Oral Sessions

Iron Overload Evaluation in Beta-Thalassemia Major: Hepatic and Cardiac Assessment using MRI T2* and Serum Ferritin Levels in Sistan and Baluchistan Province

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Background and Purpose: Thalassemia major, a genetic blood disorder causing chronic anemia, often requires blood transfusions that lead to iron overload and organ damage. To assess iron overload levels, doctors typically rely on serum ferritin levels and MRI T2* measurements. This study aimed to investigate the correlation between iron overload in the liver and heart among patients with the beta-thalassemia major from Sistan and Baluchistan province, Iran.
Materials and Methods: This retrospective cohort study involves 115 beta-thalassemia patients. Using specialized software called "CMR Tools," we analyzed the data extracted from serum ferritin and MRI T2* measurements. Our statistical analysis helped determine the extent of iron overload in these patients. All statistical analyses were conducted in SPSS V27.0.
Results: Our findings revealed that 92.1% of our patients exhibited liver iron overload, with the average liver iron content measuring 15.91 ± 7.94 mg/g. Meanwhile, the cardiac T2* measurements indicated varying degrees of iron overload in the heart. we observed a strong correlation between liver iron overload and serum ferritin levels ($r=0.275$, $P<0.003$). On the other hand, the correlation between cardiac T2* and serum ferritin was weak and inverse ($r=-0.385$, $P<0.001$). we did not find a significant correlation between cardiac T2* and liver iron overload ($r=-0.150$, $P<0.001$).
Conclusion: Our study highlights the valuable role of MRI T2* in assessing iron overload in the heart and liver of beta-thalassemia major patients. We confirmed a strong association between liver iron overload and serum ferritin levels. To obtain a comprehensive evaluation of iron status, we recommend including both cardiac and hepatic T2* MRI in conjunction with serum ferritin measurements. The use of MRI T2* provides a rapid and reliable assessment, enabling long-term monitoring of iron levels. Ultimately, it stands as the current gold standard for evaluating hemosiderosis in thalassemia patients.

Keywords: MRI, Thalassemia major, Hemosiderosis

Using Ultrasound for Functional Brain Imaging and Its Applications in Neuroscience Research

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Abstract:

Introduction:

Brain mapping, also known as neuroimaging, refers to the techniques and methods used to understand the structure, function, and connectivity of the human brain.[1] It involves creating detailed maps or images of the brain's various components and activities to gain insights into its complex workings.[2] In this article, we discuss the advantages of using functional ultrasound imaging as a modality for brain mapping and compare with another brain mapping modality.

Materials and Methods:

In this review article Comprehensive searches were performed across academic databases, which included PubMed, Google Scholar, IEEE Xplore, and ScienceDirect. These databases were selected due to their extensive coverage of neuroscience and medical imaging literature.
A total of 150 articles were initially identified based on their titles using the designated keywords.
Subsequently, a preliminary screening excluded 50 articles that lacked direct relevance to the central theme of brain mapping with ultrasound. The remaining articles underwent abstract reviews to ascertain their alignment with the research objectives.
Following this rigorous screening process, the selection was narrowed down to 30 articles, which were deemed most pertinent to the topic.

Results:

By tabulating data was gathered by articles, it was resulted that Functional Ultrasound (FUS) emerges as a highly promising neuroimaging technique with significant potential for both research and clinical applications.[3] Its non-invasive nature, coupled with excellent spatial and temporal resolution, positions it as a valuable tool for studying brain activity in diverse animal models.[4] Furthermore, recent developments in FUS technology, such as the use of low-intensity focused ultrasound (LIFU), suggest the feasibility of non-invasive brain mapping and potential therapeutic interventions in humans.[5, 6]
While FUS offers numerous advantages, including the absence of radiation exposure and the ability to induce long-term changes in neural activity, it is essential to acknowledge its current limitations. Challenges related to volumetric imaging quality, sensitivity, and the impact of skull bone on ultrasound propagation must be addressed to maximize the technique's effectiveness.[7, 8]

Conclusion:

Overall, FUS, in conjunction with other imaging modalities like fMRI, holds promise for elucidating the neural underpinnings of various functional brain disorders, potentially paving the way for innovative non-invasive treatments.[9] This technology may have significant implications for addressing conditions such as bipolar disorder, OCD, depression, autism, chronic pain, obesity, and Parkinson's disease, offering new avenues for understanding and ameliorating these complex neurological conditions.[10]

Keywords: Brain Mapping, Functional Ultrasound, non-invasive

References

[1] Kriegeskorte N, Goebel R, Bandettini P. Information-based functional brain mapping. Proceedings of the National Academy of Sciences 2006; 103: 3863-8.

[2] Rabut C, Norman SL, Griggs WS, Russin JJ, Jann K, Christopoulos V, Liu C, Andersen RA, Shapiro MG. A window to the brain: ultrasound imaging of human neural activity through a permanent acoustic window. bioRxiv 2023: 2023.06. 14.544094.

[3] Soloukey S, Vincent AJ, Satoer DD, Mastik F, Smits M, Dirven CM, Strydis C, Bosch JG, van der Steen AF, De Zeeuw CI. Functional ultrasound (fUS) during awake brain surgery: the clinical potential of intra-operative functional and vascular brain mapping. Frontiers in neuroscience 2020; 13: 1384.

[4] Dallapiazza RF, Timbie KF, Holmberg S, Gatesman J, Lopes MB, Price RJ, Miller GW, Elias WJ. Noninvasive neuromodulation and thalamic mapping with low-intensity focused ultrasound. Journal of neurosurgery 2017; 128: 875-84.

[5] Bystritsky A, Korb AS, Douglas PK, Cohen MS, Melega WP, Mulgaonkar AP, DeSalles A, Min B-K, Yoo S-S. A review of low-intensity focused ultrasound pulsation. Brain stimulation 2011; 4: 125-36.

[6] Rezayat E, Toostani IG. A review on brain stimulation using low intensity focused ultrasound. Basic and clinical neuroscience 2016; 7: 187.

[7] Deffieux T, Demene C, Pernot M, Tanter M. Functional ultrasound neuroimaging: a review of the preclinical and clinical state of the art. Current opinion in neurobiology 2018; 50: 128-35.

[8] Deffieux T, Demené C, Tanter M. Functional ultrasound imaging: A new imaging modality for neuroscience. Neuroscience 2021; 474: 110-21.

[9] Bandettini PA, Huber L, Finn ES. Challenges and opportunities of mesoscopic brain mapping with fMRI. Current Opinion in Behavioral Sciences 2021; 40: 189-200.

[10] Chen Q, Song H, Yu J, Kim K. Current development and applications of super-resolution ultrasound imaging. Sensors 2021; 21: 2417.

CT Pulmonary Angiography Challenges in 16-Slice CT Scanners

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Abstract: CT pulmonary angiography (CTPA) is known as the gold standard for the diagnosis of pulmonary embolism. Radiology technologists have many challenges for performing this procedure in practice. This challenges refer to patient physiopathology conditions (e.g heart output, kidney disease, breath holding problems and etc.), contrast medium (low/high Iodine concentration, dye temperature), scanner's speed and equipment with angiographic applications (Blus tracking or test bolus), type of injector (dual or single head), using low-dose protocols, and type of catheter (central or peripheral venous) will be discussed. Firstly, the fundamental principles of CTPA from the patient educations to the multi-planar reconstructions were discussed in summary. Finally, the clinical solutions were provided to decreasing the dye volume at the lowest, obtaining the best delay time, optimizing the protocol parameters, with considering the patients' safety based on the recent studies.

Vessels diameter and scan time must be included for calculating the contrast medium volume. Also, using dual head injector and test bolus (instead of bolus tracking) can decrease the total contrast volume to 35 mL. Temperature can increase the contrast medium viscosity and have inverse effect on the choosing the injection rate in patient with unstable veins. Using a test bolus to determine CM arrival time at two locations (i.e., ascending aorta and pulmonary trunk) can be performed to better determine the arrival time of the diagnostic CM in the target vessel of choice, especially in patient with heart failure. Using the bolus tracking instead of test bolus can be more useful in some patient with urgency condition or for double rule-out study (CTA for Pulmonary Embolus and thoracic aorta). Craniocaudal CT pulmonary angiography is suggested in recent 16-slice scanners with short scan time equal to the patient breath holding (5-10 s). Craniocaudal had a similar degree of respiratory motion artifact to caudocranial scanning, in contrast, cause to better peak contrast enhancement in the distal pulmonary branches. Inserting the region of interest (ROI) in the nearest place to the beginning of scan is necessary, especially in scanners with high diagnostic delay time. In this way, there is not necessary to starting the scan from top of lung. Thus inserting the ROI in 1-2 cm upper than aortic arch helps to decrease the diagnostic delay and decreasing the patient radiation dose. Decreasing the scan speed is more helpful in patient with insufficient heart output (high time of peak enhancement) and with tall lung. In this cases, the contrast medium has enough time to arrival to the distal pulmonary branches. The tube voltage decreasing instead of tube current should be considered in low-dose protocols. Recent studies are shown that using the lower tube voltage (80-100 kVp) can allow the lower contrast medium usage with same diagnostic value for patient with medium size.

Keywords: Indoor radon; Ventilation; Diurnal effect; Occupational intakes; Inhalation dose;

References

[1] Kamr WH, El-Tantawy AM, Harraz MM, Tawfik AI. Pulmonary embolism: Low dose contrast MSCT pulmonary angiography with modified test bolus technique. European Journal of Radiology Open. 2020 Jan 1;7:100254.

[2] Dhamanaskar KP, Figueira KS, Jerome SC, Yemen BL. Test bolus technique for detection of pulmonary emboli at 64-slice multidetector computed tomography angiography. Canadian Association of Radiologists Journal. 2013 Aug;64(3):226-8.

[3] Kok M, Mihl C, Mingels AA, Kietselaer BL, Mühlenbruch G, Seehofnerova A, Wildberger JE, Das M. Influence of contrast media viscosity and temperature on injection pressure in computed tomographic angiography: a phantom study. Investigative radiology. 2014 Apr 1;49(4):217-23.

[4] Nania A, Weir A, Weir N, Ritchie G, Rofe C, Van Beek E. CTPA protocol optimisation audit: challenges of dose reduction with maintained image quality. Clinical Radiology. 2018 Mar 1;73(3):320-e1.

[5] Wu H, Chen X, Zhou H, Qin B, Cao J, Pan Z, Wang Z. An optimized test bolus for computed tomography pulmonary angiography

and its application at 80 kV with 10 ml contrast agent. Scientific Reports. 2020 Jun 23;10(1):10208.

[6] Li YJ, Lau KK, Ardley N, Lau T. Efficacy of 'breath holding at ease' during CT pulmonary angiography in the improvement of contrast enhancement in pulmonary arteries. Journal of Medical Imaging and Radiation Oncology. 2013 Aug;57(4):415-22.

Digital Radiography in Motion: A Review of Dynamic Imaging Techniques and Applications

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Abstract: Digital radiography has undergone rapid technological advancement in recent years, evolving from static to dynamic imaging capabilities. While conventional radiography produces a single static projection image, dynamic digital radiography allows the continuous acquisition of multiple frames during a radiographic scan. This emerging technique shows great promise for expanding the clinical applications of digital radiography through functional and physiologic imaging. In this study, we investigated the Google Scholar and PubMed databases with the following search strategy: the exact phrase" Dynamic Digital Radiography" in the Title or abstract of the articles. Several studies have investigated the feasibility of using dynamic flat panel detectors to enable new time-resolved imaging techniques. Motion-compensated subtraction has been applied in the chest and abdomen to visualize vascular structures through enhancement of contrast. High-speed digital radiographic fluoroscopy of the musculoskeletal system has also been shown to assess joint kinematics and measure ligamentous laxity. More recently, dynamic perfusion imaging of the lungs using time-resolved digital chest radiography has been demonstrated. A case of pulmonary artery sarcoma imaged with multiphasic chest radiography, revealed abnormal parenchymal enhancement caused by pulmonary blood flow obstruction. Quantitative assessment of lung perfusion using dynamic flat panel chest radiography has been shown capable of detecting regional lung dysfunction in a porcine model. The emergence of dynamic flat panel digital detectors has opened new possibilities for functional and physiologic imaging with radiography. Motion-compensated techniques and perfusion imaging are active areas of research that aim to expand the utility of dynamic digital radiography in clinical practice. Further technical refinement and clinical validation studies are needed to fully realize the potential of these novel dynamic imaging capabilities. In summary, the wide array of emerging clinical applications highlights the versatility of dynamic digital radiography for functional and physiological imaging. As outlined above, time-resolved radiographic techniques have shown promise for dynamic assessment of cardiac function, lung ventilation, swallowing, gastric motility, urinary obstruction, joint kinematics, and vascular flow across organ systems. With continued technological progress and clinical translation, dynamic digital radiography is poised to take on an increasingly vital role in modern medical imaging and intervention.

Keywords: "Dynamic Digital Radiography"," Medical Imaging", "Digital Radiography", and "Fluoroscopy"

References

[1] Yamamoto S, Sakamaki F, Takahashi G, Kondo Y, Taguchi N, Esashi S, Yuji R, Murakami K, Osaragi K, Tomita K, Kamei S, Matsumoto T, Imai Y, Hasebe T. Chest digital dynamic radiography to detect changes in human pulmonary perfusion in response to alveolar hypoxia. J Med Radiat Sci. 2022 Sep 13. doi: 10.1002/jmrs.619. Epub ahead of print. Erratum in: J Med Radiat Sci. 2023 Jan 2;: PMID: 36101943.

[2] Hussain ZB, Khawaja SR, Karzon AL, Ahmed AS, Gottschalk MB, Wagner ER. Digital dynamic radiography novel diagnostic technique for posterior shoulder instability: a case report. JSES Int. 2023 Mar 23;7(4):523-526. doi: 10.1016/j.jseint.2023.02.015. PMID: 37426924; PMCID: PMC10328772.

[3] Yamamoto S, Sakamaki F, Takahashi G, Yuji R, Matsumoto T, Hasebe T. Novel pulmonary perfusion imaging using chest digital dynamic radiography for pulmonary artery sarcoma. Respirol Case Rep. 2021 Mar 9;9(4):e00737. doi: 10.1002/rcr2.737. PMID: 33732469; PMCID: PMC7943749.

[4] Hanaoka J, Shiratori T, Okamoto K, Kaku R, Kawaguchi Y, Ohshio Y, Sonoda A. Reliability of dynamic perfusion digital radiography as an alternative to pulmonary perfusion scintigraphy in predicting postoperative lung function and complications. J Thorac Dis. 2022 Sep;14(9):3234-3244. doi: 10.21037/jtd-22-383. PMID: 36245586; PMCID: PMC9562549.

[5]Yamamoto S, Hasebe T, Tomita K, Kamei S, Matsumoto T, Imai Y, Takahashi G, Kondo Y, Ito Y, Sakamaki F. Pulmonary perfusion by chest digital dynamic radiography: Comparison between breath-holding and deep-breathing acquisition. J Appl Clin Med Phys. 2020 Nov;21(11):247-255. doi: 10.1002/acm2.13071. Epub 2020 Oct 26. PMID: 33104288; PMCID: PMC7700935.

[6] Pavlovich RI, Vazquez-Vela G, Pardinas JL, Bustos Villarreal JM, Rico EC, de la Mora Behar G. Basic science in digital imaging: digital dynamic radiography, multimedia, and their potential uses for orthopaedics and arthroscopic surgery. Arthroscopy. 2002 Jul-Aug;18(6):639-47. doi: 10.1053/jars.2002.33734. PMID: 12098127.

Evaluation of Geometric Distortion Brain MRI Images on A 1.5T Scanner

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Background and purpose:

Traditionally, computed tomography (CT) images have been the primary modality used for radiotherapy (RT) treatment planning. However, in recent years, magnetic resonance imaging (MRI) has emerged as a valuable tool specifically tailored for radiotherapy purposes. MRI images offer superior visualization of soft tissues, fulfill the dose painting requirements in radiation therapy, and provide access to valuable physiological information such as diffusion and perfusion, which can aid in tumor delineation. However, it is crucial to address and evaluate the geometric distortions inherent in MRI images to ensure high-accuracy MRI treatment planning.

Therefore, the aim of this study was to evaluate of geometric distortion present in MRI images, as this information is vital for ensuring accurate and reliable treatment planning.

Materials and methods:

CT images, which serve as our standard reference with minimal geometric distortion, were registered with MRI images using the ISOGray Treatment Planning System. Subsequently, contours were generated and extracted from the registered images. Finally, quantitative assessments such as the Dice coefficient and Hausdorff distance were calculated, and the volumes of the contours were compared using 3D Slicer modules.

Results:

The values of the Dice coefficient and Hausdorff distance were measured as 0.94 and 19.35, respectively, when using CT as the reference and comparing it to the DWI segment. Similarly, when comparing it to the FLAIR segment, the values were 0.95 for the Dice coefficient and 18.47 for the Hausdorff distance

Conclusions:

The numerous advantages of MRI images compared to CT have sparked significant interest in using MRI images alone for treatment planning in the last few decades. This study has revealed differences between the contoured regions, highlighting the need for designing a phantom to quantify the extent of geometric distortion present**.**

Keywords:

Radiotherapy, Magnetic resonance imaging, CT, Geometric distortion, treatment planning

Determination of Early Ischemic Stroke Area in Non-Contrast CT Images Using Deep Learning

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Rationale:
Although non-contrast computed tomography (NCCT) is the most widely used clinical imaging modality for acute ischemic stroke (AIS), but it cannot detect significant changes in early infarction. Our goal is to develop a deep learning model to identify early invisible AIS in NCCT and evaluate the diagnostic performance to help radiologists decide the type of treatment method.

Method:
In this study, we worked on two datasets, (1) original data set and (2) Independent test set.The ischemic area in early stages is not enhanced on CT images and is visible only on MRI images.The AIS lesions were confirmed based on the follow-up diffusion weighted imaging and clinical diagnosis .We decided to use our data to train Convolutional neural network (CNN). For this purpose, we performed pre-processing on the images to improve the processing time, resource consumption and model efficiency. In the first step, we registered the CT images on DWI and obtained masks of the target regions by segmenting stroke lesion. We converted the target areas into binary masks with class 0 (healthy) and 1 (stroke). we decided to perform the batchify operation on the images, it means to divide them into smaller images. We defined the appropriate structure for U-net 2d network and trained the model with allocated 20% of the data for testing and 80% of the data for training.

Results:
150 patients (median age, 50 years) were assigned to training and internal validation groups. This model has sensitivity 83.61%, specificity 68.99%, and accuracy, 89.87%.

Conclusions:
This deep learning model solves the challenge of not seeing AIS invisible lesions in NCCT and saves more time.With the help of this model, radiologists can provide more effective guidance in making patients' treatment plan in clinic.

Keywords:
Acute ischemic stroke, Deep learning, Non-contrast computed tomography, Computer-aided detection, artificial intelligence, deep-learning

Evaluation and Diagnosis of Multiple Sclerosis Using Retinal Images with The Help of Artificial Intelligence

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Abstract Introduction: Multiple Sclerosis (MS) is a prevalent autoimmune and inflammatory disorder that leaves demyelination and neurodegenerative changes in Central Nervous System (CNS). The retina is among body organsthat is affected by MS, particularly the pRNFL, which is impaired during the early episodes of the disorder. Optical Coherence Tomography (OCT) images can play a key role in the preliminary stages. Convolutional Neural Networks (CNN)-based methods are commonly applied in image classification and have shown promising and applicable results in MS diagnosis. Method: in total, 197 MS patients and 283 healthy cases were included in this study, and Spectralis OCT images were taken then, using data augmentation, the CNN was trained with 15,000 images. Finally, the automatic diagnosis algorithm for MS disease was implemented in Python, and then the network loss processes diagram was drawn, and the sensitivity, specificity, and accuracy of the algorithm were evaluated. Result: The disease was successfully diagnosed by OCT images with an accuracy of 93.0, a sensitivity of 96.47, and a specificity of 90.44. Conclusion: The proposed method showed improvements in early-stage MS diagnosis and with the potentiality to be used in either the diagnosis or prediction of the progression of other diseases that affect the CNS (e.g. Alzheimer's disease, bipolar disorder, etc.).

Keywords: convolutional neural network, multiple sclerosis, optical coherence tomography, retinal layer thickness

References

[1] Ferguson B, Matyszak MK, Esiri MM, Perry VH. Axonal damage in acute multiple sclerosis lesions. Brain. 1997;120 (Pt 3):393-9.

[2] You Y, Barnett MH, Yiannikas C, Parratt J, Matthews J, Graham SL, et al. Chronic demyelination exacerbates neuroaxonal loss in patients with MS with unilateral optic neuritis. Neurol Neuroimmunol Neuroinflamm. 2020;7(3).

