe to perform an immediate TBCT scan, with the omission of conventional imaging (X-rays and FAST). This thesis aimed to answer the question: will the advantages of a TBCT scan in trauma patients outweigh the disadvantages? The first randomized trial on this topic worldwide, the REACT-2 trial, partially provided us with answers: No, there is no difference in survival in trauma patients that undergo an immediate TBCT scan. Yes, 40% of the patients in the standard work-up had a radiation dose below the minimum radiation dose of patients who underwent a TBCT scan. Yes, TBCT scanning is safe, shortens imaging time at the trauma room and does not increase the medical costs.

Future perspectives Future studies should be directed to optimize the selection criteria for severely injured patients. The REACT-2 trial was one of the first trials that listed inclusion criteria to select severely injured (i.e. polytrauma patients) immediately after admission to the trauma room. Polytrauma patients are defined as patients with an Injury Severity Score (ISS) of 16 or above. In the REACT-2 trial, we aimed to include polytrauma patients solely, but in fact only 64% of the patients was severely injured. The study showed how difficult it is to determine which patients are severely injured on beforehand, as opposed to select polytrauma patients retrospectively, when results of radiography are known and an ISS is already attributed to the patient. The vital parameters, clinical suspicion of potential injuries and injury mechanisms used in the REACT-2 trial are a good, but certainly not the perfect starting point for future studies. Theoretically, these less injured patients will benefit less from a TBCT scan. When the benefit decreases, disadvantages in terms of radiation dose and costs become more prominent. The REACT-2 showed that 40% of the patients in the standard work-up group had a radiation dose below the minimum radiation dose of patients who underwent a TBCT scan. Thus, if an individual patient is suspected to have a total radiation dose of 20 mSv or higher, this patient will have a lower radiation dose when evaluated with an immediate TBCT scan without previous 162 conventional imaging than when evaluated with the standard work-up.

However, giving a proper estimation of the amount of radiation exposure a patient will receive, will be a challenge for a trauma team leader. Polytrauma patients, with multi-region injuries, are candidates for a higher radiation dose. Future studies should focus on how to identify these patients on beforehand, i.e. prior to diagnostic imaging. Until that time, the trauma team leader has to decide whether or not a TBCT scan is indicated in each individual trauma patient. Furthermore, improvements in scan algorithms may also help to further decrease the radiation dose. Another point of interest is if the TBCT scan should be used as a supplement to or as a replacement of conventional imaging. In 9% of the REACT-2 patients randomized to an immediate TBCT scan, previous conventional imaging, such as a chest X-ray or FAST, was done. Whether this was strictly necessary, can be doubted. In our experience, the need for conventional imaging decreases with the increase of experience and confidence in the safety of the TBCT scan. Even in hemodynamically unstable patients, the TBCT scan can be a safe or even preferred imaging modality.

If conventional imaging can be omitted, the radiation exposure in TBCT patients will further decline and more time will be saved. Since various level-1 trauma centers worldwide have already incorporated the use of the TBCT scan in their daily practice, it is unlikely that more randomized clinical trials on this topic will follow. However, prospective analysis of a cohort of hemodynamically unstable patients can provide information on the transition point between 'unstable but stable enough for a TBCT scan' and 'too unstable to perform a TBCT scan'. It has to be noted that close cooperation among the entire trauma team (trauma surgeons, anesthesiologists, radiologists) is essential to make an immediate TBCT scan possible. Also an optimal infrastructure and workflow are necessary to provide safe and rapid care to a trauma patient during the first diagnostic phase of trauma survey. In Europe the CT scanner is located in or near the trauma room in almost all level-1 trauma centers and mostly used for blunt trauma patients. In North America however, penetrating injuries are more common and in this population, the role of total-body CT scanning is less clear. The REACT-2 study included only a small percentage of patients with penetrating injury and larger cohorts are needed to draw conclusions in this subgroup. Given the great variety in type and severity of penetrating injury (stab or gunshot wound, the presence or absence of an exit wound, the involvement of one or more body regions), an individual approach for each patient seems to be more suitable than performing a TBCT scan per se. For severe blunt trauma patients on the other hand, the REACT-2 trial shows that a TBCT scan is a safe and fast method, with similar costs involved compared to a standard radiological work-up. A CT scanner in or near the trauma room is therefore indispensable in a modern Level-1 trauma centre, in both Europe and North America.

