Journal of Medical Imaging & Case Reports

https://doi.org/10.17756/micr.2022-suppl1

Meeting Abstracts

Open Access

Proceedings of 3rd International Conference on Medical Imaging and Case Reports (MICR-2022)

Keynotes Session

Accelerating Deep Learning Medical Image Analysis in Radiology

Leo Joskowicz, PhD

School of Computer Science and Engineering, The Hebrew University of Jerusalem, ISRAEL

Abstract

Radiology, one of the cornerstones of modern healthcare, is undergoing rapid and profound changes due to the ever-increasing number of imaging examinations, the shortage of certified radiologists, the dynamics of healthcare economics, and the technological developments of artificial intelligence based image processing. This talk will present an overview of our new methods for the fast development of deep learning-based image processing solutions in Radiology with very few annotated datasets. The key idea is to bootstrap the creation of expert-validated annotations with new techniques for annotation uncertainty estimation and for learning how experts correct annotations generated by deep learning networks initially trained with very few annotated datasets. Our methods aim to optimize radiologist time, reduce the annotated dataset size, and increase the accuracy and robustness of the deep neural networks results. We expect that our methods will significantly lower the entry cost, shorten the time and reduce the effort currently required to develop and deploy deep learning based solutions for radiology.

Prostate cancer 2022

Dr. Clare Tempany, MD, FACR, FISMRM

Ferenc Jolesz MD Professor of Radiology Harvard Medical School, Vice-Chair, Radiology Research Department of Radiology Brigham & Women's Hospital, Boston, MA

Abstract

This talk will introduce the audience to the current issues in the diagnosis and detection of prostate cancer in 2022 There have been major changes prostate cancer workflows across the globe which will be presented and discussed. Clinically significant prostate cancer is one which contains Gleason pattern 4 disease. This is the specific target of multiparametric Magnetic Resonance imaging. The Speaker will present the latest approaches using an assessment scoring system known as PI-RADS. This standardized approach will be reviewed with attention to how the MRI images are acquired and interpreted by diagnostic radiologists. The audience will learn new approaches using MRI to select candidates targets within the prostate gland for biopsy sampling. Updates to Prostate cancer pathology on Gleason grade grouping will be presented in the context multiparametric MRI for the detection suspicious lesions within the gland.

AI in Healthcare: Where will we take this?

Constance Lehman, PhD, MD, FACR

Professor of Radiology, Harvard Medical School, Chief of Breast Imaging/Co-director of AVON Breast Center, Massachusetts General Hospital, Boston, MA

Abstract

We are poised to apply the power of AI to support two key elements of quality screening programs: equitable risk assessment and accurate image interpretation. Since the creation of the Gail model in 1989, risk models have supported risk-adjusted screening and prevention, and their continued evolution has been a central pillar of breast cancer research. Prior research has

explored multiple risk factors related to hormonal and genetic information. One factor that has received substantial attention is mammographic breast density. Incorporating mammographic breast density into clinically used models such as the Gail and Tyrer-Cuzick risk models significantly improves prediction and discrimination. The tools of AI and deep learning allow the opportunity to extract predictive data from the mammogram far exceeding the limited feature of breast density. Artificial intelligence (AI) applications for screening mammography are being marketed for clinical use in the interpretative domains of lesion detection and diagnosis, triage, and breast density assessment. Evidence in support of these applications, particularly for lesion detection and diagnosis, is largely based on multireader studies with relatively small cancer-enriched datasets rather than on studies to measure the impact on performance in clinical practice. This presentation will review our current understanding of AI based tools available to support more effective risk assessment and to support more accurate image interpretation through AI based methods of triage and human reader support.

Machine Vision in Medicine

Automated Annotation and Deep Learning in Training Medical Imaging AI Models

Patrick Bangert, Ph.D.

Vice President of AI, Samsung SDSA, San Jose, CA

Abstract

Creating quality AI models for medical images is time-consuming due to the amount of human time spent annotating images before training, and tuning models and parameters during training. Automated methods can dramatically reduce both times. In this paper, we introduce advanced active learning for automating the annotation process by approximately 90% and automated deep learning methods for automating the feature engineering, model selection, and hyper-parameter tuning process in training these models. We illustrate the efficiency and effectivity of these methods in several practical case studies such as breast cancer detections based on whole slide images, colonoscopy based on video footage, and heart disease based on angiography and intra-vascular ultrasound.