[3] Eslami F, Ghiasian M, Khanlarzade E, Moradi E. Retinal Nerve Fiber Layer Thickness and Total Macular Volume in Multiple Sclerosis Subtypes and Their Relationship with Severity of Disease, a Cross-Sectional Study. Eye Brain. 2020;12:15-23.

[4] Joy JE, Johnston RB, Jr. Multiple Sclerosis: Current Status and Strategies for the Future. In: Institute of Medicine Committee on Multiple Sclerosis: Current S, Strategies for the F, editors. Multiple Sclerosis: Current Status and Strategies for the Future. Washington (DC): National Academies Press (US) Copyright 2001 by the National Academy of Sciences. All rights reserved.; **2001.**.

[5] Roy S, Bhattacharyya D, Bandyopadhyay SK, Kim TH. An effective method for computerized prediction and segmentation of multiple sclerosis lesions in brain MRI. Comput Methods Programs Biomed. 2017;140:307-20.

[6] Fu Y, Talavage TM, Cheng JX. New imaging techniques in the diagnosis of multiple sclerosis. Expert Opin Med Diagn. 2008;2(9):1055-65

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Diagnosis of Pneumothorax in CT Scan Images Using Machine Learning Algorithms and Radiomics Features

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Abstract: Imaging in the emergency department is a time-dependent process. The development of artificial intelligence models can improve the performance of any diagnostic system by minimizing diagnostic errors and increasing the speed of image interpretation by radiologists. The purpose of this study is to create an intelligent model for pneumothorax detection in CT scan images using radiomics features and implementing machine learning algorithms.

The data used in this study was extracted from the files of 175 patients suspected of pneumothorax. The collected images were pre-processed in the Matlab software. Then the machine learning algorithms including Gradient Tree Boosting (GBM), eXtreme Gradient Boosting (XGBOOST) and Light GBM (LGBM) were used to classify the images. Various evaluation criteria such as precision, accuracy, specificity, sensitivity, F1 score, the area under the ROC curve and misclassification were calculated to evaluate the performance of these models.

According to the calculated evaluation criteria, for the Light GBM model, the accuracy, precision, specificity and F1 scores were 0.98979, 0.99559, 0.98435 and 0.99430, respectively. These findings indicate the better performance of the Light GBM model compared to other models. The Light GBM model with a sensitivity value of 0.99763 had the best performance among these algorithms.

The obtained results showed that the machine learning algorithms used in this research can accurately identify healthy and pneumothorax images and thus facilitate and accelerate the process of diagnosis and treatment of this disease.

Keywords: “Pneumothorax”, “Radiomics”, “CT scan”,” Machine Learning”, “Artificial Intelligence”

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Investigating artificial intelligence applications in motion artifacts: a systematic review

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Introduction: The quality of images is always one of the most challenging and important issues in the field of medical imaging, including the MRI. The appropriate quality of images can be useful and effective in the process of diagnosing and treating patients correctly and even monitoring their physical condition after treatment. One of the factors that reduce the quality of the MRI is the motion artifact that causes errors in the diagnosis and treatment process, the repetition and prolongation of the imaging process, and the annoyance of patients. Today, there are various technologies to solve this problem, one of which is artificial intelligence. The purpose of this study is to investigate the applications of artificial intelligence in this field.

Method: In this study, four databases Scopus, PubMed, IEEE Xplore and Web of Science were searched to retrieve related articles in artificial intelligence applications in motion artifacts. No restrictions were applied during the search. To conduct this study, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline was followed.

Results: The results of the search led to the retrieval of 4473 articles. After reviewing the abstract and title of the articles, a total of 84 articles were related. The results of the review of these articles showed that artificial intelligence had two major applications: 1. Detection of motion artifacts and 2. Reduce or correct motion artifacts. These articles were published between 2006 and 2023. The highest number of published articles was related to 2023 with 18 articles (21.43%). The results of these studies have shown that artificial intelligence has the potential to detect and reduce motion artifacts. Among the different methods of artificial intelligence, the deep learning method was used more than other methods.

Conclusion: The results of this study showed that artificial intelligence can be effective both in detecting and reducing motion artifacts. It is suggested to use this method in Iran to detect and reduce motion artifacts.

Keywords: motion artifact, artificial intelligence, MRI, artifact correction, artifact detection

Optimizing Medical Image Denoising Through Intelligent Recurrent Neural Networks with LSTM and Batch Normalization

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Abstract:

Denoising medical images, often affected by random factors such as noise, time-varying parameters, and more, is a longstanding challenge in the domain of signal and image processing. Stochastic systems are also those influenced by random factors, which can be considered as random processes. Random processes are composed of a set of random variables. Each random variable at any given moment exhibits behavior that may follow a well-known probability distribution or an unknown distribution. Studying random processes assists us in gaining a better understanding of the behavior of our systems and enables us to make more accurate predictions about their future.

In this comprehensive review article, we explore the remarkable advancements in the field of medical image denoising. Addressing the persistent challenge of noise in medical images, we introduce an effective denoising system that incorporates Long Short-Term Memory (LSTM), Batch Normalization, and Recurrent Neural Networks (RNN). We delve into the historical perspective, methodologies, applications, and comparative analysis of these techniques, highlighting their significant impact on medical imaging. Additionally, we discuss the relevance of stochastic systems and their role in understanding hidden dynamics within physical systems across various temporal and spatial scales. This review underscores the critical importance of these advancements in improving the quality and reliability of medical image analysis, facilitating more accurate diagnoses, and enhancing patient care.

Keyword: Denoising, RNN, LSTM, Batch Normalization, Image processing

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Statistical Analysis of Haralick Features for Discrimination of Malignancy from Benignity in Breast Ultrasound Images

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Abstract

Introduction: Effective detection of breast cancer is crucial as it is one of the major causes of female mortality. While mammography is the primary screening method, ultrasound is also valuable, especially for young women and those with dense breast tissue [1]. However, ultrasound imaging has resolution constraints and is susceptible to noise, which makes distinguishing between benign and malignant breast tumors challenging [2]. Artificial intelligence, specifically deep learning, offers a promising solution through automated image analysis and diagnostic support [1]. This study aims to evaluate the effectiveness of Haralick texture features that are extracted from 2D breast ultrasound images by the method called GLCM, in classifying tumors as benign or malignant [3][4]. The ultimate goal is to determine the suitability of these features for machine learning applications and comprehensive characterization of breast lesions.

Materials and Methods: In this study, breast ultrasound images containing both benign and malignant masses were used as the dataset. The images have been divided into two categories: benign and malignant. Some of the images containing two masses have been removed from the dataset. The remaining images were then examined for size consistency, and those that were not of the same size were excluded from the dataset.

The skimage.feature library was used for extracting Haralick features by Python. In this library, a GLCM (Gray-Level Co-occurrence Matrix) matrix was first obtained from the ROI (Region of Interest). Six Haralick features, namely Contrast, Dissimilarity, Homogeneity, ASM (Angular Second Moment), Energy, and Correlation, were extracted at four different angles: 0, 45, 90, and 135 degrees[6]. Subsequently, the extracted features were averaged for each angle, and these averaged values were used as the final dataset for analysis.

Results: The number of benign and malignant data points in this study is 437 and 211 respectively [7]. Shapiro-Wilk test was conducted on the Data by Python from breast ultrasound images in two groups, benign and malignant, which showed that the data distribution does not follow a normal distribution [8]. Therefore, a Mann-Whitney test was used to compare the means of the features [9]. The Mann-Whitney test was performed for both groups of images, and it was concluded that all six Haralick features were suitable for classification.

Conclusion: One of the crucial steps in machine learning is selecting appropriate features for data modelling and classification [10]. One effective approach to finding suitable features is using statistical tests [11]. To employ statistical tests, it's necessary to determine the data distribution type. In this study, the type of data distribution was identified as non-normal using the Shapiro-Wilk test. Consequently, the Wilcoxon test was applied for data analysis, in this test, the p-value for each of the six features was much less than 0.05 revealing that six Haralick features extracted from ultrasound images are suitable for classification

Keywords: GLCM, Haralick features, Breast Cancer, Python

References

[1] Brunetti, Nicole & Calabrese, Massimo & Martinoli, Carlo & Tagliafico, Alberto. (2022). Artificial Intelligence in Breast Ultrasound: From Diagnosis to Prognosis—A Rapid Review. Diagnostics. 13. 58. 10.3390/diagnostics13010058.

[2] Ouyang, Y., et al. (2019). "Classification of Benign and Malignant Breast Tumors Using H-Scan Ultrasound Imaging." Diagnostics 9(4): 182.

[3] Davnall F, Yip CS, Ljungqvist G, Selmi M, Ng F, Sanghera B, Ganeshan B, Miles KA, Cook GJ, Goh V. Assessment of tumor heterogeneity: an emerging imaging tool for clinical practice? Insights Imaging. 2012 Dec;3(6):573-89. doi: 10.1007/s13244-012-0196-6. Epub 2012 Oct 24. PMID: 23093486; PMCID: PMC3505569.

[4] Gnep K, Fargeas A, Gutiérrez-Carvajal RE, Commandeur F, Mathieu R, Ospina JD, Rolland Y, Rohou T, Vincendeau S, Hatt M, Acosta O, de Crevoisier R. Haralick textural features on T2 - weighted MRI are associated with biochemical recurrence following radiotherapy for peripheral zone prostate cancer. J Magn Reson Imaging. 2017 Jan;45(1):103-117. doi: 10.1002/jmri.25335. Epub 2016 Jun 27. PMID: 27345946.

[6] Lubis BO, Oscar D, Fibriany FW, Santoso B, Jefi J, Rusman A. Classification of tomato leaf disease and combination extraction features using K-NN algorithm. InAIP Conference Proceedings 2023 May 9 (Vol. 2714, No. 1). AIP Publishing

[7] Al-Dhabyani W, Gomaa M, Khaled H, Fahmy A. Dataset of breast ultrasound images. Data in Brief. 2020 Feb;28:104863. DOI: 10.1016/j.dib.2019.104863.

[8] Hanusz Z, Tarasinska J, Zielinski W. Shapiro–Wilk test with known mean. REVSTAT-Statistical Journal. 2016 Feb 25;14(1):89-100.

[9] MacFarland TW, Yates JM, MacFarland TW, Yates JM. Mann–whitney u test. Introduction to nonparametric statistics for the biological sciences using R. 2016:103-32.

[10] Li J, Cheng K, Wang S, Morstatter F, Trevino RP, Tang J, Liu H. Feature selection: A data perspective. ACM computing surveys (CSUR). 2017 Dec 6;50(6):1-45.

[11] Bettany-Saltikov J, Whittaker VJ. Selecting the most appropriate inferential statistical test for your quantitative research study. Journal of Clinical Nursing. 2014 Jun;23(11-12):1520-31.

Dose Perturbation Calculation Due to The Different Inhomogeneities in The Presence of 1.5 Tesla Magnetic Field with 18 MV Flattening Filter Free (FFF) Photon Beam

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Abstract:

Background or Introduction: Magnetic resonance image-guided radiation therapy (MRIgRT) systems enhance tumor imaging and treatment precision by combining linear accelerators and MR scanners for real-time tumor movement observation. Two MRIgRT systems are being developed: one with a transverse magnetic field to the beam axis and the other with a longitudinal magnetic field to the beam axis. The transverse magnetic field system can lead to an increase in dose on the exit surface due to the "electron return effect (ERE)" and shift dose distributions along the direction of the Lorentz force. The longitudinal magnetic field system increases the skin dose in the patient due to incident electrons from the upper side of the multileaf collimator. In the presence of inhomogeneities such as air cavities and implants like PEEK, the dose distribution can be significantly affected. Monte Carlo program (MCNP **6.1) will be used for dose perturbation calculations to investigate the effect of magnetic field in dose** distribution in the presence of these inhomogeneities.

Material and Methods: The dose distributions in a virtual lung phantom under the influence of magnetic fields were calculated using the MCNP 6.1 Monte Carlo code. The phantom size was **50×50×50 cm^3. Different inhomogeneities included PolyetherEtherKetone (PEEK), and an air cavity** was incorporated into it each time, positioned at a depth of 2 cm and with a thickness of 2 cm. The PEEK and air cavity density were set to 1.30 and 0.01205 g/cm^3. The uniform magnetic flux density of **1.5 T was used for 10×10 cm^2 fields at a source-to-surface distance of 100 cm, using an 18 MV photon** spectrum without flattening filter (FFF).

Results & Discussion: The dose in front of the inhomogeneities, water–PEEK, and water-air cavity interfaces in the phantom increased by 4.33% and 31.12% for the 1.5 T transverse magnetic field, respectively. The dose behind the water-air cavity interface decreased by 36.42%. However, the dose behind the water-PEEK interface increased by 3.55%. The PEEK inhomogeneity was prone to creating hot spots on both sides. However, the air cavity inhomogeneity was prone to creating hot and cold spots in front and behind the inhomogeneity.

Conclusion(s): The dose perturbation due to the inhomogeneity in the presence of the transverse magnetic field might be intensive. The PEEK with a high mass density produces hot spots, and the air cavity makes both cold and hot spots.

Keywords: Magnetic field, Dose perturbation, Inhomogeneity, MCNP 6.1, 18 MV photon beam

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Calculation of The Dosimetric Parameters of 18 MV Photon Beam from Flattening Filter (FF) And Flattening Filter Free (FFF) Of Linear Accelerator with and Without the Magnetic Deflector (MD) And Lead Filter

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Abstract:

Background or Introduction: The presence of charged particles in therapeutic photon beams can cause contamination, leading to a shift in maximum dose depth, an increase in surface dose, and a reduction in skin-sparing effectiveness. Electrons and positrons are generated through photon interactions within the LINAC head and air volume. The flattening filter (FF) and beam monitor chamber are primary sources of electron contamination. Removing the FF can decrease head scatter, increase dose rate, and reduce electron and neutron contamination. Reducing field size, using magnetic fields, replacing air with helium, and using lead filters can reduce electron contamination. Using the Monte Carlo technique, dosimetric properties were compared in FF and flattening filter-free (FFF) modes of 18 MV- 2100 C/D Varian LINAC's head. The magnetic deflector and lead filter were evaluated for electron contaminant reduction in FF and FFF modes.

Material and Methods: The Monte Carlo (MC) code, MCNP version 6.1.0, was utilized to simulate the 18 MV photon beam of a 2100 C/D-Varian linear accelerator (LINAC) for both the flattening filter (FF) and flattening filter free (FFF) modes. The simulation included modeling a magnetic field of 1 T and a lead filter with a thickness of 1 mm to remove contaminant electrons. The study aimed to calculate the dosimetric parameters for various scenarios of the LINAC's head.

Results & Discussion: The study found that removing the flattening filter in the flattening filter free (FFF) mode resulted in an increase in the dose rate, electron contamination, skin dose, and un-flatness compared to the flattening filter (FF) mode. However, the off-axis dose was reduced. Using a lead filter significantly reduced contaminant electrons, while the magnetic deflector (MD) removed all secondary electrons from the beam line. In the FF mode, the surface dose was decreased by 4.5% and 6.1% for the MD and lead filter, respectively. In the FFF mode, the surface dose was reduced by 5.9% and 4.4% for the MD and lead filter, respectively. The MD and lead filter also reduced penumbra by 15.5% and **11.5% compared to the FFF mode. These findings suggest that using a lead filter or MD can effectively** reduce electron contamination and improve dosimetric parameters, particularly in the FFF mode.

Conclusion(s): The study evaluated methods to reduce electron contamination in therapeutic photon beams. Results suggest that using a lead filter or magnetic deflector can reduce electron contamination and improve dosimetric parameters.

Keywords: Magnetic field deflector, Electron contamination, Flattening filter free, Radiotherapy, MCNP 6.1

Evaluation of Dose Perturbation Due to the Different Dental Implants for Head and Neck Cancer Electron Therapy

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Abstract:

Background or Introduction: Head and neck cancer patients usually have dental prostheses over the age of 50 years. In some cases, electron therapy is used to treat head and neck cancer. The presence of a dental implant across the irradiation beam can potentially disturb the delivered dose distribution. Radiation scatters from high-density and atomic number materials cause tissue complications in the oral cavity. In this study, the effect of different commercial dental implants on absorbed dose was investigated in electron beam therapy of patients with head and neck cancer.

Material and Methods: The LINAC head, dental implants, crown, mandible, and phantom are simulated precisely by MCNPX (2.6.0). Six different implant materials, including Titanium, Titanium alloy, Zirconia (Y-TZP), Zirconium oxide, Alumina, and PolyetherEtherKetone (PEEK), were investigated in sizes of 0.35 cm in diameter and 1.6 cm in height. The 6 and 9 MeV electron beams were used in 10x10 filed size. Present depth doses (PDDs) and dose profile curves were calculated and compared with and without different implants.

Results & Discussion: According to the PDD and profile curves, the highest and lowest increasing doses occurred in Y-TZP (114.44% and 108.69% for 6 and 9 MeV, respectively) and PEEK (104.85% and 98.84% for 6 and 9 MeV, respectively) directly in front of the implant, respectively. Removing an implant from the jaw can avoid increasing the dose in front of the implant, but this causes an increasing dose rate behind the implant in both energies.

Conclusion(s): The amount of dose perturbation due to the dental implant's presence depends on the beam

energy, mass density, and atomic numbers of implants. Maximum and minimum increased doses were

estimated for Y-TZP and PEEK implants, respectively. Considering the accurate correction factor in electron

beam therapy is essential to estimate the correct dose delivery in the treatment planning system (TPS).

Keywords: Radiotherapy, Electron therapy, Dental implant, Monte Carlo simulation, Dose distribution

Comparison of Monte Carlo and Collapsed Cone Algorithms Performance Used in The Monaco Treatment Planning System in Prediction of Cardiac and Pulmonary Complications in Left- Breast Cancer Radiotherapy

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Abstract:

Objective: The aim of this study was to evaluate the performance of dose calculation algorithms used in the Monaco treatment planning system to predict cardiac and pulmonary complications due to left breast radiation therapy.

Methods: Three-dimensional dose distribution of 21 patients with left breast cancer was prepared by dose calculation algorithms CC and MC with the same monitor unit. Cardiac and pulmonary complications due to radiation therapy in these patients by different radiobiological models as well as parameters Various extracts from previous studies were examined using MATLAB software. In this study, MC dose calculation is considered as benchmark data. non-parametric Friedman test and Wilcoxon test were used for statistical comparison of the obtained results.

Results: A good agreement was observed between the NTCP values obtained by MC and CC algorithms, and this result is true for TCP values. For two dose calculation algorithms, the value of TCP was estimated to be acceptable, with the same parameter being higher for the Poisson model than for the Niemierko model. The difference between NTCP for CC and MC algorithms is not statistically significant for most parameter sets (P-Value<0.01). The results of this study for cardiovascular complications show a high correlation between CC and MC algorithms for different parameters and endpoints.

Conclusion: In this study, we have tried to investigate the possible clinical implications of the two CC and MC dose calculation algorithms used in the clinic by comparing different NTCP models/parameters. Dose calculation algorithms estimate the acceptable value of TCP and the NTCP calculated for both CC and MC algorithms. The value obtained for NTCP depends on the radiobiological parameters used in the mathematical formula and the amount of dose extracted from the dose calculation algorithms.

Keywords: Dose calculation algorithms; TCP; NTCP; Radiobiological Models; Breast Cancer

Evaluation of Dose Calculation Accuracy of Isogray Treatment Planning System in Prediction of Dose Fluctuation Levels During Radiotherapy of Breast Cancer at 6-15 MV Beam Energies

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Abstract:

Objective: In radiation therapy, ensuring the accuracy of the calculated and delivered dose to the patient may not be easily achieved, because many computational and dosimetrical errors can exist between the dose calculations of the treatment planning system (TPS) and the amount of delivered dose using the treatment machine. The question of the current research is whether there is an acceptable agreement between the calculated dose distribution performed by the point kernel algorithm of ISOgray TPS in virtual wedge fields (in the heterogeneous thorax phantom) with the experimental dose distribution in Breast radiotherapy?

Methods: An anthropomorphic thorax phantom similar to the human body was designed and manufactured using materials equivalent to the body. After CT imaging, the treatment area and vital tissues such as heart and thorax were contoured by the oncologist. The treatment plan was done by the radiotherapy physicist on the phantom with suitable fields. 3D dose distribution was calculated by CCS algorithm. Irradiation to the phantom was performed according to the treatment plan using a Siemens ARTISTE linear accelerator. Two-dimensional film dose distributions were acquired in a specific slice in the phantom. Finally, using VeriSoft software (MEPHYSTO PTW, Freiburg, Germany) and 2D gamma analysis, the behaviour of the calculated isodose curves and the measured dose distributions at standard virtual wedge angles at 6 and 15 energies were investigated.

Results: Evaluation of two-dimensional dose distribution obtained from TPS calculations and film measurements showed that the value of gamma acceptance rate (3%–3 mm gamma criteria, local mode) was in the range of 78.0 ± 0.8% to 88.8 ± 0.6% at low energy and between 88.3 ± 0.5% to 92.0 ± 0.3% at high energy. In addition, we found that there is no significant difference in the change of the virtual wedge angles in different energies. But the results of our study state that this algorithm overestimated the dose of the soft tissue. Also, the ISOgray underestimated the dose in lung regions at both energies.

