Message From The Chair and Co-Chair

Barry D. Pressman, MD, FACR, Chair
M. Marcel Maya, MD, Co-Chair

We are pleased to present you with our latest newsletter to keep you informed of the breadth and depth of our clinical and research activities.

During the past year we have undertaken several initiatives to ensure the quality and safety of patient care and enhance patient satisfaction – efforts that are in line with Cedars-Sinai’s goals of improving efficiency and controlling costs while maintaining the highest standards of care. These include:

I. Imaging Computerized Decision Support at the time of ordering to enhance the choice of appropriate studies: This will be implemented in advance of a 2020 federal mandate. Until the implementation is completed, we encourage you to contact imaging physicians (310 423-6500) when you have questions as to the appropriate imaging study.

II. Reducing unnecessary admissions of dialysis patients with clotted fistulas: This multidisciplinary process is being developed in consultation with the Procedure Center, the Nephrology Section, the Emergency Department and the Surgery Department. The initiative has already achieved a reduction in unnecessary admission and delayed services.

III. Streamlined pre- and post-iodinated intravenous contrast studies: By using recently acquired dual-energy CT acquisition techniques, some of these examinations will no longer require the pre-contrast component, which can be created from the post-contrast study. This process will reduce patient radiation, expedite examinations and enhance diagnostic information.

IV. Expansion of literature guidelines and references in imaging reports to guide clinicians in choosing appropriate follow-up to imaging findings.

V. Cost Reduction for imaging studies and procedures through standardization of supplies, such as contrast agents and devices, for imaging studies and procedures.

VI. Increased Imaging hours and reduced turnaround time: The addition of two new CT scanners in the Emergency Department has reduced the load on other scanners and thereby improved turnaround times and patient throughput for the Emergency Department and inpatients.

VII. Utilization of Artificial Intelligence (AI) in imaging studies: We recently implemented AI for detection of cerebral hemorrhage and cervical spine fracture, allowing for expedited review of positive studies that have been detected by the AI program. Additional future modules include detection of free air in the abdomen, pneumothorax, and pulmonary infiltrates. We will soon start a trial evaluating detection of compression fractures in routine CT patients as a surrogate for early detection of osteoporosis.

VIII. Inpatient educational videos: Recently published articles show that better patient understanding of their imaging studies leads to greater satisfaction. As part of our continuing effort to improve patient communication, we introduced educational videos for patients scheduled for imaging and interventional procedures. The videos, available for patients to watch in their rooms, cover all aspects of the imaging exam experience.
Radiologists With Subspecialized Training in Musculoskeletal Disorders Play a Pivotal Role in Bone Tumor Diagnosis and Treatment

“The quality of the musculoskeletal interventional radiologists at Cedars-Sinai allows programs like the sarcoma service to achieve the highest level of care because you are only as strong as your weakest link, and we have no weak links here,” Earl W. Brien, Surgical Director of the Sarcoma and Bone Tumor Program.

Thomas J. Learch, MD
Chief, Musculoskeletal Imaging

The diagnosis, treatment planning and therapy of sarcomas and bone tumors require state-of-the-art imaging systems, exceptional expertise in the unusual nature of these diseases and close collaboration among multidisciplinary team members. With improvements in imaging technology in recent years, radiologists with subspecialized training in musculoskeletal disorders and musculoskeletal interventions play a vital role in the coordination of pre- and post-treatment care.

A carefully timed and highly coordinated partnership is especially important when an undiagnosed bone lesion could turn out to be a sarcoma. Using image guidance, radiologists perform percutaneous needle biopsies that rival open biopsies for diagnostic and staging purposes, with lower cost and reduced risk of complications. But even with this minimally invasive approach, cancerous cells can escape into the biopsy track, and survival rates are low if sarcomas recur at the local site.

“Most sarcomas can now be surgically removed without amputation through limb-sparing surgery, and we work closely with Dr. Brien in reviewing images and planning biopsies and treatment. We make sure that the path we use for the biopsy needle is the same path that Dr. Brien will use for the surgery because removing tissue involved in the biopsy track along with the tumor reduces the risk of recurrence,” said Thomas J. Learch, MD, chief of musculoskeletal radiology and director of the Diagnostic Radiology Residency at Cedars-Sinai.

Earl W. Brien, MD, co-director of Orthopedic Oncology in the Samuel Oschin Comprehensive Cancer Institute and surgical director of the Sarcoma and Bone Tumor Program, said he and the musculoskeletal radiologists – Learch, Joseph Giaconi, MD, and Joseph Robinson, MD – are in communication daily to be sure diagnostic procedures and treatments are performed in the most efficient way possible.

“When the radiologists see something abnormal, they immediately call me. This team approach is critical to outcome, but it is also beneficial for patients who travel from a distance,” Brien said, adding that a new patient will typically be seen in clinic on a Tuesday morning, and biopsies will be performed that afternoon. Pathology results will be reviewed Wednesday, and surgery or an alternative treatment will be scheduled for Thursday. Because sarcomas are rare – only about 12,000 cases of soft tissue sarcoma and 1,000 cases of bone sarcoma are diagnosed each year – and because only a few centers offer specialized multidisciplinary expertise, patients come to Cedars-Sinai from throughout Southern California and beyond.

Giaconi, who is the director of the Musculoskeletal Radiology Fellowship at Cedars-Sinai, said it is not uncommon for a patient to arrive from an outside institution with a misdiagnosis because scans often
have been read by radiologists who do not have specialized training in musculoskeletal imaging.