Metrics Matter – How to Choose Validation Metrics that Reflect the Biomedical needs

Annika Reinke, Ph.D.

Division of Computer Assisted Medical Interventions and HIP Helmholtz Imaging Platform, German Cancer Research Center (DKFZ), Germany

Abstract

Performance metrics are key for objective, transparent and comparative performance assessment in the field of biomedical image analysis. So far, however, relatively little attention has been given to practical pitfalls when using specific metrics for a given image analysis task. Several international initiatives have therefore joined forces to provide researchers with guidelines and tools for choosing performance metrics in a problem-aware manner. The talk will present (1) potential limitations of metrics and (2) the proposed recommendation framework, capturing the characteristics of the given biomedical problem in a problem fingerprint, which comprises domain interest-, target structure- and data set-related properties.

Medical Imaging and Analysis

Which Imaging Modality Better Detects Intraprostatic Prostate Cancer? A Comparison Between Pre-operative Multiparametric Prostate MRI vs 68Ga-Prostate-Specific Membrane Antigen Positron Emission Tomography/Computerized Tomography on Histological Findings at Radical Prostatectomy

William Yaxley

Urology Principal House Officer, Queen Elizabeth II Jubilee Hospital, Brisbane, Australia

Abstract

Introduction:

Our study aimed to evaluate the ability of mpMRI and PSMA PET/CT individually and in combination, to predict tu-

mour location and Gleason score ≥3+4 on robot assisted laparoscopic radical prostatectomy (RALP) histology.

Materials and Methods:

Our study involved a retrospective review of 1,123 men with both a preoperative mpMRI and 68Ga-PSMA PET/CT prior to a RALP. Tumour locations were collected from both imaging modalities and compared to findings on totally embedded prostate histology. Lowest apparent diffusion coefficient (ADC) value on mpMRI and the highest maximum standardized uptake value (SUVmax) on 68Ga-PSMA PET/CT were collected on the index lesions to perform an analysis on detection rates.

Results:

The index lesion and multifocal tumour detection were similar between mpMRI and 68Ga- PSMA PET/CT (p = 0.10; p = 0.11). The index Gleason score ≥3+4 cancer was identified on mpMRI in 80% (881/1,106) of men and 68Ga-PSMA PET/CT in 82% (905/1,106) of men. 68Ga-PSMA PET/CT identified cancer in 117 (10%) men not identified on mpMRI and vice-versa, mpMRI identified cancer in 93 (8%) men not seen on 68Ga-PSMA PET/CT. Importantly, when combining both mpMRI and 68Ga-PSMA PET/CT, the index Gleason score ≥3 + 4 cancer was identified in 92% (1,020/1,106) men.

Conclusions:

The addition of a diagnostic 68Ga-PSMA PET/CT to mpMRI can improve the detection of significant prostate cancer and improve the ability to identify men suitable for active surveillance.

Where's the line? (Talk on Pediatric lines and tubes on CXR and AXR)

Aadil Ahmed, MBBCh, FCRad (Diag)

Bayradiology, Port Elizabeth, South Africa

Abstract

Radiologists are confronted with a spectrum of catheters placed in various locations in routine radiology practice and have to be familiar with the different catheters, their uses and acceptable positioning for suggested safe practice.

Malpositioning of catheters and complications resulting from catheter placement will also be addressed.

Aortoenteric Fistula following Endovascular Aneurysm Repair

Alexander B. White

University of North Carolina at Chapel Hill School of Medicine, Chapel Hill, NC

Abstract

Aortoenteric fistula is an exceedingly rare complication with a variable reported incidence between 0.25-3.6% following endovascular stent grafting. Historically, aortoenteric fistula has been more frequently reported as a life-threatening complication of open aortoiliac repair secondary to close anatomical contact, graft protrusion, or iatrogenic manipulation that precipitates fistula formation. The case presented here describes a 69-year-old male with a past medical history of hypertension, coronary artery disease, colonic mass resection and abdominal aortic aneurysm status post endovascular repair who presented to an outside facility with worsening low back pain over several weeks and a temperature of 102.4°F. At an outside hospital, he was found to have dilated small bowel and a thickened, inflamed, aortic wall with air foci within the native aneurysm on CT abdomen/pelvis with contrast. At the referral center, the patient underwent CT angiogram that demonstrated soft tissue stranding and air within the proximal aneurysmal sac along the aortic stent graft. He was started on broad-spectrum antibiotics and received emergent right axillary bifemoral bypass grafting with explantation of the aortic endograft and creation of proximal and distal aortoiliac stumps. Intraoperative tissue cultures grew Streptococcus anginosus, Prevotella denticola, and Parvimonas micra, suggesting a possible dental vs. enteric source of infection. He returned for final abdominal washout and closure, and was discharged home after an 18-day hospital admission. While the incidence of aortoenteric fistula post-EVAR is lower than that of traditional open repair for abdominal aortic aneurysm, it still presents a significant life-threatening complication that must be evaluated with high suspicion.

Comparison of 68Ga-DOTA-JR11 PET/CT with Dosimetric 177Lu-satoreotide Tetraxetan (177Lu-DOTA-JR11) SPECT/CT in Patients with Metastatic Neuroendocrine Tumors Undergoing Peptide Receptor Radionuclide Therapy

Simone Krebs, MD, MS

Assistant Attending, Molecular Imaging and Therapy Service, Department of Radiology, Memorial Sloan Kettering Cancer Center, New York, NY

Abstract

Purpose: Paired imaging/therapy with radiolabeled somatostatin receptor (SSTR) antagonists is a novel approach in neuroendocrine tumors (NETs). The aim of this study was to compare tumor uptake of ^{68}Ga-DOTA-JR11 and ^{177}Lu-satoreotide tetraxetan (^{177}Lu-DOTA-JR11) in patients with NETs.

Methods: As part of a prospective clinical trial, 20 patients with metastatic NETs underwent ^{68}Ga-DOTA-JR11 PET/CT and serial imaging with ^{177}Lu-satoreotide tetraxetan. PET/CT and SPECT/CT parameters for lesion uptake and absorbed dose of ^{177}Lu-satoreotide tetraxetan in lesions were compared using linear regression analysis and Pearson correlation.

Results: A total of 95 lesions were analyzed on ^{68}Ga-DOTA-JR11 PET/CT and ^{177}Lu-satoreotide tetraxetan SPECT/CT. SUVs and tumor-to-normal-tissue ratios on PET/CT and SPECT/CT were significantly correlated ($p < 0.01$), but the degree of correlation was modest with Pearson correlation coefficients ranging from 0.3 to 0.7. Variation in intrapatient lesional correlation was observed. Nevertheless, in all patients, the lesion SUVpeak uptake ratio for ^{177}Lu-satoreotide tetraxetan vs. ^{68}Ga-DOTA-JR11 was high; even in those with low uptake on ^{68}Ga-DOTA-JR11 PET/CT (SUVpeak ≤ 10), a ratio of 8.0 ± 5.2 was noted. Correlation of SUVpeak of ^{68}Ga-DOTA-JR11 with projected ^{177}Lu-satoreotide tetratexan-absorbed dose ($n = 42$) was modest ($r = 0.5$, $p < 0.01$), while excellent correlation of SUVpeak of ^{177}Lu-satoreotide tetraxetan with projected ^{177}Lu-satoreotide tetraxetan-absorbed dose was noted ($r = 0.9$, $p < 0.0001$).

Conclusion: Our study shows that ^{68}Ga-DOTA-JR11 PET can be used for patient selection and PRRT and that low tumor uptake on PET should not preclude patients from treatment with ^{177}Lu-satoreotide tetraxetan. The ability to use single time-point SPECT/CT for absorbed dose calculations could facilitate dosimetry regimens, save costs, and improve patient convenience.

PET Imaging Probes Development for Epigenetics

Changning Wang, PhD

Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Harvard Medical School, Boston, MA

Abstract

Developing imaging tracers targeting epigenetic enzymes to visualize disease-related changes in the brain may provide as a useful biomarker in elucidating neuroanatomical mechanisms of brain diseases. Recently, we developed and characterized new tracers that can be used to visualize epigenetics by positron emission tomography (PET) imaging. In past years, we have designed, radiosynthesized and evaluated several epigenetic PET imaging probes for histone deacetylases and bromodomains, some of them has been used in animal research or human imaging study wit the potential to serve as a putative imaging biomarker that can significantly improve understanding of epigenetic functions of human diseases and rapidly enhance the drug development. In this talk, I will present the recent progress from my lab to develop new PET probes for bromodomains.

MPI: Effect of BMI on High Vs Low Administered Activity Scan time and Radiation Effective Dose

Kalpna Prasad, MD, MPH

Department of Radiology, Walter Reed National, Military Medical Center, Bethesda, MD

Abstract

Cadmium Zinc Telluride (CZT) crystal-based myocardial perfusion imaging (MPI) cameras have increased count sensitivity compared to Anger cameras and can be used to lower either the injected activity or the image acquisition time. Institutions adopting CZT cameras need to decide whether to lower the injected activity or imaging time or attempt to lower both with a compromise. The aim of our study was to compare the MPI scan time for obtaining similar count images using high activity

rest-stress protocol (HAP) versus low activity rest-stress protocol (LAP) stratified by body mass index (BMI) and assess the impact on radiation effective dose (Hereby radiation). Using a CZT camera, a cohort of 100 consecutive patients imaged with LAP with approximately 185 MBq and 555 MBq activity was compared to a similar cohort with HAP using approximately 370 MBq and 1110 MBq. Administered activity and BMI both had a statistically significant effect on scan time and radiation. LAP scans took an average of 9 min longer than HAP scans, P < 0.0001 and larger BMIs took longer than smaller BMIs, P < 0.0001. Radiation was inversely proportional to BMI with an overall decrease of approximately 50% with LAP. LAP increased scan time while lowering the radiation when compared to HAP, proportional to BMI. The radiation was inversely proportional to BMI. This increase in time did not have a significant impact on our local workflow, but its implications should be considered in the setting of LAP implementation, especially in obese or high patient volume practices.

Computed Tomography

Bilateral Absence of the Superior Vena Cava

Narisha Maharaj, MMed, FCRad Diag

King Edward VIII Hospital, Nelson R Mandela School of Medicine, University of Kwa-Zulu Natal, South Africa

Abstract

Congenital venocaval/systemic venous anomalies are relatively uncommon, occurring in <2% of the general population. They may be completely asymptomatic or present with other complex congenital cardiac anomalies or conduction defects. The asymptomatic congenital venocaval anomalies may be isolated and may only declare themselves when they complicate catherisation, central venous access or cardiac surgery.

The commonly documented anomaly in the literature describes a persistent left superior vena cava (SVC) as the most common congenital thoracic venous anomaly, together with a bilateral SVC whereby both the right and left superior caval veins are present.

We present a case of bilateral absence of the SVC in a patient who presented with penetrating trauma to the left hemithorax. This is an extremely rare documented caval anomaly; with only 11 prior cases published up to March 2019 and are usually benign and asymptomatic in most cases.

Multispiral Computed Tomography Diagnostic Capability at the Stages of Pre- and Postoperative Management of Patients with Purulent Inflammatory Diseases of the Spine

Irina Afanaseva, PhD

Saint-Petersburg I.I. Dzhanelidze Research Institute of Emergency Medicine, Saint-Petersburg, Russia

Abstract

Purpose of the study. To study diagnostic capability of multispiral computed tomography (MSCT) at the stages of intra- and postoperative imaging in patients with purulent-inflammatory diseases of the spine.

Materials and methods. MSCT of the spine was performed to 32 patients (20 men and 12 women), with signs of inflammation of the intervertebral discs, vertebral bodies, paravertebral tissues, and tissues of the spinal canal. Average age of patients was 38±15 years. Stabilizing surgery using transpedicular systems was performed in 18 patients (56.2%), transpedicular fixation supplemented with cage - 12 (37.5%), drainage of inflammatory focus - in 22 patients (68.7%). MSCT was performed on a GE Light Speed tomograph.

Study results. Lesion of lumbar spine was detected in 24 patients (75.0%), thoracic spine - in 8 patients (25.0%). In 4 patients (12.5%), both parts of the spine were involved in the pathological process CT signs of spondylodiscitis were revealed in 27 patients (84.4%), isolated discitis in 2 patients (6.3%), CT signs of both spondylodiscitis and epiduritis in 4 patients (12.5%). Paravertebral abscesses were observed in 15 patients (46.8%). Intraoperative imaging was made using image intensifier GE OEC 9900 Elite. Transpedicular fixation was performed with DePuy synthes screws (24 percutaneous cases (75.0%), 8 cases (25.0%) using the open surgery method. Technical difficulties that caused improper implant placement during surgical intervention occurred in 12 patients (38.0%).

Findings. MSCT is a highly effective method of virtual planning of surgical intervention and postoperative control in patients with purulent-inflammatory diseases of the spine.

The Authors declare that there is no conflict of financial interest.

Harmonization of In-plane Resolution in CT Scans: Improving Image Resolution from Multiple Reconstructions

Gonzalo Vegas Sanchez-Ferrero, PhD

Assistant Professor of Radiology. Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Abstract

The in-plane resolution is a critical factor in the analysis of fine structures like pulmonary vasculature and airways. The effective resolution depends on the reconstruction algorithm. Sharp kernels are specifically designed to provide higher spatial resolution at the expense of image noise. In contrast, soft kernels produce reasonably low-noise images and lower resolution. Researchers are aware of these characteristics and define the acquisition protocols with multiple reconstruction methodologies to ensure the appropriate conditions to measure densities and structures (e.g., COPDGene and SPIROMICS). The in-plane resolution is also spatially variant across the image due to its dependence on the x-ray focal spot size and shape, detector aperture, and scanner geometry. This results in a resolution decrease as the distance to the isocenter grows. This effect impacts the measurement accuracy of peripheral vasculature and airways, where the resolution decays remarkably. In this work, we propose a method that combines multiple reconstruction images to simultaneously improve both the in-plane resolution and the signal-to-noise ratio. The results of this work were published in the Medical Physics journal.

Magnetic Resonance and Ultrasound

MRI in Planning of Maximal (maximum) Acceptable Liver Resections in Patients with Hepatoblastoma

Tarba Naala, MD

B.V. Petrovsky National Research Center of Surgery, Russian Federation

Abstract

Objective: to evaluate diagnostics facilities of MRI in pre-operation quantitative and qualitative evaluation of hepatic parenchyma for planning maximal acceptable liver resection.

Materials and Methods: MRI was performed in 68 patients with hepatoblastoma (average age 3.1 years) on a 1.5T system for evaluation volume and tumor spread. Study protocol included images in the mode T1 and T2 WI, DWI, MRCP and IV contrast enhancement.

Results: On MRI hepatoblastomas were detected as solid lesions affecting larger part of liver, often rendered as multifocal lesions, with signs of hypervascularization in arterial and venous phases, with signs of decay in central sections. PRETEXT system was used for tumor staging. In PRETEXT I group (n = 3, 4,4%) three patients underwent left lateral sectionectomy. In PRETEXT II group (n = 26, 38,2%) twelve patients underwent hemihepatectomy, two - left lateral sectionectomy, twelve - extended right hemihepatectomy. In PRETEXT III group (n = 21, 30,8%) 17 patients underwent extended right hemihepatectomy, 3 patients - extended left hemihepatectomy, one patient – mesohepatectomy. In one case two-stage surgery with extended right hemihepatectomy was performed due to insufficient future liver remnant. In PRETEXT IV group (n = 18, 26,4%) 9 patients underwent bilobar resection, and 9 - living donor liver transplantation (left lateral section graft - in 8 and right lobe graft - in one cases)

Conclusions: MRI with contrast enhancement allows to reliably assess the quantitative and qualitative state of the liver parenchyma, which is fundamental in the planning of the maximum acceptable (allowable) liver resection.

Fetus with CHAOS syndrome – evaluated through Radiological Aspect

Vidya Desai* MD, Bhawana Sonawane, Anagha Deshpande and Abhishek Mashirkar

Junior Resident, Indira Gandhi Government Medical College, India

Abstract

Introduction

Congenital high airway obstruction syndrome (CHAOS) refers to a extremely rare, often lethal, congenital laryngotracheal condition. There is complete intrinsic obstruction of the fetal upper airway that can be located at the level of the larynx, trachea, or bronchi. Airway obstruction results in retention of bronchial secretions, which leads to abnormal expansion of the fetal lungs,

marked tracheobronchial dilatation, and pulmonary developmental impairment.

The incidence of CHAOS is unknown. It is associated with high mortality (80-100%)

Pathology: - CHAOS can be of three possible types:

Complete laryngeal atresia without an esophageal fistula.

Complete laryngeal atresia with a tracheo-esophageal fistula.

Near-complete high upper airway obstruction.

- The pathogenetic mechanism implicated for CHAOS includes intrinsic changes that prevented the normal development of the tracheobronchial tree during embryogenesis. The histopathologic findings of the fetal airways include the presence of webs, cysts, atresia, stenosis, or agenesis. Thus, the cause of CHAOS can be a thin membrane, or web, obstructing the airway, or a more complex dysplasia and atresia of the affected portion of the airway. The obstructed flow of fetal lung fluid leads to intrapulmonary changes including alveolar hyperplasia and accumulation of fluid in the alveoli.

Associations - Fraser syndrome (extremely rare autosomal recessive congenital anomaly).