An interesting development is the integration of trauma resuscitation and management. The hybrid operating room (OR), currently built in several trauma centres including the Academic Medical Centre in Amsterdam, is a great example. In this multi functional operating room, the trauma surgeon and the interventional radiologist can work together to provide an optimal form of care to the severely injured patient, following appropriate selection of patients by a TBCT in the trauma room. It is well possible that this room will be used as both a resuscitation room and operating room in the near future. Diagnostic procedures and management by surgeon or interventional radiologist can go hand in hand, in order to save time and provide the best care possible to the injured patient. With these advancements in technology, cooperation between different trauma centres is of major importance to provide a clear and practical protocol for radiological imaging in severely injured patients.

Conclusions

Risk stratification criteria can be used for deciding need of imaging in patients subject to high-energy trauma. WBCT does not affect patient care in high-energy trauma if the patient is mentally alert, not intoxicated nor shows signs of other than minor injuries when evaluated by a trauma-team. The risk of missing important traumatic findings in these patients is very low. Observation of the low-risk patient with re-examination instead of imaging may be considered in this group of often young patients where radiation exposure is an issue. After observation in the ED, most of these patients can be discharged without follow-up.

N.B : REACT-2:

Multi center randomized clinical trail for CT scanning of severely injured trauma patients .

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Glimpses of SIR CME - 2023 Calicut

Organised by: Society of Indian Radiographers Kerala Chapter on 26th February 2023

Role of the Charge Coupled Devices in reducing the patient dose by Indirect Digital Radiography

Himani Kheary, B.R.I.T, NIMS University, Jaipur, Rajasthan.

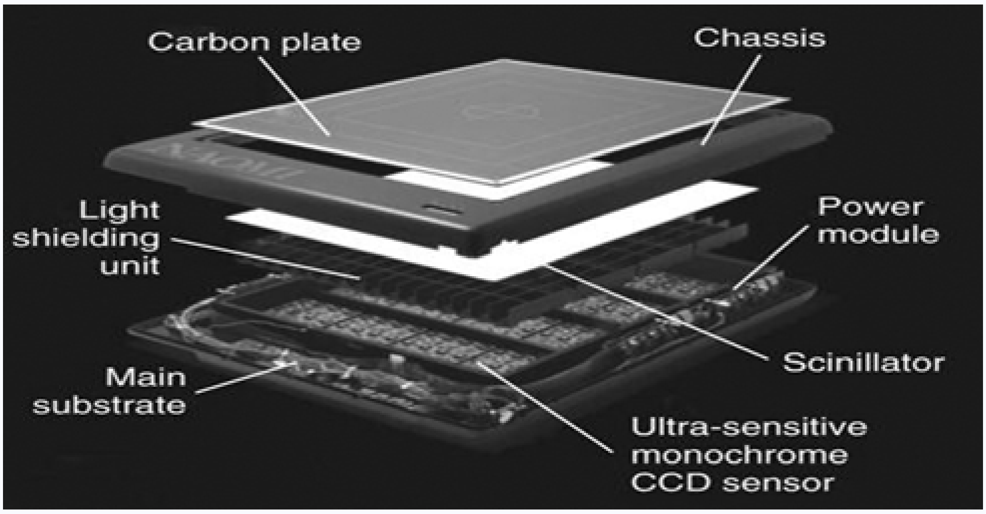
This Article is going to give us the basic idea about how Charge Coupled devices are used in the Indirect Digital Radiography? Which is used for the Radiology department for the general imaging purpose of the patient which leads to the diagnosis of the disease at its earliest phase as possible.

CCD's was invented in 1969 by George Smith and Willard Boyle at Bell Labs-

It was not until the 1970s that Michael P. Thompsett at Bell Labs refined the CCD's design to better Accommodate imaging.

After that, the CCD continued to be improved by Thompsett and other researchers, leading to enhancements in light sensitivity and overall image quality and CCD soon becoming the primary technology is used for digital imaging.

CCD's are not the only technology to allow for light detection. (CD image sensors are widely used in professional, medical used and scientific Applications where high quality image data are acquired.



Design and Manufacturing: -
CCD form images from visible light and usually used with intensifying screens and Image Intensifier tubes. Basically CCD chip is an integrated circuit, made up of amorphous silicon.

The Surface the CCD is arranged in the form of pixels where the pixels are broken down into the electrical signal by the intensity of light and the electrical signal will be equals at each and every time.

Before the exposure of amorphous silicon surface to the incident light, they are made biased into the depletion region in channel of CCD's.

The silicon which is used for the working purpose is slightly Doped with the doping impurity usually with boron and called the p-doped or intrinsic.

