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Meeting Abstracts

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Keynotes Session

Neurotransmitter Imaging: A Novel Frontier in Neuroimaging

Rajendra D. Badgaiyan

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Abstract

Because of the lack of a reliable and sensitive method for detection of acute changes in neurotransmission, it is unclear how the neurotransmitters control human cognition and behavior. We recently developed a technique to detect, map and measure dopamine released acutely during cognitive and behavioral processing. The technique is called neurotransmitter imaging technique or single scan dynamic molecular imaging technique (SDMIT). It exploits the competition between dopamine and its receptor ligand for occupancy of receptor site. In this technique after patients are positioned in the positron emission tomography (PET) camera, a radio-labeled ligand is injected intravenously, and volunteers are asked to perform a cognitive or behavioral task while in the scanner. Based in the PET data acquired, dopamine released during a task performance in different brain areas is measured dynamically using a receptor kinetic model. The technique can be used to define the nature of dysregulated dopamine neurotransmission in psychiatric and neuropsychiatric conditions by comparing the data acquired in the patients with those acquired in healthy volunteers during performance of a similar task. This comparison also helps us understand whether dopamine neurotransmission is dysregulated and whether the dysregulation is responsible for clinical symptoms in these patients. Since this technique measures dopamine released under conditions of cognitive stress, it can detect dysregulation in neurotransmission even before appearance of clinical symptoms.

MRICloud As a High-Throughput Neuroinformatics Software As a Service

Michael I. Miller

Department of Biomedical Engineering, The Johns Hopkins University, Baltimore, MD

Abstract

I will discuss recent progress in delivering magnetic resonance imaging based neuroinformatics as a software as a service. Pipelines for brain imaging will be discussed with various aspects of machine learning applied to image retrieval, diagnosis, neurodegenerative diseases and stroke will be shown.

Cinematic Rendering - Clinical Applications and Future Directions

Elliot K. Fishman

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Abstract

Cinematic Rendering (CR), is a 3D visualization method that produces photorealistic images from volumetric data. CR shares many similarities with traditional volume rendering (VR), including the need for isotropic-voxel-based, thin-slice-

reconstructed data that can be stacked to create an image volume, as well as the assignment of color and transparency to the voxels in the volume based on the attenuation properties of component tissues. The added surface detail and image depth of CR relative to VR arises from the use of a global illumination model that incorporates path tracing in order to model thousands of photons passing through the imaged volume and the realistic interactions of those photons with the different tissues composing the volume as well as with each other CR images can be helpful in regions of complex anatomy, and may also have a role in the visual characterization of lesions . This talk will focus on some of the basic principles of cinematic rendering and then detail many of its current clinical applications. The focus of cinematic rendering as a tool for both improved diagnosis and patient management will also be addressed. Finally, novel techniques for GI imaging and cardiac imaging will be discussed.

Imaging Pathophysiology with PET and MR

Georges El Fakhri

Gordon Center for Medical Imaging, Harvard Medical School, Boston, MA

Abstract

In this talk, recent developments in Positron Emission Tomography (PET) and Magnetic Resonance Imaging (MRI) are explored and the challenges of simultaneous imaging in PET/MR and PET/CT as well as the opportunities afforded by two modalities in the era of bigdata are discussed. The unique sensitivity of PET (picomolar) and its quantitative capabilities can be associated with the superb spatial and temporal resolution of MR as well as its excellent soft tissue contrast to provide an ideal imaging modality for many cancers as well as cardiac and brain explorations. Improvements in image quality and diagnostic accuracy are illustrated in specific patient studies in PET/MR and PET/CT, and synergies between PET and MR spectroscopy are discussed in the context of guiding radiotherapy, especially in the context of AI. Beyond oncology, Molecular AI imaging applications in cardiac (viability, perfusion) and brain imaging (neurodegenerative disease, traumatic brain injury) are presented including very early imaging of prodromal AD and normal aging, mapping of mitochondrial membrane potential and simultaneous PET/fMRI for mapping dopaminergic and serotoninergic neurotransmission.

Deep Learning in Medical Imaging: Solving the Data Augmentation Challenge for Enhanced-Value Radiology Reporting

Hayit Greenspan

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Abstract

Medical image acquisition has improved substantially over recent years, with devices acquiring data at faster rates and increased resolution. The image interpretation process, however, has only recently begun to benefit from computer technology. Most interpretations of medical images are performed by radiologists; however, image interpretation by humans is limited due to its subjectivity, large variations across interpreters, and fatigue.

In this talk I will give an overview of the Deep Learning computer-aided detection and diagnosis tools we are developing, which can support the detection, segmentation and the characterization tasks of the radiologist. Examples will be presented in Chest X-ray pathology identification, CT liver analysis, as well as MRI brain lesion segmentation. Obtaining large-scale annotated datasets is a key challenge in the medical domain. I will present novel methods we are developing to solve these data challenges. I will conclude with an overview of possible translations of these tools towards augmented radiology reports and advanced radiologist workflows.

Sensing Psychosis: Toward Computational Phenotypes in Severe Mental Illness

Justin T. Baker

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Abstract

Until recently, the inconsistency of neurobiological measures taken together with the imprecise nature of clinical observation has severely limited our ability to apply a personalized medicine approach in psychiatry, or to optimize care for all individuals

seeking treatment. As a result, psychiatric care has remained largely open-loop and non-quantitative in nature, since providers may resist adding coarse, quantitative methods to their nuanced, albeit subjective, assessments. The widespread adoption of pervasive computing provides the field with unprecedented opportunities to build and test deep, dynamic models of illness by quantifying behavior at the level of individuals over time. If harnessed effectively, these new tools will allow us to move past the false choice between precise and personalized psychiatry that has confounded the field and limited progress. Critically, unobtrusive, quantitative behavioral phenotyping strategies could transform our ability to infer causal relationships between illness fluctuations, contextual factors, and treatment interventions and thereby radically reshape the process of discovery and development of novel therapeutics, making it more closed-loop, personalized, and targeted toward specific neural circuits. Here I discuss recent efforts to bridge these complementary approaches through single-case experimental designs in individuals with severe mental illness including bipolar disorder and schizophrenia.

Functional Neuroimaging of Reward and Aversion Processing in Patients with Post-Traumatic Stress Disorder

Igor Elman

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Abstract

In patients with post-traumatic stress disorder (PTSD), a decrease in the brain reward function was reported in behavioral- and in neuroimaging studies. While pathophysiological mechanisms underlying this response are unclear, there are several lines of evidence suggesting over-recruitment of the brain reward regions by aversive stimuli rendering them unavailable to respond to reward-related content. The purpose of the present study was to juxtapose brain responses to functional neuroimaging probes that reliably produce rewarding and aversive experiences in PTSD subjects and in healthy controls. The stimuli used were pleasant, aversive and neutral images selected from the International Affective Picture System (IAPS) along with pain-inducing heat applied to the dorsum of the left hand; all were administered during 3T functional magnetic resonance imaging. Analyses of IAPS responses for the pleasant images revealed significantly decreased subjective ratings and brain activations in PTSD subjects that included striatum and medial prefrontal-, parietal- and temporal cortices. For the aversive images, decreased activations were observed in the amygdala and in the thalamus. PTSD and healthy subjects provided similar subjective ratings of thermal sensory thresholds and each of the temperatures. When 46 °C (hot) and 42 °C (neutral) temperatures were contrasted, voxelwise between-group comparison revealed greater activations in the striatum, amygdala, hippocampus and medial prefrontal cortex in the PTSD subjects. These latter findings were for the most part mirrored by the 44 vs. 42 °C contrast. Our data suggest different brain alterations patterns in PTSD, namely relatively diminished corticolimbic response to pleasant and aversive psychosocial stimuli in the face of exaggerated response to heat-related pain. The present findings support the hypothesis that brain sensitization to pain in PTSD may interfere with the processing of psychosocial stimuli whether they are of rewarding or aversive valence.

Biophotonic Technologies for Advanced Eye Diagnostics

Boris Gramatikov

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Abstract

In the past few decades, the use of light has played an important role in revealing structural and functional information from the human retina in a non-destructive and non-invasive manner. Ophthalmic optics as an active research area has been expanding steadily, providing scientists and doctors with priceless multidisciplinary information and enabling new diagnostic and therapeutic methods. New scanning and imaging technologies have had a tremendous impact on ophthalmology, where information about the fovea (the most sensitive part of the retina) and the optic nerve head is essential. Three major technologies are undergoing vigorous development: Confocal Scanning Laser Ophthalmoscopy, Optical Coherence Tomography, and Polarization-Sensitive retinal scanning based on the property of certain parts of the retina to change the polarization state of light (birefringence). The latter, known also as Retinal Birefringence Scanning (RBS), has proven to be utterly important in screening for medical conditions in young children, such as strabismus and amblyopia ("lazy eye") by allowing the development of a series of pediatric vision screeners that have the potential of preventing vision loss by reliably detecting the position of the fovea in a binocular setting, and hence detecting eye alignment or misalignment. If done early on, at a young age, misalignment and defocus can successfully be fixed. The talk focuses on many related issues, such as device design, suppressing optical and

electronic noise, minimizing the interference from the corneal birefringence, optimization of the polarization-sensitive system, speed, etc. Five US patents issued to the speaker and his team will briefly be discussed.