- CHAOS is characterized by retention of bronchial and alveolar secretions resulting in elevated intratracheal pressure and a significant increase in the amount of fluid within the lungs and tracheobronchial tree, leading to severely increased lung volume and tracheal dilatation. The massively enlarged lungs result in an inversion of the normal diaphragmatic convexity, if the airway obstruction is unilateral, a mediastinal shift. These findings can be detected on ultrasound (US) in the first trimester of pregnancy.

Imaging findings

Prenatal USG and fetal MRI shows signs of complete airway obstruction. At the level of the four-chamber view of the fetal heart, the lungs appear severely enlarged and highly hyperechoic, due to the high intrathoracic pressure and the degree of pulmonary expansion, the heart is squeezed into the middle of the fetal mediastinum between the lungs and shows a reduction of the cardiac angle. The sagittal and coronal views of the fetal thorax on USG & fetal MRI reveals two pathognomonic signs: flattening or inversion of the diaphragmatic convexity and markedly dilated airways, which allows observation of the entire tracheobronchial tree as a bronchogram. In addition, absence of flow in the trachea during fetal breathing or swallowing can be shown using color Doppler US. Extrapulmonary signs include nonimmune hydrops fetalis, ascites and placentomegaly secondary to cardiac failure or impeded venous return or both and polyhydramnios secondary to esophageal compression.

Improve Delineation of Pelvic Anatomy on MRI: the Use of Aqueous Vaginal Contrast in Complex Müllerian Anomalies

Phillip Romanski, MD

Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Cornell Medical Center, New York, NY

Abstract

Objective: To demonstrate the advantage of using aqueous vaginal contrast and scheduled hematocolpos with MRI to improve the delineation of gynecologic anatomy, and to recommend that this modality be considered in patients with complex *müllerian anomalies.*

Methodology: OHVIRA is a unilateral obstructed müllerian anomaly that can be definitively treated with resection of the obstruction. When the obstructed hemivagina is within close proximity to the patent hemivagina, vaginal septum resection should be performed. However, when the obstructed hemivagina and uterus are not adjacent to the patent hemivagina, the risk of post-resection stenosis is increased due to the thickness of the obstructing tissue. Laparoscopic removal of the obstructed side should be considered as an alternative approach.

In the presented case, a 17-year-old patient with OHVIRA presented for definitive surgical management. A pelvic MRI was performed, but due to hormonal suppression the vaginal cavity was decompressed, making it very difficult to discern the relationship between the two uteri and vaginas. To better determine whether vaginal septum resection was feasible, norethindrone was discontinued to allow menstrual blood to fill the obstructed hemivagina, followed by a subsequent pelvic MRI with aqueous vaginal contrast gel to improve the visualization of the decompressed vaginal cavities.

The addition of vaginal aqueous contrast clearly delineated the course and caliber of the patent vagina and its relationship to the obstructed hemivagina, now filled with blood. The inferior margin had a <1 cm narrow segment adjacent to the patent vagina, and the obstructed cervix was superiorly displaced 3.5 cm above the patent vagina. Given these findings, the risk of post-operative stenosis following a vaginal septum resection was determined to be too high.

The decision was made to proceed with a laparoscopic resection of the obstruction, and a laparoscopic resection of the right hemiuterus, fallopian tube, cervix, and vagina was performed. The patient recovered without complication post-operatively, and her menses resumed without any pain.

Conclusion: We highlight the use of two techniques to optimize MRI imaging of pelvic anatomy in a patient with a complex müllerian anomaly. First, the use of aqueous vaginal contrast with MRI is advantageous to clearly delineate the course and caliber of the patent vagina in patients with complex gynecologic anatomy. Second, the cessation of hormonal suppression to allow menstruation to develop hematocolpos helped delineate the relationship between the obstructed vagina and the patent vagina. In the presented case, these MRI adjuncts provided necessary detail that could not be appreciated with standard MRI to confirm that vaginal septum resection to preserve the right uterus would be too high risk for post-operative stenosis in this patient. Aqueous vaginal contrast and scheduled hematocolpos should be considered as adjuncts to MRI when standard imaging modalities are unable to clearly describe the relationship between pelvic structures in cases of complex müllerian anomalies in order to help guide diagnosis and treatment recommendations.