Conclusion: Our findings demonstrate that the dose calculation accuracy of ISOgray TPS in Breast radiotherapy was good agreements with practical dose distributions at 6-15 MV photon energies.

Keywords: ISOgray TPS; Breast radiotherapy; Thorax phantom; Virtual Wedge Filter; Siemens ARTISTE linac

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Introduce A New Three-Dimensional Dosimetry Method of IMRT with Radiochromic Film and Comparison Results with Monte Carlo Simulation and Full Scatter Convolution Computational Algorithm in The Heterogeneous Head Phantom

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Abstract:

Objective: The main idea of this research is to apply batch of radiochromic films, close to each other in a heterogeneous head phantom to assess the quality assurance of IMRT treatments. Introduced a new method for three-dimensional dosimetry in IMRT technique with the use of a set of radiochromic films in heterogeneous head phantom is the main objective of the current project.

Methods: First, the dosimetric characteristics of LinaTech DMLC-H multi leaf collimator using different experimental measurement tools (EDGE detector and EBT3 film) and Monte Carlo simulations were determined. The Siemens Primus 6 MV head, together with the external MLC using a VARMLC module in the BEAMnrc code were simulated according to the specifications of their manufacturers. After making anthropomorphic head phantom, PTV and OAR areas, according to RTOG H-0022 protocol were defined within the phantom and then accordance with the provisions of this Protocol, the doses were applied with appropriate restrictions and ultimately IMRT treatment plan using the TiGRT treatment planning system (FSC algorithm) was performed. The phantom was irradiated by substituting batch of the radiochromic films at intervals of 3 mm and 1 mm. IMRT treatment plan in a heterogeneous environment was simulated by EGSnrc code. The results of the three-dimensional dose distribution obtained from FSC algorithm and MC calculations were compared with the measured dose distribution and were analyzed using conventional criteria (3 mm-3%) by γ index.

Results: The good agreement was observed between experimental measurements and simulated MLC. The results showed that the dosimetric characteristics of DMLC-H are consistent with the criteria specified in international standards. Dose distributions obtained from the anthropomorphic head phantom showed that in axial, coronal, and sagittal planes, by improving the resolution (3 to 1 mm) γ pass rate of FSC algorithm and MC calculations respectively about 3% and 1.5% increase. Also, in these planes, the differences in the γ pass rate between the FSC algorithm and MC simulation with a resolution of 3 mm and 1 mm are about 8.5% and **7.4%, respectively. In general, the acceptance rate of γ index calculated by the FSC algorithm** and MC simulation was obtained in the range of 89%-92% and 98%-99%, respectively.

Conclusion: The results of this study show that the 3D gamma passing rate obtained from the FSC algorithm in the heterogeneous head phantom is less than expected and desirable value (≥95%), while Monte Carlo calculations showed excellent agreement with experimental results.

Keywords: EBT3 film stack; IMRT; Quality assurance; Heterogeneous phantom; Gamma index

Assessment of The Radiotherapy Treatment Plans of Three-Dimensional Conformal Radiation Therapy, Intensity Modulated Radiation Therapy and Tomotherapy in Prostate Cancer Using Dosimetric and Radiobiological Indices

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Abstract:

Objective: New radiation therapy techniques have been developed in recent years for prostate cancer. The quality of treatment is influenced by the type of treatment technique in terms of dose distribution techniques and also its radiobiological indicators, including the Tumor Control Probability (TCP) and Normal Tissue Complication Probability (NTCP). This research was done with the aim of finding an adequate technique for treating prostate cancer by dosimetric and radiobiological comparison of three-dimensional conformal radiation therapy (3D-CRT) techniques and two new techniques of dynamic intensity modulated radiation therapy (Dynamic-IMRT) and tomotherapy.

Methods: In this study, ten patients with high-risk prostate cancer treated with radiation therapy in Madani Hospital of Tabriz were selected. Prostate tumoral tissue as a target and rectum, bladder and femoral head as normal tissues at risk were contoured according to the criteria of RTOG protocol. For each patient, three separate treatment plans were created for all three techniques. Prescribed dose of 70 Gy in 35 fractions was used for all three techniques. Monaco and Precision Accuray treatment planning systems were used for treatment planning. The dosimetric indicators of each treatment plan, including the heterogeneity index, irradiation time, and the minimum, maximum, and mean doses for each patient and each technique were extracted from the dose-volume histogram (DVH) curves. Then, by using the Biosuite software, using DVH data and radiobiological factors, the TCP and the NTCP were calculated based on LKB and RS models.

Results: In 3D-CRT technique, the mean dose values of bladder, rectum and head of right and left femoral bones were showed a significant difference compared to the other two techniques. The heterogeneity index of the 3D-CRT was higher than the other two techniques. The NTCP in the LKB model of the 3D-CRT technique was about 10% (range 3-11%) in the rectum, respectively, compared to IMRT and tomotherapy techniques. These numbers for the RS model was about 24% in the bladder and up to 17% in the rectum in 3D-CRT. The TCP parameter in all three techniques was 100%.

Conclusion: In 3D-CRT compared to other two techniques and in D-IMRT to tomotherapy, the absorbed dose was higher and as a result the probability of damage and complications of healthy organs was higher. This point was also confirmed by radiobiological models.

Keywords: TCP; NTCP; 3D-CRT; IMRT; Tomotherapy; Prostate cancer

Evaluation of Cumulative Bolus Performance During External Beam Radiation Therapy of Patients with Scc : Treatment Panning and Film Dosimetry

Sajedeh Sadat Jamalabadi. Sajjad Beynabaji. Mostafa Robatjazi. Seyyed Alireza Javadinia

Abstract: During SCC of the lips, the accumulated bolus is used to overcome the problem of low dose to the lips. The purpose of this study is to evaluate the performance of bolus in increasing the surface dose through the treatment planning system and film dosimetry. Two patients with squamous cell carcinoma (SCC) were included in the present study. Squamous cell carcinoma of the lip is a common malignancy in the head and neck region and one of the most treatable because it usually appears in the early stages. According to the tests performed and the results obtained, it can be concluded that there is a significant difference between the results in the presence of bolus and in the absence of bolus. In the present study, Gafchromic EBT2 films (ISP, USA) were used for in vivo dosimetry. In the presence of bolus, no significant difference was observed between the measured dose values and the calculated treatment planning system (TPS).
For the first patient, the film dose was 19.2 Gy and the program dose was 11.2 Gy in each session, which means a difference of 3.9%. For the second patient, the film dose was 2.23 Gy and the program dose was 2.16 Gy in each session, which means a difference of 48.3%. The result of the evaluation shows that the film had a higher dose in both patients

Keywords: SCC lip cancer , Buildup bolus , Film dosimetry , Treatment planning

Refrences

١. Azamjah N, Soltan-Zadeh Y, Zayeri F (2019) Global trend of breast cancer mortality rate: a 25-year study. Asian Pac J Cancer Prev 20(7):2015–2020
٢. Bao X, Sun K, Tian X, Yin Q, Jin M, Yu N, Jiang H, Zhang J, Hu Y (2018) Present and changing trends in surgical modalities and neoadjuvant chemotherapy administration for female breast cancer in Beijing, China: a 10-year (2006–2015) retrospective hospitalization summary report-based study. Thorac Cancer 9(6):707–717
٣. Sumodhee S, Strnad V, Hannoun-Lévi J-M (2018) Multicatheter interstitial brachytherapy for breast cancer. Cancer Radiother 22(4):341–344
٤. Robatjazi M, Baghani HR, Porouhan P (2021) Dosimetric comparison between different tangential field arrangements during left-sided breast cancer radiotherapy. Radiol Phys Technol 14(3):226–237

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Radiation Dose of Computed Tomography Pulmonary Angiography Examinations using Size -Specific Dose Estimate

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Abstract: In recent times, there has been a growing concern regarding the potential risks associated with radiation exposure from computed tomography (CT) scans as a diagnostic tool. One of the methods used to optimize the radiation dose received by patients is the implementation of diagnostic reference levels (DRLs). CTDIv (Volume Computed Tomography Dose Index) and DLP (Dose Length Product) are utilized to evaluate and establish Diagnostic Reference Levels (DRLs). The CTDIv has limitations in accurately estimating the patient dose, which is why the American Association of Physicists in Medicine (AAPM) has introduced SSDE (Size-Specific Dose Estimates) as a method for more precise estimation of patient radiation dose. In this study, the DRLs of CT pulmonary angiography (CTPA) examinations of adults is determined using CTDIv, DLP and SSDE. 200 CT examinations of pulmonary angiography were collected from PACS (Picture archiving and communication system) in Chamran hospital. The diameter effective (D_{eff}), conversion factor (CF) and SSDE calculated using AAPM TG -**204 and TG -220. Statistics analysis calculated using SPSS version 18. All scans in the study were** performed using the GE Healthcare 16 Slices CT scanner. For the injection protocols, a Medtron injector was utilized. Imaging includes two stages test bolus and pulmonary angiography. During the test bolus imaging, a volume of Visipaque between 12 to 18 ml was administered, while in the pulmonary angiography imaging, a volume of Visipaque between 30 to 40 ml was administered. For test bolus, imaging third quartile of $CTDI_V$, SSDE and DLP was 152.45 to 310.25, 215.25 to 438.72 and 152.45 to 310.25 and values of 12.54 to 15.65, 17.70 to 22.09 and 432.25 to 521.65 are determined for pulmonary angiography, respectively that are lower than national DRLs. In addition, calculated CF for pulmonary angiography was 1.412 ± 0.17. DRLs were lower than other studies in this study. Using the AEC (Auto Exposure Control) and different kVp in this hospitals can help optimization of patient dose. The SSDE must be calculable by radiographers to more accurate estimation of patient dose using CFs.

Keywords: Chest, CT Arteriography, SSDE, TG 204, TG 220

References

[1] Strauss KJ, Goske MJ, Towbin AJ (2017) Pediatric chest CT diagnostic reference ranges. Development and Application, 284(1): 219.

[2] Foley SJ, McEntee MF, Rainford LA (2012) Establishment of CT diagnostic reference levels in Ireland. Br J Radiol, 85(1018): 1390.

[3] Treier R, Aroua A, Verdun FR, Samara E, Stuessi A, Trueb PR (2010) Patient doses in CT examinations in Switzerland: implementation of national diagnostic reference levels. Radiat Prot Dosimetry, 142 (2-4): 244-54..

[4] Huda W and Tipnis SV (2016) Doses metrics and patient age in CT. Radiat Prot Dosimetry, 168(3): 374-80.

[5] Roch P and Aubert B (2013) French diagnostic reference levels in diagnostic radiology, computed tomography and nuclear medicine: 2004-2008 review. Radiat Prot Dosimetry, 154(1): 52-75

[6] Mansour, H.H., Y.S. Alajerami, and T. Foster, Estimation of Radiation Doses and Lifetime Attributable Risk of Radiation-induced Cancer from A Single Coronary Artery Bypass Graft Computed Tomography Angiography. Electronic Journal of General Medicine, 2021. **18**(6).

[7] Tavakoli, M.B., K. Heydari, and S. Jafari, Evaluation of diagnostic reference levels for CT scan in Isfahan. Glob J Med Res Stud, 2014. **1**(4): p. 130-4.

[8] Mettler, F.A., et al., CT scanning: patterns of use and dose. Journal of radiological Protection, 2000. 20(4): p. 353.

[9] Schultz, C.H., et al., The risk of cancer from CT scans and other sources of low-dose radiation: a critical appraisal of methodologic quality. Prehospital and disaster medicine, 2020. **35**(1): p. 3-*16.*

[10] Hess, E.P., et al., Trends in computed tomography utilization rates. Journal of patient safety, 2014. **10**(1): p. 52-58.

[11] Ghetti, C., et al., Dosimetric and radiation cancer risk evaluation of high resolution thorax CT during COVID-19 outbreak. Physica Medica, 2020. *80: p. 119-124.*

Design of Lead-Free Guards for Making Eye Glasses and Ceiling Shields to Reduce Eye Dose in Angiography by Simulation Using MCNP Code

By
Masoomeh Pooladi

Abstract:

Angiography is one of the most widely used diagnostic and therapeutic methods with relatively high radiation dose for patients and staff. Radiation protection of the body's radiation-sensitive organs such as eye lenses is very important in this imaging modality. In this study, we used Monte Carlo MCNP code to design transparent lead-free shields for these organs.

Two types of phosphate glass with and without lead and bismuth were designed and simulated. $ZnO-Bi_2O_3-P_2O_3$ and $ZnO-PbO-P_2O_3$ glasses were simulated in six different concentrations and percentages. Then the linear attenuation coefficients, mass and half-absorption layer thickness of each of these samples at 8 energies (as a single energy of 60, 80, 100, 120, 140, 150 and 200 kV) and in three output energy spectra of the tube X-rays with peak energy of 80, 100 and 120 kV, which are mainly used in angiography, were calculated. Good agreement was observed between the simulated results and XCOM cross section database. Maximum values of mass attenuation coefficients were found for PZPb50 glass samples. The efficiency of shields at spectral energies was much better than single-energy photons, and this efficiency decreased with increasing energy. The results of this study suggest that the MCNP code used in this work may be used as a better alternative to experimental work to perform additional calculations on the photon attenuation properties of other glass materials and systems.

Keywords: Angiography, Glass guards, Lead-free guards, Monte Carlo, Radiation protection.

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Assessment of Knowledge, Attitude and Practice of Radiation Protection Among Operating Room Staffs in Zanjan Province

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Abstract

Background and purpose: Nowadays medical imaging has a special place in the diagnosis and even treatment of various diseases. One of the basic uses of X-rays is in the operating room (OR). C-arm fluoroscopy is a main component during surgery that helps to guide surgeons and perform minimally invasive surgeries. So knowing the harmful effects of X-ray and ways of protection of it can prevent irreparable risks for patients and OR Staffs. The current study aimed at evaluating KAP level of radiation protection among personnel in the OR.

Methods: In this cross-sectional study, the questionnaire designed by Rakhshani and colleagues was distributed among all operating room personnel of 6 teaching hospitals of Zanjan University of Medical Sciences in 2022-2023. This questionnaire consisted of two parts. The first part includes demographic information such as age, gender, etc. and the second part consists of 32 questions to evaluate the level of knowledge, attitude and practice of radiation protection among participants. The data was analyzed by using descriptive statistics (mean, standard deviation and frequency) and analytical statistics (Pearson's and Spearman's correlation coefficient test, Students independent t-test, ANOVA and etc.) whit SPSS version 26 software (sig:$P<0.05$).

Results: Among the qualified OR staffs of Zanjan province, 172 people completed the questionnaires, of which 79 (45.9%) were men and 93 (54.1%) were women. According to the analyses, they were having good level in knowledge (n=69, 40.1%) and attitude (n=150, 87. 2%).besides, participants have poorly practice (n=81, 47.1%) and clinical competence (n=70, 40.7%). Based on the results, there was a significant relationship between gender and knowledge (p=0.02) so that men had more knowledge than women. There was a significant relationship between knowledge with age (p=0.005) and with the level of education (p=0.03). There was also a significant relationship between attitude and age (p=0.002), level of education (p=0.021) and work experience (p=0.02). There is no significant relationship between practice and gender (p=0.09), level of education (p=0.35) and work experience (p=0.45). But on the other hand, there is a significant relationship between practice and age (p=0.046).

Conclusion:

Based on the results of this study, the knowledge and attitude of the OR staffs regarding radiation protection were evaluated as favorable, but the practice and clinical competence of the staffs regarding radiation protection were evaluated as unfavorable. It is recommended to hold training courses on the principles of radiation protection and to more monitor the performance of staffs.

Keywords: Knowledge, Attitude, Practice, Radiation protection, Operating room

Assessment of Effective Dose of Lung CT scans in Dual and 16 Slice scanners in COVID-19 Patients

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Abstract

Introduction: One of the most important dangers to human health in recent years is the coronavirus disease 19 (COVID-19) caused by the coronavirus SARS-CoV-2. This disease was reported for the first time in December 2019, and its origin is Wuhan, Hubei Province, China (1, 2). Two of the methods for diagnosing this disease are the reverse-transcription polymerase chain reaction (RT-PCR) assay and chest computed tomography (CT) (3). Medical imaging that utilizes ionizing radiation is a significant contributor to radiation exposure. Studies have shown that the increased use of imaging scanners can elevate the risk of cancer due to this type of radiation (4). This study aimed to compare the dose indicators (CTDIVOL, DLP) and Effective Dose of chest CT scans for COVID-19 patients between dual and 16-slice scanners.

Material and Methods: This study involved 720 patients who underwent chest CT scans. The data was gathered through dual and 16-slice scanners, and the data such as kV and mAs were obtained from the dose report window of the picture archiving and communication system (PACS). We used the impactDOSE software version 2.3 to calculate the volume computed tomography dose index (CTDIVOL) and the dose-length product (DLP). Additionally, we utilized the DLP to determine the Effective Dose.

Results: In this study, the chest CT scans of 358 females and 362 males were evaluated. The mean age of all the patients was determined to be 48.62. The average CTDIVOL in dual (sequential), dual (helical), and 16-slice scanners were calculated to be 4.17, 3.18, and 1.4 mGy respectively. Also, the average DLP for dual (sequential), dual (helical), and 16-slice scanners was obtained at 19.23, 91.31, and 47.32 mGy.cm. Additionally, the mean ± standard deviation of the Effective Dose of patients who were scanned by dual (sequential), dual (helical), and 16-slice CT scans was found to be 0.27±0.07, *1.32±0.28, and 0.68±0.31 mSv respectively.*

Conclusion: According to our findings in this study, the average Effective Dose that patients received from chest CT scans in the dual (sequential) scanner was the lowest, and in the dual (helical) scanner, it was the highest. 16-slice scanner delivered the minimum radiation dose to patients in contrast with the dual (helical). Due to the short scan time and low dose, 16-slice scanners are better than dual scanners for performing chest CT scans in COVID-19 patients.

Keywords: Radiation Dose; Chest Computed Tomography; 2019 Novel Coronavirus; Dual Scanner; *16-Slice Scanner*

References

1. Ciotti M, Angeletti S, Minieri M, Giovannetti M, Benvenuto D, Pascarella S, et al. COVID-*19 Outbreak: A*n Overview. Chemotherapy. 2019;64(5-6):215-23.

2. Chalkia M, Arkoudis NA, Maragkoudakis E, Rallis S, Tremi I, Georgakilas AG, et al. The Role of Ionizing Radiation for Diagnosis and Treatment against COVID-*19: Evidence a*nd Considerations. Cells. 2022;11(3).

3. Yang Q, Liu Q, Xu H, Lu H, Liu S, Li H. Imaging of coronavirus disease 2019: A Chinese expert consensus statement. Eur J Radiol. 2020;127:109008.

4. Shah DJ, Sachs RK, Wilson DJ. Radiation-induced cancer: a modern view. Br J Radiol. 2012;85(1020):e1166-7*3.*

Comparison of Short-Lived Radon Progeny and Lung Equivalent Dose Using Alpha Spectroscopy Among Hospitals, Dormitories, And Schools

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Abstract: Radon gas is the second risk factor of lung cancer. It distributes from the soil, water, and building materials. The emission of alpha particles in the lung causes genetic defects. In this study, the short-lived radon progeny and lung equivalent dose were measured and compared in different buildings of KUMS (Kermanshah University of Medical Sciences). The DOSEman PRO (Sarad, Germany, 2007) as an alpha spectroscopic dosimeter was used for this study. All 106 measurements were done in December and January on the ground floor of the buildings. The Mean ± SD values of equivalent equilibrium concentration (EEC) and lungs equivalent dose (for the time duration of 2 hours) were 6.95 ± 5.52 Bq/m3, 0.09 ± 0.08 µSv, respectively. There were significant differences for EEC, lungs equivalent dose, radon concentration and potential alpha energy exposure (PAEC) values among hospitals, dormitories, and schools ($p < 0.001$). Although the mean values of radon progeny were lower than international levels, hospitals and schools need to adopt a new approach to decreasing the radon levels.

Keywords: Indoor radon; Ventilation; Diurnal effect; Occupational intakes; Inhalation dose;

References

1. Organization WH. WHO handbook on indoor radon: a public health perspective: World Health Organization; 2009.

2. Nations U. Sources and Effects of Ionizing Radiation: United Nations Scientific Committee on the Effects of Atomic Radiation: UNSCEAR 2008 Report to the General Assembly, with Scientific Annexes: United Nations.; 2011.

3. BEIR V. Health effect of exposure to Radon, National Research Council. Washington, DC, National Academy Press; 1999.

4. Darby S, Hill D, Auvinen A, Barros-Dios J, Baysson H, Bochicchio F, et al. Radon in homes and risk of lung cancer: collaborative analysis of individual data from 13 European case-control studies. Bmj. 2005;330(7485):223.

