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TECHNOLOGISTS

Radiographers' Journal

The official magazine of Society of Indian Radiographers (SIR)
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February, 2024

24th February
RAM Foundation Day

A meeting of the Radiographers from Mumbai was held on 24th February 2001 at 3:00 pm at Chokshi Auditorium Tata Memorial Hospital to form the “Radiographers’ Association of Maharashtra” (RAM). Following 29 Radiographers where present for the meeting:

1. **Late. Anil Chandolikar, Jagjivan Ram Hospital**
2. **Late. Sharad Patkar – BYL Nair Hospital**
3. **Late. Vijay Ghadigaonkar – Indian Cancer Society**
4. **Late. Shekhar W. Tawate, Tata Memorial Hospital.**
5. **Late. Dilip Doiphode – Shushurusha Hospital**
6. **Late. D G Joshi, , LTMG Sion Hospital**
7. **Late. S G Ubare, KEM Hospial**

1. **Shri. Prakash Marathe - Tata Memorial Hospital (Retired)**
2. **Shri. Dilip Relekar, Breachcandy Hospital (Retired)**
3. **Shri. Ganpat Kharade – H N Hospital (Retired)**
4. **Shri. Narayan Kamble - Tata Memorial Hospital (Retired)**
5. **Shri. Sunil Chavan, BARC Hospital (Retired)**
6. **Shri. Kumar Chauhan, KEM Hospital (Retired)**
7. **Shri. A B Shinde, BARC Hospital (Retired)**
8. **Shri. Bahusaheb Sangle - Tata Memorial Hospital (Retired)**
9. **Shri. Ramjet Yadav - Tata Memorial Hospital (Retired)**
10. **Shri. Madhukar Bhambid - Tata Memorial Hospital (Retired)**
11. **Shri. Pandurang Wagh - Tata Memorial Hospital (Retired)**
12. **Shri. Ramesh Patade - Bhagavati Hospital (Retired)**
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15. **Shri. R. R. Pawar, Cooper Hospital (Retired)**

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2. **Shri. Shankar Bhagat - Tata Memorial Hospital**
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Installation Ceremony of Radiographers' Association of Maharashtra President & Team (2024-25)

at Hotel Ganesh Kudale Plaza, Pimpri, Pune on 11th February 2024


Radiographer's Association
of Maharashtra


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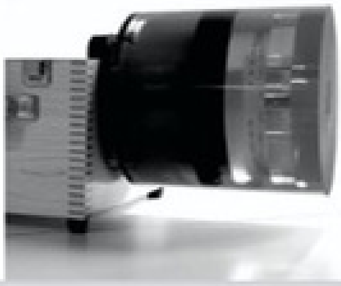
at Hotel Ganesh Kudale Plaza, Pimpri, Pune on 11th February 2024



Diagnostic Accuracy of Artificial Intelligence in MRI Imaging

Josh Jung, BS, R.T. (R) (MR) (ARRT), MRSO & **Brett Butle,** BS, R.T. (R) (MR)(CT) (ARRT)

Abstract

A systematic review was performed evaluating the accuracy of artificial intelligence (AI) in identifying pathology on magnetic resonance imaging (MRI) imaging exams. Deep Learning Software (DSL) was the primary focus of this review. A total of 5,343 imaging cases compiled from seven previous research studies were evaluated during this quantitative review. Quantitative results were determined via statistical analysis regarding pathology detection. Results from previous literature were provided in the form of area under the curve (AOC). Imagining cases for this research were comprised from multiple areas of anatomy including body, musculoskeletal, and neurological MRI. Pathology was diagnosed utilizing multiple created concept convolutional neural networks (CNN) including MRNet, ResNET and VisLVO. Additionally, this research included direct comparison of pathology detection between CNN and radiologists in several studies. Results from this research demonstrate no statistically significant reduction in pathology detection associated with deep learning software.

Diagnostic Accuracy of Artificial Intelligence in MRI Imaging

Artificial intelligence (AI) is rapidly advancing in the field of medical imaging. Computer-aided detection (CAD) is a common form of AI utilized in modern imaging. Implementation of CAD systems has been proven to increase the diagnostic accuracy of radiologist imaging interpretation (Meeuwis et al., 2010). Another form of AI being investigated for use in medical imaging is deep learning software (DLS). Deep learning is a machine learning process that utilizes complex mathematic algorithms to enable AI to independently detect imaging abnormalities (Chassagnon et al., 2020).

The specific forms of deep learning software evaluated in this research are known as convolutional neural networks (CNNs). These neural networks are multi-layer algorithms that compare medical imaging to data sets of previous images containing both normal and pathologic findings. Increasing advancement in the field of deep learning has created a pathway for AI to one day replace the human element of image interpretation (Mazurowski, 2019). This possible transition hinges on the level of accuracy with which AI can identify imaging abnormalities. The possibility of AI becoming sufficiently accurate to replace radiologists is the impetus behind this research study.

This research functions as a systematic review evaluating the accuracy of the deep learning subset of AI. Direct comparison of MRI imaging pathology detection between deep learning and radiologist interpretation was performed when possible. Data for this evaluation was obtained via online database searches including PubMed, Scopus, and Google Scholar. The key terms “deep learning”, “artificial intelligence”, and “MRI imaging” were used to compile data. The data amassed from this database search was then subjected to quantitative analysis. Results from previous literature acquired in this search were provided in the form of statistics and area under the curve (AOC). A total of 5,343 imaging exams were compiled from eight previous research studies were included in this systematic review. Comprehensive analysis encompassing multiple anatomic regions including neurological, musculoskeletal, and body imaging was performed.

Limitations were encountered due to the specificity of the research topic. While much data exists demonstrating the creation of individual deep learning networks, there is little research comparing the accuracy of multiple networks as a group. More specifically, the comparison of multiple (CNNs) to radiologist interpretation of medical imaging to evaluate accuracy. The rapidly advancing nature of deep learning also leads to constant updates in available data. The expedited advancement of AI can also lead to recent data becoming obsolete in a short time frame.

Discussion/ Literature Review

Data for review was separated according to anatomic region to ensure consistent comparative analysis. Statistical data comparing AI accuracy was analyzed for each anatomic region. Data was then combined to evaluate overall statistical accuracy of AI compared to that of radiologists when possible.

Neurological Imaging

The analysis of neurological imaging contained data from three previous research studies. All three studies utilized the incorporation of MRI imaging. Rauscheker et al., (2020) compared the accuracy of pathology detection between AI and radiologists at multiple career stages. This study evaluated the abnormality detection of AI software and radiologist interpretation from 1,780 medical imaging cases. Imaging cases were evaluated for pathology identification regarding multiple neurological diagnoses. Results were provided via statistical analysis. The AI software in this study outperformed all other methods of detection for the top three neurological conditions. Accuracy results for these diagnoses were AI (91%), academic neuroradiologists (86%), radiology residents (56%), general radiologists (57%), and radiology fellows (77%) (Rauscheker et al., 2020).

A similar study performed by Yahav-Dorvat et al., (2021) analyzed the accuracy of large-vessel occlusion detection by AI software. This study evaluated data from 1,180 Magnetic Resonance Imaging (MRI) exams interpreted by specialized deep learning software named Viz LVO. The accuracy of Viz LVO software identifying occlusions was compared to formal readings performed by senior neuroradiologists. Results from this study demonstrated a sensitivity rating of 95% for AI in both detection and negative predictive value regarding large-vessel occlusions (Yahav-Dorvat et al., 2021). The ratios for AI detection were calculated via comparison to formal senior neuroradiologist readings as the baseline in identifying occlusions. The utilization of radiologist readings as a baseline does not allow for a statistical value by which to compare radiologist to AI accuracy.

A retrospective research study performed by Grovik et al., (2020) evaluated AI detection of brain metastases on multi sequence MRI imaging. This research subjected a deep learning convolutional neuro network (CNN) to 156 imaging exams evaluating brain met detection. Area under the ROC curve results were calculated to determine the accuracy of AI detection. Detection results varied depending on the number of metastases each case possessed. Area under the curve results were 0.99 for patients having 1-3 metastases, 0.97 for 4-10 metastases, and 0.97 for greater than 10 metastases (Grovik et al., 2020).Overall, AI area under the curve results software was determined to be 0.98 for metastatic brain disease detection. This represents a high accuracy detection ratio with 1.0 being the highest possible ratio.

Body Imaging

The evaluation of pathology detection involving body MRI imaging combined two previous studies. Both studies centered on the creation of CNN deep learning software versions of AI.Both body imaging studies utilized MRI as the primary imaging modality. Only one of the provided studies offered a direct radiologist to AI comparison.

In the first study, Hamm et al., (2019) developed and tested a custom CNN deep learning algorithm to identify common hepatic lesions. The AI algorithm was trained using 43,400 training samples. The AI was then used to evaluate a combination of 334 imaging cases with hepatic lesions on multi-phase MRI images and 60 test cases. These imaging cases contained a known combined total of 494 hepatic lesions. Pathology detection data was provided via statistical analysis and was directly compared to that of radiologists. The deep learning software detected hepatic lesions with an average accuracy of 92%. Additionally, the software demonstrated a sensitivity ratio of 92% and a specificity of 98% (Hamm et al., 2019). Results demonstrated a radiologist sensitivity ratio of 82.5% with a specificity of 96.5%. In this study AI outperformed radiologists in the category of sensitivity.

A similar deep learning software name ResNet50 was created by Zhou et al., (2020) to evaluate benign and malignant breast lesions on MRI images. This software was then utilized to evaluate 133 MRI imaging cases with histological confirmed breast lesions. For this study a combination of region of interest (ROI), radiomics, and deep learning method approaches were employed to calculate various characteristics and accuracy of lesion detection. Statistical analysis was performed comparing each method of detection. Statistical results demonstrated accuracy ratios of ROI (76%), radiomics (84%), and deep learning (89%) (Zhou et al., 2020). The per-lesion accuracy of the deep learning software ranged from 69%-91% depending on the ROI size of the box including the evaluated lesion. The highest accuracy of 91% was achieved by utilizing the smallest boundary box. This study demonstrated a high diagnostic accuracy level for the ResNet 50 deep learning AI software. There was no direct comparison of AI accuracy to radiologist's accuracy in this study. The assumed accuracy of radiologists for this study was 100%, as the data provided was based off cases with previously determined pathology via radiologist report.

Musculoskeletal Imaging

Two additional studies were evaluated to determine the accuracy of AI as a method of identifying pathology in knee MRI imaging. Bien et al, (2018) performed an investigation into the accuracy of AI diagnosing ACL and meniscus injuries. This research incorporated MRI imaging from 1,370 knee exams obtained from Stanford University Medical Center. Bien and his associates utilized MRNet as the AI platform for image analysis. Results from this study were once again calculated as area under the curve (AUC). The MRNet software created for this study provided AUC results 0.937 which translated to an accuracy rating of 95% for ACL tears (Bien et al, 2018). The same software demonstrated AUC results of 0.965 (95%) accuracy ratings for the detection of meniscal tears. According to Bien et al, (2018) these were no statistically significant difference between the accuracy results of the MRNet software compared to three board certified radiologists evaluated in this study. Similar research performed by Rizk et al., (2021) further investigated the accuracy MRNet relating to meniscus tears on MRI imaging of the knee. This study utilized data from over 8,000 knee MRI exams to create a deep learning algorithm which was then evaluated on 299 test patients. Results were provided in AUC and compared to radiologist reports. According to Rizk et al., (2021) AUC results for MRNet software were 0.93 which calculated to an accuracy rating of 95%.These results also demonstrated no statistically significant difference between MRNet software and radiologist interpretation.

Additional musculoskeletal research was performed by Kim et al., (2020), evaluating the accuracy of DSL to identify rotator cuff tears on shoulder MRI imaging. This study evaluated 2,447 shoulder MRI exams containing known rotator cuff tears via an engineered CNN. The CNN in this study successfully identified rotator cuff pathology with 87% accuracy. Radiologist detection of rotator cuff pathology in this same study averaged only 76%. In this study the AI created by the researches was able to outperform its human counterpart.

Results

A systematic review of literature investigating the accuracy of artificial intelligence identifying MRI imaging pathology was performed. Results from this review demonstrated positive accuracy percentages amongst several anatomic categories. The AI accuracy averages were 94.6% for neurological cases (Rauscheker et al., 2020) (Yahav-Dorvat et al., 2021) (Grovik et al., 2020), 91.5% for body imaging (Hamm et al., 2019) (Zhou et al., 2020), and 92.3% for musculoskeletal imaging (Bien et al, 2018) (Rizk et al., 2021) (Kim et al., 2020),.This is compared to averages of 95.3%, 60.66%, and 88.66% for human radiologist interpretation respectively. The overall average statistical accuracy of the combined deep learning AI platforms was calculated to be 92.85 % compared to an 81.5% radiologist accuracy rating.

Conclusion

While the results of this review may answer the question of AI accuracy in detecting pathology, they do not provide grounds for the use of AI as a replacement for radiologists. In fact, without initial radiologist readings, deep learning software would not be possible. The data provided by initial radiologist readings is the platform used to teach the “learning” portion of deep learning. Without initial readings, accuracy statistics could not be calculated.

Further research on this topic is recommended as future studies become available. With rapidly advancing computer processing power it may someday be possible to create new AI software capable of processing all archived imaging data on record. AI has proven to be accurate at imaging interpretation at present capability levels. However, at this point in time deep learning software appears to function more effectively as a supplemental tool rather than a replacement for the human radiologist.

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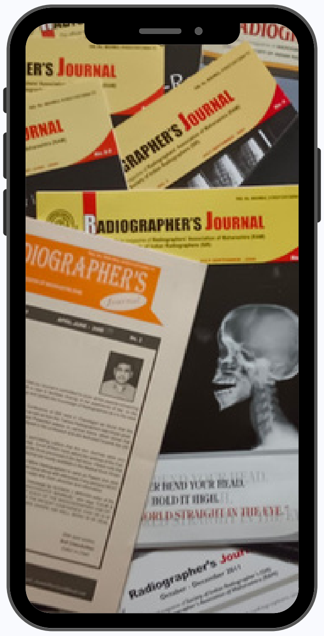

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Radiation Safety: Essential Safety Measures for Radiologic Technologists

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Introduction:

The purpose of radiation protection is to provide an appropriate level of protection for humans without unduly limiting the beneficial actions giving rise to radiation exposure. Radiologic technologists are among the earliest occupational groups exposed to radiation. This article explores essential radiation safety measures that radiologic technologists should adhere to in their daily practice.

1. Education

Educate Radiologic technologists about the harmful effects of radiation and method to minimize the effect of radiation via training programmes. As the use of medical radiation in diagnosis and procedural and surgical treatment is increasing. Therefore, healthcare personnel should be adequately aware and knowledgeable about radiation hazards to protect themselves and their patients from its adverse effects.

2. Use of PPE (Personal Protective Equipment’s)

3 pieces of PPE for all technologists are Aprons, Thyroid Shields, and Dosimeters.

PPE should include a personal radiation dosimeter whenever there is concern about exposure to penetrating ionizing radiation direct-reading personal radiation dosimeters maybe used to monitor radiation dose and can help workers stay within recommended dose limits for emergency workers.

- It is a category of special protective gear specifically designed to shield the radiology professional from the hazards of scatter radiation.

3. ALARA principle (As Low As Reasonably Achievable)

The ALARA principle is a relatively simple safety protocol designed to limit ionizing radiation exposure to workers from external sources.

- This principle was established by the National Council on Radiation Protection and Measurements (NCRP) in 1954. In response to the atomic bombings of Hiroshima and Nagasaki and the increased interest in nuclear energy and weaponry Post-WWII.
- ALARA is based on the idea that any amount of radiation exposure big or small can increase negative health effects such as cancer, for an individual.

4. Increase Distance

The inverse square law states that radiation exposure and distance are inversely related meaning the greater the distance from the source of radiation, the less the intensity of the dose.

5. Proper Collimation

Collimation is the primary beam to the area of interest limits the radiation dose to the patient by limiting the amount of tissue that is exposed, also reduces the amount of scatter produced.

6. Minimize Time

“Time” simply refers to the amount of time you spend near a radioactive source. Minimize your time near a radioactive source to only what it takes to get the job done. If you are in an area where radiation levels are elevated,

- Complete your work as quickly as possible, and then
- Leave the area

There is no reason to spend more time around it then necessary

7. Shielding

Put a barrier between you and the radiation source. The type of barrier will depend on what kind of radiation source is being emitted but should be made of material that absorbs radiation such as lead, concrete, or water.

Limit time spent near a radiation source, increase distance away from a radiation source, or use shielding.

Conclusion

Radiation Safety is paramount in the daily practice of Radiologic Technologist. By following the above mentioned steps Radiologic Technologists doesn’t only protect themselves but it will also be beneficial for the patients as the poorly informed technologists can put the patient at a higher risk by not optimizing the pertinent imaging parameters.

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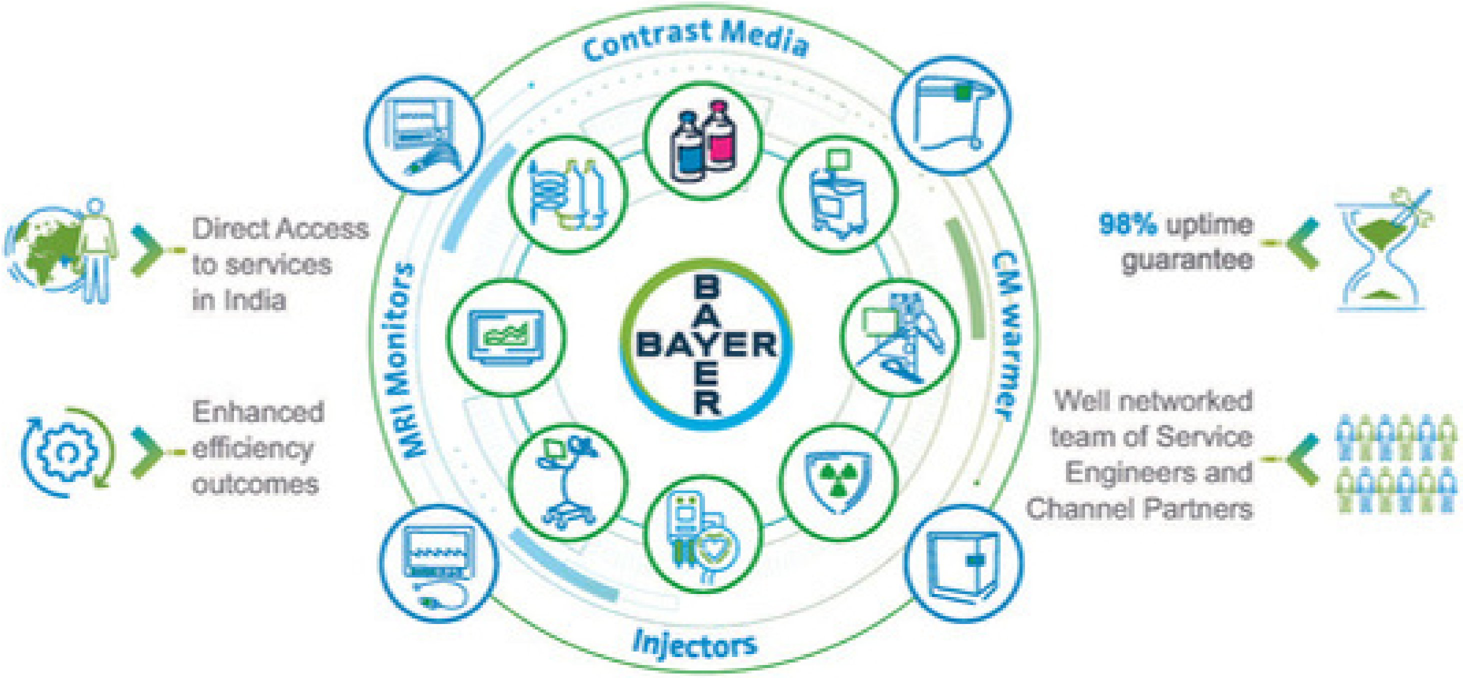
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75
100
38
98.6
120
90
97
70

How to choose a right cyclotron?

Rajaram Patil, Director Nuclear Medicine & MI

Choosing a right cyclotron is always important. But we often see that people are not aware as to how and why should they select a particular cyclotron.

A cyclotron is a type of accelerator invented by Ernest Lawrence in 1929–1930 at the University of California, Berkeley, and patented in 1932. A cyclotron accelerates charged particles outwards from the center of a flat cylindrical vacuum chamber along a spiral path. The particles are held to a spiral trajectory by a static magnetic field and accelerated by a rapidly varying electric field. Lawrence was awarded the 1939 Nobel Prize in Physics for this invention.

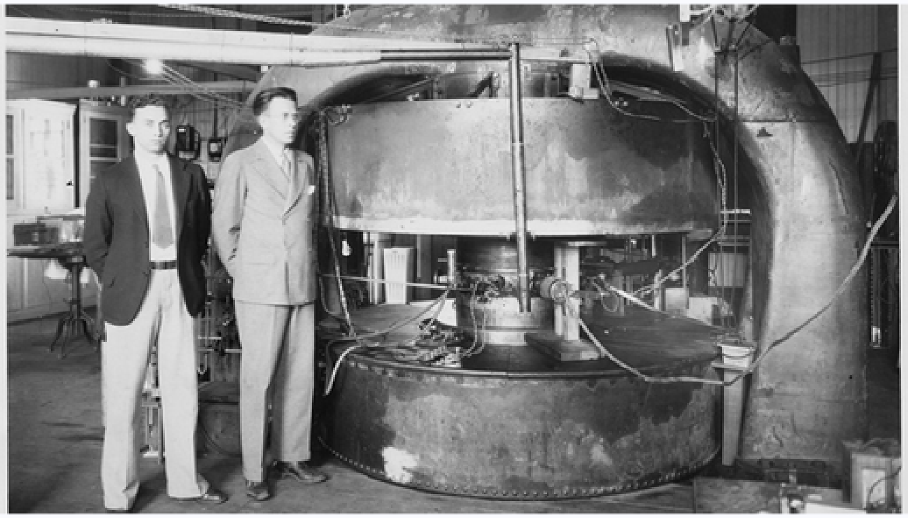

Image source; https://en.wikipedia.org/wiki/Cyclotron

Cyclotron Type and Energy Range:
Determine the specific isotopes required for your medical applications, such asF-18, C-11, or Ga-68, and ensure that the cyclotron can reliably produce these isotopes within the desired energy range.

Available ranges from following ranges:
Small Range 7.5/9.5 MeV
Medium Range15/16.5/18/19/20MeV
Large Range 30/35 MeV-70 MeV

Production Capacity:
Assess the production capacity of the cyclotron in terms of dose yield and frequency to meet the demands of your facility and the volume of patients.
Single Dose - To be self sufficient for in-house consumption
Multi-Dose - To be self sufficient and supply 2-3 PETCT
Commercially Supply more than 20 plus PETCT

Foot print and Facility Requirements:
Evaluate the physical footprint of the cyclotron and ensure that it fits within the available space in your facility. Consider additional infrastructure needs such as radiation shielding, ventilation, and power requirements.
Small Footprint Vs Bunker Based

Reliability and Maintenance:
Choose a cyclotron from a reputable manufacturer known for reliability and minimal downtime. Consider maintenance requirements, availability of spare parts, and service support to ensure smooth operation over time.

Radiation Safety Features:
Ensure that the cyclotron is equipped with robust radiation shielding and safety features to protect operators, patients, and the environment from radiation exposure.

Self Shielded Cyclotron Vs Unshielded

Compliance with Regulations:
Verify that the cyclotron complies with regulatory standards and guidelines set forth by relevant authorities, such as the International Atomic Energy Agency (IAEA) and local nuclear regulatory agencies.

Integration with Imaging Equipment:
If your facility includes PET or SPECT imaging systems, ensure compatibility and seamless integration between the cyclotron and imaging equipment for efficient production and imaging workflows.

Cost Considerations:
Evaluate the initial capital investment, operational costs, and potential return on investment associated with the cyclotron. Consider long-term cost implications, including maintenance, upgrades, and isotope production expenses.

Future Expandability and Upgrades: Choose a cyclotron platform that allows for future expansion and upgrades to accommodate evolving medical imaging and therapy needs.

User Training and Support: Ensure that comprehensive training programs and technical support are available for cyclotron operators and maintenance personnel to optimize system performance and ensure safe operation.

In conclusion, selecting the right medical cyclotron involves careful consideration of technical specifications, safety features, regulatory compliance, cost factors, and support services. Collaborating with experienced professionals and consulting with manufacturers can help ensure that your facility chooses a cyclotron that meets its specific requirements and contributes to high-quality patient care in nuclear medicine.

Karnataka State Radiology Imaging officer's Association (R), Bangalore EC Meeting and 2024 Calendar release

The Evolution of Electronic Cropping in Digital Radiography: A Paradigm Shift in Collimation

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Introduction: In the realm of medical imaging, the advent of digital radiography has revolutionized the way healthcare professionals capture and interpret diagnostic images. One significant advancement within this digital landscape is electronic cropping, a process that allows for the manipulation and adjustment of radiographic images after acquisition. However, as this technology continues to evolve, questions arise regarding its impact on traditional radiographic practices, particularly in relation to collimation – the process of restricting the X-ray beam to the area of interest. This article explores the evolution of electronic cropping in digital radiography and its implications for collimation, ultimately addressing the question: has electronic cropping resulted in the death of collimation?

The Evolution of Digital Radiography: Digital radiography (DR) has emerged as a cornerstone of modern medical imaging, offering numerous advantages over traditional film-based radiography. With DR, images are captured using digital detectors that convert X-ray photons into electronic signals, which are then processed and displayed on computer screens. This digital approach eliminates the need for film processing, enhances image quality, and allows for immediate image interpretation and transmission.

Electronic Cropping: A Game-Changer in DR: One of the key features of digital radiography is electronic cropping, a process enabled by advanced imaging software. Electronic cropping allows radiographers to manipulate and adjust the captured image by cropping out irrelevant areas or enhancing specific regions of interest. This capability offers flexibility in image interpretation and can improve diagnostic accuracy by focusing attention on pertinent anatomical structures.

The Impact on Collimation: Traditionally, collimation has been a fundamental aspect of radiographic technique, aimed at minimizing patient exposure to ionizing radiation and producing images with optimal contrast and resolution. Collimators are devices attached to X-ray machines that restrict the X-ray beam to the desired area, reducing unnecessary radiation exposure to surrounding tissues. However, the introduction of electronic cropping has led to discussions regarding its potential impact on collimation practices.

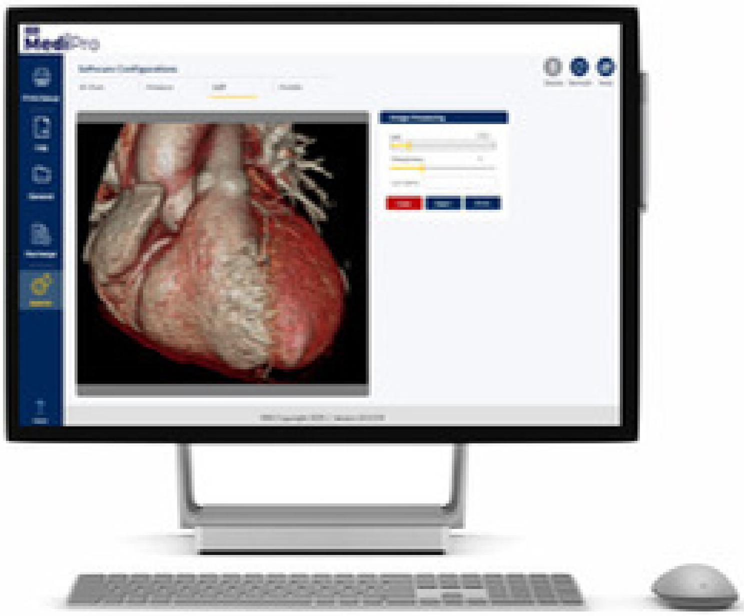
Concerns and Considerations: While electronic cropping offers undeniable advantages in terms of image manipulation and interpretation, concerns have been raised regarding its implications for collimation. Some argue that the ability to crop images post-acquisition may lead to complacency among radiographers, resulting in a decreased emphasis on proper collimation techniques during image acquisition. This could potentially lead to overexposure of patients to radiation and compromise image quality.

Moreover, there is a risk of over-reliance on electronic cropping as a substitute for proper collimation, which may undermine the principles of radiation protection and optimization in medical imaging. It is essential to recognize that electronic cropping should complement, rather than replace, effective collimation practices to ensure the delivery of high-quality radiographic images while minimizing patient radiation dose.

The Future of Collimation in Digital Radiography: As digital radiography continues to evolve, it is crucial to strike a balance between leveraging technological advancements such as electronic cropping and upholding established principles of radiographic technique, including collimation.

Rather than viewing electronic cropping as a threat to collimation, it should be integrated into comprehensive training programs for radiographers, emphasizing the importance of judicious image acquisition and post-processing techniques.

Conclusion: In conclusion, the introduction of electronic cropping in digital radiography represents a significant technological advancement that offers flexibility and versatility in image interpretation. However, it is essential to recognize the potential implications of electronic cropping on traditional collimation practices. While electronic cropping enhances the radiographer's ability to manipulate images, it should not overshadow the importance of proper collimation techniques in minimizing patient radiation dose and optimizing image quality. By embracing electronic cropping as a complementary tool and ensuring adherence to rigorous collimation practices, the field of digital radiography can continue to advance while prioritizing patient safety and diagnostic accuracy.

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From Lab to Hand:
Recent Advances in X-Ray Imaging with Advanced Computation on Portable Devices

Rohit Bansal, Assistant Professor, Sanskriti University, Mathura

X-ray imaging, a cornerstone of modern medicine, has revolutionized diagnostics and treatment since its accidental discovery by Wilhelm Roentgen in 1895. Understanding the intricacies of X-ray technology involves delving into its historical context, basic principles, technological advancements, recent breakthroughs, and future prospects.

Historical Context: Wilhelm Roentgen's serendipitous discovery of X-rays transformed the scientific landscape. While experimenting with cathode tubes, Roentgen noticed that certain materials fluoresced when exposed to cathode rays. Curiosity led him to place objects between the cathode tube and a photographic plate, resulting in the first X-ray image of his wife's hand, revealing the skeletal structure beneath her skin. This ground breaking experiment marked the dawn of X-ray imaging and earned Roentgen the Nobel Prize in Physics in 1901.

Basic Principles: X-rays are a form of electromagnetic radiation, akin to light waves but with higher energy levels. When directed at matter, X-rays interact with atoms, displacing inner electrons and emitting photons. These photons are captured by detectors, producing images that highlight variations in tissue density. Dense structures like bone absorb more X-rays, appearing lighter on images, while softer tissues allow more X-rays to pass through, appearing darker.

Technological Progress: Over the decades, X-ray technology has undergone significant advancements. Early cathode tubes evolved into sophisticated X-ray machines capable of generating focused X-ray beams. Digital imaging replaced traditional film-screen radiography, offering clearer images and enhanced diagnostic capabilities. Moreover, computed tomography (CT) scanning and fluoroscopy emerged as powerful imaging modalities, providing detailed cross-sectional images and real-time visualization of dynamic processes within the body.

X-ray Capture and Imaging Plates: The development of imaging plates, particularly flat panel detectors, revolutionized X-ray capture. Direct and indirect conversion panels convert X-ray photons into electronic signals, which are then processed to produce high-resolution images. CT scanning, with its rotating gantry and advanced detectors, enables precise 3D imaging of internal structures, while fluoroscopy facilitates real-time observation of procedures such as angiography and gastrointestinal studies.

Recent Breakthroughs and Future Directions: Recent advancements in X-ray imaging promise to reshape medical diagnostics and treatment. Flexible X-ray imaging panels and liquid nanocrystal technology offer enhanced flexibility and resolution, paving the way for personalized imaging solutions. Portable X-ray devices, integrated with advanced computation and machine learning algorithms, enable point-of-care diagnostics and remote healthcare delivery. Additionally, innovations in spectral CT and photon-counting detectors hold the potential to revolutionize imaging accuracy and tissue characterization.

In conclusion, X-ray imaging stands at the forefront of medical innovation, bridging the gap between science fiction and reality. As technology continues to evolve, the future of X-ray imaging holds immense promise for safer, more precise, and accessible healthcare solutions, driving advancements in early disease detection, treatment planning, and patient care.

