Since 2004 For free Circulation

Radiographers' Journal

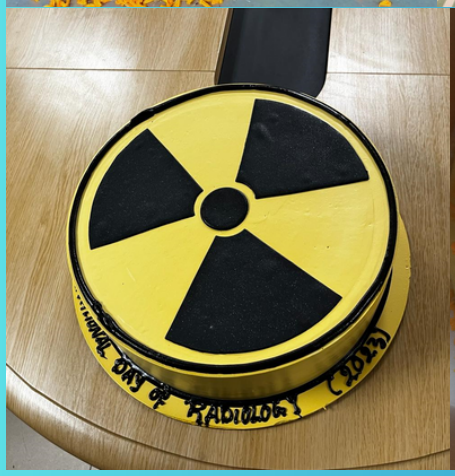
The official magazine of Society of Indian Radiographers (SIR)
Published by Radiographers' Association of Maharashtra (RAM)

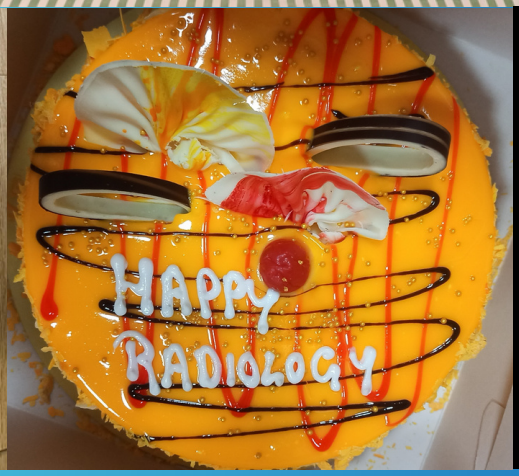
November, 2023

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

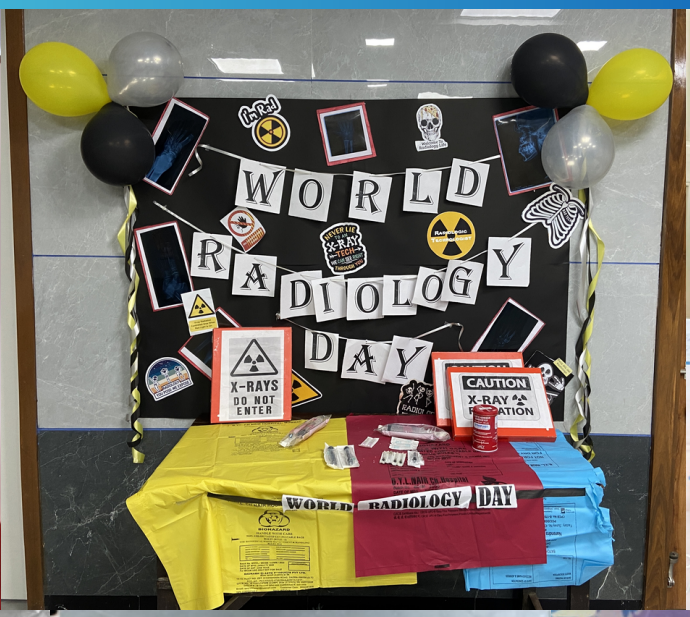
International Radiography Day Celebrations

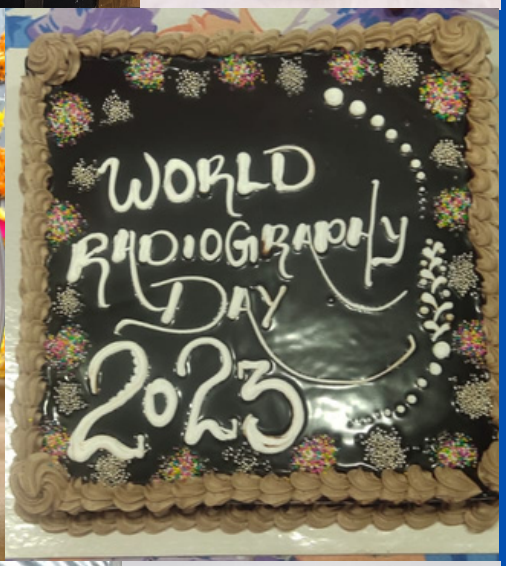
International Radiography Day Celebrations





International Radiography Day Celebrations





Triple – Phase MDCT of Liver Scan protocol modification to obtain Optimal vascular and Lesion contrast

Divya Mary.S.D, Assistant Professor -BMIT, RR Institute of Medical Sciences- Bangalore

Introduction:

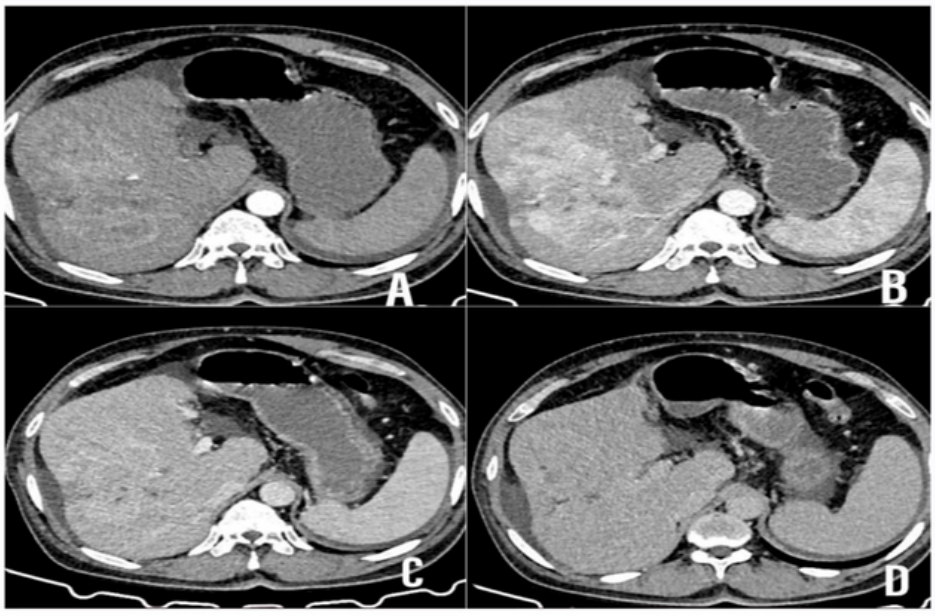
Hepatocellular carcinoma (HCC) is the fifth most common cancer in men and the eighth most common cancer in women. Currently, it is one of the most common .Causes of cancer related death worldwide. HCCs derive their blood supply predominantly from the hepatic arterial system, Whereas normal liver parenchyma receives 70–80% of its blood supply from the Portal vein. Dynamic contrast-enhanced imaging studies exploit this physiologic difference by Imaging the hepatic parenchyma and HCC during the arterial phase of contrast Enhancement, when differential enhancement is maximized. With advances in helical computerized tomography (CT) with greater anatomic Coverage, more rapid scanning times have revolutionized hepatic imaging. The entire Liver can be evaluated in a single breath-hold without respiratory miss-registration. Hepatic circulation has two major components: Arterial and portal venous. A rapidly injected contrast bolus can opacify the liver in two stages: an initial hepatic arterial phase followed by a portal venous phase. Consequently, optimizing the scan window has become critical. The mini-bolus and automated techniques have inherent drawbacks including limited

Availability, added cost of the automated-technique software, and increase in table time needed for review of mini-bolus images to calculate the time delay thereby decreasing patient throughput. Because of the reasons mentioned above, studies have been carried out using fixed timing delays for a variety of examinations, including hepatic imaging. A bolus-tracking technique has become widely available for the optimization of scan timing in individual patients to compensate for the variability of circulation time between patients. The purpose of our study was to optimize scan delays for hepatic arterial and portal venous phases for bolus-tracking techniques in multi detector Computed tomography (MDCT) of the liver. With the advent of MDCT, the acquisition time for whole liver imaging is fewer than 5-10 seconds. Such a short acquisition time provides an opportunity to capture peak enhancement in visceral organs by optimizing contrast medium injection and scan protocols.

However, an off-timing scan markedly increases the risk of suboptimal contrast Enhancement. A bolus-tracking technique has become widely available and may be indispensable for the optimization of scan timing in individual patients to compensate for the variability of circulation time between patients. Multiphase CT improves the sensitivity of liver lesion detection .MRI, despite being recognized to be superior in characterizing focal liver lesions, remains a secondary tool due to limited resources in most centers in India.

Standard Parameters for Abdomen Triple Phase Study:

Scan Phase	Scan Delay	Pitch	Slice Thickness
Arterial phase	4 secs	1	5mm (recon-o.5 to 1mm)
Portal phase	19 secs	1	5mm(1mm)
Venous phase	44 secs	1	15mm (1mm)
Delayed phase	180 secs	1	5 mm (1mm)



Shows the different phases of triple phase study of Standard protocol.
A) Arterial phase ,B) Portal phase
C) Venous phase & D)Delayed phase

Contrast Material Injection:

All patients were administered non-ionic iodine contrast material containing 300 mg/mL (Omnipaque 300) using a pressure injector (MEDRAD salient) at a rate of 4.5-5 mL/s through a 18-gauge plastic IV catheter placed in an upper extremity vein, typically in an antecubital vein. The volume of contrast material delivered was 1.5 mL/kg of body weight in all patients.