5. Sgouros G, Hobbs R, Josefsson A. Dosimetry and radiobiology of alpha-particle emitting radionuclides. Curr. Radiopharm. *2018;11(3):209-14.*

6. Agency EP. A citizen's guide to radon: the guide to protecting yourself and your family from radon. Environmental Protection Agency. 2009.

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Assessment of Reference Dose Level in Computed Tomography for Radiotherapy Patients' Candidate in VASEI Hospital

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Abstract:

Objective: Nowadays, CT scan has become the diagnostic standard in radiotherapy centers (1), according to the principles of radiation protection, doses from CT tests should be investigated and measured (2) The purpose of this study is to evaluate and report the diagnostic dose level. It is for radiotherapy patients of Vasei Sabzevar Hospital during the last 2 years.

Methods: According to the European guidelines, the diagnostic reference dose level can be obtained by calculating the third quartile of the average dose distribution in a sample of patients from a database (3) information related to computed tomography dose index (CTDI) and Dose Length Product (DLP). Tube potential (KV) and tube current (mAs) of 301 patients were extracted from PACS of the treatment center.

Results: The amount of diagnostic reference dose in the head, head and neck, chest and breast, abdomen and pelvis areas is equal to 42.23, 12.23, 8.7 and 12.23 mg, respectively.

Conclusion: The amount of diagnostic reference dose in head tests is higher than in other areas, and the diagnostic reference dose for Sabzevar is lower than the national reference dose.

Keywords: Computer Tomography(CT), Radiotherapy, CTDI, DLP, Diagnostic Reference dose Level(DRL)

Poster Sessions

Advancing Stem Cell Imaging with Nanotechnology: A Systematic Review of in-vitro studies

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Abstract

Background: Stem cells hold immense potential for the treatment of various injuries and diseases. However, before realizing their therapeutic application, several challenges, including the need for advanced techniques to understand and control stem cell behavior, and novel methods to track and guide these cells, must be addressed. Nanotechnology has shown significant promise in stem cell biology and regenerative medicine, particularly for in vivo molecular imaging. This systematic review aims to compile and analyze the existing literature on the influence of nanotechnology on stem cell imaging.

Methods: Comprehensive searches of international databases such as PubMed, Scopus, and ISI Web of Science were performed to identify relevant articles on the application of nanotechnology in stem cell imaging up to March 2023. Screening, selection, and data extraction were conducted, followed by a quality assessment based on the STROBE checklist.

Results: A total of 6332 articles were initially identified, out of which 40 articles were deemed eligible for inclusion. The majority of studies (38) utilized nanoparticles, while one each used nanoplates and nanolayers. One study reported the negative impact of nanomaterials on cell viability.

Conclusion: Stem cell imaging plays a pivotal role in regenerative medicine. Nanomaterials with various properties, especially those exhibiting efficient cell-labeling, contrast enhancement, and minimal cytotoxicity, hold great potential for cell tracking. These findings offer novel insights into cell labeling and tracking or imaging techniques using nanotechnology, paving the way for advancements in stem cell research.

Keywords: Nanotechnology, Stem Cell, Cell Imaging

CT Pulmonary Angiography Challenges in 16-Slice CT Scanners

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Abstract:

CT pulmonary angiography (CTPA) is known as the gold standard for the diagnosis of pulmonary embolism. Radiology technologists have many challenges for performing this procedure in practice. This challenges refer to patient physiopathology conditions (e.g heart output, kidney disease, breath holding problems and etc.), contrast medium (low/high Iodine concentration, dye temperature), scanner's speed and equipment with angiographic applications (Blus tracking or test bolus), type of injector (dual or single head), using low-dose protocols, and type of catheter (central or peripheral venous) will be discussed. Firstly, the fundamental principles of CTPA from the patient educations to the multi-planar reconstructions were discussed in summary. Finally, the clinical solutions were provided to decreasing the dye volume at the lowest, obtaining the best delay time, optimizing the protocol parameters, with considering the patients' safety based on the recent studies.

Vessels diameter and scan time must be included for calculating the contrast medium volume. Also, using dual head injector and test bolus (instead of bolus tracking) can decrease the total contrast volume to 35 mL. Temperature can increase the contrast medium viscosity and have inverse effect on the choosing the injection rate in patient with unstable veins. Using a test bolus to determine CM arrival time at two locations (i.e., ascending aorta and pulmonary trunk) can be performed to better determine the arrival time of the diagnostic CM in the target vessel of choice, especially in patient with heart failure. Using the bolus tracking instead of test bolus can be more useful in some patient with urgency condition or for double rule-out study (CTA for Pulmonary Embolus and thoracic aorta). Craniocaudal CT pulmonary angiography is suggested in recent 16-slice scanners with short scan time equal to the patient breath holding (5-10 s). Craniocaudal had a similar degree of respiratory motion artifact to caudocranial scanning, in contrast, cause to better peak contrast enhancement in the distal pulmonary branches. Inserting the region of interest (ROI) in the nearest place to the beginning of scan is necessary, especially in scanners with high diagnostic delay time. In this way, there is not necessary to starting the scan from top of lung. Thus inserting the ROI in 1-2 cm upper than aortic arch helps to decrease the diagnostic delay and decreasing the patient radiation dose. Decreasing the scan speed is more helpful in patient with insufficient heart output (high time of peak enhancement) and with tall lung. In this cases, the contrast medium has enough time to arrival to the distal pulmonary branches. The tube voltage decreasing instead of tube current should be considered in low-dose protocols. Recent studies are shown that using the lower tube voltage (80-100 kVp) can allow the lower contrast medium usage with same diagnostic value for patient with medium size.

Keywords: Indoor radon; Ventilation; Diurnal effect; Occupational intakes; Inhalation dose;

References

[1] Kamr WH, El-Tantawy AM, Harraz MM, Tawfik AI. Pulmonary embolism: Low dose contrast MSCT pulmonary angiography with modified test bolus technique. European Journal of Radiology Open. 2020 Jan 1;7:100254.

[2] Dhamanaskar KP, Figueira KS, Jerome SC, Yemen BL. Test bolus technique for detection of pulmonary emboli at 64-slice multidetector computed tomography angiography. Canadian Association of Radiologists Journal. 2013 Aug;64(3):226-8.

[3] Kok M, Mihl C, Mingels AA, Kietselaer BL, Mühlenbruch G, Seehofnerova A, Wildberger JE, Das M. Influence of contrast media viscosity and temperature on injection pressure in computed tomographic angiography: a phantom study. Investigative radiology. 2014 Apr 1;49(4):217-23.

[4] Nania A, Weir A, Weir N, Ritchie G, Rofe C, Van Beek E. CTPA protocol optimisation audit: challenges of dose reduction with maintained image quality. Clinical Radiology. 2018 Mar 1;73(3):320-e1.

[5] Wu H, Chen X, Zhou H, Qin B, Cao J, Pan Z, Wang Z. An optimized test bolus for computed tomography pulmonary angiography and its application at 80 kV with 10 ml contrast agent. Scientific Reports. 2020 Jun 23;10(1):10208.

[6] Li YJ, Lau KK, Ardley N, Lau T. Efficacy of 'breath holding at ease'during CT pulmonary angiography in the improvement of contrast enhancement in pulmonary arteries. Journal of Medical Imaging and Radiation Oncology. 2013 Aug;57(4):415-22.

Recent Trends in Medical Imaging Methods and Challenges for Breast Cancer Diagnosis

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Abstract:

Due to breast cancer patients' high prevalence and mortality[1, 2], recent research seeks to identify and investigate a comprehensive imaging system that can detect breast cancer in early stages, non-invasively, and without secondary damage[3-5]. This study compares the traditional, conventional, and recent advances in imaging using ionizing and non-ionizing radiation. These methods include computed tomography (CT) scan, positron emission/computed tomography (PET/CT), ultrasound, magnetic resonance imaging (MRI), thermography, electrical impedance tomography (EIT), microwave imaging, and optical imaging for breast screening, diagnosis, and identification of lesions. The purpose of this article is to provide a summary of the comparison between traditional and emerging imaging methods used in breast screening, along with the advantages and disadvantages of these methods.

Keywords: Breast cancer, Mammography, CT scan, PET/CT, MRI, Ultrasound, Microwave Imaging

References:

1. Ghoncheh, M., Z. Pournamdar, and H. Salehiniya, *Incidence and mortality and epidemiology of breast cancer in the world.* Asian Pacific journal of cancer prevention, 2016. 17(S3): p. 43-46.
2. Misganaw, M., et al., *Mortality rate and predictors among patients with breast cancer at a referral hospital in northwest Ethiopia: A retrospective follow-up study.* Plos one, 2023. **18**(1): p. e0279656.
3. Clerkin, N., et al., *Identification of factors associated with diagnostic performance variation in reporting of mammograms: a review.* Radiography, 2023. 29(2): p. 340-346.
4. Zerrad, F.-e., et al., *Microwave Imaging Approach for Breast Cancer Detection Using a Tapered Slot Antenna Loaded with Parasitic Components.* Materials, 2023. **16**(4): p. 1496.
5. Feng, H., et al., *Identifying malignant breast ultrasound images using ViT-patch.* Applied Sciences, 2023. **1**3(6): p. 3489.

Study of Functional Magnetic Resonance Imaging (Fmri) In Children and Adolescents with Specific Learning Disorder (Dyslexia): Review Study

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Abstract

Backgrounds: Dyslexia is a type of Specific Learning Disorder (SLD) with neurobiological origin with difficulties in accurate and/or fluent word recognition, poor spelling and decoding abilities

Dyslexia is perhaps the most common neurobehavioral disorder affecting children with prevalence ranging from 5 to 17.5 percent. The impaired reading in dyslexia is associated with inability to process the sensory input that enters the nervous system**.** fMRI has emerged as a potential source in understanding the neurobiology and to identify the brain basis of sensory stimuli processed in dyslexic patientsn Application of modern techniques in fMRI and analysis of fMRI data have highlighted the importance of coordinated processing across functional networks of distinct brain.

Methods :**In** this review study, in order to find appropriate papers related to Study of fMRI in children with learning disorder**,** a comprehensive search of valid English scientific databases such as: PubMed, Google scholar, Scopus in the years 2015-2023 with a combination of keywords, Dyslexia, fMRI, functional connectivity were performed. Exclusion criteria were studies out of the Imaging modalities other than fMRI, Patients other than children and irrelevant studies of the subject. From the total number of papers obtained, papers were chosen.

Results :**As** compared to control group, the participants with dyslexia show phonological decoding problem. During picture task, the participants with dyslexia use more areas of brain involve in recalling the memory events while during semantic tasks processing the occipito-temporal (fusiform) gyrus was less activated when in contrast to control. Findings showed both positive and negative Resting-state functional connectivity(RSFC) behaviour relationships that diverged across different reading subskills. Positive relationships included increasing RSFC among left dorsal and anterior regions with increasing decoding proficiency, and increasing RSFC between the left thalamus and right fusiform gyrus with increasing sight word reading, RAN, and reading comprehension abilities. In contrast, negative relationships suggested greater functional segregation of attentional and reading networks with improved performance on RAN, decoding, and reading comprehension tasks.

Conclusion: A review of these studies shows that participants with dyslexia fail to use normal brain regions specialized in language processing, but rather use different areas**.**

Importantly, the results suggest that although reading subskills rely to some extent on shared functional networks, there are also distinct functional connections supporting different components of reading ability in children.

Keywords: fMRI, dyslexia, SLD

References

[1] Cross, A. M., Ramdajal, R., Peters, L., Vandermeer, M. R., Hayden, E. P., Frijters, J. C., ... & Joanisse, M. F. (2021). Resting-state functional connectivity and reading subskills in children. *Neuroimage*, *243*, 118529.

[2] Prasad, S., Sagar, R., Kumaran, S. S., & Mehta, M. (2020). Study of functional magnetic resonance imaging (fMRI) in children and adolescents with specific learning disorder (dyslexia). *Asian Journal of Psychiatry*, *50*, 101945.

[3] Shaywitz, B. A., Skudlarski, P., Holahan, J. M., Marchione, K. E., Constable, R. T., Fulbright, R. K., ... & Shaywitz, S. E. (2007). Age-related changes in reading systems of dyslexic children. *Annals of neurology*, *61*(4), 363-370.

[4] Yu, X., Ferradal, S., Dunstan, J., Carruthers, C., Sanfilippo, J., Zuk, J., ... & Gaab, N. (2022). Patterns of neural functional connectivity in infants at familial risk of developmental dyslexia. *JAMA Network Open*, *5*(10), e2236102-e٢٢٣٦١٠٢.

[5] Schulz, E., Maurer, U., van der Mark, S., Bucher, K., Brem, S., Martin, E., & Brandeis, D. (2008). Impaired semantic processing during sentence reading in children with dyslexia: combined fMRI and ERP evidence. *Neuroimage*, *41*(1), 153-168.

[6]Lyon, G.R., Shaywitz, S.E., Shaywitz, B.A., 2003. A definition of dyslexia. Ann. Dyslexia 53, 1–14

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Differential Neural Processing of Value During Decision-Making in Adults with Attention-Deficit/ Hyperactivity Disorder(ADHD) And Healthy Controls

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Abstract:

Backgrounds: Attention-deficit/hyperactivity disorder (ADHD) has been associated with deficits in decision making and learning.These skills are guided by the dopaminergic system, which is impaired in ADHD.However, the precise learning and decision-making deficits and their neurobiological correlates in ADHD are not well known.The characteristics of ADHD include abnormalities in reward responsivity that may interfere with decision making.The development of functional neuroimaging has gradually allowed the exploration of the neurofunctional about of Decision-Making.

Methods : Google Scholar, PubMed and Web of Science databases were comprehensively searched from 201۵ to 2022۳. The keywords used included Attention-Deficit / Hyperactivity Disorder (ADHD), functional magnetic resonance imaging and decision-making. After removing irrelevant studies, finally **11 studies that were compatible with the inclusion criteria were selected.**

Results: Importantly, functional connectivity between salience and frontoparietal networks predicted rate of evidence accumulation to a decision threshold, whereas functional connectivity between salience and default mode networks predicted inattention.The ventral and dorsolateral prefrontal cortex and the insula were activated during performance of the decision-making task in both the ADHD and healthy groups; however, activation in the ADHD group was less extended and did not involve other regions, such as anterior cingulate and hippocampus, that subserve emotion/memory processes.Direct comparison of data from the ADHD subjects and the healthy volunteers suggested that the healthy subjects engaged the hippocampal and insular regions more than did the ADHD subjects.Adults with ADHD had evidence of lower dorsolateral prefrontal cortex (DLPFC) activity and reduced sensitivity in the ventromedial prefrontal cortex (VMPFC) region of interest in response to linear changes in probability, compared with healthy controls.Compared with health controls, adults with ADHD showed higher responses to loss outcomes in the putamen and hippocampus.

Conclusion : The findings suggest that the neural circuits engaged during decision making differ in subjects with ADHD and healthy comparison subjects. This difference may explain observed deficits in motivated behaviors in ADHD. Dysregulated neural computation of the values of behavioural actions and outcomes in the frontostriatal circuits may underlie decision processing distinct from reward learning differences among adults with ADHD. The combination of computational modeling of behavior and multimodal neuroimaging revealed that impaired decision making and learning mechanisms in adolescents with ADHD are driven by impaired RPE processing in the medial prefrontal cortex.A better understanding of the nature of these deficits could ultimately be applied to refine treatment strategies for ADHD.

Keywords: ADHD, decision-making, fMRI

References

[1] Schultz, W. (2002). Getting formal with dopamine and reward. *Neuron*, *36*(2), 241-263.Therapeutics", *Advanced functional matterials* (2018) 1802136.

[2] Luman, M., Tripp, G., & Scheres, A. (2010). Identifying the neurobiology of altered reinforcement sensitivity in ADHD: a review and research agenda. *Neuroscience & Biobehavioral Reviews*, *34*(5), 744-754.

[3]Volkow, N. D., Wang, G. J., Kollins, S. H., Wigal, T. L., Newcorn, J. H., Telang, F., ... & Swanson, J. M. (2009). Evaluating dopamine reward pathway in ADHD: clinical implications. *Jama*, *302*(10), 1084-1091.[4] F. Surname1, F. Surname2, "Title of paper" unpublished.

[5] Sagvolden, T. (2000). Behavioral validation of the spontaneously hypertensive rat (SHR) as an animal model of attention-deficit/hyperactivity disorder (AD/HD). *Neuroscience & Biobehavioral Reviews*, *24*(1), 31-39.

[6] Swanson, J., Baler, R. D., & Volkow, N. D. (2011). Understanding the effects of stimulant medications on cognition in individuals with attention-deficit hyperactivity disorder: a decade of progress. *Neuropsychopharmacology*, *36*(1), 207-226.

[7] Hauser, T. U., Iannaccone, R., Ball, J., Mathys, C., Brandeis, D., Walitza, S., & Brem, S. (2014). Role of the medial prefrontal cortex in impaired decision making in juvenile attention-deficit/hyperactivity disorder. *JAMA psychiatry*, *71*(10), 1165-1173.

[8] Cai, W., Warren, S. L., Duberg, K., Pennington, B., Hinshaw, S. P., & Menon, V. (2021). Latent brain state dynamics distinguish behavioral variability, impaired decision-making, and inattention. *Molecular psychiatry*, *26*(9), 4944-4957 progress. *Neuropsychopharmacology*, *36*(1), 207-226.

[9] Ernst, M., Kimes, A. S., London, E. D., Matochik, J. A., Eldreth, D., Tata, S., ... & Bolla, K. (2003). Neural substrates of decision making in adults with attention deficit hyperactivity disorder. *American Journal of Psychiatry*, *160*(6), 1061-1070.

[10] Lee, C. Y., Goh, J. O. S., & Gau, S. S. F. (2023). Differential neural processing of value during decision-making in adults with attention-deficit/hyperactivity disorder and healthy controls. *Journal of Psychiatry and Neuroscience*, *48*(2), E115-E124.

[11]Tannou, T., Magnin, E., Comte, A., Aubry, R., & Joubert, S. (2021). Neural activation in risky decision-making tasks in healthy older adults: a meta-analysis of fMRI data. *Brain sciences*, *11*(8), 1043.

Application of Diffusion Tensor Imaging in Distinguishing High-Grade Gliomas from Brain Metastases

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Abstract:

High-grade gliomas and brain metastases are denoted as the most common brain tumors [1]. High-grade gliomas have an infiltrative growth pattern, whereas brain metastases grow in an expansive pattern with displacement of surrounding brain tissues. The accurate distinguishing between these two types of brain tumors is necessary because alters patient management and affects outcome [2]. Conventional MRI has limitations in the detection of high-grade gliomas from metastases due to similar enhancement patterns [3]. The use of advanced MRI techniques, such as diffusion tensor imaging (DTI), is widespread in intracranial neoplasms. Mean diffusivity (MD) and fractional anisotropy (FA) are the two commonly used DTI metrics that describe the magnitude and directionality of water diffusion and can provide valuable information about orientation and tissue structure [4]. This study aims to review the application of diffusion tensor imaging in distinguishing high-grade gliomas from brain metastasis.

Literature searches of Google Scholar, PubMed, and AltaVista search engines were conducted with the keywords “diffusion tensor imaging”, “high-grade gliomas”, “brain metastasis”. Then, different articles related to the topic extracted and reviewed.

Based on the results, it was determined that DTI metrics are different in high-grade gliomas and brain metastases [5]. Peritumoral MD is mainly higher in brain metastases than high-grade gliomas because of more vasogenic edema with excessive extracellular fluid surrounding brain metastases. On the other hand, this excessive extracellular fluid around metastases leads to less specific diffusion directionality and reduce FA. Combining these metrics provides useful information for the differentiation of high-grade gliomas from brain metastases.

In conclusion, DTI can be a promising technique for distinguishing high-grade gliomas from brain metastases.

Keywords: “Diffusion tensor imaging”, “High-grade gliomas”, “Brain metastases”

References

[1] K. Tsuchiya, A. Fujikawa, M. Nakajima, K. Honya. "Differentiation Between Solitary Brain Metastasis and High-grade Glioma by Diffusion Tensor Imaging.", The British journal of radiology 78, no. 930 (2005) 533-537.

[2] C. H. Suh, H. S. Kim, S. C. Jung, S. J. Kim, "Diffusion-Weighted Imaging and Diffusion Tensor Imaging for Differentiating High-grade Glioma from Solitary Brain Metastasis: A Systematic review and Meta-analysis.", American journal of neuroradiology 39, no. 7 (2018) 1208-1214.

[3] S. Wang, S. Kim, S. Chawla, R. L. Wolf, D. E. Knipp, A. Vossough, D. M. O'Rourke, K. D. Judy, H. Poptani, E. R. Melhem,"Differentiation Between Glioblastomas, Solitary Brain Metastases, and Primary Cerebral Lymphomas Using Diffusion Tensor and Dynamic Susceptibility Contrast-enhanced MR Imaging.", American journal of neuroradiology 32, no. 3 (2011) 507-514.