Challenging Conventional Wisdom

Ronald L. Eisenberg

Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA

Abstract

Conventional wisdom may be the way things have always been done, but that does not make it correct. This talk presents several examples in which standard practice and general belief seemed to conflict with practical experience. When this occurred, we instituted studies to determine whether the conventional wisdom was correct – and will share instances in which they were not.

Deep Learning-based AI in Medical Image Processing and Computer-aided Diagnosis

Kenji Suzuki

Institute of Innovative Research (IIR), Tokyo Institute of Technology, Japan

Abstract

Deep learning in artificial intelligence (AI) has become one of the most active areas of research in the biomedical imaging field including medical image analysis and computer-aided diagnosis (CAD), because "learning from examples or data" is crucial to handling a large amount of data ("Big data") coming from medical imaging systems. Deep learning, including our original massive-training artificial neural networks (MTANNs), is an end-to-end machine learning model that enables a direct mapping from the input images to the desired outputs, eliminating the need for handcrafted features in feature-based machine learning. Deep learning is a versatile, powerful framework that can acquire medical image-processing and analysis functions through training with image examples. In this talk, deep learning in medical imaging and computer-aided diagnosis is overviewed, including 1) separation of bones from soft tissue in chest radiographs, 2) CAD for lung nodule detection in chest radiography and thoracic CT, 3) distinction between benign and malignant nodules in CT, 4) polyp detection and classification in CT colonography, and 5) radiation dose reduction in CT and mammography.

Featured Presentations

The AI Grand Challenge on Chest X-rays: Advances in Deep Learning for Radiology Imaging

Tanveer Syeda-Mahmood

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Abstract

With advances in machine learning and artificial intelligence, a new role is emerging for machines as intelligent assistants to radiologists in their clinical workflows. After the success of Watson Jeopardy challenge, IBM Researchers have been engaged in a new radiology grand challenge to build machines with offer provably good capabilities for being eligible to serve as cognitive assistants. The resulting work has advanced research in many fronts including new multimodal deep learning networks, clinical knowledge, clinical reasoning/inference, text analytics, crowd-sourced annotation platforms, evaluation methodologies and clinical studies. It has also spurred new look at federated AI in building robust algorithms, and the development of AI commons with co-learning for auto labeling. In this talk I will give an overview of the progress made in this area in my research lab with a focus on the chest X-ray challenge.

Machine Learning for Fetal Well Being Monitoring with Ultrasound Dopler

Denis Kouame

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Abstract

The purpose of this work was to investigate a medical device and related digital signal processing techniques fetal well-being monitoring. After evaluating various signal processing methods to extract relevant information on fetal behavior mainly, fetal heart rate, movements of the upper and lower limbs, mother movements pseudo-breathing movements of the fetus, we showed that an appropriate choice of hyperparameters made it possible to efficiently detect well-being or compromised activity of the fetuses. In order to evaluate these hyperparameters we investigated machine learning techniques, using data provided by our system. Alternatively, physicians performed independent analysis of the same data. The results show a very good agreement.

A Joint Network Optimization Framework to Predict Clinical Severity from Resting State Functional MRI Data

Niharika Shimona D'Souza[1*], Mary Beth Nebel[2], Nicholas Wymbs[2], Stewart Mostofsky[2-4] and Archana Venkataraman[1]

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[3]Department of Neurology, Johns Hopkins School of Medicine, Baltimore, MD
[4]Department of Pediatrics, Johns Hopkins School of Medicine, Baltimore, MD

Abstract

The problem of linking functional connectomics to behavior is extremely challenging due to the complex interactions between the two distinct, but related, data domains. We propose a novel optimization framework to predict clinical severity from resting state fMRI (rs-fMRI) data. Our model consists of two coupled terms. The first term decomposes the correlation matrices into a sparse set of representative subnetworks that define a network manifold. These subnetworks are modeled as rank-one outer-products which correspond to the elemental patterns of co-activation across the brain; the subnetworks are combined via patient-specific non-negative coefficients. The second term is a linear regression model that uses the patient-specific coefficients to predict a given measure of clinical severity. We validate our framework on a cohort of fifty-eight patients diagnosed with Autism Spectrum Disorder (ASD) in a ten-fold cross validation setting. Our method outperforms standard semi-supervised frameworks, which employ conventional graph theoretic and statistical representation learning techniques to relate the rs-fMRI correlations to the scores. In contrast, our joint network optimization framework exploits the structure of the rs-fMRI correlation matrices to simultaneously capture group level effects and patient heterogeneity. We employ three different clinical measures of severity to demonstrate the predictive power of our method. Finally, we demonstrate that our proposed framework robustly identifies clinically relevant networks characteristic of ASD.

The Use of Functional MRI to Look at Various Issues in Patients with Dissociative Identity Disorder

Robert L. Savoy

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

Abstract

The former diagnosis of "Multiple Personality Disorder" (M.P.D., now Dissociative Identity Disorder, D.I.D.) has long been controversial, but also fascinating, both scientifically and for the public. It is also a phenomenon that has special connections to psychoanalysis and more commonly seen defensive mechanisms. There are very few reported studies of D.I.D. patients using functional brain imaging, but patients with D.I.D. are often eager to understand their own psychological function more fully, and frequently volunteer for studies that might elucidate the condition. This presentation will tell the story of several such volunteers: one of which led to a publication using functional brain imaging (functional MRI) to look at switching between identity states [1]; one of which is associated with a televised personal account [2]. Some challenges with publishing such a case study will also be discussed.

References

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2) Many Sides of Jane, A&E, https://www.aetv.com/shows/many-sides-of-jane, Season 1 Episode 6.

A Longitudinal Study of Relationships Between Resting State Functional Connectivity and Recovery Outcomes in Early Psychosis

Shi Yu Chan, Melissa Hwang, Amy Higgins, Kathryn Nielsen, Dost Öngür, Roscoe Brady and Mei Hua Hall*

Schizophrenia and Bipolar Disorders Program, McLean Hospital, Harvard Medical School, Belmont, MA

Abstract

Objectives: Imaging studies in psychotic disorders typically examine cross-sectional relationships between MRI signals and diagnosis or symptoms. We sought to examine changes in network connectivity identified using resting state fMRI corresponding to divergent functional recovery trajectories and relapse in early stage psychosis (ESP). Prior studies have linked schizophrenia to hyperconnectivity in the default mode network (DMN). Given the correlations between the DMN and behavioral impairments in psychosis, we hypothesized that dynamic changes in DMN connectivity reflect the heterogeneity of outcomes in ESP.

Methods: Longitudinal imaging and behavioral outcome data were collected from thirty-six ESP patients and twenty healthy controls. Longitudinal cluster analysis identified subgroups of ESP patients with similar trajectories in terms of symptom severity and functional outcomes. We measured DMN connectivity longitudinally over 2 scans separated by a mean of 12 months. We then compared connectivity between patients and controls, and among the different subgroups defined by outcome trajectories.

Results: Outcome trajectories among ESP participants were highly heterogeneous. Four subgroups were empirically identified corresponding to: "Poor", "Middle", "Catch-up" and "Good" outcomes. DMN connectivity changes differed significantly between functional subgroups ($F_{3,32} = 6.06$, p-FDR corrected = 0.01); DMN connectivity increased over time in the "Poor" outcome cluster (b = +0.144) but decreased over time in the Catch-up cluster (b = -0.212).

Conclusion: DMN connectivity is dynamic and correlates with change in functional status over time in ESP. This approach identifies a brain-based marker that reflects important neurobiological processes required to sustain functional recovery.

Implementation of a Multi-Phase Contrast Injection: Single-Pass Acquisition Trauma CT Protocol

David Biddle*, Susan Freeman and Sara Upponi

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Abstract

Purpose: Can the radiation dose for trauma CT be reduced utilizing a multiphase contrast injection, single-pass acquisition, whilst maintaining the overall image quality?

Methods and Materials: 50 consecutive trauma CTs using the established two-pass protocol were retrospectively analyzed (standard arterial thoracic and abdominal imaging and portal venous abdominopelvic imaging). Retrospective analysis was also made of 50 consecutive trauma CTs utilizing the new single-pass, multiphase injection protocol (mixed arterial and venous phase of chest, abdomen and pelvis). All patients were imaged on a Siemens Definition AS+ 128 slice scanner. Both trauma protocols were triggered using a region-of-interest (ROI) placed over the descending thoracic aorta. Hounsfield Unit measurements were obtained with a ROI drawn over the main pulmonary artery, descending thoracic aorta and portal vein. Two Consultant Radiologists assessed the overall quality of the studies, rating the studies as diagnostic or non-diagnostic, and evaluating contrast density. Splenic enhancement was specifically assessed as a marker of solid organ enhancement. Radiation dose was compared.

Results: the single-pass cohort had significant dose reduction compared with the two-pass method (DLP 935.60 vs 1849.58 mGycm : p=0.0000000005506), and a lower kV (p = 0.0029). Pulmonary artery enhancement was comparable (p = 0.401), whilst the aortic and portal vein attenuation was significantly higher in the single-pass cohort. Both cohorts had excellent diagnostic quality: 100% in two-pass method and 98% in single-pass method. Both cohorts maintained diagnostic

splenic attenuation (100%).

Conclusion: The single-pass, multiphase technique significantly reduces the radiation dose in trauma patients, compared with the established technique, whilst maintaining diagnostic accuracy.