Integration of Quantitative MR Imaging and Artificial Intelligence in Clinical Neuro Oncology

Amita Shukla-Dave, PhD, FISMRM

Director Quantitative Imaging, Deputy Service Chief Predictive Informatics Attending Physicist (Professor), Memorial Sloan-Kettering Cancer Center, New York, USA

Abstract

The invited talk encompasses the four subtopics: (i) personalized medicine and artificial intelligence (AI) in radiology: work in progress; (ii) quantitative imaging (QI) biomarkers: Radiological Society North America's (RSNA) perspective; (iii) academic-industrial collaboration: prototype technology testing and implementation in phantoms and brain imaging; (iv) promise of AI in neuro MRI: platforms available and clinical application. A lot of strong literature is available on QI, but we are now learning how best to integrate AI into it. This involves the development of reliable AI algorithms. The steps include (i) reliable dataset engineering with reference standards and good quality data annotations, (ii) a training dataset that matches the intended use-case, (iii) tuning hyperparameters on a dataset independent of the training dataset, and (iv) using external validation datasets to evaluate the model performance. The AI methods should be robust to variability in MRI acquisition parameters, settings, and clinical conditions, and they should be trained with a heterogeneous dataset. QI should aid AI in implementing optimum methods for standardization, including harmonization of the input MR images and additional pre-processing steps. It could be challenging for multiple vendor data, especially when the inputs are multimodal. AI models used for clinical endpoints should be further fine-tuned at each institution with their data. Each update needs to be monitored for repeatability and reproducibility as they may change with time. In MRI, field strength, organ-specific coils, and gradients are ever-evolving, and we will need to make finer adjustments to the QI measurements used in the AI pipeline. Quality assessment methods of AI at each institution need to be established. The recent advances in computational virtualization and AI frameworks greatly facilitate the implementations of complex deep neural networks in a more structured, transparent, and reproducible way. Adoption of these newer standardized technologies will increase the application of deeplearning algorithms and QI tools to accelerate the translation of these methods into clinics. The multiparametric MRI, genomic, pathological, and clinical data can be integrated into the AI platform for applications ranging from detection to assessment of treatment response in oncological setting

Advanced Imaging of the Pediatric Head and Neck

Mai-Lan Ho, MD

Associate Professor of Radiology, Nationwide Children's Hospital, The Ohio State University, Columbus, OH

Abstract

Objectives: Provide broad overview of advanced imaging techniques in the pediatric head & neck.

Summarize fundamental physical principles required for accurate utilization & interpretation.

Demonstrate practical clinical value, based on multiple real-life case examples.

Summary: The pediatric head & neck is a challenging diagnostic area due to complex anatomy, age-dependent developmental changes and disease pathologies. Advanced imaging techniques can provide added value by interrogating additional tissue properties that serve as more accurate biomarkers of disease. In this lecture, we will review the key physical principles of new imaging technologies that enable optimal clinical utilization. Furthermore, we will present several real-life cases where advanced imaging elevated patient diagnosis & management. Specific techniques to be covered include high-resolution,

phase-contrast, diffusion, perfusion, ultrashort-echo, ultra-high-field, elastography, spectroscopy, PET/MR, chemical exchange saturation transfer, and anatomic modeling.

Low-field MRI System Accuracy Analyses

Selin Chiragzada

Product Engineer, Promaxo Inc, Oakland, CA

Abstract

The Promaxo MRI system is a novel single-sided low-field MRI system FDA cleared for prostate cancer interventions. The aim of this study was to evaluate accuracy of targeting prostate lesions by measuring various errors arising from navigation, image registration, and patient motion.

The navigation accuracy study measured needle localization error using five prostate phantoms with three or more needles scanned using the Promaxo low-field system and an external 1.5T MRI. Four board certified urologists identified ground truth needle coordinates in 1.5T images and localized the planned needle location in low-field images using external fiducials. The images were co-registered to compute the distance between the planned target and the ground truth. The registration accuracy study was performed using T2 images of five subjects acquired on the low-field and 1.5T systems each. Four clinical experts co-registered the two sets of images and identified the coordinates of various anatomical landmarks, which were then compared. In the patient motion analysis study, several subjects underwent two consecutively acquired low-field T2 scans. Six such pairs of images were manually registered using external fiducial markers and corresponding anatomical landmarks identified by experts were compared.

The average navigation error was 2.57 ± 1.02 mm for the planned target to center of core, and 2.05 ± 1.24 mm for point-to-line perpendicular distance. Average registration error was 1.84 ± 1.45 mm based on 27 landmarks. Motion analysis showed average movement of 0.855 ± 1.30 mm based on 41 landmarks. Average error of less than 5 mm is considered clinically acceptable.