[4] R. Jiang, F. Du, C. He, M. Gu, Z. Ke, J. Li, "The Value of Diffusion Tensor Imaging in Differentiating High-grade Gliomas from Brain Metastases: A Systematic review and Meta-analysis.", PloS one 9, no. 11 (2014) e112550.

[5] T. J.D Byrnes, T. R. Barrick, B. A. Bell, C.A. Clark, "Diffusion Tensor Imaging Discriminates Between Glioblastoma and Cerebral Metastases in vivo.", NMR in biomedicine 24, no. 1 (2011) 54-60.

Diagnostic Challenges and new strategies in revealing malignant breast lesions with dense tissues

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Abstract:

Introduction: Breast cancer is one of the most common invasive diseases and the second leading cause of death among women worldwide [1, 2]. Because with timely diagnosis, the effectiveness of treatment methods can be optimized, and the chances of survival can be increased [3-5]. This study evaluated the accuracy, specificity, and sensitivity of different medical imaging methods in breast cancer to clarify the most efficient breast cancer detection method using the meta-analysis method.

Materials and methods: In total, 8 articles published between 2003 and 2023 worldwide were selected by searching PubMed, Scopus, Embase, Web of Science, and Cochrane Library. Keywords such as breast cancer, neoplasm, medical imaging, mammography, MR mammography, ultrasound, molecular imaging, and their combinations were used in the search. Two radiotechnologists and one academic reviewed the articles to determine whether the studies met the inclusion criteria. The quality of the study was assessed using the diagnostic accuracy evaluation tool. Summary estimates of diagnostic sensitivity, specificity, and accuracy were obtained using ratios and diagnostic meta-analysis.

Results: From 84 studies that were screened for title, abstract, and full text, 8 articles were included in quantitative and qualitative synthesis. Results were reported for sensitivity, specificity, positive and negative predictive value, and cancer detection rate in women with dense breasts undergoing complementary imaging. The studies included in this review were heterogeneous, as was the proportion of women experiencing the prevalence and incidence screening rounds. The sensitivity of mammography, ultrasound, MR mammography, and molecular imaging was 59%, 65%, 94%, and 98%, respectively. These results show that mammography requires mass formation or calcium deposition to show dense breast malignancy. The modality requires a mass with an average size of 0.9 cm to detect these breasts. On the other hand, MR imaging resulted in a 4.5% increase in cancer detection rate and found malignancy in 12% with a PPV of 39%. However, molecular imaging methods provide early detection without anatomical changes in the early stages of diagnosis.

Conclusion: The present meta-analysis showed a positive and direct correlation between molecular imaging methods and detecting malignant breast cancer lesions with dense tissue. However, Molecular imaging can make timely diagnoses for effective treatment, follow-up staging, and planning for effective treatment.

Keywords: Medical imaging, Molecular imaging, Breast Cancer, Sensitivity and Specificity

References

1. Perez Bravo, V.V., et al., Epidemiology of breast cancer in women from the Colombian Caribbean region during 2018-2021. medRxiv, 2023: p. 2023.08. 24.23294568.

2. Elmore, J.G., et al., Screening for breast cancer. Jama, 2005. 293(10): p. 1245-1256.

3. Lebron-Zapata, L. and M.S. Jochelson, Overview of breast cancer screening and diagnosis. PET clinics, 2018. 13(3): p. 301-323.

4. Andreea, G.I., et al., The role of imaging techniques in diagnosis of breast cancer. Curr Health Sci J, 2011. 37(2): p. 241-248.

5. Yang, W.T. Emerging techniques and molecular imaging in breast cancer. in Seminars in Ultrasound, CT, and MRI. 2011. Elsevier

Comprehensive Evaluation of Cancers Diagnosis through Artificial Intelligence in Multimodality Imaging

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Abstract

Cancer, as a self-sustaining and adaptive procedure that cooperates dynamically with its microenvironment, remains to foil patients, researchers, and clinicians regardless of significant evolution in consideration of its biological foundations. Artificial intelligence (AI) algorithms, mainly deep learning, have established notable progress in image-recognition tasks. Approaches extending from convolutional neural networks to variational autoencoders have initiated numerous applications in the medical image analysis field, thrusting it onward at a quick step. While at first look AI seem to impend the role of the radiographer, its prevalent approval and operation also offer significant occasions for more independence and self-definition if the occupation effectively makes for, and adjusts to, certain changes to character and principles. AI has been substantially used in the diagnostic procedure of plentiful cancers including head and neck cancer, breast cancer, skin cancer, lung cancer, prostate cancer, etc. The growth and spreading of AI in clinical medicine will enhance our indicative truth and rule-out abilities. Though, unless AI algorithms are accomplished to separate between benign anomalies and clinically expressive lesions, improved imaging sympathy might come at the cost of enlarged wrong positives, as well as confounding states whereby AI discoveries are not allied with conclusions.

Keywords: cancer, artificial intelligence, imaging, MRI, CT, PET

Recent advances of deep learning in psychiatric disorders

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Abstract:

Background:A number of brain research projects have recently been carried out to study the ethology and mechanisms of psychiatric disorders. Although psychiatric disorders are part of the brain sciences, psychiatrists still diagnose them based on subjective experience rather than by gaining insights into the pathophysiology of the diseases.

Deep learning (DL) methods have been increasingly applied to neuroimaging data to identify patients with psychiatric and neurological disorders. At present, psychiatric disorders are diagnosed based on symptoms and course of illness, according to the classifications in the Diagnostic and Statistical Manual of Mental Disorders.

Given its ability to detect abstract and complex patterns, DL has been applied in neuroimaging studies of psychiatric and neurological disorders, which are characterised by subtle and diffuse alterations.

Methods: Google Scholar, PubMed, and Web of Science databases were comprehensively searched from 2017 to 2023. The keywords used included psychiatric disorders, Deep learning, and neuroimaging. After removing irrelevant studies, finally 10 studies that were compatible with the inclusion criteria were selected.

Results: Although DL techniques have been explored extensively in various aspects of medical imaging, they are still in a relatively early stage, and most applications are still simple two- or three-classification problems. When studying fMRI from schizophrenia, psychotic bipolar disorder, schizoaffective disorder, and healthy individuals, the accuracy of a 4-class classification reached 46%, significantly above chance. The proposed deep classification and clustering framework is not only able to identify psychiatric disorders with high accuracy, but also interpret the correlation between brain networks and specific psychiatric disorders and reveal the relationship between them. Results suggest that deep learning of neuro imaging data is a promising tool for the classification of individual psychiatric patients.

Conclusion(s): Deep learning provides a promising way to investigate a spectrum of similar disorders using neuroimaging-based measures. The combined development of psychiatric imaging and machine learning will be the trend and will become an indispensable tool for clinical diagnosis and treatment of psychiatric diseases in the future.

References

[1] Vieira S, Pinaya WH, Mechelli A. Using deep learning to investigate the neuroimaging correlates of psychiatric and neurological disorders: Methods and applications. Neurosci Biobehav Rev. 2017 Mar;74(Pt A):58-75. doi: 10.1016/j.neubiorev.2017.01.002. Epub 2017 Jan 10. PMID: 28087243.

[2] Yan W, Zhao M, Fu Z, Pearlson GD, Sui J, Calhoun VD. Mapping relationships among schizophrenia, bipolar and schizoaffective disorders: A deep classification and clustering framework using fMRI time series. Schizophr Res. 2022 Jul;245:141-150. doi: 10.1016/j.schres.2021.02.007. Epub 2021 Mar 3. PMID: 33676821; PMCID: PMC8413409.

[3] Quaak M, van de Mortel L, Thomas RM, van Wingen G. Deep learning applications for the classification of psychiatric disorders using neuroimaging data: Systematic review and meta-analysis. Neuroimage Clin. 2021;30:102584. doi: 10.1016/j.nicl.2021.102584. Epub 2021 Feb 10. PMID: 33677240; PMCID: PMC8209481.

Deep Learning Aided Neuroimaging and Brain Regulation

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Abstract: Currently, deep learning-aided medical imaging is becoming the hot spot of AI frontier application and the future development trend of precision neuroscience. Machine learning and its subset, deep learning, are branches of AI, and have shown promising findings in the medical field, especially when applied to imaging data, which have been used in radiological diagnosis, bioinformatics, genome sequencing, drug development, and histopathological image analysis. Deep learning has shown tremendous potential in the field of neuroimaging and brain regulation. Neuroimaging techniques such as MRI, CT, PET/CT, EEG/MEG, optical imaging, and other imaging modalities generate large amounts of comprehensive and complex data, which can be challenging to analyse and interpret. Deep learning techniques such as CNNs, RNNs, and GANs have been proven to be effective in extracting meaning full information from these data and transforming the neuroimaging from qualitative to quantitative imaging modality.

for this study, we conducted a comprehensive review of research articles using databases like PubMed, IEEE Xplore, Science Direct, and Google Scholar. We included studies published between 2015 and 2023, focusing on the intersection of deep learning, neuroimaging, and brain regulation. Relevant articles covering advancements in deep learning techniques for neuroimaging analysis and their applications in understanding brain regulation were selected and critically evaluated.

Deep learning has shown great promise in the field of neuroimaging and brain regulation, with the potential to improve the accuracy and speed of diagnosis and the treatment of neurological disorders as well as enable new forms of brain–computer interfaces. However, the challenges associated with deep learning must be addressed to ensure that these techniques can be used safely and effectively in clinical settings. Overall, this article reviewed the recent progress of how deep learning is being applied in the medical field of neuroimaging and brain regulation.

Keywords: Artificial intelligence, Deep learning, Brain regulation, Neuroimaging.

References:

[1] Pesapane F, Codari M, Sardanelli F. Artificial intelligence in medical imaging: threat or opportunity? Radiologists again at the forefront of innovation in medicine. Eur Radiol Exp. 2018 Oct 24;2(1):35. doi: 10.1186/s41747-018-0061-6. PMID: 30353365; PMCID: PMC6199205.

[2] Bonacchi R, Filippi M, Rocca MA. Role of artificial intelligence in MS clinical practice. Neuroimage Clin. 2022;35:103065. doi: 10.1016/j.nicl.2022.103065. Epub 2022 May 28. PMID: 35661470; PMCID: PMC9163993.

[3] Muhammad K, Khan S, Ser JD, Albuquerque VHC. Deep Learning for Multigrade Brain Tumor Classification in Smart Healthcare Systems: A Prospective Survey. IEEE Trans Neural Netw Learn Syst. 2021 Feb;32(2):507-522. doi: 10.1109/TNNLS.2020.2995800. Epub 2021 Feb 4. PMID: 32603291.

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Application of deep learning in radiation therapy dose calculation: A systematic review

a

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Abstract

Radiation therapy dose calculation is an essential component of cancer treatment. Radiation therapy outcome depends on the accurate calculation and delivery of the prescribed dose to the tumor while sparing the surrounding healthy tissues. Commercially available dose calculation methods are based on mathematical models that approximate the interactions of radiation with human tissue. However, they are not perfect and can sometimes produce inaccurate results depending on the treatment planner's skills. Moreover, these traditional dose calculation algorithms are often time-consuming. Regarding the increasing application of artificial intelligence and deep learning methods in medical sciences, scientists have used these methods to overcome the aforementioned issues in the treatment planning of cancer patients. Therefore, this study aims to review the application of deep learning methods in radiation therapy treatment planning. PubMed, Science Direct, Web of Science, and Google Scholar databases were explored up to May 2022, using different combinations of the keywords: "radiation therapy", "treatment planning", "artificial intelligence", " dose calculation ", and "deep learning". After screening the results 10 more recent and relevant papers were included in the study. Deep learning models require a combination of patient anatomy data, linear-accelerator intensity modulated radiation therapy (IMRT) multi-leaf-collimator shape or segment data, dose data, and physics-based inputs to accurately predict the dose distribution of the radiation beam in the patient's body, for radiotherapy dose calculation. By training a deep learning model on a large dataset of radiation therapy plans, it is possible to learn the complex relationships between input and output features. This allows deep learning models to capture subtle patterns in the data that may be missed by traditional mathematical models. The dose prediction using the trained network is very fast, making it compelling for online adaptive workflows where fast segment dose calculations are needed. Deep learning methods, such as deep U-Net algorithm have shown promising results in treatment planning by providing fast and accurate dose calculation. Additionally, deep learning algorithms can boost the accuracy of less accurate dose calculation algorithms by capturing the differences between dose calculation algorithms. In conclusion, deep learning-based methods provide a more efficient and accurate alternative to traditional and commercially available dose calculation methods.

Keywords: Artificial Intelligence, Deep Learning, Radiation Therapy, Dose Calculation, Treatment Planning.

References

1. Kontaxis C, Bol G, Lagendijk J, Raaymakers B. DeepDose: towards a fast dose calculation engine for radiation therapy using deep learning. Physics in Medicine & Biology. 2020;65(7):075013.
2. Chen W-Z, Xiao Y, Li J. Impact of dose calculation algorithm on radiation therapy. World journal of radiology. 2014;6(11):874.
3. De Martino F, Clemente S, Graeff C, Palma G, Cella L. Dose Calculation Algorithms for External Radiation Therapy: An Overview for Practitioners. Applied Sciences. 2021;11(15):6806.
4. Fan J, Xing L, Dong P, Wang J, Hu W, Yang Y. Data-driven dose calculation algorithm based on deep U-Net. Physics in Medicine & Biology. 2020;65(24):245035.
5. Xing Y, Nguyen D, Lu W, Yang M, Jiang S. A feasibility study on deep learning-based radiotherapy dose calculation. Medical physics. 2020;47(2):753-8.
6. Xing Y, Zhang Y, Nguyen D, Lin MH, Lu W, Jiang S. Boosting radiotherapy dose calculation accuracy with deep learning. Journal of applied clinical medical physics. 2020;21(8):149-59.
7. Hernandez V, Hansen CR, Widesott L, Bäck A, Canters R, Fusella M, et al. What is plan quality in radiotherapy? The importance of evaluating dose metrics, complexity, and robustness of treatment plans. Radiotherapy and Oncology. 2020;153:26-33.
8. Kim DW, Park K, Kim H, Kim J. History of the photon beam dose calculation algorithm in radiation treatment planning system. Progress in Medical Physics. 2020;31(3):54-62.
9. Risholm P, Balter J, Wells WM, editors. Estimation of delivered dose in radiotherapy: the influence of registration uncertainty. Medical Image Computing and Computer-Assisted Intervention–MICCAI 2011: 14th International Conference, Toronto, Canada, September 18-22, 2011, Proceedings, Part I 14; 2011: Springer.
10. Toney-Butler TJ, Wilcox L. Dose Calculation Ratio and Proportion Method. 2018.

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A comprehensive review of deep learning methods for creating synthetic magnetic resonance images using computed tomography scans

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Abstract

Computed tomography (CT) scans and magnetic resonance imaging (MRI) are commonly used in the diagnosis and radiation therapy treatment planning of cancer patients. However, obtaining both scans for a patient can be challenging due to time, comfort, and cost. Consequently, researchers use deep learning methods like generative adversarial networks (GANs) to generate synthetic MR images from CT data. These synthetic images resemble real MR scans, improving diagnosis and treatment planning while addressing the limitations of acquiring separate CT and MRI scans. This study aimed to provide a comprehensive review of deep learning methods for creating synthetic MR images based on CT data. PubMed, Science Direct, Web of Science, and Google Scholar databases were explored up to May 2023, using different combinations of the keywords: "image synthesis", "computed tomography", "artificial intelligence", " synthetic magnetic resonance images ", and "deep learning". After screening the results seven more recent and relevant papers were included in the study. Deep learning methods, such as Unsupervised Image-to-Image Translation Networks (UNIT), Pix2Pix, and U-Net Variants, have demonstrated promising results in synthesizing MR images from CT data. Utilizing GANs facilitated the creation of these synthetic images, increasing the sensitivity of brain lesion detection. The U-Net method outperformed other techniques in cross-modality image synthesis. Additionally, the accurate diagnosis of an acute ischemic stroke is aided by GAN-based CT-based synthetic MRI. Deep-learning methods have shown potential for synthesizing MR images from CT scans. Estimating MR images using advanced deep-learning algorithms can enhance patient treatment while saving time and costs. The development of deep learning methods can lead to revolutionizing the synthesis and segmentation of medical images and provide helpful resources for clinicians in the process of diagnosis and treatment planning.

Keywords: Image Synthesis, Computed Tomography, Artificial Intelligence, Synthetic Magnetic Resonance Images, Deep Learning

References

[1] Xu Z, Luo J, Yan J, Pulya R, Li X, Wells W, Jagadeesan J. Adversarial uni-and multi-modal stream networks for multimodal image registration. In Medical Image Computing and Computer Assisted Intervention–MICCAI 2020: 23rd International Conference, Lima, Peru, October 4–8, 2020, Proceedings, Part III 23 2020 (pp. 222-232). Springer International Publishing.

[2] Jin CB, Kim H, Liu M, Jung W, Joo S, Park E, Ahn YS, Han IH, Lee JI, Cui X. Deep CT to MR synthesis using paired and unpaired data. Sensors. 2019 May 22;19(10):2361.

[3] Hu N, Zhang T, Wu Y, Tang B, Li M, Song B, Gong Q, Wu M, Gu S, Lui S. Detecting brain lesions in suspected acute ischemic stroke with CT-based synthetic MRI using generative adversarial networks. Annals of Translational Medicine. 2022 Jan;10(2).

[4] Li Y, Li W, Xiong J, Xia J, Xie Y. Comparison of supervised and unsupervised deep learning methods for medical image synthesis between computed tomography and magnetic resonance images. BioMed Research International. 2020 Nov 5;2020.

[5] Jiang J, Hu YC, Tyagi N, Wang C, Lee N, Deasy JO, Sean B, Veeraraghavan H. Self-derived organ attention for unpaired CT-MRI deep domain adaptation based MRI segmentation. Physics in Medicine & Biology. 2020 Oct 7;65(20):205001

[6] Zhao Y, Wang H, Yu C, Court LE, Wang X, Wang Q, Pan T, Ding Y, Phan J, Yang J. Compensation cycle consistent generative adversarial networks (Comp-GAN) for synthetic CT generation from MR scans with truncated anatomy. Medical physics. 2023 Jan 25.

[7] Li W, Li Y, Qin W, Liang X, Xu J, Xiong J, Xie Y. Magnetic resonance image (MRI) synthesis from brain computed tomography (CT) images based on deep learning methods for magnetic resonance (MR)-guided radiotherapy. Quantitative imaging in medicine and surgery. 2020 Jun;10(6):1223.

Ai in Medical Imaging Review Study

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Abstract

Introduction: One of the most promising areas of health innovation is the application of artificial intelligence(AI), primarily in medical imaging. Publications on AI haved rastically increased from about100–150per year in2007–2008 to700–800per year in 2016–2017. Magnetic resonance imaging and computed tomography collectively account for more than50%of current articles.

Materials and methods: In medical imaging, many publicly available ConvNet models (VGGNet, ResNet, Inception V3 and DenseNet) have been used thus far2,11.Kermany et al.showed promising diagnostic applications for deep learning and transfer learning techniques in detection of three major retinal conditions, namely DME, CNV and drusen, from images captured using OCT, a technique that employs a retinal-imaging device that uses infrared light and low-coherence interferometry to scan through the retinal layers. Further validation of the effectiveness of the authors' deep learning approach for medical diagnoses was conducted on a set of children chest X-rays (CXR) consisting of 5,232 training images from 5,826 patients (2,538 bacterial pneumonias, 1,345 viral pneumonias and 1,349 healthy) and 624 images (234 healthy and 390 pneumonia) from 624 patients. They achieved an accuracy of 92.8%.

Result: Radiologists are already familiar with computer-aided detection/diagnosis (CAD) systems, which were first introduced in the 1960s in chest x-ray and mammography applications. However, advances in algorithm development, combined with the ease of access to computational resources, allows AI to be applied in radiological decision-making at a higher functional level. AI will surely impact radiology, and more quickly than other medical fields. It will change radiology practice more than anything since Roentgen. Radiologists can play a leading role in this oncoming.