Impact of Mir137 Pathway Genetic Risk Variants on Brain Morphometry in Schizophrenia

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Abstract

Schizophrenia (SZ) is a major neurodevelopmental disorder affecting 1% of the population worldwide. Lateral ventricles (LV) increased and corpus callosum (CC) decreased volumes are typical of the disease. Here we hypothesized that SZ risk genes mir137 and further miR137-regulated genes would associate with such abnormalities.

3257 individuals from the GENUS Consortium (Genetics of Endophenotypes to Understand Schizophrenia), a collaborative SZ neurogenetics project funded by NIMH, were utilized to assess association of miR137, the PGC-defined polygenic variant, and five relevant miR137 biological pathways with two neural substrates: Volumes of LV and CC.

All phenotypes displayed the expected SZ/HC differences with increased LV volumes in SZ (~ 0.5 SD above controls), and decreased CC volumes in SZ (~ 0.5 SD below controls). The PGC-SZ PRS explained up to 1.4% (LV) of the variance in the LV and CC volumes.

Among the 5 pathway PRS, the highest R^2 (and strongest association) was for the axon guidance pathway with CC/LV ratio (~0.30%). Overall, CC/LV ratio showed the highest R^2 by the pathway PRS, and the axon guidance pathway was associated with most phenotypes.

Here, in the richly phenotyped GENUS dataset, we demonstrate that the ratio of CC/LV is an important measure beyond the individual measures of CC and LV separately. The percentage variance explained by the miR137 axon guidance pathway for CC/LV ratio likely indicates the essential role of this pathway in cortical axon guidance during development of the CC.

Functional and Structural Changes in Addicted Brain

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Abstract

Addiction is a brain disorder characterized by compulsive engagement in rewarding stimuli despite adverse increase. MRI is a way to show the structural and functional changes in brain in addictions.

Methods: We used 3 Tesla MRI scanner to obtained data from 76 individuals with cross addictions. The study included: routine MRI, resting state fMRI (RS-fMRI), task-based fMRI (TB-fMRI), surface-based morphometry and diffusion tensor imaging (DTI) tractography. All individuals were examined by a psychiatrist.

Results: Compared to controls drug users showed some specific changes in default mode network, for example decreased activation in subcallosal area, parahippocampal region and others. Moreover, drug users showed drug-related cues in TB-fMRI, as an increased activation in right hippocampus. Thinner cortices in addicts was seen in prefrontal cortex by SBM. Furthermore, some specific changes in white matter tracts were observed using DTI. Some individuals saved non-drug status during half a year after first examination. Compared to individuals, who didn't save non-drug status, they demonstrated changes in RS-fMRI and TB-fMRI during the second examination.

Conclusions: Application of different MRI methods, such as fMRI, SBM and DTI allow to obtain data about structural and functional changes in brain in addictions, that cannot be obtained using routine MRI. Long-term study allows to assess the dynamics of changes.

The Associations of Subclinical Atherosclerotic Cardiovascular Disease with Hip Fracture Risk and Bone Mineral Density in Elderly Adults

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Abstract

Introduction: Clinically recognized cardiovascular disease (CVD) is associated with osteoporosis and hip fracture risk, but the relationship of subclinical atherosclerosis to bone health is not certain.

Methods: We followed 3385 participants from the Cardiovascular Health Study (mean age 74.7 ± 5.3 years) with a median time to fracture of 12.1 years who underwent baseline carotid artery and aortic wall ultrasound scanning and ankle brachial blood pressure index (ABI) determinations. A subset underwent bone mineral density (BMD) testing.

Results: There were 494 hip fractures during follow-up. Among persons without clinical CVD, an average standard-deviation increase of a composite score of maximal common and internal carotid artery intimal medial thickness (cIMT) was associated with increased risk of hip fracture [(HR 1.18 [1.04, 1.35]), even though cIMT was positively associated with BMD. Neither aortic wall thickness nor ABI were associated with hip fracture risk or BMD. Among participants with clinical CVD, cIMT and aortic wall thickness, but not ABI, were associated with increased hip fracture risk.

Conclusion: Subclinical cIMT is associated with an increased risk of hip fractures despite being associated with increased BMD. This finding suggests that vascular health, even in its early stages, is linked to bone health, by pathways other than BMD.

Cardiac and Lung Ultrasound in Critically Ill Patients

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Abstract

Diagnosis and initial management of critically ill patients with respiratory distress and hypotension must be prompt and accurate in the emergency department (ED). Often, selecting the right diagnosis and initial intervention requires complex decision-making in order to achieve hemodynamic balance, improve outcomes, and decrease mortality.

Early utilization of point-of-care ultrasound using a focused cardiopulmonary protocol has a clinically significant impact on physicians' differential diagnosis as well as leading to significant changes in patients' management in the ED. History and physical examination may give an incomplete picture, and the diagnostic challenge is increased in complex patients (e.g., sepsis and pneumonia in a patient with preexisting heart failure).

We studied the utilization of US among critical cases in our ED with high academic advantages and found only 32% of patients who had an indication for ultrasound, actually underwent an ultrasound exam in the ED. In another study among 118 patients with undifferentiated hypotension we observed a significant improvement in narrowing down on differential diagnoses and 27.7% decrease in the mean aggregate complexity of diagnostic uncertainty after the ultrasound (1.85–1.34; –0.51 [95% CI, –0.41 to –0.62]) as well as a significant increase in the absolute proportion of patients with a definitive diagnosis from 0.8% to 12.7%. In 10% of the cases, ultrasound dramatically changed the diagnosis and identified pathology such as tamponade or RV dilation that required a complete shift of management and immediate interventions. In another study we proposed incorporating the screening CLIFF protocol for rapid evaluation of Cardiac-Lung-Inferior vena cava, and Free Fluid in the chest, for differentiating etiology in patients with acute respiratory distress such as cases with COPD exacerbations.

In this presentation, I will appraise the utility of an integrated CLIFF protocol, focusing on the differential diagnostic process in respiratory distress situation and hypotension and the sequence of scanning. Further studies focusing on clinical outcomes is the logical next step to validate the benefits of this protocol among the patients with undifferentiated dyspnea and respiratory distress.

Novel Patterns of Left Ventricular Mechanical Activity During Experimental Cardiac Arrest in Pigs Evaluated by Transthoracic Echocardiography

Roman Skulec[1,2*], David Astapenko[3], Renata Cerna Parizkova[3], Branko Furst[4] and Vladimir Cerny[1,4]

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[4]Department of Anesthesia, Pain Management and Perioperative Medicine, Dalhousie University, Halifax, Nova Scotia, Canada

Abstract

Introduction: We conducted an experimental study to evaluate the presence of coordinated left ventricular mechanical myocardial activity (LVMA) in two types of experimentally induced cardiac arrest: ventricular fibrillation (VF) and pulseless electrical activity (PEA).

Methods: Twenty anesthetized domestic pigs were randomized 1:1 either to induction of VF or PEA. Surface ECG, presence of LVMA by transthoracic echocardiography and sublingual microcirculation were recorded throughout the protocol. The experimental animals were left in nonresuscitated cardiac arrest until the cessation of LVMA and microcirculation.

Results: One minute after induction of cardiac arrest, LVMA was identified in all experimental animals. In the PEA group, rate of LVMA was of 106±12/min. In the VF group, we identified two patterns of LVMA. Six animals exhibited contractions of high frequency (VFhigh group), four of low frequency (VFlow group) (334±12 vs. 125±32/min., p<0.001). A time from cardiac arrest induction to asystole (19.2±7.2 vs. 7.3±2.2 vs. 8.3±5.5 min, p=0,003), cessation of LVMA (11.3±5.6 vs. 4.4±0.4 vs. 7.4±2.9 min, p=0.027) and cessation of microcirculation (25.3±12.6 vs. 13.4±2.4 vs. 23.2±8.7 min, p=0.050) was significantly longer in VFlow group than in VFhigh and PEA group, respectively.

Conclusions: LVMA was found to be preserved for a certain period after induction of cardiac arrest in all experimental animals regardless of the induced electrical activity. Two patterns of LVMA were identified in VF group animals. The pattern with LVMA of low frequency contractions was associated with the longest time from cardiac arrest induction to asystole, to cessation of LVMA and to microcirculation arrest.

Intraventricular Stent Loss – What to do?

Imran Iftikhar[1], Sajid Dhakam[1] and Chanza Fahim Shaikh[2]

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[2]Indus Hospital Research Center, The Indus Hospital, Pakistan

Abstract

A 60-year-old male presented with CCS-II angina in OPD. Previously had CABG (LIMA to LAD and SVG to OM1 and OM2) 11 years back when he had NSTEMI with three vessel CAD. He had Normal LV function. Coronary angiogram showed three vessel native CAD; mid LAD 60%, Proximal LCX 70-80%, OM1: 70-80%, LIMA to LAD occluded in mid, SVG to OM – Patent, RCA non-dominant vessel with CTO in middle. The patient was planned for PCI to native LCX and OM. During the procedure the LCX to OM route was observed to be highly tortuous. LM was engaged with XB 3.0 6F Guide and Sion wire crossed the lesions across LCX and OM. The lesions were predilated with Sprinter NC Balloon 2.5 x 9 and distal OM lesion stented with Coflexus BMS 3.0 x 12 successfully. Resistance was noted while attempting to cross Coflexus BMS Stent 3.5 x 12 for Proximal LCX at the LM. However, the guide system dislodged during maneuvering from LM resulting in stent loss into the LV Cavity. The position of the stent into the LV Cavity was confirmed with LV Gram. The snear was not available in the cathlab at that time but since the patient was hemodynamically stable so no attempt was made for stent retrieval from the LV Cavity. Fluoroscopy done next day showed the stent in a branch of right femoral artery. The patient was on dual anti-platelet agent, after one year remained stable with stent at the same position.