CT-like MRI: A Qualitative Assessment of ZTE Sequences for Knee Osseous Abnormalities

Upasana U. Bharadwaj, MD

Postdoctoral Scholar, Department of Radiology and Biomedical Imaging, University of California, San Francisco, CA

Abstract

We present a qualitative evaluation of the utility of zero echo-time (ZTE) MRI sequences in identifying osseous findings and compare ZTE with optimized spoiled gradient echo (SPGR) sequences.

ZTE and standard knee MRI sequences were acquired at 3T in 100 consecutive patients. Three radiologists rated confidence in evaluating osseous abnormalities and image quality on a 5-grade Likert scale in ZTE compared to standard sequences. In a subset of knees SPGR sequences were also obtained, and diagnostic confidence in identifying osseous structures was assessed, comparing ZTE and SPGR sequences.

Image quality of the ZTE sequences was rated high by all reviewers with 278 out of 299 scores ≥ 4 on the Likert scale. Diagnostic confidence in using ZTE sequences was rated "very high confidence" in 97%, 85%, 71%, and 73% of the cases for osteophytosis, subchondral cysts, fractures, and soft tissue calcifications/ossifications, respectively. The diagnostic confidence in using ZTE over SPGR sequences for osseous structures was favorable and statistically significant ($p < 0.01$).

Incorporating ZTE sequences in the standard knee MRI protocol was therefore technically feasible and improved diagnostic confidence for osseous findings in relation to standard MR sequences.

Atypical Clinical Manifestations of Autoimmune Encephalitis

Patricia Le

Creighton University School of Medicine Omaha, NE

Abstract

Introduction: Autoimmune encephalitis (AE) is an inflammatory process of the brain mediated by antibodies primarily affecting limbic structures.

Case Description: We present a 33-year-old female with a past medical history significant for major depressive disorder and stage 2 cervical cancer status post chemotherapy and radiation presenting with acute confusion and memory decline.

Brain MR was notable for increased FLAIR signal in the mesial temporal lobes and globi pallidi. Her EEG was unremarkable and she denied any history of seizures. Stroke and infectious central nervous system workup were unremarkable. Body imaging did not reveal any other evidence of infection or acute malignancy. Further investigation for antibodies was inconclusive. She was treated empirically for limbic encephalitis with multiple administrations of cyclophosphamide and rituximab with subsequent improvement in memory and mental status.

Discussion: The patient presented classic clinical findings of limbic encephalitis including altered mental status, depression, and memory loss responsive to cyclophosphamide and rituximab. Workup showed classic MRI findings of T2/FLAIR intensity in bilateral mesial temporal lobes and globi pallidi. Common associated features in AE include ovarian teratomas and anti-NMDA antibodies, though not cervical cancer. (1) Her workups also ruled out common differential diagnoses such as herpes simplex encephalitis, status epilepticus, and stroke. Overall, findings are most consistent with non-paraneoplastic encephalitis (2), which includes a small subset of patients in which paraneoplastic antibodies are not detected.

Quantitative Imaging of Apoptosis using AI Boosted Molecular Magnetic Resonance Fingerprinting

Or Perlman, PhD

Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital and Harvard Medical School, Boston, MA

Abstract

The highly invasive nature of many cancer types and the toxicity of most systemic chemotherapies represent significant challenges for cancer therapies. A promising approach for overcoming these challenges is the use of oncolytic viruses that selectively kill cancer cells. Non-invasive imaging of the underlying molecular processes is an essential tool for achieving the full potential of this therapeutic. Here, a new method for noninvasive, quantitative, and rapid molecular imaging of oncolytic virotherapy treatment response will be presented. The method combines molecular MRI with deep learning, yielding quantitative biomarker maps of protein and lipid/macromolecule concentrations as well as intratumoral pH. Validation in a mouse brain tumor model allowed the early detection of apoptotic response to oncolytic virotherapy, in excellent agreement with histology and immunohistochemistry findings. Clinical translation produced reproducible 3D molecular maps of the healthy human brain across 3 different imaging sites.

Received: April 24, 2022 **Accepted:** April 26, 2022 **Published:** April 28, 2022

Citation: Proceedings of 3rd International Conference on Medical Imaging and Case Reports (MICR-2022) *J Med Imaging Case Rep* 6(1): S1-S10.

Published by United Scientific Group.