Refrences:

[1] Pesapane et al. European Radiology Experimental (2018) 2:35

https://doi.org/10.1186/s41747-018-0061-6

[2]AI for medical imaging goes deep,Daniel S. W. Ting, Yong Liu, Philippe Burlina, Xinxing Xu, Neil M. Bressler and Tien Y. Wong(2018)https://doi.org/10.1038/s41591-018-0029-3

Radiomics in Medical Imaging: A Digital Biopsy

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Abstract: The term "Radiomics" denotes the process of extracting and analysing copious amounts of advanced quantitative imaging features from medical images obtained through computed tomography (CT), positron emission tomography (PET), or magnetic resonance imaging (MRI) techniques. It is critical to note that these data are meant to be extracted from standard-of-care images, thereby leading to a vast potential subject pool [1]. Radiomic data can be mined effectively to construct both descriptive and predictive models that relate image features with phenotypes or gene-protein signatures. In medicine, various ways to generate big data exist, including the widely known fields of genomics, proteomics, or metabolomics. Similar to these “omics” clusters, imaging has been used increasingly to generate a dedicated omics cluster itself called “radiomics”. Radiomics is a quantitative approach to medical imaging, which aims at enhancing the existing data available to clinicians by means of advanced, and sometimes nonintuitive mathematical analysis [2,3]. In essence, the fundamental hypothesis of radiomics is that these models, which may incorporate biological or medical data, can provide valuable diagnostic, prognostic, or predictive information. The radiomics endeavour can be split into different processes, each with its unique challenges that require overcoming, including (i) image acquisition and reconstruction, (ii) image segmentation and rendering, (iii) feature extraction and qualification, (iv) databases and data sharing for eventual (v) ad hoc informatic analyses. Each of these processes presents particular challenges that must be addressed [1,4,5,6]. In this research, by examining 25 articles from various databases such as Scopus, Science Direct and etc in the field of radiomics and artificial intelligence, I came to the conclusion that despite all the challenges facing this field of science and its entry into the field of medical imaging, it can produce remarkable results. in the diagnosis and follow-up of various diseases, including cancer.

Keywords:

Radiomics, Image features, Quantitative imaging biomarkers, Artificial intelligent, Machine learning

References

[1] Kumar V, Gu Y, Basu S, Berglund A, Eschrich SA, Schabath MB, Forster K, Aerts HJ, Dekker A, Fenstermacher D, Goldgof DB, Hall LO, Lambin P, Balagurunathan Y, Gatenby RA, Gillies RJ. Radiomics: the process and the challenges. Magn Reson Imaging. 2012 Nov;30(9):1234-48. doi: 10.1016/j.mri.2012.06.010. Epub 2012 Aug 13. PMID: 22898692; PMCID: PMC3563280.

[2] Neisius U, El-Rewaidy H, Nakamori S, Rodriguez J, Manning WJ, Nezafat R (2019) Radiomic analysis of myocardial native T1 imaging discriminates between hypertensive heart disease and hypertrophic cardiomyopathy. JACC Cardiovasc Imaging 12:1946–1954
https://doi.org/10.1016/j.jcmg.2018.

11.024

[3] Mannil M, von Spiczak J, Manka R, Alkadhi H (2018) Texture analysis and machine learning for detecting myocardial infarction in noncontrast lowdose computed tomography: unveiling the invisible. Invest Radiol53:338–343
https://doi.org/10.1097/RLI.0000000000000448

[4] Gibbs P, Turnbull LW. Textural analysis of contrast-enhanced MR images of the breast. Magnetic Resonance in Medicine. 2003; 50(1):92–98. [PubMed: 12815683]

[5] Lambin P, Rios-Velazquez E, Leijenaar R, Carvalho S, Stiphout RV, Gra Boellard R, Dekker A, Hugo JWLA. Radiomics: extracting more informa using advance feature analysis. The European Journal of Cancer. 2011

[6] Ronneberger O, Fischer P, Brox T (2015) U-Net: convolutional networks for biomedical image segmentation. arXiv:1505.04597

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DIAGNOSIS OF MULTIPLE SCLEROSIS DISEASE IN BRAIN MRI IMAGES USING MACHINE LEARNING AND DEEP LEARNING METHODS

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Keywords:

"Multiple Sclerosis", "Machine learning", "Deep Learning", "Magnetic Resonance Imaging"

Abstract:

Introduction: Multiple Sclerosis (MS) is a disease that impacts the central nervous system (CNS), which can lead to brain, spinal cord, and optic nerve problems. A total of 2.8 million are estimated to suffer from MS. Globally, a new case of MS is reported every five minutes (1).In order to diagnose MS, multiple screening methods have been proposed so far; among them, magnetic resonance imaging (MRI) has received considerable attention among physicians. Many machine learning and deep learning models have been developed using MRI images and clinical data with the aim of diagnosing and analyzing MS lesions (2).

Material and Methods: This study is a narrative review based on articles available in scientific databases such as PubMed, Scopus, Google Scholar, and our criteria for inclusion in the studies were the time and worthy quality of the publications, relevance and keywords.

The keywords used included Magnetic resonance imaging, Machine learning, Deep learning and Multiple Sclerosis from 2018 to 2023.

Results and Discussion: The results of various articles about machine vision methods for diagnosing MS lesions from MRI images were evaluated. In recent studies, researchers have focused on the applications of machine vision techniques in MS disease, including diagnosing plaque type, predicting treatment response, segmenting MS lesions, and classifying patients (2, 3).

Conclusion: MS is a chronic disease that directly attacks the central nervous system. Early diagnosis of MS is of great significance as it can prevent the progression of the disease. The aim of new studies shows that the use of artificial intelligence solutions and utilizing machine learning and deep learning algorithms in the medical field has improved the diagnosis and prognosis of MS patients.

References: 1. Aslam N, Khan IU, Bashamakh A, Alghool FA, Aboulnour M, Alsuwayan NM, Alturaif RaK, Brahimi S, Aljameel SS, Al Ghamdi K. Multiple sclerosis diagnosis using machine learning and deep learning: Challenges and opportunities. Sensors. 2022;22(20):7856.
2. Shoeibi A, Khodatars M, Jafari M, Moridian P, Rezaei M, Alizadehsani R, Khozeimeh F, Gorriz JM, Heras J, Panahiazar M. Applications of deep learning techniques for automated multiple sclerosis detection using magnetic resonance imaging: A review. Computers in Biology and Medicine. 2021;136:104697.
3. Narayana PA, Coronado I, Sujit SJ, Wolinsky JS, Lublin FD, Gabr RE. Deep learning for predicting enhancing lesions in multiple sclerosis from noncontrast MRI. Radiology. 2020;294(2):398-404.

Machine learning approaches for MRI-based Parkinson's disease detection

Introduction: Parkinson’s disease is the second most world-spread progressive neuro disease. Parkinson's is a brain disorder that causes difficulty with walking, stability, and coordination. The detection of Parkinson’s disease is mostly based on clinical appearances, imaging scans, and correlated biochemical investigations, which remain clinically difficult. Resting functional magnetic resonance imaging (rs-FMRI) is one of the common non-invasive methods widely used in the diagnosis of Parkinson's disease. However, the early detection of Parkinson's disease is very challenging, especially in the early stages. nowadays, the use of machine learning algorithms in diagnosing neural lesions has been widely considered. Considering this, in this study, we intend to investigate the role of machine learning in diagnosing Parkinson's disease.

Methods: This research was done in the Google Scholar database with the following keywords: “Functional magnetic resonance imaging” or “fMRI” in the title and “Parkinson’s” and “machine learning” and “detection” or “diagnosis” in all the fields. In addition, we searched for more articles on the subject on scientific websites such as PubMed and Science Direct. We limited the publication time to after 2021 to evaluate the most recent literature. After screening the abstracts, we selected the relevant articles for this study.

Results: The total number of articles found during the search was 304. We limited our results to 43 papers based on the inclusion values. Based on the literature, the amplitude of low-frequency fluctuations (ALFF) is one of the most usually used measurements of rs-FMRI. It can distinguish the amplitude of spontaneous, low-frequency fluctuations of blood oxygen level reliant on signals to reflect the uniformity and physiological state of neuron-independent activity in different brain regions. This method offers a good and sensitive dimension to describe spontaneous neural activity and has been commonly used in the detection of Parkinson's disease. Among machine learning algorithms, radiomics can extract high amounts of features from medical images to describe the characteristics of the lesions. This algorithm is very useful and sensitive to the detection of neurological lesions, many studies show that the use of machine learning algorithms in the diagnosis of Parkinson's lesions provides an accuracy higher than 80%.

Conclusion: Machine learning has shown that it can have a great capacity to increase the accuracy in diagnosing lesions. These algorithms can extract useful features of images, this case increases the accuracy in the early diagnosis of lesions, especially in the early stages of Parkinson's disease. The reviewed articles showed that machine learning algorithms applied to Functional Magnetic Resonance images, seem to be strong and useful assistants to detect the lesions of Parkinson's disease in the early stage. This paper shows the ability of machine learning to be an effective assistant for radiologists or other specialists involved in the interpretation of Parkinson's images for better diagnosis.

Artificial Intelligence at the Service of Medical Imaging in the Detection of Breast Cancer: Advancements, Challenges, and Future Prospects

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Abstract: Breast cancer ranks among the frequently occurring malignant tumours in women, casting a grave impact on their physical and emotional well-being. Furthermore, the primary challenges in breast cancer screening and imaging diagnosis arise from intricate and variable image attributes, varying image quality, and disparities in interpretation among diverse radiologists and medical facilities. Artificial Intelligence (AI) has emerged as a transformative force in the field of medical imaging, revolutionizing the early diagnosis and analysis of breast tumours. The field of breast imaging is undergoing rapid development with promising outcomes thanks to the advancements in artificial intelligence (AI). At present, artificial intelligence can replicate clinical reasoning to facilitate diagnoses, notably in cases of breast cancer. In this article, the fundamental principles of AI and its application in the realm of breast medical imaging, spanning across mammography, ultrasound, and MRI. It delves deeply into activities such as identifying, segmenting, and classifying lesions, along with evaluating breast density and assessing the risk of breast cancer. In addition, we consolidate the latest advancements in AI-supported imaging diagnosis and explore the strides made in clinically-oriented, AI-driven accurate diagnosis of breast cancer. Finally, it is concluded that the "better" method depends on the specific clinical scenario, the goals of the diagnosis, and the capabilities of the AI algorithms. The integration of AI in medical imaging is a rapidly evolving field, and ongoing research and validation are essential to determine the most effective applications in breast cancer diagnosis.

Keywords: Breast Cancer, Medical Imaging, Artificial Intelligence, Challenges, Future Prospects.

References

[1] Baughan, Natalie, Lindsay Douglas, and Maryellen L. Giger. "Past, present, and future of machine learning and artificial intelligence for breast cancer screening." Journal of Breast Imaging 4, no. 5 (2022): 451-459. [2] Deshmukh, Pramod B., and Kanchan Lata Kashyap. "Solution Approaches for Breast Cancer Classification Through Medical Imaging Modalities Using Artificial Intelligence." In Smart Trends in Computing and Communications: Proceedings of SmartCom 2021, pp. 639-651. Springer Singapore, 2022. [3] Zheng, Dan, Xiujing He, and Jing Jing. "Overview of artificial intelligence in breast cancer medical imaging." Journal of Clinical Medicine 12, no. 2 (2023): 419. [4] Lewis, Sarah J., Ziba Gandomkar, and Patrick C. Brennan. "Artificial Intelligence in medical imaging practice: looking to the future." Journal of Medical radiation sciences 66, no. 4 (2019): 292-295. [5] Zhang, Tianyu, Tao Tan, Riccardo Samperna, Zhang Li, Yuan Gao, Xin Wang, Luyi Han, Qifeng Yu, Regina GH Beets-Tan, and Ritse M. Mann. "Radiomics and artificial intelligence in breast imaging: a survey." Artificial Intelligence Review (2023): 1-36. [6] Houssami, Nehmat, Christoph I. Lee, Diana SM Buist, and Dacheng Tao. "Artificial intelligence for breast cancer screening: opportunity or hype?." The Breast 36 (2017): 31-33. [7] Suzuki, Kenji, and Yisong Chen, eds. Artificial intelligence in decision support systems for diagnosis in medical imaging. Vol. 140. Cham: Springer, 2018.

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The Impact of Computer Vision in Enhancing Ovarian Tumor Detection

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Abstract:

Background: Detection of ovarian tumors is crucial for early diagnosis and treatment, which in turn improves patients' overall survival rate. Conventional methods for tumor detection typically involve manual interpretation of medical images, resulting in subjective and time-consuming evaluations.

Methods: Recent advancements in computer vision techniques have transformed the field of medical imaging by automating the detection process and enhancing accuracy.

Results: The use of computer vision techniques has shown promising results in the analysis of ovarian tumors. These techniques have the ability to extract quantitative picture information that cannot be detected by the human eye. This provides a more accurate evaluation of the tumor compared to traditional methods [1-3].

Conclusions: Picture feature extraction applying radiomics or deep learning (DL) has demonstrated promising results in tumour analysis and can provide quantitative picture information that is invisible by human eyes, in contrast to subjective radiological imaging evaluation by humans [2-12].

Keywords: Computer vision; ovarian tumor; medical imaging; detection; diagnosis; technology

References:

1. Jan, Y.-T., et al., Machine learning combined with radiomics and deep learning features extracted from CT images: a novel AI model to distinguish benign from malignant ovarian tumors. Insights into Imaging, 2023. 14(1): p. 68.

2. Rizzo, S., et al., Radiomics of high-grade serous ovarian cancer: association between quantitative CT features, residual tumour and disease progression within 12 months. European radiology, 2018. 28: p. 4849-4859.

3. Wang, S., et al., Deep learning provides a new computed tomography-based prognostic biomarker for recurrence prediction in high-grade serous ovarian cancer. Radiotherapy and Oncology, **2019. 132: p. 171-177.**

4. Chaudhary, K., et al., Deep learning–based multi-omics integration robustly predicts survival in liver cancer. Clinical Cancer Research, 2018. 24(6): p. 1248-1259.

5. Chiappa, V., et al., A decision support system based on radiomics and machine learning to predict the risk of malignancy of ovarian masses from transvaginal ultrasonography and serum CA-**125. European radiology experimental, 2021. 5(1):** p. 1-15.

6. Chiappa, V., et al., Using rADioMIcs and machine learning with ultrasonography for the differential diagnosis of myometRiAL tumors (the ADMIRAL pilot study). Radiomics and differential diagnosis of myometrial tumors. Gynecologic Oncology, 2021. 161(3): p. 838-844.

7. Jian, J., et al., MR image-based radiomics to differentiate type I and type II epithelial ovarian cancers. European Radiology, 2021. 31: p. 403-410.

8. Song, X.-l., et al., Radiomics derived from dynamic contrast-enhanced MRI pharmacokinetic protocol features: the value of precision diagnosis ovarian neoplasms. European Radiology, 2021. 31: p. 368-378.

9. Sun, R., et al., A radiomics approach to assess tumour-infiltrating CD8 cells and response to anti-PD-1 or anti-PD-L1 immunotherapy: an imaging biomarker, retrospective multicohort study. The Lancet Oncology, 2018. 19(9): p. 1180-1191.

10. Vargas, H.A., et al., A novel representation of inter-site tumour heterogeneity from pre-treatment computed tomography textures classifies ovarian cancers by clinical outcome. European radiology, 2017. 27: p. 3991-4001.

11. Xia, X., et al., Comparison and fusion of deep learning and radiomics features of ground-glass nodules to predict the invasiveness risk of stage-I lung adenocarcinomas in CT scan. Frontiers in oncology, 2020. 10: p. 418.

12. Zhang, H., et al., Magnetic resonance imaging radiomics in categorizing ovarian masses and predicting clinical outcome: a preliminary study. European Radiology, 2019. 29: p. 3358-3371.

Evaluation of the Claude AI Assistant's Performance on the Iranian Master's Entrance Exam in Medical Physics

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Abstract:

Aim: This study aimed to assess the performance of the Claude AI assistant[2] on a multiple choice exam covering key topics in medical physics and determine areas needing improvement.

Methods: Claude was provided a 160 question multiple choice exam from the Iranian Master's Entrance Exam in Medical Physics directly in PDF form [1] without using any OCR tools. Claude provided its best reasoned answers, which were compared to the answer key to calculate percent correct overall and by topic.

Results: Overall Claude achieved 61% accuracy compared to the answer key. Performance was strongest in Physiology and Anatomy (67% correct), radiation physics, general physics, and math (60% each), and general English (68%). Weaker areas were nuclear/atomic physics (55% correct), radiobiology (58%), biology (60%), and physiology/anatomy (67%).

Conclusion: The Claude AI assistant demonstrated a foundational command of key physics topics, with room for improvement in specialized medical applications. Additional training focused on nuclear physics, radiobiology, and biological sciences would further enhance Claude's performance on medical physics exams and tasks requiring cross-disciplinary knowledge. However, Claude shows promise in integrating physics and medical concepts.

Keywords: artificial intelligence, medical physics, exam performance, physics knowledge, cross-disciplinary learning

References

[1] Medical Education Assessment Center(Sanjeshp.ir).

[2] Claude by Anthropic(Claude.ai).

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Cardiovascular magnetic resonance imaging (CMRI) for the evaluation of patients with cardiovascular diseaseusing(CVD) using machine learning: An overview

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Abstract

Backgrounds: Despite significant advances in diagnosis and treatment, CVD remains the most common cause of morbidity/mortality worldwide, accounting for approximately one third of annual deaths.Cardiovascular imaging has a pivotal role in diagnostic decision-making and treatment follow-up for CVD. Among the diagnostic methods, CMRI is increasingly used to diagnose, monitor the disease, plan treatment and predict CVDs.CMR enables accurate quantification of the cardiac chamber volume, ejection fraction and myocardial mass. In addition to quantitative measurements, for years, clinicians have been relying on manual approaches for CMR image analysis which is time consuming and prone to subjective errors. It is a major clinical challenge to automatically derive quantitative and clinically information from CMR images.Because of the large number of cardiac images that are routinely acquired with a wide range of modalities researchers have proposed artificial intelligence (AI) techniques for the automatic diagnosis of CVDs using CMRI data.

Methods: Various databases like Google Scholar, PubMed, Scopus, and Web of Science were searched over a period of 8 years from 2015 to 2023.All the studies indicating the The potential role of imaging for heart disease, including Cardiovascular magnetic resonance and artificial intelligence techniques such as a machine learning were included in this review. Exclusion criteria were studies unavailable and irrelevant studies of the subject.

Results: Correlations between machine learning and manual segmentation-derived flow approached unity ($r = 0.99$, $p < 0.001$).Among patients without advanced mitral regurgitation, machine learning correlated well ($r = 0.63$, $p < 0.001$) .Among advanced mitral regurgitation patients, machine learning yielded lower stroke volume than did volumetric cine-CMR (Δ 12.6 ± 20.9 mL, $p = 0.005$), further supporting validity of this method. the results demonstrated that ANNs, DTs, SVMs, Naïve Bayes, and KNN are the most widely used algorithms for CAD detection.Due to inherent differences among datasets, inconsistent performances have been reported for different datasets using similar ML algorithms.The reported results indicate that KNN, SVM, and ANN have achieved the highest accuracies for most of the CAD datasets.

Conclusion: Findings support use of machine learning for analysis of large scale CMR datasets.However, Despite the progress that has been made in recent years, there remain key shortcomings in ML-based detection of CAD that must be addressed in upcoming years.AI researchers introduced DL methods to tackle the challenges of ML method.

Keywords: CMRI, CVD, Machine learning

References

[1] Wilkins, E., Wilson, L., Wickramasinghe, K., Bhatnagar, P., Leal, J., Luengo-Fernandez, R., ... & Townsend, N. (2017). European cardiovascular disease statistics 2017.

[2] Ritchie, H., Spooner, F., & Roser, M. (2018). Causes of death. *Our world in data*.

[3] Mavrogeni, S. I., Kallifatidis, A., Kourtidou, T., Lama, N., Christidi, A., Detorakis, E., ... & Kelekis, N. (2023). Cardiovascular Magnetic Resonance for evaluation of patients with cardiovascular disease. An overview of current indications, limitations and procedures. *Hellenic Journal of Cardiology*.

[4] Bai, W., Sinclair, M., Tarroni, G., Oktay, O., Rajchl, M., Vaillant, G., ... & Rueckert, D. (2018). Automated cardiovascular magnetic resonance image analysis with fully convolutional networks. *Journal of Cardiovascular Magnetic Resonance*, *20*(1), 1-12.

[5] Levin, D. C., Parker, L., Halpern, E. J., & Rao, V. M. (2019). Coronary CT angiography: reversal of earlier utilization trends. *Journal of the American College of Radiology*, *16*(2), 147-155.

[6] Jafari, M., Shoeibi, A., Khodatars, M., Ghassemi, N., Moridian, P., Alizadehsani, R., ... & Acharya, U. R. (2023). Automated diagnosis of cardiovascular diseases from cardiac magnetic resonance imaging using deep learning models: A review. *Computers in Biology and Medicine*, 106998. (2019). Machine learning derived segmentation of phase velocity encoded cardiovascular magnetic resonance for fully automated aortic flow quantification. *Journal of Cardiovascular Magnetic Resonance*, *21*, 1-11.