“We routinely double-read scans because there are common misdiagnoses, such as a benign popliteal cyst or hematoma being identified as a sarcoma, or vice versa. Radiologists with subspecialized musculoskeletal training can narrow down a differential tumor diagnosis based on imaging alone, and then can cinch the diagnosis with a percutaneous biopsy,” he said.

In addition to assisting in diagnosis and treatment planning, the radiologists perform image-guided ablation procedures. “Percutaneous, image-guided ablations can destroy certain low-grade tumors such as osteoid osteomas or leiomyosarcoma, or can be used to treat painful metastases,” said Giaconi.

Bimonthly tumor board meetings are held in which all musculoskeletal tumors, including sarcomas, are reviewed. The imaging and biopsy of the tumor are reviewed by the team of musculoskeletal radiologists, Brien, and Bonnie Balzer, MD, PhD, vice chair for Anatomic Pathology and director of the Musculoskeletal Pathology Service, to ensure an accurate diagnosis. Radiation oncologist Behrooz Hakimian, MD, and medical oncologist Charles Forscher, MD, also attend these meetings and provide radiation therapy and medical therapy expertise. This team of doctors, under the direction of Brien, is able to plan and deliver the best course of treatment for any particular tumor.

“The quality of the musculoskeletal interventional radiologists at Cedars-Sinai allows programs like the sarcoma service to achieve the highest level of care because you are only as strong as your weakest link, and we have no weak links here,” Brien said.

Clinical Highlights

CT guided biopsy of right knee shows the biopsy needle (arrow) in the thick rind of hypertrophic soft tissue (brackets) growing out from the distal femur (*) in sun burst pattern in osteosarcoma.

Frontal x-ray of the right femur shows osteosarcoma growing in and out of the distal right femur. The cloudy like areas of increased sclerosis, and sunburst periostitis (arrow), and location of distal femur are classic features of osteosarcoma.

Coronal STIR MRI of the right femur shows osteosarcoma growing in the distal femur and out of the femur in a sun burst pattern (arrow). Note the normal bone of the femur in the midshaft is low signal (*).

Coronal STIR MRI of the right scapula/shoulder shows a large, multilobular chondrosarcoma (bright white lesion) which is growing out of the deep surface of the inferior scapula. Asterisk: Subscapularis muscle. Arrow: Tip of scapula.

Transverse STIR MRI of the right scapula shows the chondrosarcoma (white lesion) growing out of the deep surface of the right scapula. Only a very small portion of the normal scapula can be seen. Asterisk: Right lung.

Transverse CT of the right scapula shows the biopsy trocar within the scapula, through which the biopsy needle will be placed to obtain core samples of the chondrosarcoma growing out of the deep surface of the scapula.
Neuroradiology Tools Are Instrumental in Diagnosing, Locating and Repairing Spontaneous Cerebrospinal Fluid Leaks

“Patients with CSF leaks travel from all over the world to seek care at Cedars-Sinai, because we have the expertise and vast experience in diagnosing and treating the most complex and challenging cases.”

M. Marcel Maya, MD
Co-Chair Department of Imaging

Spontaneous intracranial hypotension can evade detection and resist treatment, which is why many patients come to Cedars-Sinai, where interventional neuroradiologists in the Department of Imaging have the subspecialty training and diagnostic imaging tools to manage the most challenging cases – often after unsuccessful treatment at other medical centers.

Interventional neuroradiologist M. Marcel Maya, MD, co-chair of the Department of Imaging, said spontaneous intracranial hypotension is rarely caused by inadequate CSF production or rapid CSF absorption, but almost always results from a spinal CSF leak. Magnetic resonance studies of the brain and spine, along with MR myelography, are the imaging tests of first choice, but others are useful in certain situations.

“In addition to craniospinal MRI and MR myelogram, many patients still require a true myelographic procedure,” Maya said, adding that the type of CT myelogram depends on whether the leaks are slow, intermediate or fast. Digital subtraction myelography, performed in an angiographic suite under general anesthesia, is particularly useful for imaging high-flow and ventral leaks, as well as leaks that otherwise evade detection. Dynamic CT-guided myelograms, in which contrast is introduced in the CT suite to provide rapid imaging sequences, is better suited for identifying intermediate leaks in select patients.

“An accumulation of CSF does not necessarily identify the source of a leak,” Maya said. “A combination of MR, CT and myelography may be necessary to find the site of leak. In one example, a patient with severe symptoms and debilitation was referred to us after an extensive, inconclusive work-up. Using DSM, we were able to identify CSF-venous fistula, a relatively uncommon cause of leak, and the patient was successfully treated.”

Most spinal CSF leaks stem from nerve root cysts, a hole or tear in the dura, a bony abnormality or a “nude nerve root,” in which a nerve root exiting the theca lacks a dural sleeve – a condition related to connective tissue disorders. In one small study, 22 percent of patients were found to have a connective tissue disorder.

Franklin G. Moser, MD, MMM, FACR, an interventional neuroradiologist and the clinical chief of neuroradiology, said spontaneous intracranial hypotension is not a rare disorder, but neither is it common, with a prevalence estimated at only 1 in 50,000 and an incidence of 5 in 100,000 people per year. He said Cedars-Sinai’s team has treated patients ranging in age from 2 to 91.

“Symptoms can be somewhat vague, making diagnosis and treatment difficult in hospitals that lack specialized neuroradiology and neurosurgical expertise,” he said, adding that while headache is the hallmark clinical manifestation, with orthostatic headache being the most common variety, some patients experience non- positional, reverse orthostatic, exertional or other types of headaches. Less frequent presentations may be as mild as neck pain or as severe as coma.