CT Angiographic Assessment of Coronary Artery Bypass Graft

Abhishek Mashirkar*, Bhavana Sonawane, Sandeep Mahajan, Purnachandra Lamghare, Narendra Tembhekar, Priya Tembhare and Gokul Kathade

Government Medical College and Super Specialty Hospital, Nagpur, India

Abstract

Introduction: CT Angiography (CTA) is a noninvasive imaging modality to evaluate the vascular system. In coronary artery bypass graft patients, this study is helpful to evaluate the status of graft.

Aims & Objective: To evaluate the coronary artery bypass graft on CT angiography.

Inclusion Criteria: Patients of all ages and either sex, who undergone post CABG cardiac CT examination.

Exclusion Criteria: Patients lost to follow up before definitive diagnosis.

Study Design: Prospective cross-sectional study.

Study Place & Duration: Department of Radiodiagnosis Government Medical College & Superspeciality Hospital, Nagpur. Duration Feb 2015 to April 2016.

Material & Method: This was a prospective study conducted during Feb-15 to April-16 at our institute. Total 91 post-CABG patients referred from CVTS department were undergone CT angiography study using standard CTA-CABG protocol on 128 slice CT scanner. Post processing was done, and images were analyzed for presence and patency of graft, distal native artery status.

Result: Total 137 grafts were evaluated in 91 patients of which 73% were patent and 27% were stenosed/occluded. 90 were arterial grafts of which 27.77% were stenosed/occluded. Out of total 47 venous grafts, 25.53% showed stenosis/occlusion. Distal native artery was normal in 68.61% cases and in rest cases it showed stenosis/occlusion.

Conclusion: CTA noninvasively assess the presence and patency of the graft and distal native artery status in post-CABG patients, which guides the CVTS surgeon in the management of these patients. Our study showed no significant difference in the type of graft (arterial/venous) and their stenosis/occlusion.

Using Histology to Evaluate Micro-CT Findings of Trauma in Three Post-Mortem Samples - A Method Validation

Mark A Williams* and Waltraud Baier

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Abstract

Forensic digital imaging technology has rapidly advanced over the previous few decades and is gaining increasing significance in medico-legal death investigations. Medical-grade Computed Tomography (CT) is now routinely used to support Pathologists in post-mortem examinations at numerous institutions across the globe. However, the resolution of medical-grade CT is severely limited when used to depict smaller anatomical structures or for the characterization of micro-trauma. High-resolution Micro-CT (XCT) offers up to 100× the resolution to help overcome this problem but is a relatively recent addition to the field of forensic radiology. Few studies have so far been attempted to validate the results from XCT, which is an essential prerequisite for the method to be used in the criminal justice process as demanded by regulatory bodies. This study directly compares micro-CT images with histology, the current gold standard for Pathology. Results from three homicide cases were subsequently examined and are presented: two larynges from suspected strangulations and one ribcage of a case of fatal child abuse. A strong correlation was observed between histology and Micro-CT with the majority of skeletal injuries being correctly identified. This study explores the forensic implications of these results and establishes how micro-CT is a complementary to histology and a valuable tool for Pathologists moving forward.

Harmonization of CT Scans: Reducing Confounding Factors in Clinical Studies

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Abstract

Quantitative analysis of CT images involves dealing with intrinsic disparities in the density measures due to differences in the acquisition parameters and/or scanners. Clinical studies have observed spatial discrepancies in the attenuation levels for the

same densities due to the characteristics of noise. We propose a harmonization technique to remove the spatial discrepancies and to minimize the difference across acquisition parameters. We also provide an assessment study of the effect on local mean density of a harmonization technique in clinical CT scans acquired with different doses, kernels and iterative methods.

As a result, harmonization reduces the effect of spatially variant noise without compromising the resolution of the images. After harmonization, no significant difference was found between reconstruction pairs and the spatially variant bias is reduced to less than 2 HU.

Regarding the clinical implications, the harmonization method shows that the percentage of detected emphysema across different doses and reconstruction methods becomes more stable (the variance across reconstruction goes from 56.21 to 4.50). Besides, the harmonization is able to remove the confounding bias induced by body mass index.

In conclusion, we show that our harmonization scheme deals with confounding effects intrinsic to the CT acquisition and reduces the bias of local mean density induced by the noise.

Hemodynamics of Prefrontal Cortex in Ornithine Transcarbamylase Deficiency: A Twin Case Study

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Abstract

Ornithine transcarbamylase deficiency (OTCD) is one of the most common subsets of Urea Cycle Disorder. Hyperammonia due to OTCD can cause a range of deficiencies in domains of executive function, working memory, and attention. Given the cognitive profile of patients with OTCD, there is a need for monitoring the disease progression and underlying neurocognitive function. We used functional Near Infrared Spectroscopy for assessment of prefrontal cortex hemodynamic in a fraternal twin with and without OTCD while performing the N-Back Working Memory (WM) task. fNIRS is a non-invasive and portable optical imaging technique that can be used to measure the cortical hemodynamics. We first investigated changes in hemodynamic response in several frequency bands, including low frequency (LF: <0.1 Hz) and very low frequency (VLF: <0.03), known to be related to mechanism of cerebral autoregulation. Our preliminary result showed that sibling with OTCD had higher hemodynamic oscillations in VLF band compared to the control sibling. The difference between these variations were not as prominent in LF band, indicating the importance of frequency bands in investigation of underlying physiological and cognitive function. We further examined the functional connectivity in PFC. Overall, the OTCD sibling showed lower functional connectivity compared to the control sibling. In control sibling the interhemispheric functional connectivity increased with the task difficulty, whereas in sibling with OTCD functional connectivity decreased. Overall, the result of this study suggests the contribution of inefficient neurocognitive function in subjects with OTCD with implication toward further investigation of underlying physiological mechanisms and functions.

Relationship between Cough-Associated Changes in CSF Flow and Disease Severity in Chiari I Malformation: An Exploratory Study Using Real-Time MRI

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Abstract

Background and Purpose: Currently no quantitative objective test exists to determine disease severity in a patient with Chiari I malformation. Our aim was to correlate disease severity in symptomatic patients with Chiari I malformation with cough-associated changes in CSF flow as measured with real-time MR imaging.

Materials and Methods: Thirteen symptomatic patients with Chiari I malformation (tonsillar herniation of - 5 mm) were prospectively studied. A real-time, flow-sensitized pencil-beam MR imaging scan was used to measure CSF stroke volume during rest and immediately following coughing and relaxation periods (total scan time, 90 seconds). Multiple posterior fossa and craniocervical anatomic measurements were also obtained. Patients were classified into 2 groups by neurosurgeons blinded

to MR imaging measurements: 1) nonspecific Chiari I malformation (5/13)—Chiari I malformation with nonspecific symptoms like non-cough-related or mild occasional cough-related headache, neck pain, dizziness, paresthesias, and/or trouble swallowing; 2) specific Chiari I malformation (8/13)—patients with Chiari I malformation with specific symptoms and/or objective findings like severe cough-related headache, myelopathy, syringomyelia, and muscle atrophy. The Spearman correlation was used to determine correlations between MR imaging measurements and disease severity, and both groups were also compared using a Mann-Whitney U test.

Results: There was a significant negative correlation between the percentage change in CSF stroke volume (resting to postcoughing) and Chiari I malformation disease severity (R_0.59; P_.03). Mann-Whitney comparisons showed the percentage change in CSF stroke volume (resting to postcoughing) to be significantly different between patient groups (P _ .04). No other CSF flow measurement or anatomic measure was significantly different between the groups.

Conclusions: Our exploratory study suggests that assessment of CSF flow response to a coughing challenge has the potential to become a valuable objective noninvasive test for clinical assessment of disease severity in patients with Chiari I malformation.

Magnetic Resonance Imaging in the Assessment of Necrosis Zones After Superselective Embolization of the Prostatic Arteries. Case Report

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Abstract

The aim of the study was to estimate the volume of the prostate gland in patient A. before and after the superselective bilateral embolization of the prostate gland. Patient A., 78 years of age, with a clinical diagnosis of benign hyperplasia with signs of infravesical obstruction, underwent multiparametric magnetic resonance imaging of the prostate gland before and after the superselective embolization of the paraprostatic arteries. The study was conducted on a Hitachi Oval magnetic resonance imager with a magnetic field induction of 1.5 T. The standard scan protocol included the parameters recommended by the European Society for the Study of the Urogenital System (ESUR), set out in the Prostate Imaging and Reporting System: Version 2 (PiRADS v2).

Examinations were performed 1, 3, and 6 months after superselective embolization of the prostate gland. In the study after 1 month was determined by the zone of necrosis in size from 5 mm to 25 mm, the volume of the gland did not change significantly. Examination after 3 months showed a decrease in the prostate gland by more than 15% due to wrinkling of the decay sites. A control study after 6 months showed a decrease in the volume of the prostate gland to 28% with a significant decrease in the areas of previously identified necrosis. Systematic dynamic MRI monitoring after endovascular intervention allowed to recognize and measure areas of necrotic changes and objectively track the reduction in the size of the prostate gland in all patients.