Working: -
The normal functioning of CCD can be divided into two phases, exposure and read out. During the first, the CCD passively collects incoming photons, storing electrons in its cells. After the exposure time is paved, the cells are read out one line at a time During the readout phase, cells are shifted down the entire area of the CCD. While they are shifted, the continue to collect light thus shifting is not fast enough errors can result from light that falls on a cell holding change during the transfer and in addition CCD cannot be used to Collect light while it is being read out and also, a foster, thifting requires faster read out and faster read out can introduce errors in the all change measurement, leading to the format of higher noise

The Amorphous silicon surface Is photo conductive. If it exposed to visible light, electrons are liberated and build up in the Pixel. Higher the incident light intensity, larger the electrons that are liberated. The elections are kept in the pixel by electronic barriers on each side of the pixel which are made up of silicon dioxide, thus each pixel acts as capacitor and collects charge which are directly proportional to the intensity of incident light. Electronic charge in each pixel is read out along the column wise. The electron in each pixel is shifted to another pixel, by adjusting the voltage barriers of each pixel. Thus, the charge pocket in one column moves in unidirectional and finally reaches the pixel in the bottom row after, thatThe bottom Row Is read out pixel by pixel and the Change is shifted to the read out electronics. Which produces an electronic signal.

This signal is digitized by an Analog to digital converter before the final construction of the Image matrix and then the data signal is used to construct the image matrix with bit depth of 8 to 12. short repetition time (TR), and a low flip.

Usually CCD’s contains 1024×1024 pixels in its surface which are used for the storage of the electronic charge which further used for the formation of digital image with the help of Analog to digital converter.

Similarly, Next column charges are shifted to the bottom Row that gives another signal. This process is Repeated until all the pixels in the detector electronics are all Read out completely. The read out process happened too faster and it is generally at the rate of 30 frames per second.

The CCD geometry is uniform and distension free. The produced image has very wide dynamic range with very low electronic noise.

Architecture: -

CCD can be implemented in several different architectures and The most common are: -

1. Frame transfer CCD- It was the first imaging structure proposed for CCD imaging by Michal tempest at Bell Laboratories.

Frame transfer CCD is a specialized CCD, often used astronomy in and some professional video cameras, designed for higher exposure efficiency.

A frame transfer CCD is shielded, not light sensitive, Area containing as many cells as the Area exposed to light and the exposed area of light is covered by a reflective.

Material such as Aluminium and when the exposure time is up, the cells are transferred very rapidly to the hidden Area to make them safe from any incoming light

2. Intensified CCD- An Intensified CCD is the one that is optically connected to an image intensifier that is mounted in the front of the CCD. An Image Intensifiers which is used in the combination with CCD includes three functional elements which are photocathode, a micro-channel plate (MCP) and a phosphor screen.

→ Photo cathode-The photons of incoming light incident on it and leads to the generation of photo electron

-The formed photo electrons are accelerated towards the MCP by an electrical control voltage applied between photo cathode and MCP.

-MCP- The electrons are multiplied inside the MCP and accelerated towards the phosphor screen.

→ Phosphor Screen – The phosphor screen finally converted the multiplied photoelectron back to the photon which are guided to the CCD by a fibre optic on lens.

All the three elements of Image Intensifier are mounted one upon each other and together with CCD known as Intensified CCD. ICCD's are used in night vision devices mostly

3.Electron multiplying CCD: -

Electron multiplying CCD is a type of CCD in which a gain register is placed between the shift register and an output amplifier.

In the shift Register, there is the shifting of the photon towards the gain Register.

In the gain register; there is the multiplication of electron by the several impact ionizations similar as Avalanche diode due to the splitting of gain register into the number of large stages.

Because of the lover costs and better resolution, EMCCD's are Capable of Replacing ICCD in many applications. but the reason behind the slight, increment in the cost of EMCCD Is the need of a cooling system either by thermoelectric cooling on liquid N2 to case the chip down to temperatures from -85°C to 139°c which adds additional costs to the EMCCD imaging system.

Application of CCD's

CCD's produces high quality images and have application in Dental Radiography, mammography, fluoroscope and cine radiography.