Minimally Invasive Approaches to Diagnosis and Treatment

Initial symptom management typically includes bedrest, oral hydration, oral caffeine and the use of an abdominal binder to increase fluid pressure in the head. Patients with severe symptoms may require an intrathecal infusion of saline or artificial CSF.

Minimally invasive therapies are curative in most cases. The first choice of intervention is an epidural blood
patch, which is usually very effective, although the procedure may need to be repeated more than once. If blood patches fail or urgent treatment is needed, percutaneous placement of a fibrin sealant is usually option No. 2.

Surgery may be needed to provide immediate intervention for an extremely sick patient, to suture or directly patch a hole, to repair a CSF-venous fistula, or to correct other underlying problems.

“At a large center like Cedars-Sinai, treating spinal CSF leaks has become routine, but we have to remember that this is not routine everywhere. We often get calls from patients around the country who are not able to get the care and treatment they need,” said neurosurgeon Wouter Schievink, MD, an internationally known expert in the treatment of CSF leaks. Schievink is director of Cedars-Sinai’s CSF Leak Program and the Microvascular Neurosurgery Program.

“In both diagnostic and treatment procedures, we strive to be as minimally invasive and even noninvasive as possible, while also exposing patients to as little radiation as possible,” Schievink said. “We’re fortunate to have a highly specialized team, with interventional neuroradiologists who do the diagnostic imaging and percutaneous procedures. Blood patches are an excellent first treatment, and they can be done multiple times, but not forever. Dr. Moser and Dr. Maya started doing fibrin glue injections about 15 years ago, and I think it’s a very good treatment to help patients avoid surgery.”

Digital subtraction myelography in the investigation of post-dural puncture headache in 27 patients: technical note

Wouter I. Schievink, MD; M. Marcel Maya, MD; Franklin G. Moser, MD, MMM, FACP


Objective: Post–dural puncture headaches are common, and the treatment of such headaches can be complex when they become chronic. Among patients with spontaneous spinal CSF leaks, digital subtraction myelography (DSM) can localize the exact site of the leak when an extradural CSF collection is present, and it can also demonstrate CSF-venous fistulas in those without an extradural CSF collection. The authors now report on the use of DSM in the management of patients with chronic post-dural puncture headaches.

Conclusions: Digital subtraction myelography is able to precisely localize the dural puncture site in patients with a post–dural puncture headache and an extensive extradural CSF collection, and it may rarely detect a CSF-venous fistula in such patients without an extradural CSF collection.

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Cedars-Sinai Study Supports Use of Gadobutrol for Contrast-Enhanced MRI

“Our study provides additional support and greater clarity on the use of macrocyclic GBCAs.”

Franklin G. Moser, MD, MMM, FCR
An interventional radiologist and Clinical Chief of Neuroradiology

Since the early days of MRI, most contrast agents have been gadolinium-based. Like other rare earth elements, free gadolinium is toxic to humans because it interferes with calcium channel-dependent processes and DNA binding. But gadolinium-based contrast agents (GBCAs), formed by using a chelate of an organic compound, are considered safe in patients without renal failure. In terms of gadolinium deposition in the brain, however, the way the element is chelated matters.

We recently published a study in the American Journal of Neuroradiology showing that repeated doses of the contrast agent gadobutrol, a macrocyclic gadolinium-based contrast agent, does not increase signal intensity in the brains of patients undergoing unenhanced T1-weighted MRIs for brain tumor surveillance – in contrast to gadolinium-based agents with linear chelation.

This supports a growing body of evidence suggesting that macrocyclic GBCAs are less likely than their predecessors to deposit gadolinium in the brain.

High-dose gadolinium-enhanced MR was introduced in the early 1990s for the evaluation of brain metastases. In 2001, researchers reported detecting leakage into subarachnoid space, and in recent years gadolinium deposition was found in biopsied and resected brain tumors as well as in normal brain tissues. There is no scientifically verified evidence that gadolinium in the brain causes neural tissue injury or neurologic symptoms, but in 2017 a committee of the European Medicines Agency recommended the discontinuation of four linear GBCAs.

Although results from earlier studies have varied, macrocyclic chelating agents have generally been found more stable than linear ones, binding gadolinium more tightly and having lower dissociation rates.

Our study, like those of previous authors, compared signal intensity ratios between the globus pallidus and pons as well as the dentate nucleus and pons. Unlike other studies, ours provided a direct comparison between linear and macrocyclic GBCAs, thanks to an institution-wide contrast formulary policy change that took place six years ago.

Prior to 2011, Cedars-Sinai exclusively used two linear, nonionic contrast agents. Between 2011 and February 2012, we primarily used gadobenate dimeglumine, a linear, ionic agent. After that date, we have exclusively used gadobutrol, a macrocyclic agent. This provided a population of patients receiving only a macrocyclic agent for comparison against the earlier population receiving only linear GBCAs.

Retrospectively analyzing records of patients who underwent a series of brain MRIs – 59 patients receiving only gadobutrol and 60 receiving only linear GBCAs – we looked at signal intensity at the first and seventh scans. As expected, a significant signal intensity increase was seen in those in the linear agent group, but not in the gadobutrol group. In fact, although it was not statistically significant, patients receiving gadobutrol showed an unexpected decrease in signal intensity between the first and seventh study.

We’re unsure why this occurred, but one possibility is that gadobutrol helped clear previously deposited gadolinium from prior administrations.