Supine Breast MR Imaging in Breast Cancer

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Abstract

The purpose of this study is to assess visibility of prone MR detected masses on an added post-contrast supine sequence and the spatial displacement of these lesions from prone to supine position.

Our study is a HIPAA-compliant, IRB-approved retrospective review of 43 patients with newly diagnosed breast cancer who underwent bilateral breast MRI for evaluation of disease extent. A supine T1-weighted post-contrast axial sequence with fat suppression was added at the end of the standard breast MRI protocol. Duration of imaging was recorded to evaluate the feasibility of performing this technique within our institutional standard 40-minute exam time slot.

Non-index tumor lesions detected on the standard prone MRI were assessed for visibility on the added supine sequence. Lesions visualized on the supine sequence were segmented on both prone and supine sequences, and distances from the center of the lesion to key landmarks (nipple and chest wall) were computed.

Among the 31 prone MR-detected non-index tumor lesions, 22 lesions (10 non-mass enhancements and 12 masses) were visible on the supine sequence.

Segmentation and computation of spatial displacement from prone to supine positioning demonstrated that the lesions in supine position are closer to the chest wall by a mean of 1.9 cm and closer to the nipple by a mean of 1.7cm.

An added supine sequence allows for identification of the majority of non-index tumor lesions and can estimate their spatial displacement from prone MRI correlates. This may aid in the detection of sonographic correlates by predicting the supine location of the lesions.

Combined Use of PET/CT With 68Ga-PSMA and 11C-Choline in Patients with Prostate Cancer with Biochemical Relapse

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Abstract

Biochemical recurrence is a common event in patients treated for prostate cancer (PCa), especially in high risk patients. In order to get better results, it should be known where the target is localized. The goal is to make a comparative analysis of the sensitivity of PET/CT with 68Ga-PSMA and 11C-choline in patients with biochemical recurrence in revealing local, regional or distant metastasis. We conducted the combined PET/CT with 68Ga-PSMA and 11C-choline in 124 patients with biochemical recurrence PCa. 11C-choline is a metabolic radiotracer and one of the constituent elements of phospholipids, forming the cell membrane. 68Ga-PSMA is a non-metabolic radiotracer specific to prostate cancer cells (and some others). The interval between whole-body PET/CT with 68Ga-PSMA and 11C-choline was 1–2 days. Both radiopharmaceuticals were injected intravenously in a dose of 68Ga-PSMA - 2 MBq per 1 kg of patient's body weight, 11C-choline - 3MBq per 1 kg of body weight. Scanning began after 60 and 10 minutes respectively. The level of prostate-specific antigen (PSA) ranged from 0.2 ng/ml to 47.0 ng/ml, the median was determined at the level of 1.32 ng/ml. The sensitivity of PET/CT with 68Ga-PSMA and 11C-choline was 75.7% and 62.5% respectively, the total sensitivity - 82%. In the diagnosis of metastases in the bones and lymph nodes 68Ga-PSMA demonstrated an advantage. In addition, in a group of patients (30 man) with a PSA level of ≤ 0.5 ng/ml, signs of local recurrence were detected in 27% of patients.

Radiation Safety Certification: A Review

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Abstract

The responsibilities of a radiation safety officer (RSO) are primarily related to the radioactive materials license. However, increasingly RSO's are being asked to take on additional safety responsibilities within the hospital. These include CT, MRI and fluoroscopy safety. A new radiation safety certification exam is available from the Nuclear Medicine Technology Certification Board. The content outline for this exam is available on-line. This presentation highlights some of the item's individuals will need to know to sit for this exam. A brief physics and instrumentation review, as well as how to measure radiation are covered. Radiation protection in nuclear medicine, CT and fluoroscopy are explored. A brief overview of MRI safety is also included.

Radiation Dose for Pediatric CT: Comparison of Pediatric Versus Adult Imaging Facilities

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Abstract

Background: The American College of Radiology Dose Index Registry for CT enables evaluation of radiation dose as a

function of patient characteristics and examination type within the United States.

Objective: To test the hypothesis that academic pediatric CT facilities have optimized CT protocols that may result in a lower and less variable radiation dose to children.

Methods: A retrospective study of doses (mean patient age, 12 years; range, 0-21 years) was performed by using data from the National Radiology Data Registry (2016 – 2017) (n = 239,622). Three examination types were evaluated: brain without contrast, chest without contrast, and abdomen-pelvis with intravenous contrast enhancement. Three dose indices – volume CT dose index (CTDIvol), size specific dose estimate (SSDE), and dose-length product (DLP) were analyzed within six different size groups. The unequal variance t-test and the F test were used to compare mean dose and variance, respectively, at academic pediatric facilities with those at other facility types for each size category. The Bonferroni-Holm correction factor was applied to account for the multiple comparisons.

Results: Pediatric radiation dose in academic pediatric facilities was significantly lower, with less variance for all brain, 78% of chest, and 89% abdomen-pelvis examinations across all six size groups, three dose descriptors, when compared with that at the other three facilities. For example, abdomen-pelvis SSDE for the 14.5-18 cm size group was 3.6, 5.4, 5.5, and 8.3 mGy, respectively, for academic pediatric, nonacademic pediatric, academic adult, and non-academic adult facilities (SSD mean and variance $P < 0.001$). Mean SSDE for the smallest patients in adult facilities was in general 50% of the facility's adult dose.

Conclusion: Academic pediatric facilities use lower CT radiation dose with less variation than do nonacademic pediatric or adult facilities for all brain examinations and for the majority of chest and abdomen-pelvis examinations.

How Can Ultrasonography Enhance Medical and Physical Therapy Education?

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Abstract

Medical Schools have been using USI in recent years to improve students' understanding of anatomy, clinical assessment skills and diagnostic skills across multiple body systems. Many studies show a positive impact in knowledge, confidence and learning of essential skills for medical students. The recent explosion in "point-of-care" ultrasound (POCUS) will make these devices portable and more widely available to educators to facilitate teaching physical assessments and skills. Current literature provides little guidance regarding the most effective education methods for using USI in a curriculum.

Due to its lower cost, higher quality images, and training availability, USI is gaining popularity in the physical therapy (PT) profession. Current research supports the use of USI in PT practice for examining anatomy with and without movement to assist with prognosis, treatment or referral and as a biofeedback instrument for patient education. This drives the need to incorporate USI into the PT curriculum. The presentation will discuss current literature regarding the use of USI in medical education and the development, implementation and outcomes of several studies using USI as an adjunct teaching tool in PT curriculum.

Impact of Uterine Contractility on Quality of Life of Women Undergoing Uterine Fibroid Embolization

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[9]Interventional Radiology and Endovascular Surgery, UNIFESP, São Paulo, Brazil

Abstract

Background: Although changes in uterine contractility pattern after uterine fibroid embolization (UFE) have been assessed by cine magnetic resonance imaging (MRI), their impact on quality of life outcomes has not been evaluated. The purpose of this study was to evaluate the impact of uterine contractility on the quality of life of women undergoing UFE measured by the Uterine Fibroid Symptom and Quality of Life questionnaire (UFS-QOL).

Results: A total of 26 patients were included. MRI scans were acquired 30-7 days before and 6 months after UFE for all patients. The UFS-QOL was applied in person on first MRI exam day and one year after UFE and the outcomes were analyzed according to the groups of evolution pattern of uterine contractility: Group A: Unchanged Uterine Contractility Pattern, 38%; Group B: Favorable Modified Uterine Contractility Pattern, 50%; and Group C: Loss of Uterine Contractility, 11%. All UFE patients presented a reduction in the mean score for symptoms and increase in mean scores on quality of life. All patients in this cohort presented a reduction in mean symptom score and increase in the mean score of quality of life subscales. Group A had more relevant complaints regarding their sense of self-confidence; Group B presented worse sexual function scores before UFE, which improved after UFE compared to Group A.

Conclusions: Significant improvement in symptoms, quality of life, and uterine contractility was observed after UFE in women of reproductive age with symptomatic fibroids. Functional uterine contractility seems to have a positive impact on quality of life and sexual function in this population.

Evaluation of Digital Radiography from Three Acquisition Systems Applied to Works of Art

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[5]*Laboratório de Conservação e Restauro José de Figueiredo do Instituto dos Museus e da Conservação, Lisboa, Portugal*

Abstract

Purpose: In order to give more contribution between imaging departments and the art centers, was carried out this study with focus in the process used in radiography painting. Furthermore, we intend to optimize the exposition's parameters in three systems comparing them.

Methods and Materials: It was selected 3 paintings produced with different materials and techniques. The paintings underwent to three acquisition systems making a total of 21 images: 1-DR Siemens Multix Select-DR; 2- CR Siemens Multix Pro combined with Agfa IP MD4.0 detector and scanner Agfa ADC Solo and 3- CR tube YXLON SMART 160E/0.4 belong to José Figueiredo Lab from investigation and conservation of cultural heritage. The acquisition procedures are reproduced in every three systems. Having one check list prepared for this purpose four readers were invited to grading the images related to the criterion: distinctness; contrast; contour; creative and techniques process; support conservation; components and materials. The readers have wisdom in two fields: 2 in medical imaging and 2 in art.