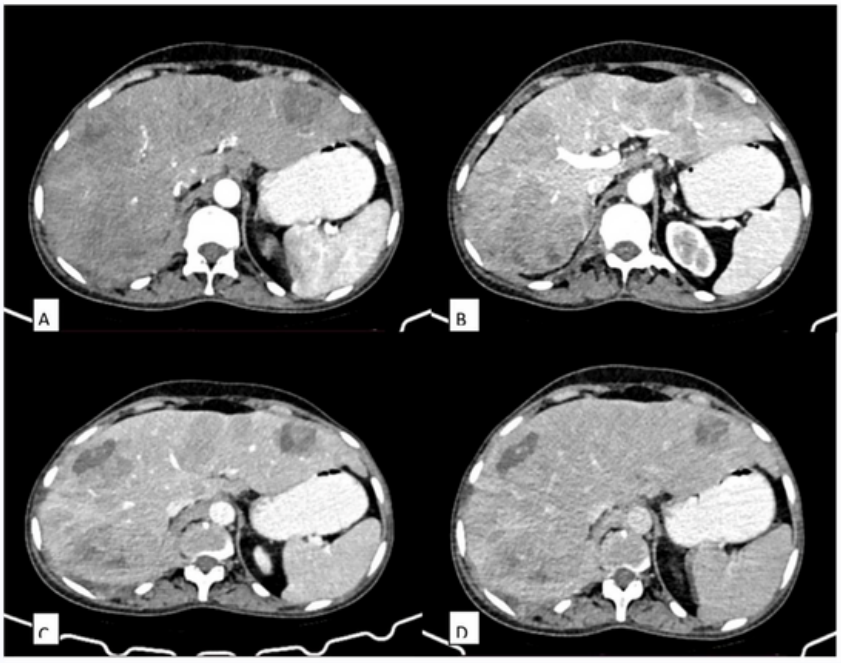
A Monitoring program was used to commence the diagnostic scans after contrast injection. This enabled real-time monitoring and the automatic calculation of CT values in a region of interest, and manual initiation of a diagnostic scan after the CT value reached a threshold. The region-of-interest cursor for bolus tracking was placed in the aorta at a level just above the diaphragmatic dome; this level was also used as a starting position for diagnostic scans. Real-time low-dose (120 kVp, 50 mA) serial monitoring scans were initiated 4 seconds after the start of contrast medium injection. During the 5-second interval between contrast injection start and the monitoring scan start, patients were carefully observed by a radiologist for extravasation or acute adverse events caused by the contrast medium injection.

Conclusion

The following conclusions can be drawn from this study: Using the bolus-tracking method, scan delays need to be optimized for portal venous and hepatic venous phases. A scan delay of 8 s, after trigger threshold (100 HU) is reached in the lower thoracic aorta, is optimal for the late arterial phase imaging. This phase is most helpful for assessment of hepatic arterial tree. The liver parenchyma showed a maximum enhancement at 48 s scan delay. This phase is optimal for assessment of hypovascular lesions like metastases from primary in the lung or colon.

Modified parameters for abdomen triple phase study

Scan Phase	Scan Delay	Pitch	Slice Thickness
Arterial phase	8 sec	1.2	5mm (recon-o.5 to 1mm)
Portal phase	23 sec	1.2	5mm (1mm)
Venous phase	48 sec	1.2	5mm (1mm)
Delayed phase	180sec	1.2	5mm (1mm)



Shows the different phases of triple phase study of Modified protocol .
A) Arterial Phase ,B)Portal phase,
C)Venous phase & D)Delayed phase

List of references:

1. Foley WD, Mallisee TA, Hohenwalter MD, Wilson CR, Quiroz FA, Taylor AJ. Multiphase hepatic CT with a multirow detector CT scanner. AJR Am J Roentgenol.
2. Bae KT. Peak contrast enhancement in CT and MR angiography: When does it Occurs and why? Pharmacokinetic study in a porcine model. Radiology
3. Bae KT, Heiken JP, Brink JA. Aortic and hepatic contrast medium enhancement at CT. Part II. Effect of reduced cardiac output in a porcine model. Radiology.
4. Kim T, Murakami T, Hori M, Takamura M, Takahashi S, Okada A, et al. Small Hyper vascular hepatocellular carcinomas revealed by double arterial phase CT Performed with single breath-hold scanning and automatic bolus tracking.
5. Heiken JP, Brink JA, McClennan BL, Sagel SS, Crowe TM, Gaines MV. Dynamic Incremental CT: Effect of volume and concentration of contrast material and Patient weight on hepatic enhancement. Radiology.
6. Awai K, Hiraishi K, Hori S. Effect of contrast material injection duration and rate on Aortic peak time and peak enhancement at dynamic CT involving injection protocol With dose tailored to patient weight. Radiology.
7. Megibow AJ, Jacob G, Heiken JP, Paulson EK, Hopper KD, Sica G, et al. Quantitative And qualitative evaluation of volume of low osmolality contrast medium needed for Routine helical abdominal CT.

International Radiography Day Celebrations by Radiographers Association of Maharashtra Nashik Unit at HCG Manavata Cancer Centre, Nashik

Dr.Vasantaro Pawar Medical College, Nashik

Disha Diagnostics, Nashik

International Radiography Day Celebrations at
Nizam's Institute of Medical Sciences, Hyderabad, Telangana

International Radiography Day Celebrations at JIPMER, Pudducherry

International Radiography Day Celebrations
Mahatma Gandhi Naturopathy Rural College, Umadi, Sangli, Maharashtra

International Radiography Day Celebrations at Taiz, Yamen

International Radiography Day Celebrations

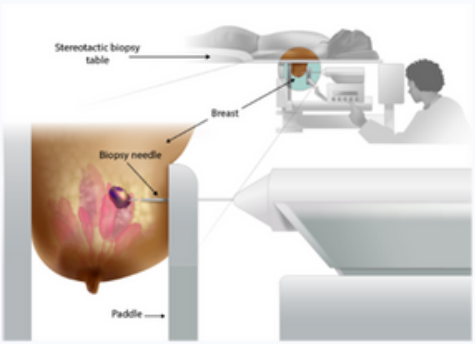
Dublin, Ireland

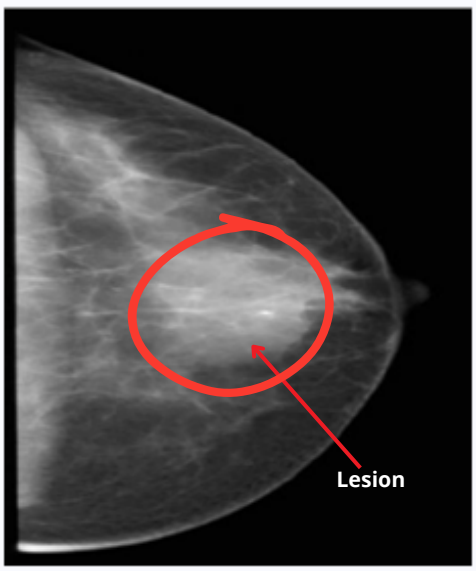
5C Network

Stereotactic Biopsy

Harshad P Naik, M.Sc. MIT, K.S. Hegde Medical Academy, Nitte Deemed to be University, Mangalore

The majority of mammographic detected questionable lesions are benign, and it is noticed that there is emerging interest among radiologist and patients in alternative to surgical biopsy for identifying these lesions. Stereotactic breast biopsy is an X-ray guided method for localising and quantifying breast lesions discovered on mammography, and considered to be suspicious for cancer. Its use in sampling small, non-palpable breast lesion using fine needle aspiration for cytology and, more recently, core needle biopsy for histology. Stereotactic biopsy have a sensitivity of 90-95 percent for cancer detection as compared to routine surgical breastbiopsy. Procedure is also quicker, cheaper and easier than standard practice of preoperative, mammographically guided localization followed by surgical biopsy. The first prone stereotactic table was acquired at the University of Chicago in US in 1986.It is used for suspicious non-palpable lesions identified on mammography or DBT but not visible on ultrasound.





Indications

- BI-RADS 5 (highly suggestive of malignancy)
- BI-RADS 4 (suspicious for malignancy) abnormalities.
- These include masses, architectural distortions, developing asymmetries and calcifications.
- Cancer Treatment planning, histological confirmation of BI-RADS 3 (Probably benign) lesions may be required in patients awaiting organ transplantation or women planning to become pregnant
- Absence of MRI-guided biopsy facility in a centre.
- Prior to breast conservation surgery for biopsy-proven impalpable lesions that require excision.

Contraindications

- Inability to visualize the target breast lesion at the time of biopsy is an absolute contraindication.
- Neuromuscular disorders such as Parkinson's disease may limit the capacity of the patient to lie still.
- Overweight patients, as most prone tables have a weight limit between 136 and 158 kg.
- Bleeding or clotting disorder

Stereotactic equipment

Can be carried out in 2 ways:

- A dedicated prone table with the patient lying prone
- Upright mammographic add-on system with the patient in a sitting or lateral decubitus position. An add-on stereotactic localization device can be fitted on the mammography machine prior to the biopsy which converts a standard mammography machine into a stereotactic biopsy unit. As the same machine is used for both mammography as well as biopsy, lesion visualization at the time of biopsy is good, as the resolution and quality of the image remains the same.

Patient carrier

The patient needs to be comfortable during the procedure as the procedure may take up to 15-30 min and to avoid movement-related complications. Dedicated stereotactic biopsy chairs are available which allow biopsies in the sitting up and decubitus positions. However, propping up the patient and supporting the back and arms is vital. If a prone table is being used, the patient should be comfortably positioned and good padding provided where required

Computer

This is the brain of the procedure which uses the concept of Stereotaxis and calculates the depth of the lesion. A 'scout' image is acquired at an angle of 0°.A +15° image and a −15° image (the stereo pair) are acquired next. The lesion shows an apparent movement between these projections referred to as 'parallax shift' and is calculated relative to the reference point. Basic trigonometry is applied to determine the X-, Y- and Z-axis of the lesion to be biopsied. This is calculated by a computer software using information from the markings done by the operator on the computer screen and mimics depth perception performed by the human brain

Biopsy equipment

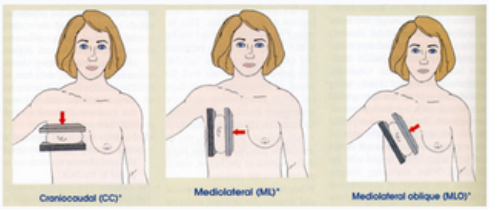
Core Biopsy (CB) or Vacuum Assisted Breast Biopsy (VABB) can be performed.