Our study provides additional support and greater clarity on the use of macrocyclic GBCAs like gadobutrol in reducing gadolinium deposition in the brain. The neuroradiology team continues to take a leadership role in the advancement of imaging technology to benefit physicians, researchers and patients locally and nationwide.

See also: Putting Knowledge Into Practice: Gadolinium-Based Contrast Agents in MRI. With Franklin G. Moser, MD; Gordon Sze, MD; and Alexander Radbruch, MD, JD. Conference video, April 23, 2017.
Dose and Quality Optimization Through Science

Jimmy (Yifang) Zhou, PhD; Alexander Scott, PhD; Jessica Nute, PhD; and Christina Lee, BS

The imaging physics group supports a wide range of imaging modalities across the institution. The physicists are all board certified by American Board of Radiology. We ensure regulatory compliance of all imaging equipment and play an instrumental role in acquiring and maintaining national accreditation. The group also has established an approach to optimizing radiation dose and image quality through two avenues: research and innovation, and clinical data analysis.

In research and innovation, we have focused on the task-based assessment of CT low-contrast detectability and minimum dose. We identified the relationship of the dose to minimum detectable contrast and the lesion size, stating this in the form of a power law, and we established the explicit patient size dependency of this relationship. Published in peer-reviewed journals and resulting in the awarding of a U.S. patent, this work helps clinicians “image gently” and “image wisely,” in keeping with campaigns of the American College of Radiology and other professional organizations.

Employing the physics practice of using a data-driven approach, we identified outliers and investigated causes, allowing for evidence-based protocol optimization especially for challenging cases. With this approach, we can now evaluate imaging technique and dose data at a very high level.

Figure 1 demonstrates patient dose tracking for two different CT scanners. Figure 2 demonstrates the clinical image quality improvement after performance of phantom studies for significant metal artifact reduction.

Another example is the exposure reduction in digital radiography (DR). We currently collect and review data on more than 30,000 DR X-rays per month. The institution’s average rejection rate, 15% when we started tracking, has been brought down to 2%, even as we have brought on new facilities. The effort also involved frequent education provided by our group on DR quality and dose. Figure 3 shows a drop of the exposure index from 1600 to 1400, amounting to exposure reduction by 37%.

Figure 1: Dose comparison of GE 750 HD CT scanner with the new GE from routine abdomen pelvis studies. The overlap at typical patient sizes indicates the dose modulation was employed appropriately for the new scanner. The deviation at larger patient sizes indicates the more powerful tube on the new Revolution CT, allowing improved image quality for obese patients.

Figure 2: Significant image quality improvement for a patient with bi-lateral hip prostheses. The metal diameter was 4 cm.

Figure 3: DR exposure index reduction after the physicist’s intervention.
Research Highlights

High Signal Intensity in the Dentate Nucleus and Globus Pallidus on Unenhanced T1-Weighted MR Images: Comparison between Gadobutrol and Linear Gadolinium-Based Contrast Agents

FG Moser, CT Watterson, S Weiss, M Austin, J Mirocha, R Prasad, and J Wang


Abstract

Background and Purpose:

In view of the recent observations that gadolinium deposits in brain tissue after intravenous injection, our aim of this study was to compare signal changes in the globus pallidus and dentate nucleus on unenhanced T1-weighted MR images in patients receiving serial doses of gadobutrol, a macrocyclic gadolinium-based contrast agent, with those seen in patients receiving linear gadolinium-based contrast agents.

Conclusions:

Successive doses of gadobutrol do not result in T1 shortening compared with changes seen in linear gadolinium-based contrast agents.

Imaging Evaluation of the Head and Neck Oncology Patient

Ravi Prasad, MD, and Beth Chen, MD, PhD


Abstract: Imaging plays a multifaceted role in the diagnosis and characterization of head and neck oncological patients and is integral to their care. Given the complexity of treatment, a multimodality approach is often necessary. With the advent of new technologies, imaging can also be used to predict tumor behavior and treatment response. In this chapter, with selected case examples, we describe the various imaging modalities available and offer suggestions on their utilization.

Head and neck cancers account for roughly 500,000 cases worldwide and comprise 3% of all malignancies in the United States. Head and neck radiology plays a critical role in the initial identification, assessment, and surveillance of these tumors, often requiring a multimodality approach. The head and neck radiologist interpretation during tumor board can restage a tumor, sway decision-making about surgical resectability, or prompt a further workup for suspicious or benign-appearing lesions that are either locoregional or distant. We provide an overview of the various imaging modalities available, offer guidelines for each modality’s utility in the cancer workup, and introduce more advanced imaging techniques to characterize tumors on a molecular level.

Above: Sample images showing obvious signal increase, indicated by arrows, after 6 injections of linear GBCAs (B) compared with the baseline scan (A)

Above: Oral cavity cancers. (a) Axial T1 post contrast shows left hard palate cancer (b) Contrast CT shows right floor of mouth cancer with involvement of adjacent mandible and buccal mucosa (arrow) (c) axial T1 post contrast and (d) PET-CT show right lateral tongue mass. This lesion was masked by dental artifact on the conventional CT neck but easily seen on MRI and PET-CT.
Pituitary Imaging
Barry D. Pressman, MD

Key Points:
- In the past, a number of indirect techniques including plain radiography, pneumoencephalography, and angiography were used to diagnose pituitary masses.
- The advent of CT allowed for diagnosis of pituitary lesions by direct visualization of the gland. However, contrast sensitivity to lesions with CT is limited, although CT does offer advantages in that it is particularly excellent for detecting calcification bone detail such as erosion of the sella turcica.
- MRI offers superb contrast resolution and very good spatial resolution. Therefore, it can be used to detect, characterize pituitary and parasellar regions with great accuracy. MRI permits follow up of lesions.