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Artifacts in Ultrasonography

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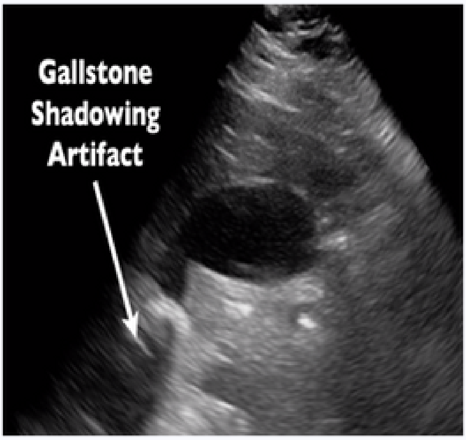
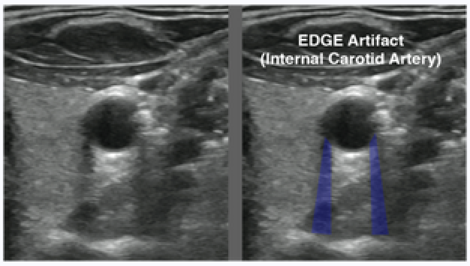
An artifact is something that you see on the ultrasound image, which is either not really there, is in another place in reality, or looks different than it actually is. This happens because the ultrasound image builds upon certain physical assumptions. One assumption is that where there is no echo, there is no structure; another would be that echoes that take longer to travel back to the transducer originate further away from it. Artifacts can hinder our view of the area of interest, fool us into thinking there is a pathology, or make measurements more difficult. Thus, every sonographer must know about and recognize the most important artifacts.

Ultrasound images are considered safe, non-invasive, and relatively inexpensive compared to other imaging modalities. However, like any medical imaging technique ultrasound is prone to image artifacts, which can cause errors .Some of these are

1. Artifact shadowing:

Ultrasound waves must travel through several layers of tissue to allow us a view of deep structures. Shadowing artifacts occur when sound waves are blocked by a dense object, such as a bone or gas-filled organ, causing a loss of signal and a shadow to appear on the image. Shadowing artifacts can also occur when sound waves encounter an area of decreased sound transmission.





2. Edge artifacts:

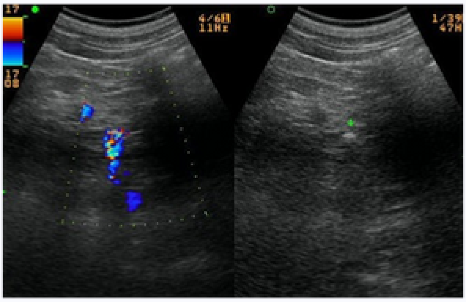
Edge artifacts occur when sound waves encounter an abrupt change in tissue density, such as the boundary between two organs. This can cause a bright line to appear on the image, which can obscure underlying structures.

3. Attenuation artifacts:

Attenuation artifacts occur when sound waves lose energy as they travel through tissue, causing a loss of signal intensity. This can result in a hypo echoic or anechoic area on the image, making it difficult to visualize the underlying structure.

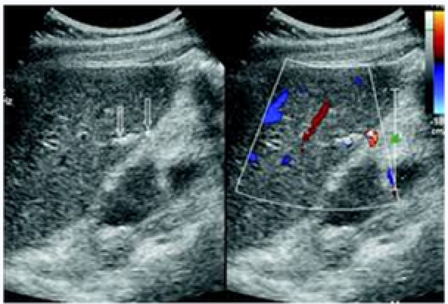
4. Reverberation artifact:

The reverberation artifact occurs as a result of repetitive reflection back and forth between two highly reflective surfaces



5. Speckle artifacts:

Speckle artifacts are caused by the interference of sound waves with each other, resulting in a granular or speckled appearance on the image. These artifacts can make it difficult to distinguish between small structures, such as blood vessels.

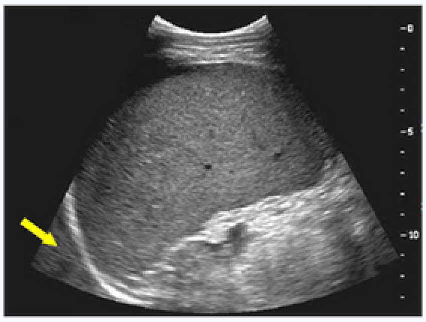


6. Doppler artifacts:

Doppler artifacts occur when there is a high amount of motion in the area being imaged, such as blood flow. This can cause distortion of the Doppler waveform and make it difficult to accurately measure blood flow velocity.

7. Mirror imaging Artifact:

Ultrasound waves reflecting between structures can result in multiple reflections of the waves and mirroring of the structures between these layers. Mirrored structures can be found on the ultrasound image but not in the original structure.



Conclusion: Ultrasound artifacts are commonly encountered and familiarity is necessary to avoid false diagnoses

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Radiological Projections with present conventional bucky X-Ray Tables

–Issues and suggested solutions from Technologist's point of view

Purnandu Deb Roy, Piyul Nag, R. Ravichandran Cachar Cancer Hospital and Research Centre, Silchar Assam

Radiological projections at different angulations demonstrate the abnormalities to achieve differential diagnosis. Skeletal deformations and images with contrast media help in the application of conventional radiology for better patient management. Positioning, Technique and Exposure factors greatly depend on Radiological technologist's skill to obtain clinically acceptable good radiographs. Filmless radiography came in a big way using digital image acquisition helping in achieving radiographs with alterable contrasts as well as could easily transferrable through picture archival and on-line reporting.

Proper patients' positioning with correct immobilization, will result in good radiographs with reduced motion unsharpness. Recently we have come out with a solution to obtain AP and Lateral orthogonal films for localization of brachy therapy implants in a conventional 300mA X-ray machine (RR et al J Med Phys 2018). This work highlighted that with presently available diagnostic x-ray machines there is difficulty to obtain lateral views of patients without keeping posture of the patients lying on their sides. When there is tilt in patient, true lateral projection is impossible, resulting in internal structures. Due to re-positioning, image registrations become difficult to get orthogonal images for localization purposes (especially for radiotherapy treatment planning) and our published work (2018) suggested use of hospital stretcher along with positioning patient axis parallel to the chest stand wall. By this process, we overcome the non-tiltable bucky x-ray table and obtain AP and Lateral Radiograph with an L-Type cassette mount.

The above work has to be looked was mentioned as 'poor man's simulator' and very relevant because patient does not move during AP and Lateral projections, with selectable distances using Pendulum Movement of the X-Ray Tube Arm. This paper illustrates the geometry of the X-Ray Tube in relation to patient; and recommend to technologists, a possibility of standardizing techniques in their department using this technique with least patient movements. This definitely overcomes the need for transferring sick patients from hospital stretcher; which will greatly help the accident/trauma patients who are in heavy distress, to obtain radiographs of good quality with least motion artifacts.

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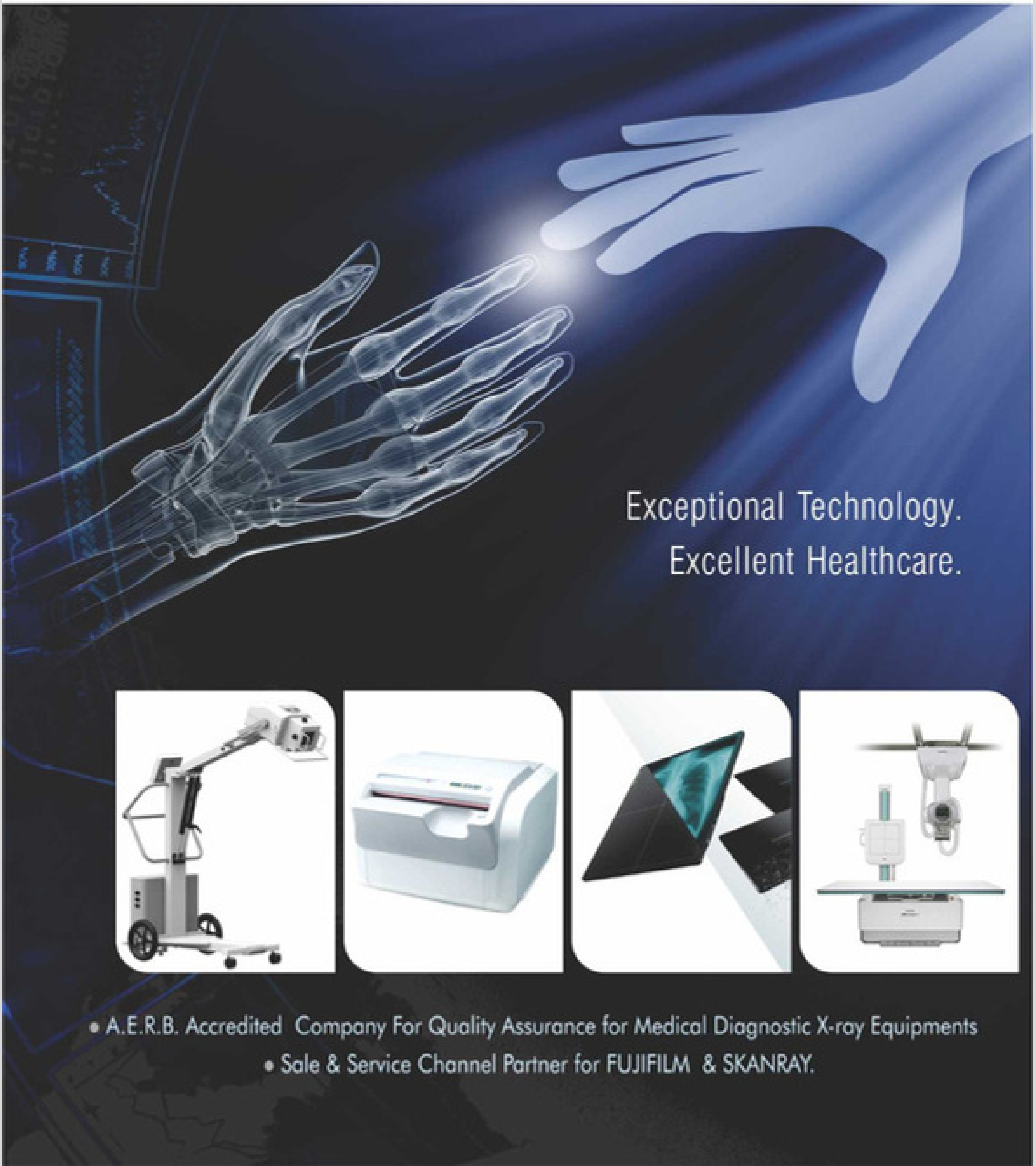
CT Perfusion Parameters in Grading of Brain Gliomas in Correlation with Histopathology

Robindra Mohan Gogoi, Sr.Radiographer Tezpur Medical College, Tezpur .

CT perfusion (CTP) imaging has emerged as a valuable tool in the evaluation of brain gliomas, providing important hemodynamic information that can aid in tumor grading. The perfusion parameters obtained from CTP, such as blood flow, blood volume, mean transit time, and permeability surface area product, can offer insights into the vascularity and microcirculation of the tumor. When correlated with histopathological findings, these parameters can help in differentiating between low-grade and high-grade gliomas.

Blood flow and blood volume are typically elevated in high-grade gliomas due to increased vascularity and angiogenesis, while low-grade gliomas exhibit lower blood flow and volume. Mean transit time, which reflects the time taken for blood to pass through the microvasculature, can also be informative, with shorter transit times often associated with high-grade tumors. Moreover, the permeability surface area product, indicative of vascular permeability, tends to be higher in high-grade gliomas.

By integrating these CTP parameters with histopathological data, clinicians can more accurately grade and characterize gliomas, leading to improved treatment planning and patient management. This multimodal approach allows for a comprehensive assessment of the tumor's biological behavior and can contribute to better patient outcomes. However, it's important to note that while CTP provides valuable functional information, it should be interpreted in conjunction with conventional MRI and clinical findings for a comprehensive evaluation of brain gliomas.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