CB is equivalent to that of open surgical biopsies and is highly reproducible and reliable

VABB is directional and can acquire tissues up to 5 mm away from its own position, into the sampling chamber and cut it away from the surrounding tissue using vacuum action, compensating for subtle patient movements

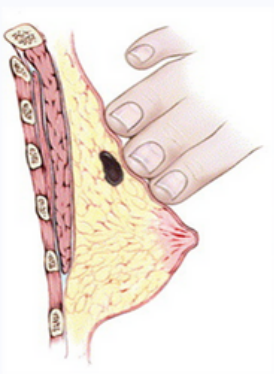
Planning

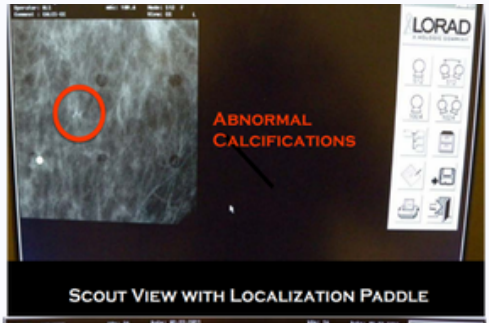
- CC, ML, LM or oblique views of breast can be used for the procedure.
- The biopsy approach could be vertical or lateral.
- The breast size, breast thickness upon compression, as well as the location of the lesion influence the approach.

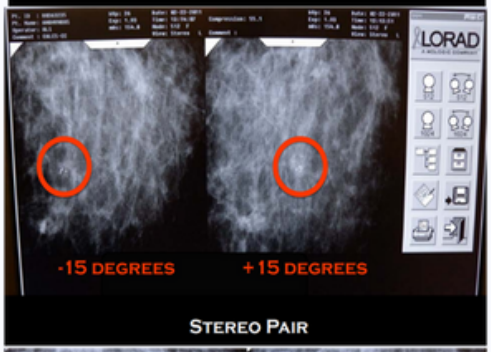


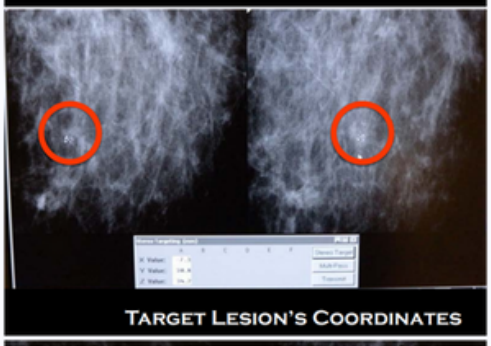
Procedure

- Position the pt. in such a way that that the target is at center of the compression paddle, confirmed by taking the 0°scout view.
- Stereo pair images are obtained by moving the X-ray tube and detector assembly +15° and −15° relative to the 0° position on the scout image
- The operator marks the center of the lesion on both stereo images on the monitor.
- The X, Y and Z co-ordinates of the lesion are calculated by the computer
- The operator cleans the skin and injects 2% lignocaine (for CB) ± epinephrine (For VABB)
- A 2 mm skin incision is made for a CB, the needle is inserted and pre-fire and post-fire check images are taken to confirm optimum needle position
- For VABB, a 4 mm incision is made and firing may not be required and hence, a single set of check images may be acquired6-12 samples are obtained









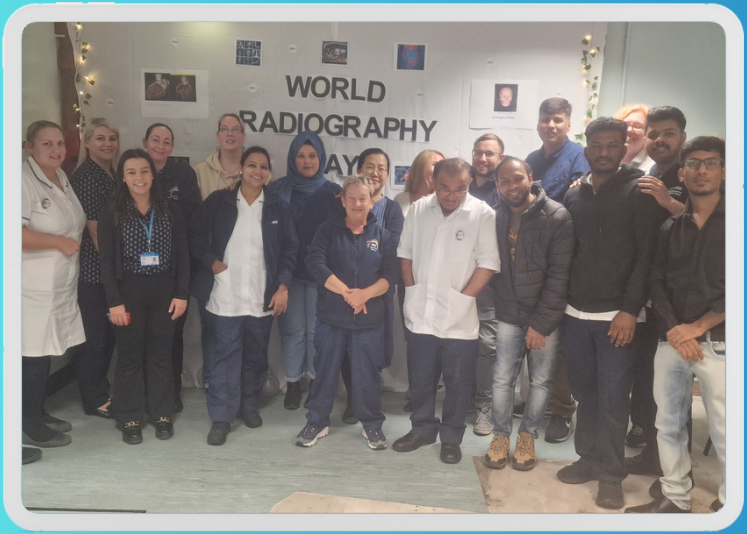
Refrences

- Stereotactic breast biopsy: A review & applicability in the Indian context by Suma Chakrabarti Indian J Med Res 154, August 2021, pp 237-247 DOI: 10.4103/ijmr.IJMR_1815_20
- STEREOTACTIC BREAST BIOPSY A review by CA cancer j Clin 1994 May
- Digital Breast Tomosynthesis: an Overview. Review article by Ekta Dhamija et al Indian Journal of Surgical Oncology https://doi.org/10.1007/s13193-021-01310-y

International Radiography Day Celebrations
All India Institute of Medical Sciences, New Delhi

International Radiography Day Celebrations at Shantiniketan College, Sangli, Maharashtra

International Radiography Day Celebrations
United Lincolnshire Hospital Trust, CT Suite, Pilgrim Hospital, Boston, USA



International Radiography Day Celebrations at Bharat College of Paramedical Allied Health Sciences, Kottayam, Kerala

International Radiography Day Celebrations Rayat Bahra University, Sahauran, Kharar, Punjab

International Radiography Day Celebrations - Lilavati Hospital & Research Center, Mumbai

International Radiography Day Celebrations - Topiwala National Medical College & B. Y. L. Nair Charitable Hospital

International Radiography Day Celebrations Grant Medical College and Sir Jamshedjee Jeejeebhoy Group of Hospitals, Mumbai

Recent Advancements in Pre-Patient Filters in Spectral Shaping Computed Tomography to Reduce the Radiation Dose

Abhijith S, M.Sc. MIT, K.S. Hegde Medical Academy, Nitte Deemed to be University, Mangalore

Introduction

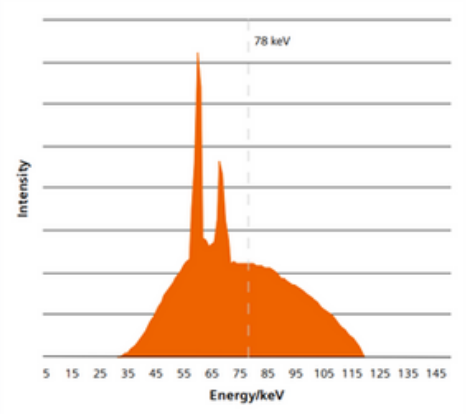
Computed tomography(CT) is the most accurate and rapid diagnostic tool for most pathologic conditions. With the recent advancements in helical multi-detector CT, achieving the most accurate diagnostic information with minimum scan time is possible. Since CT uses ionizing radiation to obtain the image, it is important to reduce the radiation dose as possible for patients. There are various dose reduction techniques in CT, one such technique is pre-patient radiation filtration. In this article, recent advancements in pre-patient filtrations are discussed.

CT filter

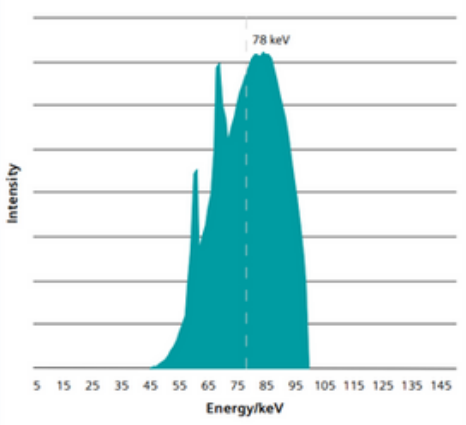
Since the X-Ray beam used is polychromatic, filtering out the low-energy photons is very important to reduce the patient dose. Widely used filter materials are Al (aluminum), and Cu(copper) to filter out the low-energy photons. As compared to conventional X-Ray, CT possesses another problem called beam hardening artefact. This means the mean energy of the X-Ray spectrum increases as it passes through the object. This is avoided by using a bow tie filter. This is the basic type of filter used mostly in all CT scanners. In addition, there is also a theory that the materials between atomic numbers 40 to 83 provide adequate filtration for the diagnostic range. The materials that reach the requirement for filter material and adequate filtration are Sn(tin) and Au(gold).

Tin filtration (k-edge)

There will be an abrupt increase in characteristic absorption of the radiation just above the K-edge of the filter material. Tin (Sn) has an atomic number of 50 and its K-edge is 29.2 keV. The k-alpha and k-beta of the target tungsten are approximately 60 and 70 keV respectively. Tin filter eliminates the photons at a range of 30 – 40 keV causing significantly increased filtration and also reduced noise as compared to conventional filters used.The mean energy of the spectrum increases thereby reducing the beam hardening artefact.The use of this with traditional filters reduces the patient dose maintaining the image quality at the diagnostic range.



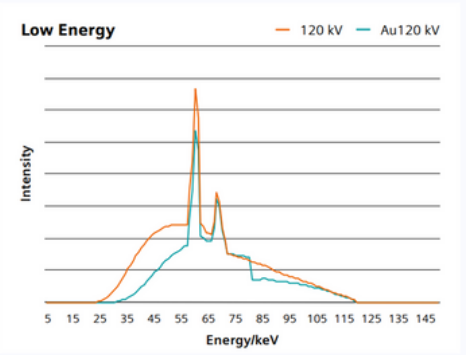
a) 120 kV spectrum with conventional



b) 100 kV spectrum with tin+convetional

Gold as a filter:

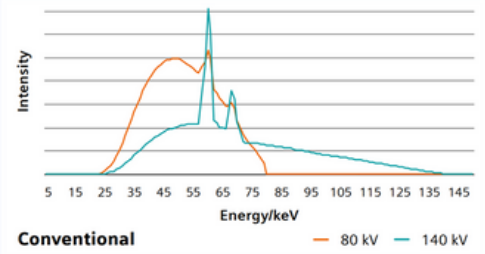
The atomic number of gold is 79 and the K-edge is 80.72 keV. This abruptly filters the photons at just above its K-edge, which means approximately at and above 81 keV. This filtration decreases the mean energy of the spectrum. This also provides a good-quality image with a significantly lower patient dose.

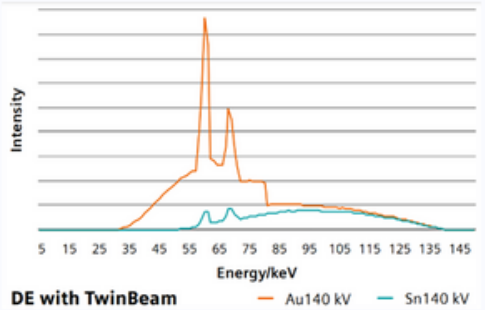


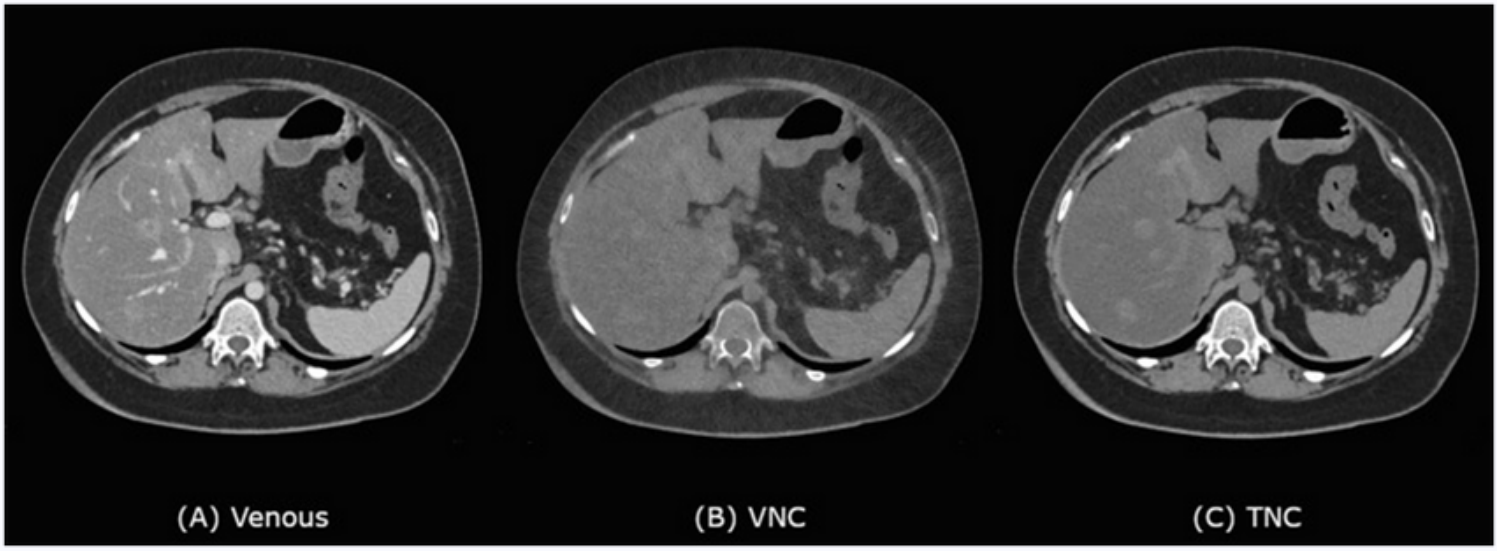
120 kV spectrum (conventional filter) with and without gold filter

Spectral CT imaging

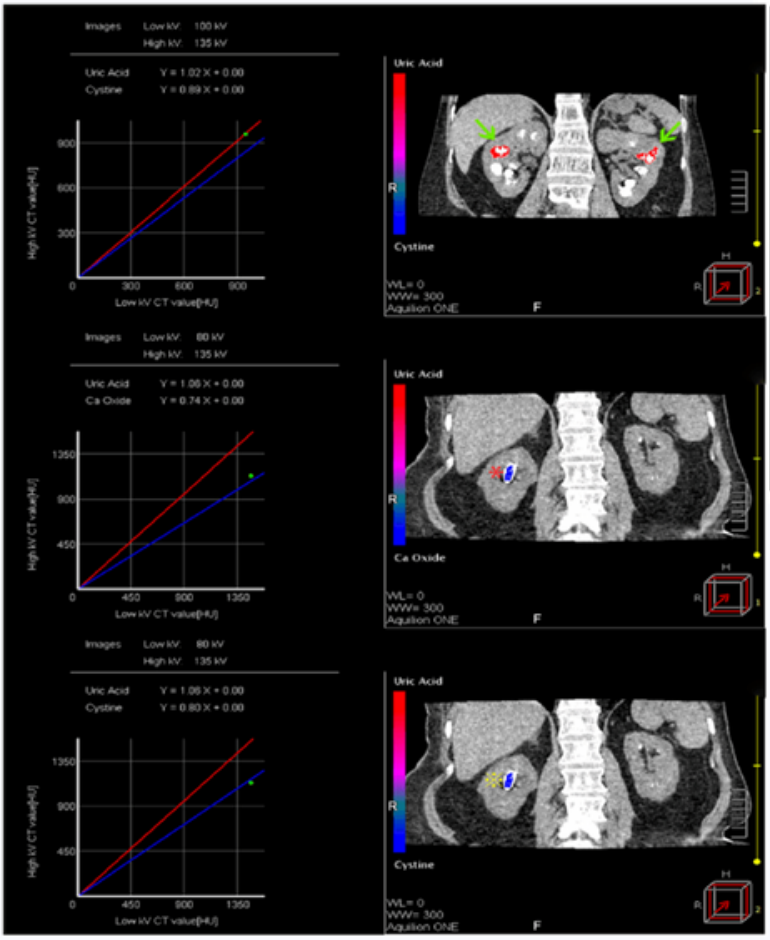
This is imaging of the object with two different energy spectra of X-ray. This helps in the decomposition of the material by their different X-ray absorption property at different energy levels. This is the most recent advancement in CT where this is achieved in many ways by various vendors. By Siemens Healthneers this is achieved by using two different K-edge filters at each source in a dual-source CT scanner. Above mentioned two filters, where the tin (Sn)filter increases the mean energy of the spectrum by filtering the low energy photons above its K-edge (29.2keV) and Gold (Au) decreases the mean energy of the spectrum by filtering the photons above its K-edge (80.72 keV). These two combinations give two different spectra with different mean energy. This makes it possible to image the object on a dual-energy basis. Currently applied in various applications such as metal artefact reduction, virtual non-contrast imaging, urinary stone classification etc.



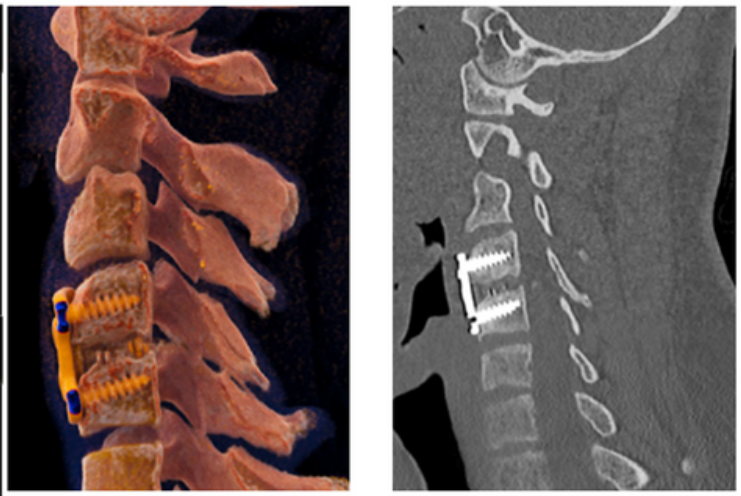




Virtual non contrast image generated by DECT with true noncontrast CT image



Urinary calculi characterisation



Sn 140 kV C-spine CT with lesser radiation dose and reduced metal artefact

References:

- https://marketing.webassets.siemens-healthineers.com/1800000006857523/27030c03dfe2/siemens-healthineers-ct-technologies-and-innovations-tin-filter-whitepaper_v2_1800000006857523.pdf
- https://www.sciencedirect.com/science/article/pii/S2211568420300036
- https://physics.stackexchange.com/questions/402910/k-alpha-and-k-beta-which-one-has-more-energy
- https://www.researchgate.net/figure/Shows-the-different-compositions-of-kidney-stones-in-the-DECT-scan-The-green-arrows_fig1_334585838

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

SIRCME Kollam 2023 & World Radiography Day Celebrations

International Radiography Day Celebrations - Mathuradas Mathur Hospital, Jodhpur, Rajasthan

International Radiography Day Celebrations
Sikkim Manipal Institute of Medical Sciences and Central Referral Hospital, Sikkim Manipal University.

Radiography books donation to Swami Vivekananda Junior College and personal diary distribution to the Students on the occasion International Radiography Day

World Radiography Day Celebrations by Society of Radiological Technologists Srilanka

Invitation

National Conference on Integrating Science& Practice Enhancing

SCIENTIFIC SESSION

1. Radiation Regulation and Safety in Computed Tomography
2. Advanced Imaging Modalities in Trauma Cases : CT and MRI Applications
3. Latest Technological Advancement in Neuro Radiography: 3D Imaging and Beyond
4. Radiographic Patterns in Trauma : A Multidisciplinary Approach to Diagnosis
5. Minimizing Occupational Radiation Exposure in Radiology

Abstract Submission Guidelines for Oral Presentation:

- Medium of Presentation- English
- We accept only individual participation
- Only selected pappers allowed for presentations
- Format: Font: Times New Roman; Font Size: 12
- Abstract must include Title, Author's Name, Department, Institution/University and Contact Number/Email ID
- Abstracts should not exceed more than 300 words
- The deadline for abstract submission is on or before 20.11.2023
- Abstract acceptance will be notified by email on or before 21.11.2023

Send the abstract to mail id: ispentr@gmail.com (Mention your Registration ID)

Guidelines for Poster Presentation:

- Medium of Presentation-English
- Only Two Authors are Permitted
- Poster Size: A0 Size (33"x46") (84cm x118 cm)

REGISTRATION FEE

Category	Fee
Faculty / Technologist	Rs.700/-
Student	Rs.500/-

Registration Includes Conference Kit, Proceedings, Certificate, Food, and Refreshments.

ACCOUNT DETAILS

BHIM

Account Name	School of Allied Health Sceinces
Account No	279201001054
Branch	VEERAPANDI
IFSC	ICIC0002792

SIR (TN & PY) OFFICE BEARERS AND EC MEMBERS

Mr.K.Munirathinam Founder President	Mr.C.Marimuthu General Secretary	Mr.M.Saravanakumar Organizing Secretary
Mr.K.Somasekar Treasurer	Mr.J.Arumugam Working President, Tamilnadu	Mr.R.Shanmugam Working President, Puducherry
Mr.G.Jayapandian Vice President, Chennai	Dr.S.Tamilselvan Vice President, Puducherry	Mr.R.Raja Vice President, Trichy
Mr.K.P.Udayakumar North Zonal President, Chennai	Mr.N.Poovalingam West Zonal President, Coimbatore	Mr.V.Rajamanickam Central Zonal President, Trichy
Mr.P.Sheik Mydeen South Zonal President	Mr.Murugesh.E Joint Secretary, Chennai	Mrs.Mahalakshmi Joint Secretary, Chennai
Mr.R.Kannan Joint Secretary, Puducherry	Mr.J.Ravichandran Asst. Secretary	Mr.V.G.Bijukrishnan Asst. Treasurer

ADVISORY COMMITTEE

Mr.K.Venkatakrishnan Chennai	Mr.E.Ranganathan Chennai	Mr.M.Kesavalu Chennai
Mr.Saleem Basha Pudukottai	Mr.K.S.Vijaya Kumar Vellore	

EC MEMBERS

Mr.R.Vijayaragavan Trichy	Mr.Cyril Francies Chennai	Mr.Thulasi Das Chennai
Mr.Janarthanam Chennai	Mr.Saravanan Madurai	Mr.Pothigaiselvan Madurai
Mrs.Akila Chennai	Mr.Suresh Kumar Puducherry	Mr.Nakkeeran Puducherry
Mr.Agathiar Puducherry	Mr.Dhayalan Puducherry	

SCIENTIFIC COMMITTEE

Mr.C.Marimuthu General Secretary	Dr.S.Tamilselvan Vice President	Mr.E.Murugesh Joint Secretary
Mr.M.Saravanakumar Organizing Secretary	Mrs.V.Kalaivani Professor, SAHS, VMRF (DU), Salem	

ORGANIZING COMMITTEE

Chief Patrons

Mrs.Annapoorani Shanmugasundaram
Trustee, VMRF-DU

Hon'ble Dr.A.S.Ganesan
Chancellor,VMRF-DU,Salem

Hon'ble Dr.Anuradha Ganesan
Vice President,VMRF-DU

Patrons

Prof.Dr.P.K.Sudhir
Vice Chancellor, VMRF-DU

Prof.Dr.J.Sabarinathan
Pro Vice Chancellor, VMRF-DU

Prof.Dr.A.Nagappan
Registrar, VMRF-DU

ORGANIZING CHAIRPERSON

Prof.Dr.B. Sendilkumar
Dean - AHS
VMRF-DU, Salem

Mr.K.Munirathinam
Co Chairman, S.I.R. President, S.I.R. TNPY
Chief X-Ray Technologist (Rtd), Chennai

ORGANIZING SECRETARY

Prof.V.Kalaivani SAHS,VMRF-DU, Salem

ORGANIZING MEMBERS

Mr.S.Antony Ruban Assistant Professor - SAHS, VMRF-DU, Salem
Ms.A.Sakeena Assistant Professor - SAHS, VMRF-DU, Salem
Ms K. Jaswanthini Assistant Professor - SAHS, VMRF-DU, Salem
Mr.E.Karthik Raja Assistant Professor - SAHS, VMRF-DU, Salem
Ms.S.Chitra Assistant Professor - SAHS, VMRF-DU, Salem

CONTACT INFORMATION

Prof.V.Kalaivani - 9787912702 Mr.S.Antony Ruban - 9677674757
Mr.E.Karthik Raja - 9965066025

International Radiography Day Celebrations at Mother Theresa PG and Research Institute of Health Sciences, Puducherry

International Radiography Day Celebrations at Dr. Jeyasekharan Medical Trust, Nagercoil, Kanyakumari, Tamilnadu

Bolus

Anupama. L, Tutor -Radiotherapy Technology, RR Institute of Medical Sciences- Bangalore

Introduction:
It is a tissue-equivalent material (material which has the property equivalent to the tissue). Bolus in radiotherapy means a soft material placed over the body.

About it:
To treat lesions on or close to the skin surface, bolus material can be placed over the skin region undergoing RT to increase radiation dosage at the skin surface. The bolus material can be a soft, rubbery tissue equivalent material placed in direct contact with the patient's skin surface.

Bolus is used to either increase the surface dose or to reduce unwanted deep penetration. Sometimes bolus is only used when there is a risk of microscopic residual disease on the skin. It is usually used to ensure 100% dose at the surface.

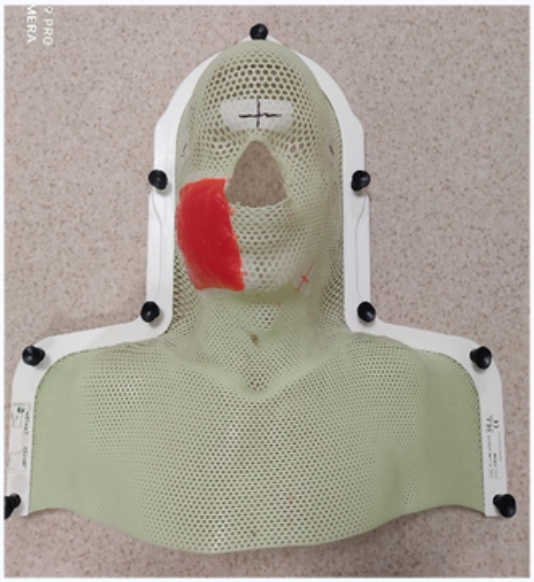
Bolus should always extend beyond the field edge so as to avoid a sharp gradient and variation in bolus thickness should be gradual.

It is also used to modify the treatment depth if limited range of electron energy is available. Based on the energy of the photon used the thickness of the bolus material varies.

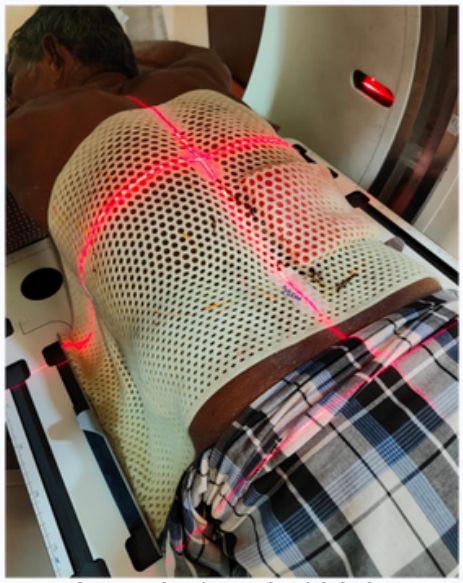
The bolus material increases the radiation dosage to the patient by providing scattering of the beam and build-up of the radiation dose prior to the beam's entry into the skin. As a result, the radiation beam deposits the maximum radiation dosage at or near the skin surface, rather than penetrating the skin and delivering the maximum dosage several cm's below the skin surface, as the radiation beam would normally do.

There are different types of bolus:

Material	Trade Name
Gels	Super flab
Moldable boluses	Super stuff, Aquaplast
Waxes	Paraffin wax



Thermoplastic mask (H&N) with bolus



Thermoplastic mask with bolus during CT simulation

Chest wall irradiation with bolus

1cm superflab bolus

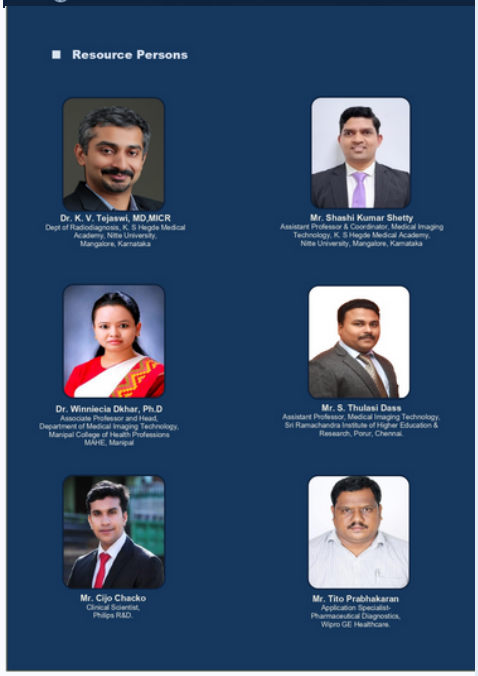
Conclusion:
PROS: Desired amount of dose can be achieved in the surface area.
CONS: Skin sparing effect cannot be achieved resulting in poor cosmesis.
It will increase the skin reaction significantly.