Results: Globally the images best ranked by experts were obtained with the system 2 where was possible to see the sharpness of profile, the brushstrokes or a matting of the canvas. The best acquisition parameters were similar to those using by National Gallery recommendations.

Conclusion: Radiography field and the knowledge of radiographers, through CR systems, may increase the image quality to expertise advice, validation and authentication of works arts. The cooperation between two of these areas may increase the performance of them.

CT Imaging of Calvarial Lumps & Bumps (Neoplasms)

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Abstract

Calvarial lesions are frequently manifests as a lump & bumps with or without associated pain and often pose a diagnostic dilemma. A wide variety of neoplasm's and non-neoplastic lesions can involve the calvarium, and their imaging appearances vary according to their pathologic features. Clinical information is an important factor in the diagnostic process. In this cross-sectional retrospective study, we illustrate the value of cross-sectional imaging techniques by computed tomography (CT) in evaluating these lesions. We also review the literature and discuss the specific imaging characteristics of the most common calvarial lesions in order to provide information that can guide radiological diagnosis or limit differential diagnosis.

Role of Cerebroplacental Ratio in Prediction of Adverse Perinatal Outcomes in IUGR Pregnancies

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Abstract

Abstract: Introduction: Cerebroplacental ratio (CPR) reflects both the placental status and fetal response, and therefore constitutes a sensitive Doppler index to detect placental insufficiency and predict adverse neonatal outcomes.

Aims and objective: The aim of the present study was to evaluate CPR; fetal middle cerebral artery pulsatility index (MCA PI) and umbilical artery pulsatility index (UA PI) ratio, to predict adverse perinatal outcomes.

Material and methods: This prospective study was conducted in our tertiary care hospital from August 2017 to July 2018 for a period of one year. A total of 120 clinically suspected singleton IUGR pregnant women with a gestational age of 34 weeks or more were enrolled in the study. A single cut off value of <1.08 was taken as abnormal CPR and correlated to adverse neonatal outcomes.

Results: In 120 cases of IUGR, three neonates were born with congenital malformations and excluded from the study. The mean age of delivery was 21.8 years with 52 (43%) primi gravida. Mean gestational age at first doppler velocimetry examination was 35.2 ± 3.46 weeks. Abnormal CPR (<1.08) was noted in 65 cases. Statistically significant findings were, caesarean delivery in 38 (P<0.001); birthweight < 2.5kgs in 90% (p<0.001) and admission to neonatal intensive care in 86%. The MCA/UA PI index showed a sensitivity of 63.16% and specificity 77.27%. The positive predictive value was 92.31% with a diagnostic accuracy of 65.81%.

Conclusion: CPR is a functional marker of fetal hypoxemia and integrating CPR evaluation into antenatal surveillance is a valuable guide for risk assessment of the IUGR fetus.

May-Thurner Syndrome Variant: An Unusual and Overlooked Cause of Deep Vein Thrombosis

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Abstract

Deep vein thrombosis (DVT) commonly occurs in people who have risk factors like prolonged immobilization, obesity, recent surgery, pregnancy, oral contraceptive use, cancer, and genetic factors. We report a case of a patient with DVT and acute PE from an unusual cause. A 66-year old man that was diagnosed with unprovoked extensive left lower extremity DVT and bilateral PE had a venogram showing significant smooth extrinsic mass effect that was compressing the left common iliac vein (LCIV). CT imaging was ordered to rule out lymphadenopathy, but it unexpectedly revealed a large osteophyte arising anteriorly from the left aspect of L5-S1 vertebrae causing extrinsic compression of the LCIV between the spine and the left common iliac artery.

These findings are consistent with a diagnosis of May-Thurner syndrome (MTS) variant. MTS is caused by extrinsic compression of the LCIV by the right common iliac artery leading to DVT. In this unique case, the LCIV was being compressed by an osteophyte instead. In patients with extensive left-sided DVT that are otherwise healthy, MTS should be considered as a possible diagnosis. Failure to correct the anatomical defect can lead to DVT recurrence, PE, and iliac vein rupture. The patient was successfully treated with mechanical thrombolysis, angioplasty, stenting of the LCIV, and anticoagulation.

Poster Presentations

Multimodal Imaging in Ornithine Transcarbamylase Deficiency Reveals Pathophysiology During Recovery from Hyperammonemia

Andrea Gropman[1,2*], Kuntal Sen[1,3] and Matthew Whitehead[2,3]

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[2]George Washington University of the Health Sciences, Washington, D.C

Abstract

Urea cycle-related brain disease may take on variable neuroimaging manifestations, ranging from normal to abnormal with or without a signature appearance. In the past, we have described the usefulness of multimodal imaging in identifying biomarkers of neuronal injury in UCD patients. In this study, we report unique findings in an adolescent male with neonatal-onset OTC deficiency after an episode of hyperammonemia. Multiplanar, multisequence MR imaging (T1WI, T2WI, T2 FLAIR, diffusion weighted images and gradient echo) of the brain was performed on seven separate occasions over the course following the acute illness; first five exams were performed within 28 days of admission and the final two exams were performed approximately 3 and 5 months later.

Results: 1. The initial MR revealed increased signal on T2WI in the basal ganglia, claustrum and frontoparietal white matter; which remained stable over time. By the 5th exam, signal changes had developed in frontal cortex; reflecting permanent injury.

2. DTI tractography of the corticospinal tracts displayed revealed diminution of the number of projectional and commissural fibers over time.

3. Blood flow measurements demonstrated hypoperfusion in first 3 exams followed by hyper-perfusion.

4. MR spectroscopy demonstrated glutamine was elevated during hyperammonemia, with myoinositol reduction, reflecting osmotic buffering. This particular lesioned pattern has not been described previously to our knowledge and expands our understanding of the effect of hyperammonemia on the structure and biochemistry of the nervous system.

A Case of Middle Cerebral Artery Infarction As a Result of Compression of Thrombosed Aneurysm of Atypical Location

Jung Hoon Han* and Kwon Sun-uck

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Abstract

18 Years old male without previous medical history was transferred to our hospital with diagnosed cerebral infarction at May 2019. His initial symptom was mild motor aphasia from 11 days before admission to our hospital. Magnetic resonance image (MRI) and magnetic resonance angiography (MRA) showed cerebral infarction in left middle cerebral artery (MCA) M2 superior territory and occlusion of relevant vessel. In MR images of previous hospital, GRE, T1, T2 sequence implied that there may be thrombosed aneurysm just proximal to occluded site. We performed transfemoral cerebral angiography (TFCA) as a further evaluation and it showed complete occlusion of left M2 superior branch without contrast dye filling aneurysm which may be caused by compression of thrombosed aneurysm to the vessel. Transthoracic & transesophageal echocardiography was performed to rule out the cause of aneurysm of atypical location, but result was negative. We have discussed the case with neurosurgeons and reached to conclusion to observe the patient with medication since aneurysm was hard to clip because of full containment of thrombus and already developed collateral vessels. We are planning to follow up the vessel status, especially change in size of aneurysm every 6 months. The patient was discharged with mild improvement in aphasia.

I would like to report this case because ischemic stroke caused by mechanical compression of thrombosed aneurysm to major intracranial vessel is very rare, and discussing further management of similar cases may be an interesting topic in the conference

Task State Classification of Four-Dimensional FMRI Time Series Using Deep Residual Convolutional Neural Networks

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Abstract

With the availability of large-scale data sets and high-performance GPU-enabled computing platforms, deep learning -- the use of multi-layer neural networks as a modeling framework -- has become a popular method for machine learning. With its proven success in image classification, natural language understanding and video activity recognition, deep learning is quickly gaining traction in medicine, and is being incorporated into detection tools, e.g., diabetic retinopathy detection from retinal fundus photographs, and breast cancer detection from pathology slides. Deep learning has also been explored in brain studies, for task classification from fMRI (functional magnetic resonance imaging) data. Previous work has only scratched the surface by using a simple convolutional neural network. In this work, we took a state-of-the-art convolutional neural network for 2D images called ResNet and augmented it to work with time series of 3D fMRI volumes. Our contribution is a novel deep learning model that takes into account both temporal and spatial information to classify task states from 4D fMRI time series. We trained and tested the network on fMRI data from the Human Connectome Project S1200 data set and achieved state-of-the-art with 94% test accuracy.

Imaging of Atypical Transitional Cell/Squamoid Carcinoma Arising from a Tailgut Duplication Cyst

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[3]Histopath Diagnostic Specialists, Australia

Abstract

A 59-year-old woman was incidentally found to have a 4cm multi-lobulated mass inseparable from the right posterolateral wall of the rectum, following investigations for right hip pain with magnetic resonance imaging (MRI) of hip and computed tomography (CT) of abdomen and pelvis. On MRI of pelvis, the mass demonstrated multiple internal cystic components (T1 hypointense, T2 hyperintense and non-enhancing) and multiple internal septations (with homogeneous enhancement and diffuse restriction) with an 8mm suspicious mesorectal lymph node.

18-F-fluoro-deoxyglucose positron emission tomography (18-F FDG PET/CT) demonstrated intense FDG uptake within the mass (SUVmax 10.9, highly suspicious of malignancy), mild FDG uptake in the adjacent sub centimetre mesorectal lymph node (SUVmax 3.6, suspicious of small volume regional nodal involvement) and no evidence of distant FDG avid disease.

The patient had no significant past medical history and reported no associated symptoms. No mucosal lesion in the rectum was identified on digital examination or colonoscopy. Histopathology of the core biopsies from the mass showed an atypical hyperplastic transitional / squamous epithelium at the edge of the cores with a small focus of possible infiltration, suggestive of a transitional cell / squamoid carcinoma (likely arising from a tailgut duplication cyst). Initial treatment with chemotherapy and radiation therapy is planned at the time of writing.

This case highlights the importance of tailgut duplication cyst as a differential diagnosis of a retrorectal mass as malignant transformation can rarely occur. Brief literature review of tailgut duplication cyst and update of the clinical outcome of this patient will be presented.

Correlation Between End-tidal Carbon Dioxide and the Degree of Compression of Heart Cavities Measured by Transthoracic Echocardiography during Cardiopulmonary Resuscitation for Out-of-Hospital Cardiac Arrest

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Abstract

Introduction: Individual optimization of cardiopulmonary resuscitation (CPR) may improve outcome of the patients. It is not known whether intra-arrest ultrasound can be used for real-time haemodynamic monitoring of CPR. While end-tidal carbon dioxide ($EtCO_2$) levels reflect cardiac output induced by CPR, we performed a pre-hospital clinical study to evaluate whether the degree of compression of the right (RV) and left ventricle (LV) induced by chest compressions during CPR for out-of-hospital cardiac arrest (OHCA) and measured by transthoracic echocardiography correlates with $EtCO_2$ levels.

Methods: Transthoracic echocardiography was performed from subcostal view during ongoing chest compressions in 30 consecutive patients resuscitated for OHCA. This was repeated three times in each patient. $EtCO_2$ levels were registered. Afterwards, maximal and minimal diameter of LV and RV were obtained from recorded loops and compression index (%) of LV (LVCI) and RV (RVCI) was calculated as *(maximal-minimal/maximal diameter) x100*. CImax defined as the value of LVCI or RVCI, whichever was greater was also assessed. Correlations between $EtCO_2$ and LVCI, RVCI, and CIMAX were calculated.

Results: Evaluable echocardiographic records were found in 18 patients. Chest compressions induced significant compressions of LV and RV (LVCI=20.6±13.8%, RVCI=34.5±21.6%, CImax=37.4±20.2%). We identified positive correlation between $EtCO_2$ and LVCI ($r=0.672$, $p<0.001$), RVCI ($r=0.778$, $p<0.001$) and CImax ($r=0.859$, $p<0.001$). CIMAX with cut-off level of 17.35% predicted $EtCO_2$>20 mm Hg with 100% sensitivity and specificity.

Conclusions: $EtCO_2$ correlated with all parameters under consideration, while the strongest correlation was found between CImax and $EtCO_2$. Therefore, CImax is a candidate parameter for haemodynamic guidance of personalized CPR.

A 40-Year-Old ALCAPA Patient Who Denied Treatment

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Abstract

Also known as Bland-White-Garland syndrome, it is a rare congenital abnormality that is known to account for <0.5% of congenital heart diseases. There are two types; the infant and the adult type. Infants may die early in 1st year of life due to MI or CHF. Rarely, ALCAPA syndrome manifests in adults which may cause MI, LV dysfunction, MR, or silent MI which can lead to SCD. Early diagnosis and prompt surgical intervention with the aim of restoring a two-coronary-artery circulatory system have excellent results and lead to gradual myocardial recovery. A 33-year-old male presented with chest pain on exertion since few years prior to presentation. On clinical evaluation ECG showed sinus rhythm and ST segment abnormality suggestive of early repolarization and echocardiogram confirmed normal left ventricular function. ETT was positive and the patient was referred for PCI. Coronary Angiogram showed extremely dilated RCA with collaterals filling left coronaries retrogradely. Left main could not be engaged with different catheters in the aorta and an aortogram done did not show any origin of left main from the coronary cusps. These findings raised the suspicion of ALCAPA and was therefore referred for a Cardiac CT Angiogram to confirm the diagnosis. Cardiac CT Angiogram confirmed the origin of left main coronary artery arising from the pulmonary trunk and its absence of origin from the aorta. Patient was then started on beta blockers and was referred for cardiac surgery. However, despite extensive counseling by the cardiac team patient declined surgery.

Thoracic Aortic Pseudoaneurysm Presents as Hemoptysis and Hematemesis

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Abstract

Thoracic pseudoaneurysms are rare but typically present symptomatically similar to acute coronary syndrome, pericarditis,

pleuritis, aortic dissection or pulmonary embolism with non-specific and vague symptoms. Here, we report a case of a 59-year-old man who initially presented with sudden onset significant hemoptysis and hematemesis and was found to have a thoracic pseudoaneurysm on aortogram. This report showcases the potential for a rare presentation of thoracic pseudoaneurysms.

A Rapid Four-Ring MRI Coil Design Optimization Approach for Low Interference and Improved Body Loading Tolerance

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Abstract

Design accuracy of MRI system with dual-tuned four-ring birdcage coils remains challenging due to inter-coil interferences. In this work, we explore finite element method (FEM) to study the characteristics of a 4-ring birdcage coil. By comparing with measurement results, model/meshing and boundary complexities are balanced with simulation time to achieve reasonable model-to-hardware correlations while minimizing computation cost, which further allows fine tuning of resonance frequencies (Larmor) in magnetic resonance imaging (MRI) systems. In addition, RF coil designs may be optimized to improve radiative efficiency, and the effects of body tissue/fluid are also taken into consideration to ensure real-world imaging quality.

A Familial Case of Spontaneous Regression of Colloid Cyst of the Third Ventricle

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Abstract

Colloid cysts of the third ventricle are histologically benign epithelial lined tumors, characteristically located in the foramen of Monro. Incidental lesions in asymptomatic patients are managed with serial imaging. The lesion appears as a well-delineated hyperattenuated mass on nonenhanced CT. On MRI it appears isointense to hyperintense on T1-weighted images and hypointense to hyperintense on T2 sequences.

Learning Outcomes: Asymptomatic colloid cysts may take a regressive course with spontaneous rupture. Familial nature of colloid cyst of the third ventricle.

Automated Multi-Class Detection of Diabetic Retinopathy Using Deep Learning

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Abstract

Diabetic retinopathy is a leading cause of blindness among working-age adults. Performing routine retinal screening examinations on all diabetic patients is an unmet need, and there are many undiagnosed and untreated cases of diabetic retinopathy. Early detection of this condition is critical for good prognosis. In this paper, we demonstrate the use of convolutional neural networks (CNNs) on color fundus images for the recognition task of diabetic retinopathy staging. Large datasets were used to evaluate the model performance for the five-stage classification (normal, mild, moderate, severe and proliferate). Our network models achieved 96% specificity and validation sensitivity of 86%, 92% and 86 % for moderate, severe and proliferate classes, respectively. We also demonstrate that errors primarily occur in the misclassification of mild disease as normal due to the CNNs inability to detect subtle disease features. We observed that the MobileNet model improves specificity, sensitivity and accuracy by 5%, respectively, compared to the InceptionV3 model generally used in dealing with diabetic retinopathy and its speed is two times faster than the InceptionV3 model. These findings demonstrate that the potential benefit of our trained CNNs is that it can classify thousands of images every minute allowing it to be used in real-time whenever a new image is acquired which will allow clinicians make a quick diagnosis and instant response to a patient possible.

Virtual Poster Presentations

Magnetic Resonance and Computed Tomography in Differential Diagnosis of Ectopic Pancreatic Tissue and Retroperitoneal Tumor

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Abstract

The semiotics of retroperitoneal ectopia of pancreatic tissue with diligence to the gates of the kidney and jejunum according to magnetic resonance and computed tomography is presented. The MRI study was performed on the MRI 1.5 T in T2, T1, FatSat, DVI. On a series of MRI in T2 retroperitoneally between the left edge of the lumbar spine and dorsal surface of the loop of the jejunum, the gate of the left kidney was determined by the formation of 40 x 36 x 23 mm, with a predominantly hyperintensive signal, against which hypointensive concretions were traced, the presence of cystic and ductal structures. At the formation were determined concretions in the upper and lower poles. At DWI the formation was hyperintense –DK -1,99. CT Data mostly coincided with the results of MRI of retroperitoneal heterotopia of pancreatic tissue in the region of the jejunum. Retroperitoneal, at the level of the gate of the left kidney, a soft tissue formation was visualized, triangular in shape, adjacent to the loop of the jejunum 38 x 33 x 23 mm. Was visualized two calcifications 6 and 2 mm, lobed macrostructure, ductal structures. With bolus enhancement was determined uniform accumulation of contrast in formation. A biopsy of the detected retroperitoneal formation was performed, in the study of the material of which acinar cells of the pancreas were obtained. During MRI-CT monitoring for 2 years no data were obtained for the negative dynamics of the macrostructure heterotopia of pancreatic tissue of the identified.