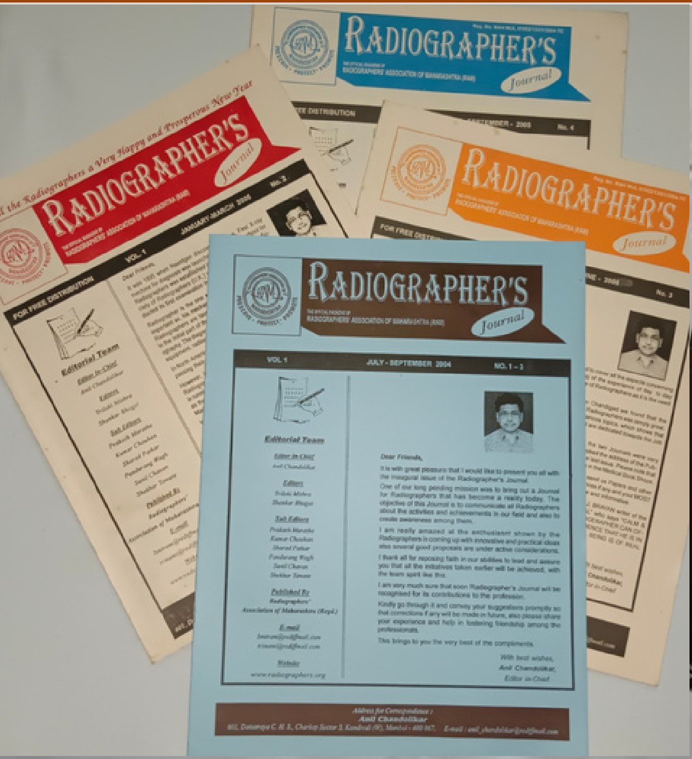
→ In Dental Radiography, intensifying screen is coupled with CCD and the field of view is too small that's why the light which is emitting by intensifying screen is collected by the CCD significantly due to good coupling of light only little light got waited and leads to a very low or negligible noise.

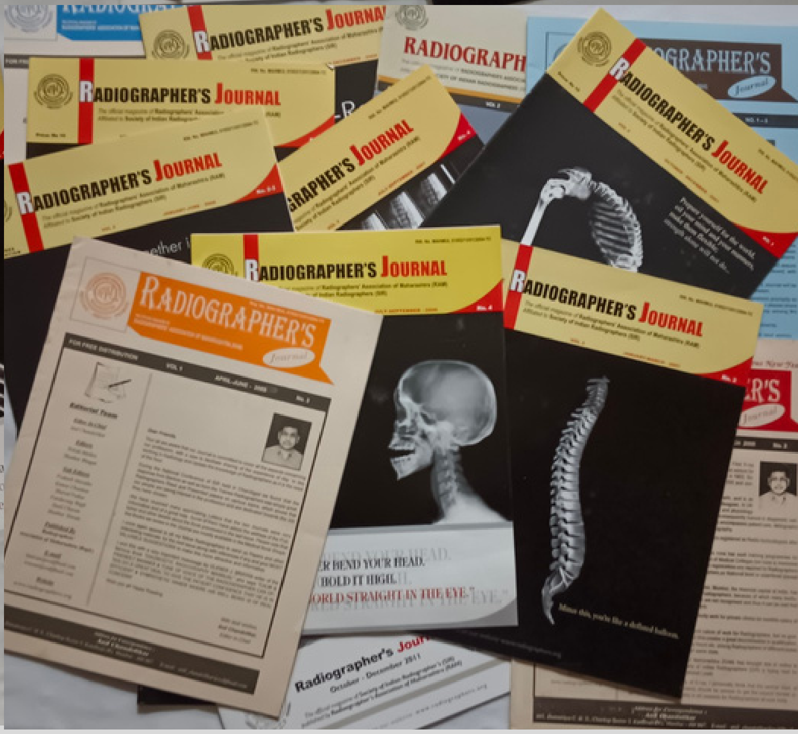
→ In digital biopsy mammography, the FOV is higher than the area of the CCD and hence, fibre optic taper is used by between the Intensifying screen and CCD and here fibre optic taper acts as lens and four the emitted light photons towards the CCD surface significantly and here loss of light is not significant in this system.

Conclusion:-

In the earlier years of invention of CCD's, they proved very helpful in reducing the Patient dose by multiplying the no of light photons with the Help of phosphor Screens in it and sometimes also with the help of lens which is used in the flouring of the incident light photons towards the CCD surface which indirectly also increase the intensity of the incident light photons towards the CCD surface and in other way makes use of very less use of Radiation for the purpose of better diagnosis. They can also be used in Astronomy, Medical, Televisions, video cameras, QR Code scanners and many more and also have made possible the introduction of digital cameras that Promise to eventually replace the traditional film cameras. Nowadays CCDs are discontinued for regular consumer use but with their high quantum efficiencies, law wise imaging, higher dynamic range and excellent uniformity, CCD's are Still used in many scientific and Industrial applications but proved very less useful in Medical field currently due to very high and many more new inventions in medical field.

"Like taxes Radiation has long been with us it's not be hated and feared but accepted and controlled Precisely!".





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