Introduction: Before the advent of CT, plain radiography, pneumoencephalography, and angiography were used to diagnose pituitary masses. Plain radiography allowed for evaluation of the size, shape, and bony erosion of the sella turcica. Pneumoencephalography offered indirect evaluation of the superior shape and size of the pituitary gland as it extended into the suprasellar space. Angiography demonstrated lateral displacement of the carotid arteries by macroadenomas that impressed on or extended into the cavernous sinus. More recently CT, and then especially MRI, made it possible to primarily delineate lesions within and around the pituitary gland rather than depending on secondary information that could only suggest their presence.

Motion-Corrected Imaging of the Aortic Valve with $^{18}$F-NaF PET/CT and PET/MRI: A Feasibility Study
Mhairi K. Doris, Mathieu Rubeaux, Tania Pawade, Yuka Otaki, Yibin Xie, Debiao Li, Balaji K. Tamarappoo, David E. Newby, Daniel S. Berman, Marc R. Dweck, Piotr J. Slomka, and Damini Dey
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We investigated whether motion correction of gated $^{18}$F-fluoride PET/CT and PET/MRI of the aortic valve could improve PET quantitation and image quality.

Methods: A diffeomorphic, mass-preserving, anatomy-guided registration algorithm was used to align the PET images from 4 cardiac gates, preserving all counts, and apply them to the PET/MRI and PET/CT data of 6 patients with aortic stenosis. Measured signal-to-noise ratios (SNRs) and target-to-background ratios (TBRs) were compared with the standard method of using only the diastolic gate. Results: High-intensity aortic valve $^{18}$F-fluoride uptake was observed in all patients. After motion correction, SNR and TBR increased compared with the median diastolic gate (SNR, 51.61 vs. 21.0; TBR, 2.85 vs. 2.22) and the median summed data (SNR, 51.61 vs. 34.10; TBR, 2.85 vs. 1.95) (P 5 0.028 for all). Furthermore, noise decreased from 0.105 (median, diastolic) to 0.042 (median, motion-corrected) (P 5 0.028). Conclusion: Motion correction of hybrid $^{18}$F-fluoride PET markedly improves SNR, resulting in improved image quality.

Above: Fused PET/CT angiograms of 79-yr-old woman with aortic stenosis. Shown are original diastolic gate (A), summed image (B), and motion-corrected image (C) with focal $^{18}$F-fluoride uptake (arrows). Right: T1-weighted postcontrast coronal image with an intrasellar mass extending into the suprasellar space. Note the narrowing of the tumor as it extends through the diaphragmatic sellae (arrows).
Pericoronary Adipose Tissue Computed Tomography Attenuation and High-Risk Plaque Characteristics in Acute Coronary Syndrome Compared With Stable Coronary Artery Disease

Markus Goeller, MD; Stephan Achenbach, MD; Sebastien Cadet, MS; Alan C. Kwan, MD; Frederic Commandeur, PhD; Piotr J. Slomka, PhD; Heidi Gransar, MSc; Moritz H. Albrecht, MD; Balaji K. Tamarappoo, MD, PhD; Daniel S. Berman, MD; Mohamed Marwan, MD; Damini Dey, PhD


Objective: To determine whether high-risk plaque characteristics from coronary CTA are associated with PCAT CT attenuation in patients with a first acute coronary syndrome (ACS) and matched controls with stable coronary artery disease (CAD).

Design, Setting, and Participants: This retrospective, single-center case-control study (data were acquired at the University of Erlangen from 2009-2010) analyzed the CTA data sets of 19 patients who presented with ACS and 16 controls with stable CAD who were matched based on sex, age, and risk factors. Study observers were blinded to patients' clinical data. Semiautomated software was used to quantify and characterize plaques. The CT attenuation (Hounsfield unit [HU]) of PCAT was automatically measured around all lesions.

Conclusions and Relevance: Pericoronary CT attenuation was increased around culprit lesions compared with nonculprit lesions of patients with ACS and the lesions of matched controls. Combined quantitative high-risk plaque features and PCAT CT attenuation may allow for a more reliable identification of vulnerable plaques.

Comparison of the Coronary Artery Calcium Score and Number of Calcified Coronary Plaques for Predicting Patient Mortality Risk

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Abstract: Multiple coronary artery calcium (CAC) parameters have recently been proposed to improve risk prediction in patients with intermediate clinical risk based on CAC scoring, but outcome data that assess these variables are relatively sparse. We analyzed data from 11,633 consecutive asymptomatic patients undergoing CAC scanning that were followed for 8.8 ± 3.5 years for all-cause mortality (ACM). The patients who had coronary artery calcification were grouped by the number of calcified coronary plaques: 0, 1 to 5, 6 to 20, and >20 plaques. We examined the independent prognostic value of plaque number and its synergistic prognostic value when added to the CAC score. We observed a stepwise increase in ACM with increasing plaque number. In patients with a CAC score of 1 to 99, 6 plaques or more were associated with increased mortality. In patients with CAC scores of 100 to 399, there was a stepwise increase in ACM with increasing plaque number. For CAC >400, the risk of ACM was high regardless of plaque number. After risk adjustment, the number of plaques was a significant predictor of risk for ACM in the patients with an intermediate CAC score. In these patients, additional consideration of plaque number improved net reclassification improvement for predicting ACM by 29%. In conclusion, the number of calcified plaques adds to risk stratification beyond the CAC score in patients with intermediate CAC scores.