[7]Alizadehsani, R., Abdar, M., Roshanzamir, M., Khosravi, A., Kebria, P. M., Khozeimeh, F., ... & Acharya, U. R. (2019). Machine learning-based coronary artery disease diagnosis: A comprehensive review. *Computers in biology and medicine*, *111*, **103346.**

Performance of deep learning algorithms in predicting autism spectrum disorders based on fMRI data

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Abstract: Autism spectrum disorder (ASD) is a complex neurodevelopmental disease [1]. People with autism have unusual communication and repetitive behaviours with restricted activities [2]. Various factors such as genetics, environment, and abnormal neural connectivity play a role in the pathogenesis of the disease [3]. Since only the evaluation of social behaviour and language skills in an autistic patient cannot provide information about the patient's neurological patterns, using functional magnetic resonance imaging (fMRI) enables the evaluation of the brain's functional connectivity as well as obtaining precise information for neuroscientists about Autism. Deep learning algorithms due to their features such as auto extract features of the images and capturing hidden representations can be effective in the early diagnosis of Autism [4]. The purpose of this study was to investigate the performance of deep learning algorithms in predicting ASD using fMRI data.

We used scientific databases such as Google Scholar, PubMed, and Web of Science to search keywords “deep learning algorithms”, “autism spectrum disorder”, and “functional magnetic resonance imaging”. Then, we extracted the related articles and reviewed them.

The obtained results indicated that various deep learning algorithms such as Conditional Generative Adversarial Network (cGAN), Artificial Neural Network (ANN), Convolutional Neural Network (CNN), and Deep Q Network (DQN) were used for ASD prediction using resting state fMRI data. Also, the accuracy and sensitivity of these approaches were determined in the range of (64-97%) and (79-90%), respectively.

It can be concluded that deep learning algorithms indicate a diagnostic performance to predict ASD using resting state fMRI data.

Keywords: “Deep learning algorithms”, “Autism spectrum disorder”, “Functional magnetic resonance imaging”

References

[1] T. Eslami, and F. Saeed. "Auto-ASD-network: a technique based on deep learning and support vector machines for diagnosing autism spectrum disorder using fMRI data.", In Proceedings of the 10th ACM International Conference on Bioinformatics, Computational Biology and Health Informatics, 2019, pp. 646-651.

[2] F.Z. Subah, K. Deb, P.K. Dhar, T. Koshiba. "A Deep Learning Approach to Predict Autism Spectrum Disorder Using Multisite Resting-state

fMRI.", *Applied Sciences* 11, no. 8 (2021) 3636.

[3] J. Stember, D. Stember, L. Pasquini, J. Merhnaz, A. Holodny, H. Shalu. "Deep Reinforcement Learning for fMRI Prediction of Autism Spectrum Disorder.", *arXiv preprint arXiv* (2022) 2206.11224.

[4] M.Tang, P. Kumar, H. Chen, A. Shrivastava. "Deep Mmultimodal Learning for The Diagnosis of Autism Spectrum Disorder.", *Journal of Imaging* 6, no. 6 (2020) **47.**

Exploring the Potential of Radiomics in Oncology: Bridging the Gap Between Imaging and Precision Medicine

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Abstract

Radiomics, a burgeoning field at the intersection of radiology, oncology, and data science, has gained substantial attention in recent years. With the advent of advanced medical imaging technologies, radiomics offers a novel approach to extract quantitative data from medical images, enabling the transformation of images into mineable data repositories. This data-driven paradigm shift has the potential to revolutionize clinical decision-making in oncology.

This article provides a comprehensive overview of radiomics, its methodologies, and its applications in oncology. We delve into the underlying principles of feature extraction, selection, and modeling techniques, highlighting the significance of radiomic features in characterizing tumor heterogeneity. Radiomics' ability to unravel hidden patterns within medical images is discussed, showcasing its potential to aid in early diagnosis, treatment response prediction, and prognostication.

Furthermore, we explore the integration of radiomics with genomics, termed radiogenomics, and its role in unraveling the intricate relationship between imaging phenotypes and genomic alterations. Radiogenomics opens new avenues for personalized medicine by elucidating the genetic basis of radiomic features and their implications in tailoring therapeutic strategies.

In this article, we also address the challenges and limitations of radiomics, including data standardization, model generalizability, and clinical translation. We emphasize the need for rigorous validation and collaboration between radiologists, oncologists, and data scientists to harness the full potential of radiomics in clinical practice.

In conclusion, radiomics stands as a promising frontier in oncology, offering a non-invasive and quantitative approach to decipher the complex landscape of tumors. By bridging the gap between medical imaging and precision medicine, radiomics holds the key to unlocking new insights into tumor biology and guiding more effective, personalized treatment strategies.

Reference

1. Lambin P, Rios-Velazquez E, Leijenaar R, et al. Radiomics: extracting more information from medical images using advanced feature analysis. Eur J Cancer. 2012;48(4):441-446

2. Gillies RJ, Kinahan PE, Hricak H. Radiomics: images are more than pictures, they are data. Radiology. 2016;278(2):563-577.

3. Aerts HJ, Velazquez ER, Leijenaar RT, et al. Decoding tumour phenotype by noninvasive imaging using a quantitative radiomics approach. Nat Commun. 2014;5:4006

4. Luo H, Xu G, Li C, et al. A comparison of radiomics and machine learning methods for the classification of lymph node metastasis in patients with gastric cancer. Front Oncol. 2019;9:867.

5. Gatenby RA, Grove O, Gillies RJ. Quantitative imaging in cancer evolution and ecology. Radiology. 2013;269(1):8-15.

6. Liu Z, Wang S, Dong D, et al. The applications of radiomics in precision diagnosis and treatment of oncology: opportunities and challenges. Theranostics. 2019;9(5):1303-1322

7. Parmar C, Grossmann P, Bussink J, Lambin P, Aerts HJ. Machine learning methods for quantitative radiomic biomarkers. Sci Rep. 2015;5:13087.

Advances in Mitigating Skin Toxicity in Whole Breast Radiotherapy for Breast Cancer: The Role of Field-in-Field Techniques

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Keywords: *Skin Toxicity, field-in-field radiotherapy, Breast Cancer, WBRT*

Abstract

Whole breast radiotherapy (WBRT) constitutes a cornerstone of treatment for women with early-stage breast cancer who have undergone breast-conserving surgery (BCS). While WBRT significantly reduces the risk of locoregional recurrence and breast cancer-related mortality, its clinical utility is often overshadowed by the development of skin toxicities. These adverse effects can have a substantial impact on a patient's quality of life and treatment compliance.

This comprehensive review article delves into the multifaceted challenges posed by skin toxicity in the context of WBRT and explores the cutting-edge strategies employed to mitigate these issues. The central focus of this discussion is the integration of field-in-field (FIF) techniques within the framework of three-dimensional conformal radiotherapy (3D-CRT) treatment planning. These FIF techniques have rapidly gained prominence as the standard of care for WBRT due to their potential to optimize dose distribution while minimizing acute skin toxicity.

Through a meticulous analysis of recent studies, clinical trials, and emerging technologies, this article provides a thorough examination of the pivotal role that FIF techniques play in skin toxicity management during WBRT for breast cancer. Additionally, it explores the mechanisms underlying the development of skin toxicities, risk factors, and patient-specific considerations that can influence their severity. By presenting a comprehensive overview of the latest advancements, this article equips clinicians, researchers, and healthcare providers with a deeper understanding of how to enhance the therapeutic benefits of WBRT while prioritizing patient's comfort and well-being. Ultimately, it aims to foster a more informed and effective approach to breast cancer radiotherapy, with an emphasis on reducing the burden of treatment-related skin toxicities.

Dosiomics: An Advanced Radiotherapy Dose Distribution Analysis for Improved Personalized Treatment Planning

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Abstract

Background and Aim Dosiomics, an emerging field in radiotherapy, leverages quantitative measures extracted from dose distributions to facilitate predictive biomarker discovery, thereby advancing personalized radiation oncology. This study conducts a comprehensive review of recent developments in dosiomics research.

Methods Our investigation involved a meticulous analysis of literature using keywords such as dosiomics, dosiomic radiotherapy dose textures, spatial dose features, and dose-based radiomics. We sourced data from reputable databases, including PubMed, Web of Science, and Scopus. Dosiomics features were studied in conjunction with clinical data, Dose-Volume Histogram (DVH) analysis, Tumour Control Probability (TCP) modelling, Normal Tissue Complication Probability (NTCP) assessments, radiomics, and dosimetric parameters.

Results Our findings are categorized into three main areas: tumour analysis, normal organ analysis, and features reproducibility. Within the realm of dosiomics analysis, we observed substantial variation in parameter selection, combinations, and statistical methodologies. Numerous studies convincingly demonstrated that the incorporation of diverse parameters significantly enhances the accuracy of prediction models, particularly in predicting normal tissue responses. Dosiomic features have proven highly effective in augmenting the Receiver Operating Characteristic (ROC) curve and consistently outperformed conventional dosimetric models. Similarly, in the prediction of local recurrence, dosiomics-based models have consistently exhibited high efficacy and validated their accuracy.

Conclusion The limited number of dosiomics studies, frequently constrained by small sample sizes, underscores the need for further exploration, including rigorous assessments of reproducibility and stability. Dosiomics offers a promising avenue for radiation response modelling, unlocking opportunities for therapeutic personalization and ultimately leading to improved treatment outcomes.

Keywords Dosiomics, Radiotherapy, Dose distribution texture analysis, Treatment optimization

References

[1] Placidi L, Gioscio E, Garibaldi C, Rancati T, Fanizzi A, Maestri D, Massafra R, Menghi E, Mirandola A, Reggiori G, et al: "A Multicentre Evaluation of Dosiomics Features Reproducibility, Stability and Sensitivity." *Cancers* 2021, 13:3835.

[2] Abdollahi H, Dehesh T, Abdalvand N, Rahmim A: "Radiomics and dosiomics-based prediction of radiotherapy-induced xerostomia in head and neck cancer patients." *Int J Radiat Biol* 2023:1-15.

[3] Liang B, Yan H, Tian Y, Chen X, Yan L, Zhang T, Zhou Z, Wang L, Dai J: "Dosiomics: Extracting 3D Spatial Features From Dose Distribution to Predict Incidence of Radiation Pneumonitis." *Front Oncol* 2019, 9:269.

[4] Kraus KM, Oreshko M, Bernhardt D, Combs SE, Peeken JC: "Dosiomics and radiomics to predict pneumonitis after thoracic stereotactic body radiotherapy and immune checkpoint inhibition." *Front Oncol* 2023, 13:1124592.

[5] Murakami Y, Soyano T, Kozuka T, Ushijima M, Koizumi Y, Miyauchi H, Kaneko M, Nakano M, Kamima T, Hashimoto T, et al: "Dose-Based Radiomic Analysis (Dosiomics) for Intensity Modulated Radiation Therapy in Patients With Prostate Cancer: Correlation Between Planned Dose Distribution and Biochemical Failure." *Int J Radiat Oncol Biol Phys* 2022, 112:247-259.

Eradication of Senescent Tumor Cells Using Nanoparticles

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Abstract

Senescence, a state of irreversible growth arrest, often occurs in tumor cells in response to various cellular stresses, including radiation therapy. While senescence halts tumor growth, it can paradoxically promote resistance to therapeutic interventions. This article explores an innovative approach utilizing nanoparticles for the targeted eradication of senescent tumor cells, opening new avenues in cancer treatment.

Nanoparticles have emerged as promising candidates for senescence-focused interventions due to their unique attributes. Their small size, surface properties, and drug-loading capabilities enable precise delivery of therapeutic payloads to senescent cells. We delve into the diverse range of nanoparticles, such as liposomes, polymeric nanoparticles, and lipid-based nanoparticles, and their potential to selectively induce apoptosis or senolysis in senescent tumor cells.

Moreover, we examine the underlying mechanisms by which nanoparticles exert their senolytic effects, including the modulation of pro-survival pathways, interference with senescence-associated secretory phenotype (SASP), and activation of apoptotic pathways. These mechanistic insights provide a foundation for the rational design of nanoparticle-based strategies for senescent cell eradication.

As we navigate the complexities of tumor heterogeneity, we discuss the prospects of tailoring nanoparticle formulations to the specific senescent cell subpopulations within tumors. Personalized approaches hold the promise of enhancing the effectiveness of senescence-targeted therapies while minimizing off-target effects.

Nevertheless, challenges in nanoparticle design, bioavailability, and clinical translation persist. We address these issues and underscore the importance of rigorous preclinical and clinical investigations to validate the safety and efficacy of nanoparticle-based senolytic therapies.

In conclusion, nanoparticles stand as a formidable contender in the quest to eradicate senescent tumor cells. This article provides an encompassing overview of the current state of research in this domain, highlighting the potential for nanoparticles to revolutionize cancer treatment by selectively eliminating senescent cells, thereby enhancing therapeutic outcomes.

Reference

1. Baar MP, Brandt RMC, Putavet DA, et al. Targeted apoptosis of senescent cells restores tissue homeostasis in response to chemotoxicity and aging. Cell. 2017;169(1):132-147.

2. Acosta JC, O'Loghlen A, Banito A, et al. Chemokine signaling via the CXCR2 receptor reinforces senescence. Cell. 2008;133(6):1006-1018.

3. Wiley CD, Velarde MC, Lecot P, et al. Mitochondrial dysfunction induces senescence with a distinct secretory phenotype. Cell Metab. 2016;23(2):303-314.

4. Zhang P, Kishimoto Y, Grammatikakis I, et al. Senolytic therapy alleviates Aβ-associated oligodendrocyte progenitor cell senescence and cognitive deficits in an Alzheimer's disease model. Nat Neurosci. 2019;22(5):719-728.

5. Hernandez-Segura A, de Jong TV, Melov S, Guryev V, Campisi J, Demaria M. Unmasking transcriptional heterogeneity in senescent cells. Curr Biol. 2017;27(17):2652-2660.

Investigating the level of awareness, attitude and behavior of female teachers in Zahedan city towards breast cancer screening in 1401

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Review:

Background and purpose: due to the prevalence of breast cancer and the importance of early detection as a result of the need to use its screening methods in the society and the importance and role of women teachers, the present study aims to determine the level of awareness, the attitude and behavior of female teachers in Zahedan city about breast cancer screening has been done.

Methodology: This research is a descriptive and analytical study, the population of which is 300 female teachers of Zahedan schools in 1401, who will be randomly selected, and the collected information will be analyzed using statistical software such as spss.

Findings: According to the studies we reviewed, it is expected that the level of knowledge of teachers about breast cancer and screening methods is average and their attitude is positive, but most of them do not use these methods. Therefore, in this research, the information of 300 female teachers of Zahedan schools will be collected, and after checking, it will be compared with similar studies.

Conclusion: Women teachers due to the importance of their role in society; In order to increase their level of awareness and attitude towards breast cancer and screening programs and as a result to increase their participation in these screenings, they need to provide the necessary training in the field of breast cancer screening methods.

Keywords: Breast cancer،screening،consciousness،attitude.

Investigation of Fetal Radiation Dose in CT Scan Diagnostic Method with a Dose Reduction Approach in Pregnant Patients

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Abstract:

Introduction: When using diagnostic methods such as CT scans and radiography, the primary priority is to obtain high-quality images while considering the minimum radiation dose to the patient. However, in pregnant patients, controlling the radiation dose to prevent harmful effects on the fetus is crucial. In some cases, performing a CT scan is vital for diagnosing diseases such as PE (pulmonary embolism), trauma, and aortic aneurysm[1, 2]. This study aims to investigate the radiation dose to the fetus in two types of scans: abdominal-pelvic and chest scans in pregnant patients.

Materials and Methods: Initially, keywords such as "CT in pregnancy," "fetal absorbed dose," "dosimetry," and "estimation" were collected from databases including PubMed, Scopus, Science Direct, and the Google Scholar search engine. Studies published between 2007 and 2022 were selected. Among the 50 articles, 35 articles with the most relevant titles to the research objective were chosen. The results extracted from these articles were then reviewed.

Results: The first trimester of pregnancy is considered the most sensitive period to the effects of radiation exposure on the fetus. In the second and third trimesters, fetal resistance to radiation increases, but receiving a dose greater than 500 mGy may lead to adverse effects such as growth disorders[3]. In the newer perspective, the fetal dose threshold for deterministic effects has decreased to 100 mGy[**4,** 5]. According to ACR statements, the risk of developing oncological diseases in fetuses exposed to **a** dose of 20 mGy is 1 in 125[6]. However, according to ICRP reports, the risk of developing oncological diseases in fetuses is lower, with a ratio of 1 in 500 for a dose of 30 mGy[7].

The analysis of the results shows that in chest scans, the fetal absorbed dose increases with the progression of gestational weeks, and this increase is attributed to the fetus's proximity to the chest. The average dose change from week 8 to week 38 is 0.43 mGy[7]. In small abdominal and pelvic scans, there is not a significant increase in fetal dose with the progression of gestational weeks[8].

Conclusion: In conclusion, based on the reviewed studies, it can be stated that the reported absorbed dose in studies for chest and abdominal-pelvic scans is much lower compared to the doses recommended by relevant radiation protection organizations. Ultimately, among the three methods, reducing the scan length, modifying technical parameters such as increasing kvp and pitch, and using shielding for reducing fetal dose, reducing the scan length is the most effective method[9, 10].

Keywords: feta dose, CT scan, scan length

References

[1] Liu H, Liu F, Li J, Zhang T, Wang D, Lan W. Clinical and CT imaging features of the COVID-19 pneumonia: Focus on pregnant women and children. Journal of infection 2020; 80: e7-e13.

[2] Sazhin A, Kirienko A, Kurtser M, Konoplyannikov A, Panin A, Son D, Shulyak G. Acute appendicitis during pregnancy. Khirurgiia 2019: 70-7.

[3] Sadro C, Bernstein MP, Kanal KM. Imaging of trauma: Part 2, Abdominal trauma and pregnancy—a radiologist's guide to doing what is best for the mother and baby. American Journal of Roentgenology 2012; 199: 1207-19.

[4] Committee Opinion No. 723: Guidelines for Diagnostic Imaging During Pregnancy and Lactation. Obstet Gynecol 2017; 130: e210-e6.

[5] Wang PI, Chong ST, Kielar AZ, Kelly AM, Knoepp UD, Mazza MB, Goodsitt MM. Imaging of pregnant and lactating patients: part 1, evidence-based review and recommendations. American Journal of Roentgenology 2012; 198: 778-84.

[6] Vodovatov AV, Golchenko OA, Mashchenko IA, Alekseeva DV, Chipiga LA, Khutornoy IV, Kozlova PV, Trufanov GE, Druzhinina PS, Ryzhov SA. Evaluation of fetal absorbed doses from computed tomography examinations of pregnant patients: A systematic review. Digital Diagnostics 2023; 4: 170-84.

[7] Vodovatov A, Chipiga L, Piven P, Trufanov G, Berkovich G, Mashchenko I, Druzhinina P, Puzyrev V, Ryzhov S. Assessment of the absorbed doses in the fetus from the computed tomography of the chest for the pregnant women. Radiatsionnaya Gygiena 2021: 126-35.

[8] Kelaranta A, Mäkelä T, Kaasalainen T, Kortesniemi M. Fetal radiation dose in three common CT examinations during pregnancy–Monte Carlo study. Physica Medica 2017; 43: 199-206.

[9] Doshi S, Negus I, Oduko J. Fetal radiation dose from CT pulmonary angiography in late pregnancy: a phantom study. The British journal of radiology 2008; 81: 653-8.

[10] Ryckx N, Sans-Merce M, Schmidt S, Poletti P-A, Verdun FR. The use of out-of-plane high Z patient shielding for fetal dose reduction in computed tomography: literature review and comparison with Monte-Carlo calculations of an alternative optimisation technique. Physica Medica 2018; 48: 156-61.

Investigation Dose Constraints for Carers and Comforters in Radiography: A Review

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Abstract:

Introduction: Medical radiation exposures are primarily administered to patients for diagnostic tests, interventional procedures, or radiation treatment. However, there are also other individuals, such as parents and close friends, who provide care and comfort to patients These carers may hold children during diagnostic procedures or be in close proximity to patients after the administration of radiopharmaceuticals or during brachytherapy[1]. Aim of this study is to investigate the Dose Constraints for Carers and Comforters in various reports and methods of radiography.

Materials and Methods: The primary objective of this study is to investigate established dose constraints for individuals referred to as "carers" and "comforters" in various medical reports and radiographic methods. These individuals often provide care and support to patients during or after radiological procedures.

A systematic search was conducted in reputable academic databases, including PubMed, ScienceDirect, and Google Scholar, using keywords such as "dose constraints" and "carers in radiography. Publications lacking specific information on dose constraints.

The selected 25 articles and reports were reviewed to identify and document established dose constraints for carers and comforters in the context of various radiographic procedures.

Results: The International Commission on Radiological Protection (ICRP) has proposed a dose limit of 5 millisieverts (mSv) for each carers episode involving patients[1]. Conversely, the European Union has established varying dose limits, 3 mSv for individuals below the age of 60 who are not pregnant, and 15 mSv for individuals aged 60 or above[2].

In Australia, the Code for Radiation Protection in Medical Exposure provides guidelines for safeguarding carers. For radiological examinations, the dose limit is set at 1 mSv, which aligns with the general public's limit. However, in treatment scenarios such as radionuclide therapy, the dose limit is elevated to 5 mS v [3].

In studies conducted, it has been found that carers in CT, mammography and radiography receive a dose significantly lower than the permissible limit set by radiation protection organizations.[4,5,6,7,8,9]

Conclusion: Due to the fact that carers receive higher doses of radiation than the general public, obtaining informed consent and providing information to caregivers is crucial. This ensures that they are aware of the risks associated with ionizing radiation and can actively participate in patient care through informed decision-making.

In a institution, it was decided that a lead apron is not required if the carer is unlikely to receive more than 2 µSv [10].

Keywords: Radiation protection, Carers, Dose

References

[1] Protection R. ICRP publication 103. Ann ICRP. 2007;37(2.4):2.
[2] European Union (Basic Safety Standards for Protection Against Dangers Arising from Medical Exposure to Ionising Radiation) Regulations 2018 SI No. 256 of 2018. Dublin: The Stationary Office; 2018
[3] Smart RC. Radiation protection in Australia: a thirty year perspective. Australasian Physics & Engineering Sciences in Medicine. 2007 Sep;30:155-9.
[4] Badawy MK, Anderson A. Radiation protection for comforters and carers in radiology and nuclear medicine. Journal of medical radiation sciences. 2023 Jun;70(2):103.
[5] Daniel OA, Xaviera IC. Integrity test of lead apron and its effect on personnel and carers. Bangabandhu Sheikh Mujib Medical University Journal. 2018 Mar 5;11(1):34-7.
[6] Kostidis M, Varcoe JG, Barnes P. Assessment of scatter radiation dose received by comforters and carers during digital breast tomosynthesis mammography. Journal of Medical Radiation Sciences. 2023 Feb 27.
[7] Jeong KH, Jung JW, Kim CB, Ahn BC, Lee HK, Yoo SJ, Day O, Lee JK. Estimation of external radiation dose to caregivers of patients treated with radioiodine after thyroidectomy. Health physics. 2014 Apr 1;106(4):466-74.
[8] Gains JE, Walker C, Sullivan TM, Waddington WA, Fersht NL, Sullivan KP, Armstrong E, D'souza DP, Aldridge MD, Bomanji JB, Gaze MN. Radiation exposure to comforters and carers during paediatric molecular radiotherapy. Pediatric blood & cancer. 2015 Feb;62(2):235-9.
[9] Stefanoyiannis AP, Ioannidou SP, Round WH, Carinou E, Mavros MN, Liotsou T, Geronikola-Trapali X, Armeniakos I, Chatziioannou SN. Radiation exposure to caregivers from patients undergoing common radionuclide therapies: a review. Radiation protection dosimetry. 2015 Dec 1;167(4):542-51.
[10] Jeong KH, Jung JW, Kim CB, Ahn BC, Lee HK, Yoo SJ, Day O, Lee JK. Estimation of external radiation dose to caregivers of patients treated with radioiodine after thyroidectomy. Health physics. 2014 Apr 1;106(4):466-74.

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The role of microRNAs in response to ionizing radiation in cancer cells

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Abstract: MicroRNAs (miRNA) are a class of conserved RNAs (with a length of 19-23 nucleotides) that are non-coding and act as post-transcriptional regulators of gene expression. miRNAs play an important role in the pathophysiology of diseases such as cancer by regulating cell proliferation, metabolism, cell cycle, metastasis, and DNA damage response (1, 2). Many studies have identified miRNA as a potential biomarker for diagnosis, prognosis, or therapeutic tool for cancer.

Ionizing radiation (IR) is one of the methods of cancer treatment using ionizing radiation, which is used in the treatment of more than 50% of cancers. Cellular response to IR damages activates many signalling pathways (such as PI3K/AKT and MAPK) mediating reacting to the damage and activating DNA damage responses (DDR) by activity homologous recombination (HR) and non-homologous end-joining (NHEJ) to restore the double-strand breaks (DSBs).

Recent studies have shown that miRNAs play a role in the signalling pathway related to radiation response and may lead to apoptosis, autophagy, DNA damage response, repair, etc (3). There is increasing interest for researchers to investigate the correlation between changes in some miRNA profiles and IR exposure. In this presentation, we will briefly overview the examples of different microRNAs and their role in response to radiation in some cancers.

The PI3K/Akt pathway is activated in response to IR exposure and causes radioresistance. miRNA-21 caused radioresistance by reducing the activity of PTEN (tumour suppressor), thus increasing AKT activation (4). Also, miRNA-205 was shown to regulate radiosensitivity by modulation of PTEN in gastric cancer. We also highlighted that some miRNAs can impact DNA damage repair and radioresistance of cancer cells. Many studies investigated the roles of miRNAs in two main mechanisms for DSB lesions for IR which include HR and NHEJ pathways. For example, miR-875 can induce radiosensitivity by regulating checkpoint kinase 1 (CHK1) expression directly to inhibit the HR pathway in prostate cancer cells (5). However, overexpression of miR-182 enhances radiosensitivity by inhibiting HR through reducing BRCA1 expression (6). Upregulation of miR-205 in PC-3 cell lines reduced the NHEJ pathway efficiency and caused radiosensitivity by targeting DNA-PKC(7).

In summary, we highlighted the role of miRNAs in the radioresistance of cancers and discussed their effects on the main signalling pathways in response to ionizing radiation exposure.

Keywords: Micro RNA, radiation resistance, biomarkers, Radiotherapy, Signalling pathway

Reference

1. Darvish L, Bahreyni Toossi MT, Azimian H, Shakeri M, Dolat E, Ahmadizad Firouzjaei A, et al. The role of microRNA-induced apoptosis in diverse radioresistant cancers. Cellular Signalling. 2023;104:110580.
2. Nguyen L, Schilling D, Dobiasch S, Raulefs S, Santiago Franco M, Buschmann D, et al. The emerging role of miRNAs for the radiation treatment of pancreatic cancer. Cancers. 2020;12(12):3703.
3. Oliveto S, Mancino M, Manfrini N, Biffo S. Role of microRNAs in translation regulation and cancer. World J Biol Chem. 2017;8(1):45-56.
4. Gwak H-S, Kim TH, Jo GH, Kim Y-J, Kwak H-J, Kim JH, et al. Silencing of microRNA-21 confers radio-sensitivity through inhibition of the PI3K/AKT pathway and enhancing autophagy in malignant glioma cell lines. 2012.
5. El Bezawy R, Cominetti D, Fenderico N, Zuco V, Beretta GL, Dugo M, et al. miR-875-5p counteracts epithelial-to-mesenchymal transition and enhances radiation response in prostate cancer through repression of the EGFR-ZEB1 axis. Cancer letters. 2017;395:53-62.
6. Moskwa P, Buffa FM, Pan Y, Panchakshari R, Gottipati P, Muschel RJ, et al. miR-182-mediated downregulation of BRCA1 impacts DNA repair and sensitivity to PARP inhibitors. Molecular cell. 2011;41(2):210-20.

7. El Bezawy R, Tinelli S, Tortoreto M, Doldi V, Zuco V, Folini M, et al. miR-205 enhances radiation sensitivity of prostate cancer cells by impairing DNA damage repair through PKCε and ZEB1 inhibition. Journal of experimental & clinical cancer research. 2019;38:1-11.

Assessment of Knowledge and Attitude of Parents about ionizing radiation and medical imaging

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Abstract:

This literature review systematically evaluates current evidence on parental knowledge and attitudes about ionizing radiation risks from paediatric imaging exams. A comprehensive search identified 10 high-quality studies that surveyed parental radiation knowledge using questionnaires. Research spanned several countries. A key finding was inadequate radiation knowledge, with under 50% of parents demonstrating correct awareness in over 5 studies. For instance, only 32-40% knew children have higher radiosensitivity and 9-31% correctly compared CT and X-ray radiation doses. However, most parents expressed positive attitudes about justified paediatric radiation procedures, especially with prior imaging experience. Still, some safety concerns persisted. In 4 studies, under 40% reported risks being clearly explained pre-imaging. Parental knowledge was higher with more education in 5 analyses. Multimedia education was preferred. In conclusion, this review reveals substantial knowledge gaps and deficient radiation risk communication among parents regarding common paediatric imaging involving ionizing radiation. Targeted multimedia education initiatives optimized for health literacy levels are required to empower informed parental decisions about child radiation exposure. Clinical protocols promoting transparent provider-parent radiation dose and risk discussions should be implemented. Further research on tailored risk communication strategies for diverse parents is warranted. Addressing these knowledge deficiencies is crucial to enhance paediatric radiation safety. In summary, this well-conducted systematic review provides compelling evidence that paediatric imaging radiation risks are inadequately communicated to parents, resulting in knowledge gaps negatively impacting informed medical decision-making and child safety. The authors make a persuasive case for improving parent education and transparent provider communication as a priority to protect children from unnecessary radiation exposure during essential diagnostic imaging. Keywords: Awareness; Patents; Caregivers; Medical Imaging; Radiation exposure Reference M. Olfati, H. Hadizadeh, “Assessment of Knowledge and Attitude of Parents about ionizing radiation and medical imaging” unpublished.

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Check the Effects of Mobile Electromagnetic Radiation on the Function of Tissues and Organs of Organisms: Review Article

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Abstract: The importance and place of mobile phones in today's human life is not hidden from anyone. Concerns about the increasing use of them in different ages from children to adults and the increase in the duration of exposure of these groups to electromagnetic waves caused by them, which is mainly in the range of 900-1800 MHz, concerns Much has been made about their side effects in recent years. Due to the importance of the subject of this review study, the effects of these waves on different parts of the body such as the brain, heart and other tissues. The present review study was performed by selecting appropriate keywords and searching for experimental and applied studies from PubMed and Google scholar databases. In this paper, the effects of electromagnetic waves emitted from a mobile phone on brain function, cardiac evaluation parameters, their effects on testicular and prostate tissue in male rats, effects on movement, bioavailability and DNA integrity of human sperm and changes Pulmonary uptake of MIBI - TC^{99M} was investigated in male rats. Studies show that cell phone-induced electromagnetic waves affect brain tissue temperature, neuron density, and nucleus diameter in mouse hippocampal neurons, and some brain-related activities such as cumulative response, dependence, and extent. Noise in irradiated chickens, cardiac parameters, sinus arrhythmia, testicular and prostate tissue structure in male rats as well as movement, survival and DNA integrity of human sperm and pulmonary absorption of MIBI - TC^{99M} in rats Affects males.

Keywords: cell phone, brain, heart, testicles, prostate, sperm, lungs

References

[1] Mugunthan N, Shanmugasamy K, Anbalagan J, Rajanarayanan S, Meenachi S. Effects of long term exposure of 900-1800 MHz radiation emitted from 2G mobile phone on mice hippocampus-a Histomorphometric study. Journal of clinical and diagnostic research: JCDR. 2016 Aug;10(8):AF01.

[2] Hasan I, Jahan MR, Islam MN, Islam MR. Effect of 2400 MHz mobile phone radiation exposure on the behavior and hippocampus morphology in Swiss mouse model. Saudi Journal of Biological Sciences. 2021.

[3] Isa R, Pasya I, Taib M, Jahidin A, Omar W, Fuad N, et al. Classification of brainwave asymmetry influenced by mobile phone radiofrequency emission. Procedia-Social and Behavioral Sciences. 2013;97:538-45.

[4] Sandström M, Wilen J, Hansson Mild K, Oftedal G. Mobile phone use and subjective symptoms. Comparison of symptoms experienced by users of analogue and digital mobile phones. Occupational Medicine. 2001;51(1):25-35.

[5] Zhou Z, Shan J, Zu J, Chen Z, Ma W, Li L, et al. Social behavioral testing and brain magnetic resonance imaging in chicks exposed to mobile phone radiation during development. BMC neuroscience. 2016;17(1):1-8.

[6] Tyagi A, Duhan M, Bhatia D. Effect of mobile phone radiation on brain activity GSM vs CDMA. IJSTM. 2011;2(2):1-5.

[7] Kumar V, Ahmad M, Sharma A. Harmful effects of mobile phone waves on blood tissues of the human body. Eastern Journal of Medicine. 2010;15(3):80.

[8] Jafari N, Heydari M, Asgari M. Simulation of Mobile Radiations in Vicinity of Adult and Child Head. Paramedical Sciences and Military Health. 2018;13(1):1-7.

[9] Forouharmajd F, Pourabdian S, Ebrahimi H. Evaluating temperature changes of brain tissue due to induced heating of cell phone waves. International journal of preventive medicine. 2018;9.

[10] Cai A, Cho Y, Nguyen M, Polamraju P. Effects of Cell Phone Radiation on the Head. 2014.

[11] Karipidis K, Elwood M, Benke G, Sanagou M, Tjong L, Croft RJ. Mobile phone use and incidence of brain tumour histological types, grading or anatomical location: a population-based ecological study. BMJ open. 2018;8(12):e024489.

[12] J-H Kim S, Ioannides SJ, Elwood JM. Trends in incidence of primary brain cancer in New Zealand, 1995 to 2010. Australian and New Zealand journal of public health. 2015;39(2):148-52.

[13] Ye M. Cellphone Usage and the Risk of Cancer. 2018.

[14] Tohidi F, BAHRAYNI TM, Azimian H, Khademi S, Fardid R, ANANI SG. The gene expression level of p53 and p21 in mouse brain exposed to radiofrequency field. 2015.

[15] Tohidi F-Z, Sadr-Nabavi A, Haghir H, Fardid R, Rafatpanah H, Azimian H, et al. Long-term exposure to electromagnetic radiation from mobile phones can cause considerable changes in the balance of Bax/Bcl2 mRNA expression in the hippocampus of mice. Electromagnetic Biology and Medicine. 2021;40(1):131-7.

[16] Alhusseiny A, Al-Nimer M, Majeed A. Electromagnetic energy radiated from mobile phone alters electrocardiographic records of patients with ischemic heart disease. Annals of medical and health sciences research. 2012;2(2):146-51.

[17] Komeili G, Sarabandi SN. Studying the effects of mobile phone waves on electro cardiogram parameters of students in zahedan university of medical sciences. International journal of high risk behaviors & addiction. 2012;1(2):75.

[18] Repacholi MH. Health risks from the use of mobile phones. Toxicology letters. 2001 Mar 31;120(1-3):323-31.

[19] Andrzejak R, Poreba R, Poreba M, Derkacz A, Skalik R, Gac P, et al. The influence of the call with a mobile phone on heart rate variability parameters in healthy volunteers. Industrial health. 2008;46(4):409-17.

[20] Kavyannejad R, Hadizade N, MohammadTaghi R, Gharibi F. Effect of electromagnutic field of mobile phones on blood pressure, heart rate and arytmia. Journal of Gorgan University of Medical Sciences. 2009;11(3):22-26.

[21] Amjadian T, Farokhi F, Ghanbari M, Khazaei M. The Effects of Cell Phone Waves (950 MHz-915MHz) on Histology of Testis and Prostate in male Rat. Journal of Animal Environment, 2016; 8(1): 23-34.

[22] Rezvanfar M, Sadrkhanlou R, Ahmadi A, Shojaei-Sadee H, Rezvanfar M, Mohammadirad A, et al. Protection of cyclophosphamide-induced toxicity in reproductive tract histology, sperm characteristics, and DNA damage by an herbal source; evidence for role of free-radical toxic stress. Human & experimental toxicology. 2008;27(12):901-10.

[23] Farahani A, Marefatpour E, Hamidi Madani A, Faraji R, Heidarzadeh A, Bahadori M. The Effects of Cellular Phone Electromagnetic Exposure on Human Sperm Viability, Motility and DNA Integrity(in Vitro Study). Journal of guilan university of medical sciences. 2015;24(94):29-35.

[24] Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. Fertility and sterility. 2008;89(1):124-8.

[25] Hansson GK. Inflammation, atherosclerosis, and coronary artery disease. New England Journal of Medicine. 2005;352(16):1685-95.

[26] Minai OA, Raja S, Mehta AC, Sullivan EJ, Khan SU, Dasgupta A, et al. Role of Tc-99m MIBI in the evaluation of single pulmonary nodules: a preliminary report. Thorax. 2000;55(1):60-2.

[27] Bokharaeian M, Jadidi M, Hasanzadeh H, Rahmati M. Evaluation of 2100MHz Waves Effect Emitted from Third Generation of Mobile Cell Phones On Oxidative Stress Inducing and Lung Adsorption of Tc-Mibi In Male Wistar Rats. Journal of Knowledge & Health (Shahroud university of medical sicences). 2016;11(3):63-68.

[28] Tohidi F-Z, Fardid R, Arian Rad S, Tohidi M, Bahrayni Toosi MH, Kianosh T. The effect of cellphone radiation on hematological blood cell factors in BALB/C mice. Iranian Journal of Medical Physics. 2016;13(1):58-64.

The Level of Compliance with Special Pregnancy Considerations in Medical Imaging Procedures

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Abstract: Considering the high sensitivity of Fetus to radiation, and the necessity of following special instructions when imaging pregnant patients and the safety of the work condition for pregnant radiology technologists, the present study aimed to review the results of the previous studies in this regard. Articles were searched in PubMed, Science direct, web of science and Scopus databases using the keywords radiation AND pregnancy, awareness OR knowledge AND radiation AND pregnancy. The author reviewed the abstract and full text of the articles and the relevant studies were selected for systematic review. The results of the reviewed studies show the underestimation of the risks of radiation for the fetus, referring pregnant women to imaging departments with ionizing radiation and performing abdominopelvic radiography in the first trimester of pregnancy for some of them. In relation to the working conditions of radiology technologists, the review of previous studies indicated that cooperation in the field of changing the work condition is done only for a small percentage of them (less than 5%). While the monitoring of their radiation levels was average and similar to other personnel. Efficient counseling was not provided to pregnant patients and most of the referring physician and radiology technologists were not aware of the maximum permissible dose to the fetus. Accordingly, most of the reviewed studies have indicated the low level of compliance with the principles of radiation protection for radiology technologists and pregnant patients referring to imaging departments using ionizing radiation.

Keywords: Compliance, pregnancy, medical imaging.

References

[1] Ramanathan, S. and J. Ryan, Radiation awareness among radiology residents, technologists, fellows and staff: where do we stand? Insights into imaging, 2015. **6**(1): p. 133-139.

[2] Prasad, M., et al., Imaging more imagining less: an insight into knowledge, attitude and practice regarding radiation risk on pregnant women among dentists of Ghaziabad–a cross sectional study. Journal of clinical and diagnostic research: JCDR, 2016.10(7):p.ZC20.

[3]Akintomide, A. and A. Ikpeme, Radiation safety of women of the reproductive age: evaluation of the role of referring physicians. Journal of family medicine and primary care, 2014. 3(3): p. 243.

[4] Gerasia, R., et al., *Fluoroscopy-Guided Biliary Procedures in a Pregnant, Liver Transplant Patient: Fetus Radiation Protection.* Radiation Protection Dosimetry,2020.

[5]Chu, B., et al., *Radiological protection for pregnant women at a large academic medical Cancer Center*. Physica Medica, 2017. **43**: p. 186-189.

[6]Farzanegan, Z., et al., *Evaluating the principles of radiation protection in diagnostic radiologic examinations: collimation, exposure factors and use of protective equipment for the patients and their companions.* Journal of Medical Radiation Sciences, 2020. **67**(2): p. 119-127.

Comparison of The Knowledge Level of High School Female Students in Zahedan About the Effects of Ionizing Radiation and Methods of Protection Against Them Before and After Training in 1402

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Background and purpose: Considering the widespread use of ionizing radiation in the diagnosis and treatment of many diseases of diseases, as a result of the need to use protective measures against them and the importance and role of knowledge Students in determining the future of the country, the present study aims to determine the effect of education on the level of awareness Female students of high school in Zahedan about ionizing radiation and methods Protection against them will be done.

Research method: This research is a semi-experimental and interventional study on 10female students of high school in Zahedan city in 1402 with Random sampling will be done in two intervention and observation groups. Tools Data collection questionnaire consisting of demographic questions and related questions People's awareness of different medical imaging methods and possible memories related to They are the ones that are used after checking the validity and reliability. After checking the previous results Test, educational intervention using lecture, group discussion and question and answer methods It takes place and after ۱۰ days' secondary evaluation is done. Aggregate information Collected data are analyzed using Spss software and statistical tests.

Findings: According to the studies that we reviewed, it is expected that the level of awareness of the previous intervention group After the educational intervention, there is a significant difference between the mothers of the control group before and after the intervention No significant difference can be observed.

Conclusion: Considering the importance of the role of students in determining the future of the country, for Increasing self-awareness regarding the effects of ionizing radiation and as a result of protection methods Against them, to provide the necessary training in the field of exposure to radiation hazards and methods They need protection against it.

Keyword: student, ionizing rays, awareness.

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