Case Report: CT and MRI of Internal-ear Structures Aplasia

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Abstract

The results of computed tomography (CT) and magnetic resonance imaging (MRI) of a rare case the analysis of the images is performed and a detailed description of changes on CT and MRI studies is given. This case of aplasia is characterized by symmetrical agenesia of the bilateral aplasia of cochlea and semicircular canals of the inner ear are presented. In this article cochlea and semicircular canals, and bilateral abnormality of the facial nerve canal, and abnormality of the internal auditory foramen on both sides, as well as unilateral agenesis of the abducent nerve and bilateral agenesis vestibulocochlear nerve. Results of the study indicates a high informative method of CT in the diagnosis of the inner ear abnormalities, as well as the possibility of using MRI in visualizing the cerebellopontine angle for the entire description of its clinical picture. This work was supported by a grant RFBR (18-34-00439_mol_a).

The Possibility of CT Angiography in the Diagnosis of Lung Defects in Newborns

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Abstract

The aim of the study is to prove the informative value of MSCT in the detection of rare congenital lung malformations in newborns by demonstrating rare cases. The truth that congenital malformations of the lungs are one of the most difficult diagnostic problems in radiology, was confirmed in the child (33 days of life) when performing a review radiograph, where he was suspected of diaphragmatic hernia, about which the laparotomy operation was performed. The defect of the diaphragm was not found, and due to the lack of x-ray dynamics, they thought about retroperitoneal formation. To exclude neuroblastoma

transferred to our hospital. MSCT with bolus contrast was carried out in the arterial phase, an airless formation with a leading vessel Ø 5 mm was revealed at the level of the thoracic aorta, which was drained into the portal vein. The presence of an aberrant vessel indicates the sequestration of the left lung with its own pleura-extralobar form. This is quickly confirmed in 1 month. 8 days after removal of extrapulmonary sequestration in the left lung. Conclusions: Diagnosis of congenital malformations of the bronchopulmonary system requires a comprehensive approach using the most informative research methods, such as computed tomography. Defects of the bronchopulmonary system are often accompanied by congenital anomalies of other organs and systems, often - vessels of the small circle of blood circulation. Thus, MSCT angiography plays a crucial role in the diagnosis of rare congenital lung malformations, for selection of adequate tactics of surgical treatment, taking into account the localization and prevalence of the process.

Gallbladder Strangulation Secondary to an Omental Band: An Extremely Rare Cause of Gallbladder Perforation

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Abstract

Introduction: Gallbladder strangulation due to an omental band is an exceedingly rare cause of gallbladder ischemia and subsequent perforation with very few reported cases in literature. We present the case of a 91 year-old female who presented with right upper quadrant pain for 3 days and a collateral history suggestive of delirium. She had a background of dementia, ischemic heart disease, and osteoporosis with a surgical history of abdominal hysterectomy. On examination, her abdomen was distended but soft and not peritonitic. Her WCC was 8 and CRP was 21. An abdominal CT suggested acute cholecystitis and an US abdomen demonstrated a perforated gallbladder with no gallstones. She was commenced on intravenous antibiotics and underwent emergency laparoscopic cholecystectomy.

Methods: A Hasson umbilical entry was conducted, pneumoperitoneum established and 5mm ports inserted under vision. Inspection of the intra-abdominal cavity revealed a grossly enlarged, strangulated gallbladder secondary to an omental band across the neck of the gallbladder. Adhesiolysis was performed on the omental band and dissection of Calot's triangle was performed. Intraoperative cholangiogram was not conducted due to an acalculous pathology and cholecystectomy was uneventful.

Results: Histopathology confirmed an ischemic gallbladder with no evidence of malignancy. The patient was discharged day 5 post-operatively due to a requiring home services prior to discharge.

Conclusion: There are very few reported cases of gallbladder strangulation due to an omental adhesion. Certainly, there are no reported cases of gallbladder perforation due to the aforementioned pathological process. Clinicians should be aware of this rare pathology.

Role of MR Neurography in the Diagnosis of Brachial Plexitis

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Abstract

Background: The diagnosis of brachial plexitis is based on history and clinical findings. EMG and MR findings are supportive. MR neurography can detect focal and multifocal inflammation within nerves.

Objective: To determine if MR neurography allows objective data mirroring clinical improvement in brachial plexitis.

Observation: A 39-year-old man developed sudden onset pain in his left arm, which started after an infection and intensified over the next 3-4 days. Weakness shortly followed with inability to lift his left arm above the level of his shoulder. There were no sensory symptoms. There was a remote history of Bell's palsy, but no relevant family history. Initial examination showed weakness of the left deltoid and infraspinatus (2/4). Reflexes were present. EMG/NCV studies showed a left C5 radiculopathy, primarily involving the anterior ramus division with severe denervation of C5 innervated muscles. An MR neurography of the left brachial plexus with gadolinium showed an enlarged, hyperintense area in the C5 nerve root at the level of the insterscalene triangle with a denervation pattern edema of regional muscles. The patient was treated with IVIG with subsequent improvement. Ten months after onset, strength of all muscles is normal, although muscle bulk is less than before

illness. Serial MRIs show progressively decreasing nerve root hyperintensity and size in the post foraminal nerve root. The last MRI and EMG/NCS are normal, correlating with the clinical syndrome.

Conclusion: MR neurography of the brachial plexus may be important in diagnosis and prognosis in patients brachial plexitis.

Sacrococcygeal Teratoma Type III in Female Infants

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Abstract

Introduction: Sacrococcygeal teratomas are rare tumors that develop at the base of the spine by the tailbone (coccyx) known as the sacrococcygeal region and is a congenital (present at birth) growth or tumour that develops at the base of the spine just above the buttocks and its a relatively uncommon tumor affecting neonates, infants, and children with a female preponderance. Age is an important predictor of malignancy in sacrococcygeal tumors.

Case presentation: We report a rare case of congenital type III cystic teratoma that may be falsely diagnosed as an anterior sacral myelomeningocele. A 1-year-old female patient complained of swelling in the coccyx area and a few weeks later his stomach felt enlarged. On x ray examination, soft tissue mass was found in the coccyx area with decree in the area. Ultrasound shows a solid and cystic components and fluid in the stomach. CT scan examination shows the inhomogenic hypodense mass with a relatively regular border septaic is in the upper abdomen to the pelvic cavity which seems to be related to the left sacrum mass with a size of 17.5 x 8.7 x 16.4 cm in the upper abdomen to the pelvic cavity that appears to be associated with a left sacral mass measuring 5.4 x 4.4 x 6, 6 cm. Then surgery is carried out with the technique of wide resection of benign lesions with coccygectomy, we found that the cyst consisted of a mostly thin, white wall, but also with small posterior narrow nodules.

Conclusion: Early diagnosis and complete excision with removal of the coccyx is associated with good prognosis, so it will help in the selection of management quickly and precisely.

Primary Cardiac Pleomorphic Liposarcoma: A Case Report and Imaging Review

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Abstract

Primary cardiac liposarcomas are extraordinarily rare tumors with no well-defined imaging characteristics or treatment guidelines. Overall, the prognosis is poor due to advanced stage at presentation, non-specific presenting symptoms, limited treatment options, rarity of disease, and delays in diagnosis. Often, liposarcomas are first found and diagnosed through imaging studies, with subsequent management guided by imaging findings. We report a case of a 72-year-old female who presented to the hospital from her primary care physicians office with symptoms of respiratory edema. With the help of multimodality imaging including chest radiographs, echocardiograms, a CTA of the chest, cardiac MRI, and PET/CT, she was diagnosed with pathology-proven cardiac liposarcoma. In the process, we discovered that the imaging features correlate with dedifferentiated liposarcomas found elsewhere in the body, including heterogeneous solid soft tissue mass with interspersed regions of myxoid and fatty tissues of variable amounts, lobulated in appearance, and resultant mass effect on adjacent structures. Furthermore, we demonstrate how cardiac imaging is essential for defining tumor characteristics, guiding surgical approach, and identifying potential complications. In our patient, imaging features helped to lead to her ultimate diagnosis, and treatment with eribulin mesylate proved effective in reducing the size and hypermetabolism of her primary cardiac liposarcoma.

Endovascular Repair of Traumatic Popliteal Artery Dissection in a Complex Polytrauma Patient

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Abstract

Introduction: Endovascular repair of arterial occlusions in the setting of major trauma is not a well-established modality. We present the case of a 39 year-old male who presented post motorbike accident suffering from acute Rutherford IIa lower limb arterial ischemia with complex compound fractures of his femur, tibial head, and fibula. A CT Angiogram showed an abrupt cut-off of contrast at the level of the popliteal artery posterior to his tibial plateau fracture with distal reconstitution of vessels. As he was sensorimotor intact, a decision was made for external fixation of his femur and a diagnostic angiogram was performed immediately afterward.

Methods: Diagnostic angiogram confirmed an occlusive dissection posterior to the tibial plateau fracture. Slippery wire was used to cross the occlusion into true lumen distally and the lesion was stented with Viabahn® 5 x 5 cm endoprosthetic stent and ballooned with restoration of perfusion.

Results: Although perfusion was restored, he developed compartment syndrome requiring fasciotomies and internal fixation of his femur. He also developed heparin induced thrombocytopenia with stent thrombosis and massive pulmonary embolism both requiring catheter directed lysis during his admission. He was transferred day 57 to a rehabilitation facility with an angiogram-confirmed patent stent prior to discharge. He was independent with a forearm support frame on transfer.

Conclusion: There are very few reported cases of endovascular management of arterial occlusions of the lower limb in the setting of trauma. This case highlights the potential for the role of endovascular repair in trauma and need for future research in this area.

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