Left: Quantification of coronary plaques and pericoronary adipose tissue (PCAT) computed tomography (CT) attenuation of a culprit lesion in the mid left anterior descending coronary artery. A, Axial view and range of Hounsfield units (HU) to detect pericoronary fat (PCAT color map ranging from bright yellow [−30 HU] to dark red [−190 HU]). B, Cross-section and straightened view of PCAT measure. C, Cross-section and straightened view of plaque measure (noncalcified plaque highlighted in red). D, Curved multiplane review of PCAT measure.
Genes Involved in Prostate Cancer Progression Determine MRI Visibility

Ping Li, Sungyong You, Christopher Nguyen, Yanping Wang, Jayoung Kim, Deepika Sirohi, Asha Ziembiec, Daniel Luthringer, Shih-Chieh Lin, Timothy Daskivich, Jonathan Wu, Michael R Freeman, Rola Saouaf, Debiao Li, Hyung L. Kim

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Abstract: MRI is used to image prostate cancer and target tumors for biopsy or therapeutic ablation. The objective was to understand the biology of tumors not visible on MRI that may go undiagnosed and untreated.

Methods: Prostate cancers visible or invisible on multiparametric MRI were macrodissected and examined by RNAseq. Differentially expressed genes (DEGs) based on MRI visibility status were cross-referenced with publicly available gene expression databases to identify genes associated with disease progression. Genes with potential roles in determining MRI visibility and disease progression were knocked down in murine prostate cancer xenografts, and imaged by MRI.

Results: RNAseq identified 1,654 DEGs based on MRI visibility status. Comparison of DEGs based on MRI visibility and tumor characteristics revealed that Gleason score (dissimilarity test, p<0.0001) and tumor size (dissimilarity test, p<0.039) did not completely determine MRI visibility. Genes in previously reported prognostic signatures significantly correlated with MRI visibility suggesting that MRI visibility was prognostic. Cross-referencing DEGs with external datasets identified four genes (PHYHD1, CENPF, ALDH2, GDF15) that predict MRI visibility, progression free survival and metastatic deposits.

Conclusions: Genes involved in prostate cancer progression and metastasis determine MRI visibility, indicating that MRI visibility has prognostic significance. MRI visibility was associated with genetic features linked to poor prognosis.

Thyroid Cancer: Ultrasound Imaging and Fine-Needle Aspiration Biopsy

Michelle Melany, MD; Sardius Chen, MD


Key Points: Ultrasound is critical in diagnosis and management of thyroid nodules. Nodules detected by imaging or palpation should undergo further characterization with diagnostic ultrasound to determine whether sonographic features suggest malignancy and the need for fine-needle aspiration. Preoperative and postoperative diagnostic ultrasound evaluation of cervical lymph nodes and ultrasound-guided intervention are also critical to management of thyroid cancer. Future developments in thyroid ultrasound, including elastography and refinements in thyroid ultrasound reporting lexicon, may impact future management and may obviate the need for follow-up in certain low-risk or frankly benign lesions. Advances in molecular testing may result in a test with strong predictive capability that could potentially prevent unnecessary thyroid surgery in significant numbers of patients.

Introduction: Ultrasound is a widely available, highly sensitive imaging modality for detection and characterization of thyroid nodules. Updated consensus guidelines from the American Thyroid Association (ATA) and other medical societies continue to highlight advantages of ultrasound and maintain that thyroid ultrasound with attention to cervical lymph nodes should be performed in all patients with suspected or known thyroid nodules.

When thyroid cancer is diagnosed, if not previously performed, focused ultrasound evaluation of lateral compartment cervical lymph nodes is performed before surgery.
Relationship between the gut and the spine: a pilot study of first-degree relatives of patients with Ankylosing Spondylitis

Amy S Kehl, Thomas J Learch, Dalin Li, Dermot P B McGovern, Michael H Weisman

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Patients with ankylosing spondylitis (AS) have a high frequency of asymptomatic acute and chronic gut inflammation resembling inflammatory bowel disease (IBD), with as many as 60% displaying evidence of microscopic gut inflammation in the absence of gastrointestinal (GI) symptoms. Further, there is considerable overlap in susceptibility loci between AS and IBD but this pleiotropic phenomenon likely only explains part of the clinical co-occurrence. Animal model data investigating molecular mechanisms point to a critical relationship between the gut and AS and the potential role of the gut in the pathogenesis of AS. Several markers are utilized in clinical practice to determine the likelihood that a patient has IBD, the most common of which is the faecal calprotectin which has an estimated sensitivity and specificity of upwards of 80% for identification of patients with IBD and thus serves as a very useful marker of gut inflammation. Similarly, various IBD-related antibodies including anti-Saccharomyces cerevisiae antibodies (ASCA), antineutrophil cytoplasmic antibodies (ANCA), anti-I2 (associated with anti-Pseudomonas activity), anti- Escherichia coli outer membrane porin C (anti-OmpC) and antiflagellin antibodies (anti-CBir1) have been shown to have very good utility in distinguishing individuals with IBD from healthy controls, particularly when these tests are used in combination and thus serve as useful serological biomarkers for IBD. Using the above biomarkers along with advanced imaging studies, this pilot study investigated if first-degree relatives (FDRs) of patients with AS, who themselves do not carry a diagnosis of AS or IBD, have evidence of mucosal dysregulation, subclinical gut or sacroiliac joint inflammation that could potentially precede the development of overt IBD or AS. We postulate that this group will provide insights into the relationship between the gut and AS.