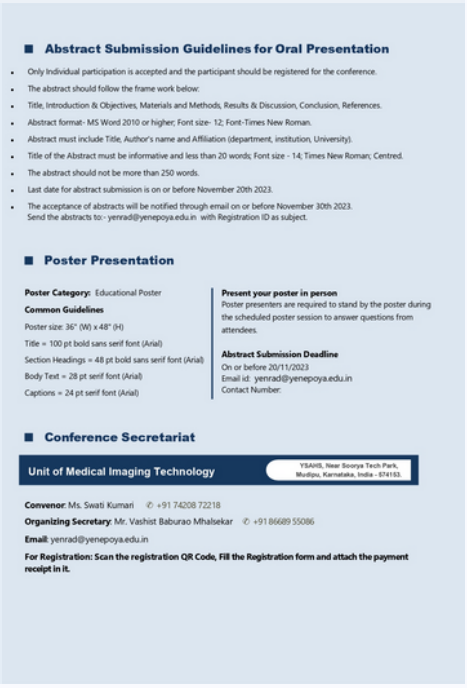
International Radiography Day Celebrations at P. D. Hinduja National Hospital and Medical Research Centre, Mahim, Mumbai

International Radiography Day Celebrations - KIMS Medical College Hubballi, Karnataka

International Radiography Day Celebrations - Civil Hospital, Honnavar, Karnataka

Invitation
YENRAD'23 - National Level Medical Imaging Conference at Mangalore





Be a Good Reader

Got the issue of the magazine, downloaded it, read it and deleted it. Only this does not prove you a good reader. You can agree with or add to the content published in the magazine, so in such cases please write us your comment or feedback. Similarly, debate openly on the issues rose in the magazine and the questions raised and send it to us in writing. With this act of yours, where other readers will be benefited; we will also get guidance in various forms. So, whenever the time demands, do not forget to pick up the pen.

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

International Radiography Day Celebrations at IIT Bombay Hospital, Powai, Mumbai




International Radiography Day Celebrations at Inlaks & Budhrani, Pune

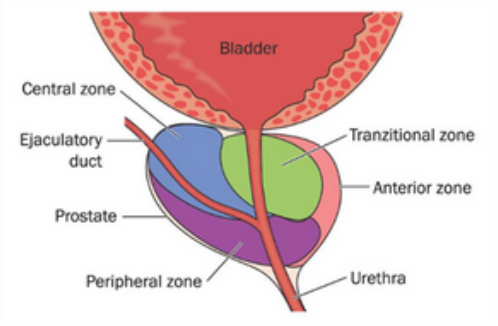


The value of diagnostic imaging in Benign Prostatic Hyperplasia.

Tancia Pires, M.Sc. MIT, K.S. Hegde Medical Academy, Nitte Deemed to be University, Mangalore

Introduction

Prostate, the walnut shaped organ is a part of the male reproductive system and is involved in the formation of alkaline semen that carries the male gamete. Enlargement of this organ or Benign Prostatic Hyperplasia (BPH) has been one of the most frequent diagnoses leading to urology referral. The growth of BPH likely begins before a man reaches age 30, with approximately 8% of men having histologic evidence of BPH by 40 years of age. Nearly 80% of men develop BPH, and as many as 30% receive treatment for this condition during their lifetime. Thus, the burden of BPH on the health care system, with respect to monetary expenditure and resource use, is substantial.



Zonal anatomy of the Prostate Gland. Courtesy:
https://atlanticurologyclinics.com/conditions/prostatitis-infection-of-the-prostate/

Symptomology

Along with the enlargement in the size of the prostate greater than 25 ml, decrease in the urinary flow rateis commonly seen due to impingement of the urethra that runs through the gland. These patients also demonstrate a high postvoid residual volume. The risk of acute urinary retention is also seen.

Severe complications of BPH include urinary retention, hydronephrosis, hydroureter, recurrent urinary tract infections, bladder calculi, recurrent gross hematuria, and ultimately, renal insufficiency. However, these are rare and occur only in severe enlargement. These data suggest that prostate size may be a factor in determining which patients with BPH will develop what kind of complications. Hence measuring the volume through imaging and correlating with clinical symptoms becomes an essential aspect in treating BPH effectively.

Imaging Modalities aiding in diagnosis

1. Plain X-ray

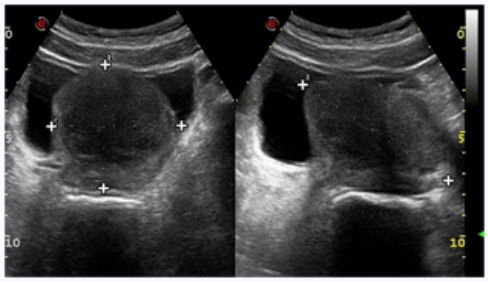
Plain radiographs have limited prostate evaluation utility but are rarely used as a skeletal survey to assess or follow metastases. However, traditionally, performing IVU was considered useful prior to initiation of the treatment for BPH. Potential benefits of upper urinary tract imaging with IVU in these patients include: determination of the presence and degree of upper urinary tract obstruction (hydronephrosis); estimation of renal function; evaluation of the bladder and prostate; detection of incidental upper tract (renal or ureteral) malignancies or stones; and medicolegal safety.

2. CT Scan

CT scan is not typically done for diagnosis, but BPH is identified when the prostate extends above the pubic symphysis on axial imaging. BPH can also be diagnosed on a CT scan with a volume greater than 30 ml (measured with the help of coronal reformate images).When compared with ultrasound and MR imaging, CT has a limited ability to define intraprostatic zonal anatomy although CT can define the relationships between the prostate and other pelvic organs, its value in the diagnosis and management of patients with BPH is limited.

3. Ultrasound

Ultrasonography of the prostate can be performed via a transabdominal, transrectal, or transurethral approach. Among these techniques, the transrectal approach is preferred by most physicians. Transurethral approach isn't utilized due to its invasiveness. Prostate length is measured in the sagittal plane, width and height are measured in the transverse plane. Prostate volume is then given by the formula: length × width × height × π/6. The average normal measurements are 3.75 to 4.00 × 2.5 to 3.00 × 3.1 to 3.8 cm (width x height x length) with a volume of 20 to 25 ml. Viewing the prostate in more than two dimensions is important diagnostically because it greatly facilitates precise localization of a suspicious area for biopsy. The normal prostate of the young adult male is composed of homogeneous, low-level echoes, with the central and peripheral zone showing uniformly hyperechoic appearance. In men with BPH, the central gland typically appears as hypoechoic when compared with the peripheral portions of the gland, and as BPH develops, the peripheral gland becomes compressed and distorted and hyperplasia may be identified as a single, focal nodule or as multiple nodules within the transition zone.



Prostatic Volume measurement on USG. Courtesy:
https://radiopaedia.org/cases/34645/studies/36045?lang=us

4. MRI

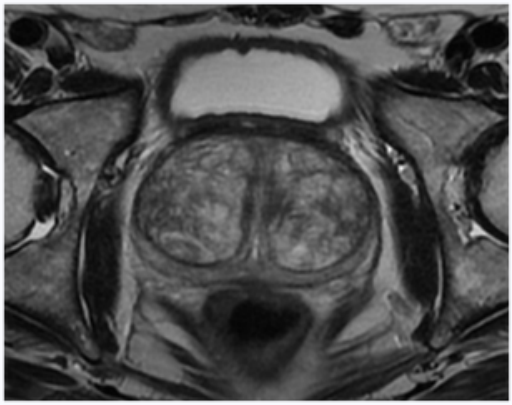
More than any other imaging modality, MR imaging accurately depicts internal prostatic zonal anatomy and displays the physiologic complexity of the gland.

Besides diagnosing BPH, MRI plays an important role in identifying carcinoma when a patient with BPH has increased PSA and suspicious or at high risk for developing prostate cancer. However, the presence of benign prostatic hyperplasia (BPH)

within the Transitional Zone of the prostate, can often mask or mimic malignancy. Hence multi-parametric MRI imaging proves to be essential for the correct diagnosis. This includes, routine T2 Weighted imaging (T2W), Diffusion studies (DWI) and Dynamic Contrast Enhanced (DCE) Examinations.

On T2Wimaging, using anatomic characteristics such as shape, structure, and growth pattern have given accurate differential diagnosis. Features such as homogeneous hypo intensity on T2W imaging, ill-defined margins, and lenticular shape have been shown to be specific for TZ cancers. Furthermore, the most recent PI-RADS classification has defined T2W imaging as the dominant pulse sequence for identifying TZ cancers.

It has been shown that DWI in addition to T2W imaging can improve cancer detection in the TZ across readers with varying expertise, However, other researchers opined that DWI has no additional value while using lower b values. More research in this would be required to comment upon this controversy. A similar contradictory scenario has been identified in case of DCE- MRI in the differentiation of BPH and Prostatic Malignancy as the enhancement patterns in some variants of BPH are similar to those seen in malignant lesions.



Axial T2W image showing enlarged transition zone with heterogeneous signal intensity.
Courtesy: https://radiopaedia.org/articles/benign-prostatic-hyperplasia

5. Newer Trends in MRI

New technologic developments, such as the endorectal coil and 3D H-1 MR spectroscopic imaging of the prostate, are currently being tested in patients with prostatic disease. The endorectal coil provides more detailed anatomic information than the body coil and allows for better visualization of the neurovascular bundle. Such technology may lead to improved local staging of patients with prostate cancer. MR spectroscopic imaging of the prostate may allow for the detection of biochemical differences between BPH and prostate cancer where significantly higher choline levels and significantly lower citrate levels are observed in regions of cancer when compared with normal peripheral zone and BPH.

References:

Grossfeld GD, Coakley FV. Benign prostatic hyperplasia: clinical overview and value of diagnostic imaging. Radiol Clin North Am. 2000 Jan;38(1):31-47. doi: 10.1016/s0033-8389(05)70148-2. PMID: 10664665.

Banker H, Selvarajan SK. Prostate Imaging. [Updated 2023 Jan 16]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK567721/

Elbuluk O, Muradyan N, Shih J et al. Differentiating Transition Zone Cancers From Benign Prostatic Hyperplasia by Quantitative Multiparametric Magnetic Resonance Imaging. J Comput Assist Tomogr. 2016 Mar-Apr;40(2):218-24. doi: 10.1097/RCT.0000000000000353. PMID: 26760185;

International Radiography Day Celebrations

Tata Memorial Hospital, Mumbai

Advanced Centre for Treatment Research and Education in Cancer, Khargar, Navi Mumbai

Homi Bhabha Cancer Hospital (HBCH)
TMC Sangrur, Punjab

HBCH and MPMMCC
TMC Varanasi, UttarPradesh

Homi Bhabha Cancer Hospital
TMC Varanasi, UttarPradesh

International Radiography Day Celebrations by M P Radiographers Association

दैनिक भास्कर

इंदौर 09-11-2023

परिचर्चा • विश्व रेडियोग्राफी दिवस पर हुए कार्यक्रम में रेडियोग्राफरों ने दिए कई सुझाव

रेडियोग्राफर को पढ़ाने ट्यूटर, लेक्चरर जैसी पोस्ट भी हो

भास्कर संवाददाता | इंदौर

जर्मन वैज्ञानिक विलहेल्म कोनार्ड रॉंजन ने 8 नवंबर 1895 को एक्स-रे का आविष्कार किया था। इसी उपलक्ष्य में हर वर्ष 8 नवंबर को विश्व रेडियोग्राफी दिवस मनाया जाता है। इस अवसर पर शासकीय कैंसर हॉस्पिटल में एक परिचर्चा आयोजित की गई, जिसका शुभारंभ अस्पताल अधीक्षक डॉ. रमेश आर्य ने किया। उन्होंने कहा- रेडियोलॉजी ब्रांच चिकित्सा जगत की सबसे महत्वपूर्ण ब्रांच है। डॉ. प्रीति जैन ने कहा- पहले मेमोग्राफी, महिलाओं के एक्स-रे करने में मुश्किल आती थी, लेकिन अब नहीं। डॉ. ओपी गुर्जर, एमआरआई टेक्नोलॉजिस्ट गोकरण चतुर्वेदी, मानसिंग चौधरी, विनोद तिवारी, शरद जैन आदि का स्वागत किया गया। एमवायएच के रेडियोग्राफर अजय सोनी ने कहा- रेडियोग्राफर को पढ़ाने के लिए ट्यूटर, लेक्चरर जैसी पोस्ट निर्मित होना चाहिए।

रेडियोग्राफी में भी हो एमएससी : अध्यक्ष शिवाकांत वाजपेयी ने बताया अन्य प्रदेशों

में रेडियोग्राफी में पीएचडी हो रही। हमारे यहां तो एमएससी भी नहीं होता, जो अत्यंत आवश्यक है। कार्यक्रम में अन्य अस्पतालों से अंचल सिसौदिया, वीरेंद्र कश्यप, महू से एस. सुनहरे, चाचा नेहरू से प्रवीण जैन उपस्थित थे। आभार दीपक शर्मा ने माना।

International Radiography Day Celebrations

Vishal Daignostic, Jalgaon, Maharashtra

Universal 3T MRI, Jalgaon, Maharashtra

Shri Saibaba Hospital Shiridi, Maharashtra

IGM Muncipal Hospital, Shirpur, Dhule, Maharashtra

National Cancer Institute, Nagpur., Maharashtra

International Radiography Day Celebrations

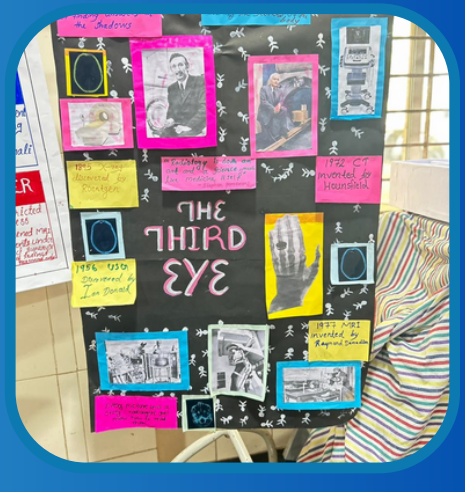
Bhatia Hospital
Grant Road , Mumbai.

Pandit Madan Mohan Malviya Shatabdi Rugnalaya
Govandi, Mumbai

K B Bhabha Hospital, Mumbai

Zydus Hospitals, Anand, Gujarat

K. Munirathinam, Chennai



EMS Co-operative Hospital,
Perinthalmanna, Kerala

Calibration Laboratory

For Radiation Monitoring Instruments & Dose Calibrators

India's first and only comprehensive calibration facility for any brand of Radiation Survey meter, Contamination Monitor, Pocket Dosimeter, Area Zone Monitor and Radioisotope Dose Calibrator.

We are recognized by Atomic Energy Regulatory Board (AERB) and Accredited by N.A.B.L.

We offer complete solution for service, repairs and recalibration for any brand or type of RMIs and Dose Calibrators. We are specialized and factory trained and have the required infrastructure to repair Pressurised Ion Chamber Survey Meters.

NABL ACCREDITED
Certificate No. CC-1027

Salient Features:

- Calibration reminder services
- Pickup and drop facility for RMIs
- Routine turnaround recalibration time is 5-6 days from any part of country
- Before sending the instrument, please make sure about the working condition, to avoid delays
- Calibration Validity: Two Years
- ISO9001:2015 Certified
- ISO/IEC 17025 Certified

Radimage Healthcare India Pvt. Ltd.
(An ISO 9001 : 2015 Certified Company)
G-236, Sector-63, Noida - 201 303 (INDIA)
Telefax: +91 120 4263270, 2406096, 2406097
• www.radimageindia.com • radimagehealthcare@gmail.com
(A Meditronix Corporation Group Company)

Design to Print #9250671670

International Radiography Day Celebrations

Poona Hospital And Research Centre, Pune

Global Hospital and Research Center, Ravet, Pune

Unicare Hospital, Chakan, Pune

Renukadevi X-ray Centre, Latur, Maharashtra

Niramay Hospital, Chinchwad, Pune, Maharashtra

International Radiography Day Celebrations

Nizar Hospital, Valanchery, Kerala

Aster MIMS, Kottakkal, Kerala

Travancore Medicity, Kollam, Kerala

Valiyath Hospital, Karunagapally, Kollam, Kerala

Mar Sleeva Medicity Pala, Kottayam , Kerala

Zero TE MRI

Apurva Dessai, M.Sc. MIT, K.S. Hegde Medical Academy, Nitte Deemed to be University, Mangalore

Introduction

Many people undergo CT examinations per year for many reasons. CT remains the first modality for many indications, such as acute screening and cortical bone assessment, especially for children. As we know, radiation exposure has many adverse effects and has always remained a great concern. These effects are primarily seen in children due to the increased sensitivity of the developing tissues or organs etc.(1)

Solid bone structures are challenging to see in MRI due to low proton density and short signal lifetimes. Conventional gradient echo or spin echo pulse sequences with echo times (TE) in the millisecond range are generally too slow for meaningful bone signal detection.(2)To overcome this problem, a new technique called zero TE is introduced in the MRI. Zero TE MR imaging is a novel technique that achieves a near-zero-time interval between radiofrequency excitation and data acquisition, enabling visualization of short-T2 materials such as cortical bone, meninges, tendons, etc.(1,3)

This ZTE sequence is applied at the readout period soon after applying the RF pulse. It is a sequence that gives a high-resolution image, and also, it is fast, silent and avoids the artifacts which occur due to the patient's movement. This technique is used in craniofacial, temporal bone, jaw, and spine because of its ultra-shot TE. Image acquisition in ZTE needs high-performance coils with rapid transmit/ receive switching capabilities and make use of center-out K-space encoding.(1–3)

It can also be used in lung imaging; it is very difficult to image the lung by using MRI as there isa presence of the lung and cardiac motion. To avoid motion artifacts, image data are acquired at a defined phase of the respiratory cycle, typically in the end-expiratory phase.(4)

Image acquisition

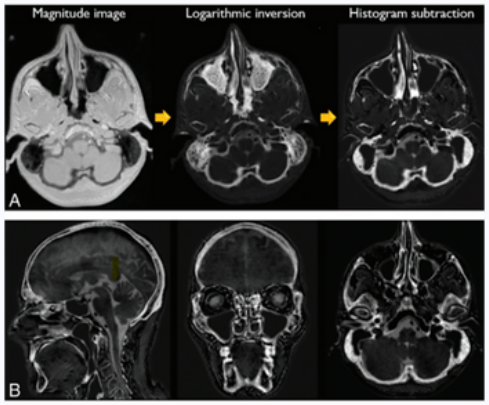
The readout gradient is switched during the RF pulse application, precluding slab selection. For the acquisition of high-bandwidth excitation with a short-duration hard pulse, ensure that the excitation is equally distributed and as consistent as possible across the entire FOV from the application of the excitation pulse continuously.(1,2,5)The RF pulse is immediately followed by the 3D data acquisition. This uses the gradients, which are continuously modulated between repetitions, to sample the data along the radial trajectories in k-space instead of quickly turning it on and off.(1)

As there is a reduction in mechanical vibration, it reduces the noise. But for the radial filling technique, a greater number of TRs are required as compared to the 3D cartesian filling. But the scan time is reduced by applying short TRs and small flip angles for quasi-steady-state magnetization. A major part of the scan time is used in data acquisition, and less time is kept between the RF pulse and a single gradient step. (1,3)This helps in isotropic scanning avoiding the artifacts caused by the motion. Low flip angles and scanner safety measures counter the RF pulse duration, increasing the concern related to high SAR values. (1)

Image post processing

Raw images show signal void compared to the surrounding soft tissues, known as the "black-bone display." To improve the bone-air differentiation and generate a "bright bone display," which appears similar to the CT images. The black-bone images, also called magnitude images, undergo signal intensity correction section by section and normalize the mean soft-tissue signal within each section. Multiresolution ROI-based intensity correction was then applied to account for residual signal intensity variations and thus reduce overall image noise.(1,3)

Logarithmic inversion of the intensity-corrected data yielded preliminary bright-bone images without optimal bone-air delineation. An intensity histogram was generated, and an intensity mask was selected to remove the peak signal of air, generating the final pseudo-CT image and enabling the generation of 3D volume renderings at a separate workstation. (1,2)



ZTE image display. A- raw magnitude black-bone images underwent signal intensity correction on a section-by-section basis with normalization to mean soft-tissue signal. Multi-resolution ROI-based correction was then applied to account for residual signal intensity variations. Logarithmic inversion of the intensity-corrected data yielded bright bone images. Histogram subtraction was used to identify and mask the peak signal of air, thus generating the final pseudo-CT image. B- sample sagittal, coronal, and axial reformats of pseudo-CT reconstruction.

Discussion

Using the ZTE sequence made it easy to perform bone imaging in small clinical case series and ex-vivo studies of the cranial vault, face, jaw, and spine. The MRI provides superior soft-tissue detail and combination with ZTE bone sequence, gives a highly efficient and radiation-free evaluation in many pediatric neuroimaging, head/neck imaging, and musculoskeletal imaging. (1) It is proven that skull properties extracted from ZTE images were equivalent to those obtained on CT images. (5) Inversion recovery techniques can also yield T1-weighted ZTE images useful for assessing brain and spinal cord myelination, tumor and pituitary imaging, vessels, and airway.

Physician awareness, scanner and hardware compatibility, vendor sequence availability, clinical workflow, and image postprocessing and analysis are the limitations of using the ZTE sequence. (1) The method might also be of interest for musculoskeletal applications and the detection of traumatic injuries. (2). The other use of the ZTE sequence for PET/MR imaging would be lung visualization to improve the estimation of parenchyma attenuation and the detection of local coils. (3) The skull features conventionally estimated from CT images were accurately replicated with ZTE MR images. (5)

Conclusion

ZTE is a technique that provides radiation-free imaging with rapid, high-resolution, silent, and artifact-resistant properties equivalent to CT images. It can be combined with PET/MR imaging to appropriately depict lung morphology, which is of key importance for oncology applications.

References

1. Lu A, Gorny KR, Ho ML. Zero TE MRI for craniofacial bone imaging. American Journal of Neuroradiology. 2019;40(9):1562–6.
2. Wiesinger F, Sacolick LI, Menini A, Kaushik SS, Ahn S, Veit-Haibach P, et al. Zero TE MR bone imaging in the head. MagnReson Med. 2016 Jan 1;75(1):107–14.
3. Delso G, Wiesinger F, Sacolick LI, Kaushik SS, Shanbhag DD, Hüllner M, et al. Clinical evaluation of zero-echo-time MR imaging for the segmentation of the skull. Journal of Nuclear Medicine. 2015 Mar 1;56(3):417–22.
4. Gibiino F, Sacolick L, Menini A, Landini L, Wiesinger F. Free-breathing, zero-TE MR lung imaging. Magnetic Resonance Materials in Physics, Biology, and Medicine. 2015 Jun 29;28(3):207–15.
5. Caballero-Insaurriaga J, Rodríguez-Rojas R, Martínez-Fernández R, Del-Alamo M, Díaz-Jiménez L, Ávila M, et al. Zero TE MRI applications to transcranial MR-guided focused ultrasound: Patient screening and treatment efficiency estimation. Journal of Magnetic Resonance Imaging. 2019 Nov 1;50(5):1583–92.

Invitation

YENRAD'23 - National Level Medical Imaging Conference at Mangalore

International Radiography Day Celebrations

SDM College of Medical Sciences & Hospital
Dharwar, Karnataka

ESIC Medical College and Hospital
Gulbarga, Karnataka

Belagavi Institute of Medical Science
Bealagavi, Karnataka

World Radiography Day celebration
with Blind Children by Karnataka State Medical
Technologists Association Raichur District Unit

SDM College of Medical Sciences & Hospital,
Dharwar, Karnataka

Raps Imaging & Diagnostics Centre,
Nashik, Maharashtra

International Radiography Day Celebrations

Government Omandurar Medical College
Chennai, Tamilnadu

Neheru Shatabdi Central Hospital
MCL, Talcher, Odisha

Delhi State Cancer Institute
Dilshad Garden, Delhi

Government General and Chest Hospital
Erragadda, Hyderabad

Zydus Hospitals, Anand, Gujarat

SGT University, Gurgaon, Haryana

International Radiography Day Celebrations

Government Sub-district Hospital, Sadulshahar, Dist. Sriganganagar, Rajasthan

Kaliga Institute of Medical Sciences, Bhubaneswar, Odissa

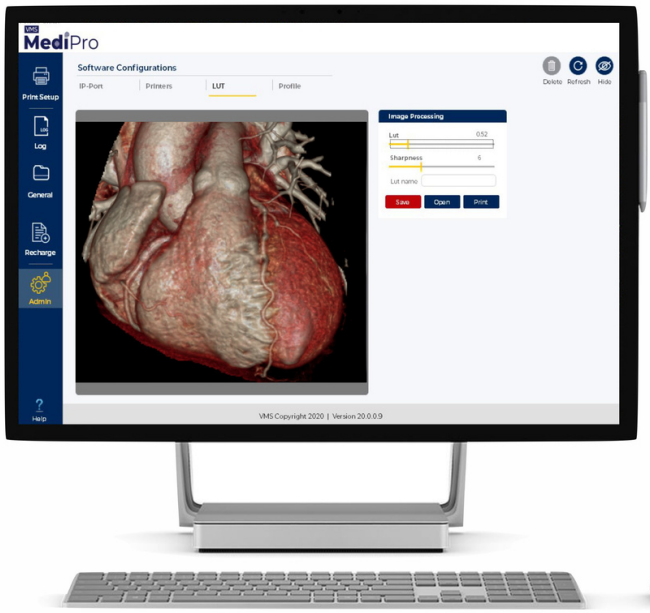
Ranchi Cancer Hospital and Research Centre, Ranchi, Jharkhand

MNJ Institute of Oncology and Regional Cancer Centre, Hederabad.

Sri Ramachandra Institute of Higher Education and Research, Chennai, Tamilnadu

VMS MediPro™

VMS®



Secure. Seamless. Smart. MediPro

The Most Intuitive DICOM Solution

The VMS MediPro DICOM Solution offers a holistic, end-to-end management option. It is ideally-suited for Hospitals, Diagnostic centres with MRI, CT-Scan, Endoscopic, Sonography, etc. looking to adopt new digital imaging technologies or radiology centres with few per-day exposures.

It provides easy integration to all digital modalities and maintains a perfect balance between image quality and convenience. Most importantly, it provides signi□cant costs reduction as well as helps minimise the environmental impact on a daily basis.

VMS MediPro is an advanced, DICOM-to-Windows printing solution with a host of rich features.

- It offers multi-modality connectivity and supports four different Windows-based printers at one time.
- For fast printing, it can be con□gured to send prints to the next available idle printer in rotation.
- Suitable for Pre-Natal Diagnostic Technique (PNDT) prints.
- Enhance print quality by applying linear DICOM Look-Up Tables (LUTs).
- Handles both Greyscale and colour prints at a time.

Vinod Medical Systems Pvt Ltd.

Corporate Office: 119, Omkar - The Summit Business Bay, 1st Floor, B. L. Bajaj Road, Near W. E. H Metro station, Andheri (E), Mumbai - 400 093. Tel: +91 022 26820517 / 18

Registered Office: Kripa Kunj, B1 - 2, Sai Nagar, Near Railway Crossing, Raipur - 492 009. India. Tel: +91 771 4214400 / 21
Email: medipro@vinodmedical.com

vinodmedical.com I 1800 202 1988 I vmscart.com

International Radiography Day Celebrations

Kerala Institute of Medical Sciences
Trivendrum, Kerala

Aster Mother Hospital
Areecode, Kerala

Mother Care Hospital
Mannarkkad, Palakkad, Kerala

Gokulam Medical College
Trivandram, Kerala

Doctors Diagnostic Centre, Nilambur
Malappuram, Kerala

Koyas Hospital
Kozhikode, Kerala

Advertising in Radiographers' Journal

Advertise your business or market your product on "Radiographers' Journal" - monthly ebulletin.

Radiographers' Journal is circulated electronically to thousands of Radiographers across the globe and posted on Social media platforms.

Monthly Tariff for Advertisement

- Full page - Rs. 3000/-
- Half page - Rs. 1500/-
- Quarter page. - Rs. 1000/-

For **yearly subscription of advertisement 50% discount in above charges**

To book your advertisement call on **+91 9322035920**