See also:


Prevalence and Associations of Avascular Necrosis of the Hip in a Large Well-characterized Cohort of Patients With Inflammatory Bowel Disease


Objectives: Avascular necrosis (AVN) is associated with significant morbidity potentially causing severe pain and debility; patients with inflammatory bowel disease (IBD) have a higher prevalence of AVN compared with non-IBD populations. The purpose of our study was to determine the prevalence of AVN in our IBD population and to evaluate these subjects for the presence of clinical characteristics associated with AVN on computed tomography (CT) imaging.

Methods: In 1313 IBD patients with abdomen/pelvis CT scans, we identified 27 patients (2.1%) with CT findings consistent with AVN. Through historical chart review, we confirmed that most patients had prior exposure to steroids, although 2 patients had no documented steroid exposure at all.

Results: We found that 59% of the concurrent radiology reports did not comment on the presence of AVN, suggesting that incidental CT findings of AVN among IBD patients are likely underreported. Notably, we found that 63% of these cases had documented complaints of low-back and/or hip pain. Using logistic regression, we found an association between anti-neutrophil cytoplasmic antibody-positive status across IBD (P = 0.007) and a smoking history in Crohn disease (P = 0.03) with the presence of AVN.

Conclusions: We found that a significant proportion of IBD patients with AVN are reported in their records as not having hip or low-back pain, and review of CT imaging under dedicated bone windows may identify AVN among this population. Our findings also suggest that additional etiological factors, beyond corticosteroids, contribute to the development of AVN in IBD. Further investigation is warranted regarding the mechanisms associated with AVN in IBD.
Clinical Trial Highlights

Cook IVC Filter Study
Principal Investigator: Richard Van Allan, MD
IRB#: 34301
Status: Follow Up

Summary: The objectives of this study are to further evaluate the safety and effectiveness of Cook's commercially available IVC filters in patients in need of temporary or permanent IVC filter placement for the prevention of pulmonary embolism.

The Cook Inferior Vena Cava Filter (IVC) Study was initiated by the manufacturer of Cook IVC filters to address FDA concerns about all currently marketed filters. We were invited by Cook Medical, Inc to participate in a study to assess device safety. Cedars-Sinai Medical Center places more filters than any other facility in the nation, with an outstanding record for safety, and we were recently acknowledged as the top-enrolling site for this study. CSMC is routinely sought out for research participation due to the expertise of our Imaging team, in this case, our Interventional Imaging investigators. Patients at risk for blood clots going to their lungs are referred to us for placement of a temporary IVC filter as part of their standard care. We follow patients in the study for symptoms and changes on imaging in assessment of filter safety and efficacy.

Functional MRI (fMRI) In Patients With Cerebrospinal Fluid (CSF) Leak Related Headaches
Principal Investigator: M. Marcel Maya, M.D.
IRB #042446
Status: Open

Summary: CSF leak related headaches can be debilitating; using resting functional MRI, this study assesses if there are changes at baseline and post standard of care treatment, if changes are reversible and if they are related and correlate with effect of treatment. This study will facilitate understanding of changes in the brain resting state connectivity in subjects with this condition and will allow investigators to monitor effects of treatment which is sometimes difficult, It could give physicians objective data about treatment response.

Proof of Concept Plus Phase II Study of 99mTc-RhAnnexin V-128 Radionuclide Imaging In Patients With Clinical Suspicion or Confirmed Diagnosis of Spondyloarthritis (sPa)
Principal Investigator: Alan D. Waxman, M.D.
IRB #045359
Status: Open

SUMMARY: 99mTc-labelled Annexin has demonstrated the ability to image abnormalities in a variety of diseases with a strong inflammatory component including rheumatoid arthritis, prosthetic joint infection, myocarditis, acute heart transplant rejection. This study aims for early diagnosis and assessment of response to therapy in patients with sPa, compared with MRI which is among the modalities currently used to assess sPa.

Resting State Functional Brain MRI (RSf-MRI) Findings In Chronic Spinal Pain Patients with Logitudinal Follow Up Compared to Normal Controls: Investigator Initiated Pilot Study
Principal Investigator: M. Marcel Maya, M.D.
IRB: #047310
Status: Open

Summary: Chronic spinal pain is a major health care issue with major individual and societal costs. Further insight into pain mechanisms will help in developing appropriate management strategies. RSF-MRI offers the promise of noninvasive and objective assessment of neurobiological underpinnings of spinal pain. RSF-MRI also affords means of longitudinal follow up and response to various treatment strategies.

A limited number of participants in the CSMC Pre-Operative Pain Management Program prior to spinal surgery will have three RSF-MRI scans at baseline, following completion of the Pain Management Program and post-operatively to assess the brain in chronic spinal pain patients and determine if finding were reversed following the pain treatment and surgery. An additional limited cohort of healthy volunteers will provide age- and gender- matched normal controls.

A Prospective Study to Screen for and Examination of Lyme Disease using SPECT
Principal Investigator: Alan Waxman, MD
IRB#: 38049
Status: Active

For a complete list of Clinical Trials, please go to www.csmc.edu/imaging-md
Complications and Retrieval Characteristics of Celect Platinum Inferior Vena Cava Filters

Brian E. Lee, MD; Richard J. Van Allan, MD; Marc L. Friedman, MD; and H. Gabriel Lipshutz, MD


Abstract: Background: The purpose of this study was to retrospectively assess the retrieval characteristics and rate of filter-related complications associated with use of the Celect Platinum (Cook Medical, Bloomington, Ind) inferior vena cava filter (IVCF).

Methods: A single-center, retrospective review was conducted to identify patients who received a Celect Platinum IVCF between June 2013 and February 2016. The patients’ charts and imaging records (computed tomography [CT] and cavography) associated with filter placement, follow-up, and filter retrieval procedures were assessed for attempted and successful retrieval rates and filter-related complications.

Results: During the review period, 562 Celect Platinum filters were placed in 556 patients. Outcome and evaluable imaging data (CT and cavography) were available from 335 patients, with median CT follow-up time of 45 days (average, 126 days) and median cavography follow-up time of 90 days (average, 102 days). IVCF leg perforation of the inferior vena cava wall >3 mm was identified in 65 cases (19.4%) on follow-up imaging (64 cases). In addition, filter tilt >15 degrees was identified in 4 filters (1.2%), filter migration >2 cm in 1 filter (0.3%), and occlusive filter or inferior vena cava or iliac vein thrombus in 11 filters; no filter fracture was observed. One case of breakthrough pulmonary embolism and two additional indeterminate cases were identified on follow-up CT pulmonary angiography (2.6%-7.7%). Retrieval was successful in 155 of 155 patients (median indwell time, 90 days; range, 1-445 days); an advanced retrieval technique was used in 11 retrievals.

Conclusions: The outcomes for the Celect Platinum filter were comparable to those previously reported for the first-generation Celect filter in all categories assessed. (J Vasc Surg: Venous and Lym Dis 2018;6:163-72.)

Incidental coronary calcification on routine chest CT: Clinical implications

Pakdaman M, Rozanski A, Berman D

Abstract: Coronary artery calcification (CAC) is a marker of atherosclerosis and an independent risk factor for cardiac-related mortality, with much of the 50% decline in mortality over the past 30 years being attributed to early detection of coronary disease and intervention of modifiable risk factors. With over 10 million computed tomography (CT) examinations of the chest performed in the United States yearly, CAC can be identified in a very large number of patients. In this review, we discuss the clinical evidence underlying the relationship between radiologic identification of CAC, atherosclerosis, and cardiac outcomes and the implications of its assessment on standard chest CT. We conclude that reporting of incidental coronary calcification found on non-gated chest CT would have a great impact on both management and mortality and thus, in the appropriate setting, should be noted in the impression of the radiologic report when identified.

Below: Coronary artery calcification on gated versus non-gated CT. Gated (A) and non-gated (B) images of a patient with high coronary calcification score (CAC = 237). Note the evidence right coronary artery calcification. Gated (C) and non-gated (D) images of a patient with low coronary calcification score (CAC = 11).
Mapping the nodal metastases in papillary thyroid carcinoma: Where exactly are the nodes?

Goyal N, Kamani D, Pakdaman MN, Randolph GW.


Conclusion: This report represents a large series describing characteristics of the primary PTC tumor and associated nodal disease not only in the central and lateral neck but also in the ectopic locations. Our results suggest that a significant proportion of patients will have nodal disease in the central compartment on initial presentation, especially younger patients. Extra-thyroidal extension and tumor size are associated with macroscopic nodal disease (including ectopic nodal). Nine percent of the patients with nodal recurrence had ectopic nodes occurring in various locations, most commonly in the retropharynx. CT scan can assist with identification and surgical planning of recurrent nodal disease.

Joseph Stuckelman, Imaging Residency Coordinator, Named President of Association of Program Coordinators in Radiology

Our Radiology Residency Coordinator, Joseph “Joey” Stuckelman, BA, MFA, C-TAGME, has been named the president of the Association of Program Coordinators in Radiology (APCR). This organization seeks to educate and mentor radiology residency coordinators through its annual conference and various professional development programs which take place throughout the year. As Chair of the Program Planning Committee, Stuckelman is responsible for scheduling the APCR’s meetings and panels, which took place in conjunction with the Association of University Radiologist (AUR) Annual Meeting this May in Orlando, Florida. This year’s program concentrated on professional development with presentations on program management, leadership, wellness, and emotional intelligence. The presentations were designed to provide solid, practical information which the attendees can readily use to improve their value and performance at work.

Stuckelman was responsible for scheduling the APCR’s meeting and panels, which took place in conjunction with the Association of University Radiologist (AUR) Annual Meeting this May in Orlando, Florida. This year’s program concentrated on professional development with presentations on program management, leadership, wellness, and emotional intelligence. The presentations were designed to provide solid, practical information which the attendees can readily use to improve their value and performance at work.

Stuckelman is currently also the head of the organization’s Electronic Communications Committee. They worked to create an iOS and Android phone app to assist members at the APCR’s annual meeting. The app provided attendees with information about the conference schedule, maps of the venue, and a social media news feed for attendees. The committee also has recruited over 100 members to the organization’s LinkedIn page which serves as a clearinghouse for questions and for cultivating professional contacts.

Stuckelman’s initiatives in Cedars-Sinai’s Radiology Residency program include the addition of a junior chief resident position. This allows the following year’s chief resident to prepare for the position, by attending conferences, taking advantage of management training resources, and learning from the program director, coordinator, and current chief resident before taking over the position. Stuckelman has also worked to bring some of the program’s alumni back to speak with current residents, providing insights on moving from residency to fellowship and to being newly-minted, practicing radiologists. In October, Stuckelman was honored with the Cedars-Sinai President’s Award in recognition for his work at Cedars and with the APCR.

The journal Academic Radiology recently published an article by Stuckelman and two associates detailing the changing role of a program coordinator in a time when both the administrative and management requirements are growing. Publication:
