How to Differentiate Focal Nodular Hyperplasia From Hepatocellular Adenomas

Diagnostic Accuracy of MRI in Differentiating Hepatocellular Adenoma From Focal Nodular Hyperplasia: Prospective Study of the Additional Value of Gadoxetate Disodium.

Bieze M, van den Esschert JW, et al:
AJR Am J Roentgenol 2012; 199 (July): 26-34

The hepatobiliary phase of gadoxetate disodium-enhanced MRI increases the sensitivity in differentiating focal nodular hyperplasia from hepatocellular adenomas measuring >2 cm.

Objective: To determine if the hepatobiliary phase of gadoxetate disodium-enhanced hepatic MRI increases the sensitivity in differentiating focal nodular hyperplasia from hepatocellular adenomas.

Design: Prospective analysis.

Methods: This study was comprised of 52 patients (2 men, 50 women) with suspicion of hepatocellular adenomas or with focal nodular hyperplasia on a previous CT or conventional gadolinium-enhanced MRI. All lesions measured at least 2 cm to avoid potential sampling error on subsequent biopsy. Exclusion criteria included contraindication to MRI, pregnancy, hemochromatosis, chronic hepatitis, cirrhosis, previous malignancy or metastatic disease, and elevated alpha fetoprotein or CEA levels. All patients underwent gadoxetate disodium-enhanced hepatic MRI. MRI examinations were performed using the 1.5T system. Sequences included 2D T1-weighted gradient echochoardiography in- and out-of-phase, T2-weighted images, and diffusion-weighted sequence using b values of 50, 400, and 800 s/mm2; 3D T1-weighted gradient echocardiographic dynamic images were acquired before and after intravenous contrast administration at 30, 60, 90, and 180 seconds. Hepatobiliary phase images were acquired 20 minutes after injection. The images acquired before the hepatobiliary phase were designated as the "standard" images, and images were reviewed by 2 radiologists. The standard images were reviewed separately from the hepatobiliary phase images. The largest or most suitable lesion for biopsy had histopathologic confirmation. The lesion shape, signal intensity, and enhancement pattern were recorded, as was the presence of fat, hemorrhage, and central scar. The standard of reference was the histopathologic diagnosis.

Results: There were 24 hepatocellular adenomas and 28 focal nodular hyperplasias. Using the standard sequences, MRI had a sensitivity of 50% in characterizing hepatocellular adenomas and 64% sensitivity in characterizing focal nodular hyperplasia. The average lesion diameter was 7.1 cm. Using the hepatobiliary phase of gadoxetate disodium-enhanced MRI, there was 96% sensitivity in characterizing hepatocellular adenomas and focal nodular hyperplasia. Bleeding, fat, and glycogen were more predictive of hepatocellular adenomas, while a central scar was more predictive of focal nodular hyperplasia.

Conclusions: Hepatobiliary phase of gadoxetate disodium-enhanced MRI increases the sensitivity in differentiating focal nodular hyperplasia from hepatocellular adenomas measuring >2 cm.

Reviewer's Comments: The results of this study are useful in demonstrating that the increased sensitivity of the hepatobiliary phase of gadoxetate disodium-enhanced hepatic MRI in characterizing hepatocellular adenomas and focal nodular hyperplasia is important, as the management options differ. One of the limitations in this study was that there was a higher prevalence of focal nodular hyperplasia than that found in the general population due to selection bias. (Reviewer-John C. Sabatino, MD).

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Keywords: Liver, MRI, Hepatocellular Adenoma, Focal Nodular Hyperplasia

Print Tag: Refer to original journal article
Diagnosing Focal Nodular Hyperplasia -- Gadoxetate Disodium vs Gadobenate Dimeglumine MRI

Diagnosis of Focal Nodular Hyperplasia With MRI: Multicenter Retrospective Study Comparing Gadobenate Dimeglumine to Gadoxetate Disodium.

Gupta RT, Iseman CM, et al:

AJR Am J Roentgenol 2012; 199 (July): 35-43

Gadoxetate disodium-enhanced MRI is equivalent to or better than gadobenate dimeglumine in detecting focal nodular hyperplasia and provides a more comprehensive evaluation.

Objective: To determine if gadoxetate disodium is comparable to gadobenate dimeglumine in the diagnosis of focal nodular hyperplasia.

Design: Retrospective analysis.

Participants/Methods: This study was comprised of 30 patients (2 men and 28 women) with focal nodular hyperplasia measuring ≥1.0 cm who underwent both gadoxetate disodium- and gadobenate dimeglumine-enhanced MRI. Patients with chronic liver disease were excluded. Gadobenate dimeglumine-enhanced MRI was always performed before the gadoxetate disodium-enhanced MRI. MRI examinations were performed using a 1.5T system. Sequences included T1-weighted gradient echocardiography in- and out-of-phase, T2-weighted with and without fat-suppression, and T1-weighted gradient echocardiography fat-suppressed dynamic images acquired before and after intravenous contrast administration during the arterial, portal venous, and late venous phases. Portal venous phase images were acquired at 60 to 90 seconds, and late venous phase images were acquired at 180 seconds. Hepatobiliary phase images were acquired at 10 and 20 minutes after injection of gadoxetate disodium. The images were reviewed by 3 radiologists. Lesion conspicuity, heterogeneity, and scars were evaluated. Regions of interest were placed on all phases and were used to calculate the mean signal intensity and signal intensity ratio.

Results: There were 51 focal nodular hyperplasias with an average size of 3.1 and 3.2 cm on the gadobenate dimeglumine and gadoxetate disodium studies, respectively. Focal nodular hyperplasia lesion conspicuity was equal for both contrast agents during the arterial phase, although it was found to be higher during the hepatobiliary phase of gadoxetate disodium. There was a significantly higher lesion signal intensity ratio in the arterial and late venous phases with gadobenate dimeglumine than with gadoxetate disodium.

Conclusions: Gadoxetate disodium-enhanced MRI is equivalent to or better than gadobenate dimeglumine in detecting focal nodular hyperplasia and provides a more comprehensive evaluation, given its shorter time to acquire the hepatobiliary phase.

Reviewer's Comments: These results are useful in demonstrating that the hepatobiliary phase of gadoxetate disodium-enhanced hepatic MRI may be a better choice for overall evaluation of focal nodular hyperplasia. One of the limitations in this study was that the dose of gadoxetate disodium was not weight based as recommended by the manufacturer, but rather was a fixed 10 mL dose. (Reviewer-John C. Sabatino, MD).

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Keywords: Liver, Focal Nodular Hyperplasia, MRI, Gadobenate Dimeglumine, Gadoxetate Disodium

Print Tag: Refer to original journal article
What Is Best Method to Diagnose Hepatic Steatosis?

Detection of Hepatic Steatosis on Contrast-Enhanced CT Images: Diagnostic Accuracy of Identification of Areas of Presumed Focal Fatty Sparing.

Lawrence DA, Oliva IB, Israel GM:

AJR Am J Roentgenol 2012; 199 (July): 44-47

There is a high specificity for diagnosing hepatic steatosis on CT during the portal venous phase.

**Objective:** To determine if identifying focal areas of increased attenuation along the gallbladder fossa or segment 4 is accurate in diagnosing hepatic steatosis.

**Design:** Retrospective analysis.

**Participants/Methods:** This study was comprised of 500 patients (248 women and 242 men) who had triple-phase CT studies. The most common clinical indications were hepatocellular carcinoma screening, abnormal liver function tests, liver mass characterization, and pancreatic carcinoma. Unenhanced and portal venous phase images were evaluated. Portal venous phase images were acquired 70 seconds after intravenous contrast administration. The unenhanced images were used as the reference standard for diagnosing steatosis. Regions of interest were placed on the liver and spleen parenchyma, avoiding vessels, calcification, and masses. Steatosis was diagnosed if the unenhanced differential liver-spleen attenuation value measured at least 10 HU, or if the liver attenuation was \( \leq 40 \) HU. The portal venous phase images were evaluated for the presence of a focal area of increased attenuation along the gallbladder fossa or segment 4 as evidence of hepatic steatosis.

**Results:** The incidence of differential liver-spleen attenuation value of at least 10 HU was 7.6%. Using this criterion, there was 100% concordance in diagnosing steatosis on contrast-enhanced studies. The sensitivity, specificity, positive predictive value, and negative predictive values were 60.5%, 100%, 100%, and 96.9%, respectively. The incidence of liver attenuation of \( \leq 40 \) HU was 8.8%. Using this criterion, there was also 100% concordance in diagnosing steatosis on contrast-enhanced studies. There were no false-positive diagnoses of steatosis. The sensitivity, specificity, positive predictive value, and negative predictive values were 52.5%, 100%, 100%, and 95.7%, respectively.

**Conclusions:** There is a high specificity for diagnosing hepatic steatosis on CT during the portal venous phase.

**Reviewer’s Comments:** These results are useful in demonstrating that identifying focal areas of increased attenuation along the gallbladder fossa or segment 4 is accurate in diagnosing hepatic steatosis. One of the limitations reported in this study was that other causes of increased liver attenuation on the portal venous phase, such as hyperemia in the setting of acute cholecystitis, might be misinterpreted as focal fatty sparing. (Reviewer: John C. Sabatino, MD).

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Keywords: Liver, Hepatic Steatosis, CT

Print Tag: Refer to original journal article
An aborted myocardial infarction is characterized on MRI by the absence of or minimal enhancement on delayed enhancement imaging and on follow-up normalization of the area at risk, minimal enhancement, and no perfusion defect.

**Background:** An aborted myocardial infarction (MI) is defined as major (≥50%) ST-segment resolution of the initial elevation and no subsequent enzyme level that is ≥2 times the upper limit of normal. Prior studies have demonstrated that aborted MI is strongly related to less time to fibrinolysis.

**Objective:** To evaluate the MRI findings of aborted MI compared to overt MI.

**Design:** Retrospective review.

**Participants:** 29 patients (18 with an overt MI and 11 with an aborted MI). MRI was performed within 7 days after revascularization, and the majority of patients also had a follow-up MRI 6 months later.

**Methods:** Cardiac MRIs had T2-weighted imaging, cine imaging, perfusion imaging after injection of gadodiamide, and delayed enhancement imaging. Images were analyzed for the location, size, and contrast ratio of the area with abnormal high signal on T2-weighted imaging. Delayed enhancement images were evaluated for location, size, enhancement pattern, and signal intensity ratio of the enhancing area.

**Results:** All overt MI patients had a symptom duration of >2 hours; 63.6% of aborted MI patients had a symptom duration of ≤2 hours; and all aborted MI patients had a symptom duration of <4 hours. The T2-weighted images in all patients demonstrated homogenous high-signal intensity along the vascular territory of the culprit coronary stenosis. In all patients with overt MI, delayed enhancement was seen in the infarcted area. In patients with aborted MI, there was either no delayed enhancement (5 patients) or minimal enhancement (6 patients), which was diffuse and fuzzy in 3 or spotty and discrete in 3. In aborted MI, the area of delayed enhancement was significantly smaller ($P = 0.001$) and had a significantly lower signal intensity ($P = 0.002$) of the enhancing region compared to that of overt MI. In those who had follow-up MRI, in most cases, the area of delayed enhancement was smaller. All but one of the initial aborted MI patients had hypokinesia and perfusion defect along the vascular territory of the culprit coronary stenosis initially. On follow-up MRI, none of these patients had hypokinesia and perfusion defect.

**Conclusions:** On cardiac MRI, an aborted MI is characterized by the absence of or minimal enhancement on delayed enhancement imaging compared with overt MI. Upon cardiac MRI 6-month follow-up, aborted MI is characterized by normalization of the area at risk, minimal enhancement, and no perfusion defect.

**Reviewer's Comments:** This article nicely demonstrates that an aborted MI is pathologically different from an overt MI based on cardiac MRI. (Reviewer-Vineet R. Jain, MD).

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Keywords: Aborted Myocardial Infarction, Gadolinium Enhancement

Print Tag: Refer to original journal article
p53 Inactivation May Be Linked to Appearance of Solid Component in Lung Adenocarcinoma

**Adenocarcinomas With Predominant Ground-Glass Opacity: Correlation of Morphology and Molecular Biomarkers.**

Aoki T, Hanamiya M, et al:

Radiology 2012; 264 (August): 590-596

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**Background:** Epidermal growth factor receptor (EGFR) and K-*ras* are the most often mutated oncogenes in lung adenocarcinoma. It is thought that these mutated oncogenes are involved in tumor cell proliferation, differentiation, and angiogenesis. p53, a tumor suppressor, can be inactivated by missense mutations and can be a cause of tumorigenesis or metastasis. According to the authors, it has been suggested that nuclear p53 accumulation occurs in the transition from early to more advanced stage adenocarcinoma, and this may be a good indicator of tumor malignancy.

**Objective:** To correlate temporal changes in peripheral lung adenocarcinoma with dominant ground-glass opacity (GGO) as seen on CT with biomolecular markers.

**Design:** Retrospective review.

**Participants:** 25 patients who had lung adenocarcinoma and had undergone tumor resection. All tumors were <3 cm, and the GGO component of the tumor was >50% of the tumor size.

**Methods:** The initial CTs and final CTs before surgery were evaluated for changes in size and morphology of the tumor. All tumors were characterized as either pure GGO or mixed GGO. Molecular analyses using genomic DNA from the surgical tumor specimens were performed.

**Results:** In 19 of 25 (76%) patients, tumor size increased on successive CT. Of these 19 patients, 8 had tumors that were pure GGO and had greater GGO on follow-up, 3 had tumors that were pure GGO but were mixed GGO on follow-up, 4 had mixed GGO that had growth of the solid component on follow-up, and 4 had mixed GGO with growth of the GGO component on follow-up. In the 6 tumors (24%) that did not demonstrate any interval growth, all 6 were pure GGO that remained stable. p53 staining was negative in 14 of 14 (100%) pure GGO lesions. p53 staining was positive in 6 of 11 (55%) patients with mixed GGO (*P* <0.01). In all 6 of these patients, the appearance or growth of a solid component on CT was seen. In both pure (36%) and mixed (45%) GGO tumors, EGFR mutations were present. This difference was not statistically significant.

**Conclusions:** p53 inactivation may be linked to new demonstration of a solid component in lung GGO adenocarcinomas.

**Reviewer's Comments:** This is a very nice article that provides a strong argument to the authors' conclusions and is something that radiologists rarely think about. (Reviewer-Vineet R. Jain, MD).

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Keywords: Adenocarcinoma, Ground-Glass Opacity, Molecular Biomarkers

Print Tag: Refer to original journal article
Objective: To evaluate how eliminating the routine use of oral contrast during abdominopelvic (AP) CT would affect emergency department (ED) length of stay (LOS) as well as diagnosis.

Design: Retrospective review.

Participants: Before the new protocol was instituted, 607 patients received oral contrast routinely; after the protocol was instituted, 611 patients did not receive oral contrast routinely before AP CT. Patients with a history of inflammatory bowel disease, gastrointestinal tract-altering surgery, or lean body habitus continued to receive oral contrast. Those who had indications in which oral contrast was not given (ie, trauma, suspected genitourinary calculus, or suspected aortic pathology) were excluded.

Methods: Information collected included CT findings per the radiology report, number of repeat CTs performed with oral contrast, 72-hour ED patient return, ED LOS, and time from CT order to CT performed.

Results: Before the change in protocol 576 of 607 (95%) patients received oral contrast before the AP CT. After the protocol change, 257 of 611 (42%) patients received oral contrast before the AP CT. After the protocol change, the average ED LOS decreased by 97.7 minutes ($P < 0.001$). The average time from CT order to CT performed decreased by 66.2 minutes ($P < 0.001$). In the post-protocol patients who did not receive oral contrast, 51.9% did not have acute CT findings. Three of these patients were rescanned with oral contrast within 6 hours of the initial CT in order to better visualize the appendix, and there was no change in CT findings, with the CT report remaining negative for acute appendicitis. One patient whose report findings were equivocal for appendicitis was rescanned 10 hours later with the subsequent findings remaining equivocal. After the protocol change, none of the patients who did not receive oral contrast received an additional CT during their inpatient stay that led to a change in diagnosis. After the protocol change, among the patients discharged from the ED, 5.3% returned within 72 hours, which was not significantly different from the rate of the pre-protocol group. None of these patients received a repeat CT.

Conclusions: The elimination of routine oral contrast during AP CT in the ED setting for adults may be successful in decreasing ED LOS without a compromise in diagnosis.

Reviewer's Comments: I wonder why 42% of patients received oral contrast after the protocol change. The fact that oral contrast was still administered for lean patients indicates that there is an inherent assumption that lack of oral contrast is a compromise. More prospective studies are needed. (Reviewer-Vineet R. Jain, MD).

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Keywords: Oral Contrast, Abdominopelvic CT, Emergency Department, Length of Stay

Print Tag: Refer to original journal article
Poor Physician Compliance With Guidelines for IVC Filter Placement

Indications for Inferior Vena Cava Filter Placement: Do Physicians Comply With Guidelines?

Baadh AS, Zikria JF, et al:

J Vasc Interv Radiol 2012; 23 (August): 989-995

Internal medicine-trained physicians are more likely to follow established guidelines for filter placement when compared to physicians trained in other specialties.

**Background:** In the United States, inferior vena cava (IVC) filters are placed by interventional radiologists (IR), vascular surgeons (VS), and interventional cardiologists (IC). A fair degree of self-referral is seen among providers. The American College of Chest Physicians (ACCP) and the Society of Interventional Radiology (SIR) have guidelines regarding filter placement with the SIR guideline being less stringent.

**Objective:** To determine if guidelines regarding IVC filter placement are being followed across the spectrum of specialties providing IVC filter placement.

**Design:** Retrospective single-center review of the medical records from a metropolitan acute-care teaching hospital.

**Methods:** The study was performed over a period of 26 months with a total of 499 filters placed. The specialty of the referring provider, adherence to guideline criteria, and other factors were recorded and then evaluated.

**Results:** Compliance with the more rigorous ACCP guidelines was moderate overall. Of the filters placed, 43.5% by IR staff, 39.9% by VS staff, and 33.3% by IC staff met the ACCP guidelines. Compliance with the SIR criteria was higher (77.5% by IR staff, 77.1% by VS staff, and 80% by IC staff). The self-referral rates among vascular surgery and interventional cardiology were 12% and 67%, respectively. When internal medicine-trained physicians requested a filter, there was a greater degree of ACCP criteria compliance (46.3%) compared to non-internal medicine-trained physicians (24.0%).

**Conclusions:** There is poor compliance with IVC filter placement guidelines, especially when the patient is not directly referred by an internal medicine-trained physician.

**Reviewer's Comments:** A true consensus to the criteria for filter placement is warranted based on the results of this study. Filter placement carries a risk of morbidity, and judicious use of this tool is important. Continuous monitoring of criteria adherence will likely improve patient outcomes and safety. I look forward to future guidelines that would clarify when IVC filters are needed. (Reviewer-Waseem A. Bhatti, MD, MS).

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Keywords: IVC Filters, Guidelines, Physician Compliance

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RF Guidewire Can Be Used to Cross Difficult Central Venous Occlusions

Radiofrequency Wire for the Recanalization of Central Vein Occlusions That Have Failed Conventional Endovascular Techniques.
Guimaraes M, Schonholz C, et al:
J Vasc Interv Radiol 2012; 23 (August): 1016-1021

A new radiofrequency guidewire shows early promise for crossing central venous occlusions.

**Background:** Central venous occlusions (CVOs) in cases such as super vena cava syndrome present challenges from crossing the lesions with a wire to stenting. A new wire with a radiofrequency (RF) tip can assist the operator in crossing these difficult occlusions.

**Objective:** To report the technique and review results of recanalization of CVOs using the PowerWire RF Guidewire.

**Methods:** The authors completed a retrospective study of 42 symptomatic patients who underwent RF wire recanalization of 43 CVOs over a period of almost 4 years at a single center. All of the patients underwent stenting of these occlusive lesions during the same session. Six of the CVOs were located in the subclavian vein, 29 in the brachiocephalic vein, and 8 in the superior vena cava (SVC) vein. After failure of conventional endovascular techniques, the RF guidewire was used to cross central venous occlusions a few millimeters at a time while using a loop snare as a target and monitoring the position on multiple oblique fluoroscopic views.

**Results:** Using the RF wire technique, the success rate was 100%. There was 1 major complication, which was a pericardial tamponade that occurred during angioplasty of an SVC stent and likely not directly related to the RF wire. Forty of the 42 patients (95%) had patent stents and were asymptomatic at 6 and 9 months.

**Conclusions:** According to the authors, "...the RF wire technique is a safe and efficient alternative in the recanalization of symptomatic and chronic CVOs when conventional endovascular techniques have failed."

**Reviewer's Comments:** The RF guidewire is an exciting new device in the interventionalists' toolbox that shows early promise in this study. As with any new technology, novel applications lead to the ability to treat patients who would have otherwise had limited options. A head-to-head comparison with the complication rates of other occlusion crossing techniques and devices would be of interest. (Reviewer-Waseem A. Bhatti, MD, MS).

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Keywords: Central Venous Occlusions, Radiofrequency Wire, Recanalization

Print Tag: Refer to original journal article
Endovascular therapy performed for the treatment of venous stenosis or occlusion in Behçet disease is less successful in the iliofemoral region than in all other regions.

**Background:** Behçet disease is a systemic vasculitis that involves both the venous and arterial systems. Venous involvement is more frequent, and it usually results in venous thrombosis. Acute Behçet disease usually responds to anti-inflammatory and immunosuppressive drugs with anticoagulants. For the chronic veno-occlusive sequelae of Behçet disease, endovascular treatment has not been well studied.

**Objective:** To report the results of endovascular therapy and the midterm patency rate.

**Design/Methods:** This is a retrospective review of the records of 10 patients with Behçet disease who had endovascular therapy performed on both the upper and lower extremities. Technical success was defined as restoration of venous flow with <30% residual stenosis or <5 mm Hg pressure gradient across the lesion. Primary patency was defined as time from the initial procedure to the first reintervention.

**Results:** 8 patients presented with occluded veins in 12 limbs, and 2 patients presented with Budd-Chiari syndrome. Five patients had chronic iliofemoral deep venous thrombosis (DVT) with occlusion. All patients with chronic iliofemoral DVT had either failed procedures or reocclusion within a month after recanalization. Three patients had upper central venous occlusions. Two patients had occlusions in the subclavian, brachycephalic, and internal jugular veins as well as the superior vena cava. The stents that were placed in these patients occluded in both patients but were successfully reopened with percutaneous transluminal angioplasty and remained open (1 at 4 years and the other at 3 years). In the third patient, a subclavian vein stenosis was successfully opened with angioplasty alone and remained open at 1-year follow-up. In the 2 patients presenting with Budd-Chiari syndrome, the inferior vena cava (IVC) segments were successfully recanalized by angioplasty and stent. The overall primary patency rate was 70% at 3 months, 44% at 1 year, and 44% at 4 years. The secondary patency rate was 75% at 3 months, 50% at 1 year, and 50% at 4 years. There were no procedural complications.

**Conclusions:** “Endovenous treatment for chronic iliofemoral DVT due to Behçet disease had a poor outcome.”

**Reviewer's Comments:** In general, the technical success rate was approximately 50% for the lower-extremity occlusions and 80% for the upper-extremity occlusions, but was 100% for the IVC occlusions. Overall technical success was 69%. The cause for vascular manifestations is unknown but is thought to be vascular endothelial injury and or a defect in coagulation. The reason that endovascular treatment is less durable for chronic venous occlusion in Behçet disease in the lower extremities is unknown. In this study, there was greater long-term success in central vein recanalization. In conclusion, this is the largest case series published about venous occlusion in Behçet disease, showing that angioplasty and stenting can successfully treat it (although with less success in the lower extremities), and that patency can be extended with re-intervention. (Reviewer- Sharon Gonzales, MD).

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Keywords: Venous Occlusion, Behçet Disease, Endovascular Therapy, Vasculitis

Print Tag: Refer to original journal article
In this preliminary animal study, percutaneous delivery of mesenchymal stem cells into intervertebral disks was feasible.

**Background:** Lower back pain can result in a decrease in quality of life, disability, loss of productivity, and financial and emotional hardship. In regenerative medicine, the focus has been to re-create functional tissues within cells, in this case within the intervertebral disk. Mesenchymal stem cells (MSCs) are a source of nondifferentiated cells that can be placed within the intervertebral disk to essentially re-grow tissue. Several centers have shown that MSCs that have been surgically transplanted into the intervertebral disk are effective in improving clinical outcomes.

**Objective:** These researchers are investigating the feasibility of a nonsurgical delivery technique involving image-guided percutaneous placement of MSCs into the intervertebral disks in vivo. A preclinical, porcine model has been developed to evaluate if this percutaneous technique indeed does deliver the cells into the intended location, if the cells remain in the target location, and if the cells are functional.

**Methods:** The experiment involved the injection of human MSCs into one level of intervertebral disks of 4 female pigs using standard protocols for degenerative disk models. This was performed using standard interventional technique for diskography. These stem cells will not elicit an immune response in pigs. The cells were labeled with iodine 124 imaging agent for PET and CT. The animals were evaluated by PET and CT on the same day as stem cell transplantation, as well as 3 days later. Fifteen days after transplantation, the pigs were euthanized and the intervertebral disks removed for histologic evaluation.

**Results:** In the first experimental animal, the initial injection did not work well, which allowed the researchers to refine the technique. In the remaining animals, PET-CT demonstrated that the radiolabeled MSCs were delivered accurately into the intervertebral disks by this technique on day 1 and were still in the intervertebral spaces 3 days later. Histologic staining specific for human mesenchymal cells demonstrated that the human MSCs were present in the transplanted discs.

**Conclusions:** Based on their research, the authors state that, "Image-guided needle delivery of MSCs for treatment of degenerated intervertebral disks is feasible as demonstrated in this preclinical model."

**Reviewer's Comments:** Percutaneous interventional techniques for the selective placement of stem cells into target organs are becoming an important part of translational research. Diagnostic radiology using MRI, CT, and PET can document correct placement and outcomes of treatment. These stem cells can potentially differentiate into nucleus pulposus and annulus fibrosis cells, thus repairing damaged disks. This has been shown to occur in several animal models. In 2 separate studies, surgical transplantation of cultured MSCs into the intervertebral disk spaces in humans resulted in radiologic and clinical improvement with no untoward effects. In conclusion, this study demonstrates the feasibility and efficacy of this percutaneous technique, as well as demonstrating that the stem cells found in the intervertebral disks were the ones injected. (Reviewer-Sharon Gonzales, MD).

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Keywords: Degenerative Disk Disease, Stem Cell Therapy, Porcine Model, Percutaneous Treatment

Print Tag: Refer to original journal article
MRI Protocol May Be Noninvasive Screening Test for Chronic Exertional Compartment Syndrome

MRI Accurately Detects Chronic Exertional Compartment Syndrome: A Validation Study.

Ringler MD, Litwiller DV, et al:

Skeletal Radiol 2012; July 13 (): epub ahead of print

An in-scanner exercise-based MRI protocol can potentially screen patients with suspected anterior compartment lower extremity chronic exertional compartment syndrome.

**Objective:** To examine the diagnostic utility of MRI in the diagnosis of chronic exertional compartment syndrome (CECS).

**Participants/Methods:** The study was comprised of 76 subjects for whom anterior compartment CECS of the lower extremities was a differential consideration. An in-scanner exercise device was used consisting of a fixed foot plate and velcro straps that allowed patients to perform isometric dorsiflexion and plantar flexion against resistance without much movement of the lower legs. Patients put their legs in this apparatus, which housed customized, paired, quadrature, transmit–receive birdcage coils. All MRIs were obtained on a 1.5-Tesla scanner. In addition to a baseline T1 sequence, 10 T2-weighted acquisitions were acquired. Each T2 acquisition captured only 3 slices centered on the bulkiest part of the anterior compartment. Acquisitions were done at baseline, upon dorsiflexion, upon recovery, upon plantar flexion, and then at the final recovery. Exertion never lasted more than 30 seconds. Regions of interest were drawn around the anterior compartments. A T2 signal ratio of 1.54 between the first recovery scan immediately after dorsiflexion and baseline was used as the cutoff to diagnose CECS. Clinical assessment, surgical outcome, and intracompartmental needle manometry (INM) were variably used as reference standards.

**Results:** The final diagnosis of CECS was made in 23 patients by clinical assessment, INM, and surgical outcome. At a threshold of 1.54 for the T2 signal ratio between the first recovery scan and baseline, MRI had a sensitivity of 96% and a specificity of 87%. Among the 7 patients with false positives, 3 patients had unilateral symptoms and 3 had undergone prior fasciotomies. A separate analysis was done of the subset of 36 patients who underwent INM; 23 of these patients had CECS by manometric measurement criteria alone, and here, the sensitivity and specificity of the MRI protocol were lower (87% and 62%, respectively).

**Conclusions:** An in-scanner exercise protocol can potentially screen patients with suspected anterior compartment lower extremity CECS.

**Reviewer’s Comments:** The authors suggest that previous attempts in the literature using MRI to diagnose CECS were unsuccessful because quantification was not assessed. One advantage to the authors’ protocol is that exercise can be done within the scanner, minimizing the delay in imaging after exercise as well as overall testing time. There are some potential limitations to this study. There is some question as to the gold standard for CECS diagnosis. INM criteria are based on studies with small samples and can overlap with normal patients. It is not clear that improvement after fasciotomy should be considered a diagnostic criterion. INM is less likely to be done in patients with a low clinical suspicion of disease, which could lead to verification bias. Customized equipment was used, which could limit widespread adoption of this protocol. (Reviewer-John Hochhold, MD).

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Keywords: Chronic Exertional Compartment Syndrome, Diagnostics, MRI

Print Tag: Refer to original journal article
How Visible Are Sacroiliitis Lesions in Ankylosing Spondylitis on Diffusion Weighted Imaging?

Sanal HT, Yilmaz S, et al:

Skeletal Radiol 2012; June 28 (): epub ahead of print

Gadolinium-enhanced and diffusion-weighted imaging sequences are comparable in terms of visual analysis and visual perception when evaluating lesions of sacroiliitis in the active inflammatory stage in patients with ankylosing spondylitis.

Objective: To evaluate contrast to noise ratios in diffusion-weighted MR sequences for lesions of sacroiliitis in patients with ankylosing spondylitis.

Design/Participants: In this case-control study, 21 patients diagnosed with ankylosing spondylitis served as the study group, while 7 patients with low back pain but normal sacroiliac joints by MR were part of the control group. Fat saturated T1-weighted fast spin echo before and after gadolinium, short tau inversion recovery (STIR), and diffusion-weighted sequences were obtained on a 1.5-Tesla scanner. Fifty-four sacroiliac lesions were first noted on STIR-weighted images as areas of increased subchondral bone marrow activity. Post-gadolinium T1- and diffusion weighted images were then reviewed for corresponding areas of signal abnormality. There were 50 lesions on each of the 3 imaging sequences of interest. Regions of interest were drawn around each lesion in order to calculate contrast to noise ratios. Contrast to noise ratios were also calculated for the control group.

Results: The mean contrast to noise ratio was 32.97 on STIR sequences, 30.16 on the gadolinium-enhanced sequences, and 24.47 on diffusion-weighted images. In the control group, the mean contrast to noise ratio was 3.52 on STIR sequences, 2.99 on the gadolinium-enhanced sequences; and 3.96 on diffusion-weighted images. The difference in mean contrast ratios between gadolinium-enhanced and diffusion-weighted sequences in patients with lesions of active sacroiliitis was not statistically significant. The differences in mean contrast ratios between the study and control groups were statistically significant.

Conclusions: Gadolinium-enhanced and diffusion-weighted imaging sequences are comparable in terms of visual analysis and perception when evaluating lesions of sacroiliitis in the active inflammatory stage in patients with ankylosing spondylitis.

Reviewer’s Comments: There are some limitations to this study. This was a small sample size, and all patients had ankylosing spondylitis that was long-standing, with a mean duration of 4 years. It is important to note that this study does not evaluate the clinical outcome or clinical effect of substituting diffusion-weighted imaging for gadolinium-enhanced images. One unstated assumption is that all lesions on enhanced images were accounted for on diffusion-weighted imaging. (Reviewer-John Hochhold, MD).

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Keywords: Sacroiliitis, Contrast to Noise Ratios, Diffusion-Weighted Imaging

Print Tag: Refer to original journal article
The tendons and fibrocartilages are the musculoskeletal structures most susceptible to injury in the practice of yoga.

Objective: To study the imaging appearance of musculoskeletal injuries related to yoga.

Methods: In this retrospective study, a database search was performed for the term "yoga" in radiology reports dated from January 2002 to January 2011. This yielded 56 reports on 38 patients (10 men and 28 women). All patients presented with acute symptoms related to the practice of yoga. Imaging reports and images were reviewed in consensus by a musculoskeletal radiologist and 3 musculoskeletal radiology fellows.

Results: A total of 23 injuries were noted in 20 of the 38 patients. Slightly more than one-third of all injuries (8/23) were tendinous. There were 3 Achilles tendon partial-thickness tears, 4 supraspinatus tendon tears (3 partial-thickness and 1 full-thickness), and 1 peroneus brevis partial thickness tear. There were also 8 fibrocartilaginous injuries comprised of 2 medial meniscal tears, 2 acetabular labrum tears, 2 glenoid labrum tears, and 2 lumbar disc annular tears with disc extrusion. Two patients had transient patellar dislocation. Finally, there was 1 inguinal hernia, a dissociation of the polyethylene liner from the acetabular cup in a hip arthroplasty, a fracture of the proximal phalanx of the first digit of the foot, and a joint effusion. Headache was the most common symptom after yoga, occurring in 7 patients, though no associated imaging abnormalities were found.

Conclusions: The tendons and fibrocartilages are the musculoskeletal structures most susceptible to injury in the practice of yoga.

Reviewer’s Comments: In their discussion, the authors describe different yoga poses and how they can mechanically lead to injury under the right circumstances. Nearly all of the injuries were of the soft-tissue variety and not osseous in nature. The injuries also varied in anatomic location, likely underscoring the plethora of different yoga styles, positions, and practices. It is important to note that this study looked at only the acute onset of symptoms. Possible chronic injuries related to yoga were not identified or studied. Finally, the prevalence of acute injury in yoga cannot be assessed, partly because injuries not referred for imaging were not considered in this study. (Reviewer-John Hochhold, MD).

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Keywords: Yoga, Musculoskeletal Injuries, Imaging

Print Tag: Refer to original journal article
Microgravity Can Induce Intraorbital and Intracranial Changes on Imaging

Orbital and Intracranial Effects of Microgravity: Findings at 3-T MR Imaging.
Kramer LA, Sargsyan AE, et al:

Radiology 2012; 263 (June): 819-827

Orbital effects of microgravity can mimic imaging findings seen in idiopathic intracranial hypertension.

Objective: To evaluate intraorbital and intracranial effects of microgravity using 3-T MRI.
Design/Participants: Retrospective study of 27 astronauts (mean age, 48.4 ± 4.5 years) with prior exposure to microgravity who underwent 3-T brain MRI between 2009 and 2010.
Methods: 3-T MRI image analysis and quantification was performed by a radiologist with 22 years of MR imaging experience, with additional quantification of optic nerve sheath diameter (ONSD) by a radiologist with 27 years of orbital ultrasonography experience. ONSD was quantified in the retrolaminar optic nerve. OND and central optic nerve T2 hyperintensity were quantified at mid orbit. Qualitative analysis of the optic nerve sheath, optic disc, posterior globe, and pituitary gland morphology was performed and correlated for association with intracranial evidence of hydrocephalus, vasogenic edema, central venous thrombosis, and/or mass lesion. The orbit was evaluated for evidence of optic disc protrusion and for posterior globe flattening. The optic nerve sheath was evaluated for the presence of normal redundancy or redundancy with a kink.
Results: MRI of the orbits and brain was performed in 27 consecutive astronauts (group 1), with 8 astronauts having undergone a repeat study after an additional mission in space (group 2). The total flight days in microgravity averaged 108 ± 100 days for group 1 and 130 ± 121 days for group 2. The mean ONSDs at 3, 4, and 5 mm posterior to the vitreoretinal interface (VRI) for group 1 had a maximum value of 3 mm. For the 8 astronauts in group 2, the mean ONSD at 4 mm posterior to the VRI was 6.65 ± 1.42 mm before space flight and did not significantly differ after the mission (6.66 ± 1.72 mm). Posterior globe flattening was seen in 7 of the 27 astronauts (26%), optic nerve protrusion in 4 (15%), and moderate concavity of the pituitary dome with posterior stalk deviation in 3 (11%) without additional intracranial abnormalities. Retrolaminar OND increased linearly relative to ONSD. A central area of T2 hyperintensity was identifiable in 26 of the 27 astronauts (96%) and increased in diameter in association with kinking of the optic nerve sheath.
Conclusions: Microgravity can induce a spectrum of intraorbital and intracranial changes that on imaging can mimic findings seen in idiopathic intracranial hypertension.
Reviewer's Comments: The article provides a comprehensive overview of findings that can be seen in astronauts exposed to microgravity. This is a relevant topic in today's age of space exploration as possibilities of potential missions to Mars and commercial space travel are being explored. Microgravity-induced changes represent a hypothetical risk factor of space flight, thus knowledge of imaging findings associated with these changes will play an important role in management of this subset of patients. (Reviewer-Sebastian Sadowski, MD).

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Keywords: Neuroradiology, Microgravity, Intracranial Abnormalities, Intraorbital Abnormalities

Print Tag: Refer to original journal article
Can BRAF Mutation Status Augment Sonography and FNA Cytology in Diagnosing PTC?

BRAF Mutation Analysis and Sonography as Adjuncts to Fine-Needle Aspiration Cytology of Papillary Thyroid Carcinoma: Their Relationships and Roles.

Moon W-J, Choi N, et al:

AJR Am J Roentgenol 2012; 198 (March): 668-674

**Objective:** To evaluate the relationship between BRAF mutation status, sonography findings, and fine-needle aspiration (FNA) cytology in patients with papillary thyroid carcinoma (PTC).

**Design/Participants:** Retrospective study of the records of 524 patients with 553 thyroid nodules (437 women, 87 men; mean age, 50 years; range, 17 to 81 years) who underwent sonography, sonography-guided FNA, and BRAF analysis between March 2006 and June 2008.

**Methods:** All patients included in the study underwent either surgery after thyroid sonography and FNA, FNA at least twice with a 1-year interval for a benign thyroid lesion, or FNA and sonography follow-up (>12 months after FNA cytology diagnosis) for a benign thyroid lesion. Two radiologists with 11 and 8 years of experience with thyroid ultrasound and FNA, respectively, performed all sonography examinations and FNA procedures. Sonography characteristics and sonography diagnoses were recorded. Final assessments were categorized as suspicious for malignancy, indeterminate, or probably benign. When a single thyroid nodule was found on sonography, FNA of the suspicious nodule was performed. Finally, cytology slides were retrieved for BRAFV600E analysis.

**Results:** BRAFV600E was detected in 141 of 170 malignant thyroid nodules (82.9%). Of these, 140 were conventional PTCs and 1 was a follicular-variant PTC. None of the 383 benign thyroid nodules harbored BRAFV600E. Only irregular shape was found to have a negative association with BRAFV600E status (P =0.004). Of all 164 PTC nodules, none were diagnosed as benign on cytology. An indeterminate cytology finding was more frequent for BRAFV600E-negative PTCs than for BRAFV600E-positive PTCs. The sensitivity and specificity of sonography for diagnosing malignant thyroid nodules were 94.1% and 93.2%, respectively. When sonography and cytology were considered in combination, they showed significantly higher sensitivity than sonography alone (97.6% vs 94.1%, respectively; P =0.014), but no significant difference in terms of specificity than sonography alone (P =1.0). The specificity of BRAFV600E status was 100%. By adding BRAFV600E analysis to cytology, sensitivity for malignancy significantly increased (94.1%) as compared with cytology alone (81.8%) (P <0.001). Finally, the triple combination of sonography, cytology, and BRAFV600E status showed higher sensitivity than BRAFV600E and cytology (98.2% vs 94.1%, respectively) (P =0.023).

**Conclusions:** A combination of sonography, BRAF mutation analysis and FNA cytology can increase the sensitivity of preoperative diagnosis for malignancy in PTC.

**Reviewer's Comments:** I agree with the authors that addition of BRAF mutation analysis to sonographic and FNA cytologic assessment of thyroid nodules can increase the sensitivity of detecting papillary thyroid carcinoma. It is a promising adjunct that may play an important role, especially in cases where FNA yields indeterminate results. The implications are important because this can help radiologists decide whether surgery should be recommended and hence help in patient management. (Reviewer-Sebastian Sadowski, MD).

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Keywords: Neuroradiology, Papillary Thyroid Cancer, BRAF Mutation

Print Tag: Refer to original journal article
Frequency and Clinical Importance of Incidental Abnormalities Detected on Lumbar CT

Extraspinal Findings at Lumbar Spine CT Examinations: Prevalence and Clinical Importance.

Lee SY, Landis MS, et al:
Radiology 2012; 263 (May): 502-509

Lumbar CT images detect a small number of clinically important findings, but also a large number of incidental irrelevant findings.

Objective: To evaluate the frequency and clinical relevance of incidentally detected findings during routine CT examination of the lumbar spine.

Design/Participants: Prospective study of 400 patients (212 men and 188 women aged 20 to 91 years) who underwent outpatient lumbar spine CT between June 2008 and July 2009.

Methods: Each lumbar spine CT examination was reported by a neuroradiologist, with extraspinal findings included in the spinal CT report. Subsequently, abdominal images for each patient were independently reviewed by a neuroradiologist with 8 years of experience and 2 body radiologists with 7 and 5 years of experience, respectively. The reporting of the extraspinal findings was modeled after the CT Colonography Reporting and Data System (C-RADS). Only anatomic variants were recorded for the C-RADS E1. The C-RADS E2 category was assigned to clinically unimportant findings for which no further work-up or assessment was indicated. C-RADS E3 findings were indeterminate, incompletely characterized, but likely benign findings for which clinical correlation and further work-up could be performed if indicated. The C-RADS E4 category designated potentially important findings requiring further work-up and communication to the referring physician, as per accepted practice guidelines. The electronic medical records of the patients with C-RADS E3 and E4 extraspinal findings were reviewed to assess how many of these findings were previously unknown and the treatment of these findings.

Results: Extraspinal findings with C-RADS E2, E3, or E4 classification were noted in 160 of 400 patients. The full field-of-view (FOV) was required to best visualize extraspinal abnormalities in 127 (79.4%) of 160 cases. Fifty-nine patients (14.8%) had indeterminate or clinically important (C-RADS E3 or E4) findings. Findings in 17 (4.3%) patients were categorized as C-RADS E4. After review of the electronic medical record, the prevalence of clinically important findings was 4.3%, comprising an early stage renal cell carcinoma and transitional cell carcinoma, chronic lymphocytic leukemia, sarcoidosis, and 13 abdominal aortic aneurysms. Excluding anatomic variants, the full FOV was required to best visualize extraspinal abnormalities in 127 (79.4%) of 160 patients.

Conclusions: Reviewing the full-FOV from lumbar CT images will detect a small number of clinically important findings as well as a large number of incidental and clinically irrelevant findings.

Reviewer's Comments: I agree with the authors' conclusions in this article. Although the article does not resolve the issues involved in this ongoing debate, it does bring into focus the reality that radiologists must weigh the risks and potential benefits for the patient before routinely screening for extraspinal findings on large FOV lumbar CT studies. We must remember that incidental findings discovered during these exams may lead to serious morbidity for the patient and contribute significantly to already escalating health care costs. (Reviewer-Sebastian Sadowski, MD).

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Keywords: Neuroradiology, Extraspinal Findings

Print Tag: Refer to original journal article
Patients With HE Show Diffuse Changes in Resting Brain Activity

Altered Resting-State Brain Activity at Functional MR Imaging During the Progression of Hepatic Encephalopathy.
Qi R, Zhang L, et al:
Radiology 2012; 264 (July): 187-195

Decreased levels of amplitude of low-frequency fluctuation (ALFF) in the default-mode network and increased ALFF in the posterior insular cortex are dependent on the severity of hepatic encephalopathy.

Objective: To evaluate spatial patterns of the amplitude of low-frequency fluctuation (ALFF) in patients with varying degrees of hepatic encephalopathy (HE) and to correlate these findings with clinical markers of HE.

Design/Participants: Prospective study of 46 patients (34 male and 12 female; 15 with severe HE, 14 with minimal HE, and 17 healthy controls) who were recruited into the study between December 2007 and December 2009.

Methods: Diagnosis and classification of overt and minimum HE was performed by 2 experienced clinical surgeons. Minimal HE was diagnosed if a patient with cirrhosis did not show clinically overt symptoms. Overt HE was graded according to the West Haven criteria. Laboratory parameters, including prothrombin time, protein metabolism test results, and venous blood ammonia levels, were obtained from all patients. The severity of liver disease was determined according to the Child-Pugh score. The ALFF, an index reflecting the amplitudes of spontaneous brain activity, was compared among patients with overt and minimal HE and controls. Pearson correlation analysis was performed between the ALFF and the venous blood ammonia level and Child-Pugh score of all patients with HE.

Results: Data from 2 patients with overt HE and 1 with minimal HE were excluded because of excessive movement. Within each group, standardized values in the posterior cingulate cortex (PCC) and precuneus were significantly higher than the global mean ALFF value. Other brain regions, including the medial prefrontal cortex (MPFC), inferior parietal lobe (IPL), and occipital areas, also have high ALFF values. Compared with control subjects, patients with overt and minimal HE showed decreased ALFF mainly in regions within the default-mode network (DMN), and increased ALFF in the cerebellum and middle temporal gyrus. Compared with patients with minimal HE, those with overt HE showed decreased ALFF in DMN regions and increased ALFF in the posterior insular cortex. Both the venous blood ammonia levels and Child-Pugh scores of individual patients with HE showed negative correlation with ALFF within some DMN regions, whereas they showed positive correlation with ALFF in the posterior insular cortex.

Conclusions: Patients with hepatic encephalopathy show diffuse changes in brain activity. In particular, decreased levels of ALFF in the DMN and increased ALFF in the posterior insular cortex are dependent on the severity of HE.

Reviewer's Comments: I agree with the conclusions of this article in that patients with HE show diffuse changes in brain activity. I think this article is an important step in the ongoing process of trying to uncover and link imaging findings with metabolic abnormalities and functional reorganization of the cortex in patients suffering from liver disease. (Reviewer-Sebastian Sadowski, MD).

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Keywords: Neuroradiology, Hepatic Encephalopathy

Print Tag: Refer to original journal article
Triple Receptor-Negative Breast Cancer -- A Bad Actor With Suspicious Imaging Features

Triple Receptor-Negative Breast Cancer: Imaging and Clinical Characteristics.
Krizmanich-Conniff KM, Paramagul C, et al:

AJR Am J Roentgenol 2012; 199 (August): 458-464

Triple receptor-negative breast cancer most commonly presents as a mammographically evident mass without calcifications.

**Background:** Triple receptor-negative breast carcinoma is described as being an aggressive form of breast cancer characterized by a lack of progesterone, estrogen, and human epidermal growth factor 2 (HER2) receptors on histologic analysis. These cancers have been shown to have poorer clinical outcomes with greater likelihood of distant metastatic disease.

**Objective:** To describe the imaging findings of triple receptor-negative breast cancer.

**Design/Methods:** Over a 9-year retrospective period, patients at a single institution who had been diagnosed with triple receptor-negative breast cancer were identified through a search in the electronic medical record system. Clinical and imaging data were reviewed and information such as patient age at diagnosis, method of detection, tumor size at diagnosis, and findings on mammography and ultrasound was recorded. Furthermore, 2 radiologists participating in the study independently retrospectively reviewed the images for those patients with triple receptor-negative breast cancer and recorded their findings.

**Results:** 207 women diagnosed with triple receptor-negative breast cancer were included in the analysis. Of those, 58% presented on mammography as masses without calcifications, with only 7% presenting as calcifications alone. Those masses that were described as having ill-defined or spiculated margins on mammography constituted 67% of all cases, with only 8% described as being well circumscribed. A total of 2% of cases were mammographically occult. As a comparison, non-triple receptor-negative cases presented as masses without calcifications 45% of the time; 11% of those presented as calcifications alone. On ultrasound, 77% of triple receptor-negative cases were described as being hypoechoic and 65% were irregular in shape. Only 20% were described as being oval and 13% were described as being round. On ultrasound, margins were described as being circumscribed only 13% of the time. About 42% of the time, the masses were deemed non-parallel (taller than wide) in configuration with respect to the skin surface. The majority of triple receptor-negative cancers presented with a clinical symptom and more than one third had no prior mammogram.

**Conclusions:** Triple receptor-negative cancers most commonly present as a mass without calcifications on mammography with irregular shape and ill-defined or spiculated margins.

**Reviewer's Comments:** The study is a nice summary of findings associated with triple negative breast cancers. The implications for practice are not that profound since the imaging features described always warrant a recommendation for biopsy. (Reviewer-Basil Hubbi, MD).

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Keywords: Mammography, Ultrasound, Triple Negative Breast Cancer, Estrogen Receptor, Progesterone Receptor, HER2

Print Tag: Refer to original journal article
Mammographic Breast Density -- In the Eye of the Beholder on Any Given Day

Reproducibility of BI-RADS Breast Density Measures Among Community Radiologists: A Prospective Cohort Study.

Spayne MC, Gard CC, et al:

Breast J 2012; 18 (July): 326-333

There is considerable intra-observer variability in the interpretation of mammographic breast density.

**Background:** Mammographic breast density is judged as the proportion of fibroglandular tissue to fat on a given mammogram. Increase in breast density has been documented to be an independent risk factor for the development of breast cancer. Mammographic breast density has been adopted as part of the standardized reporting derived from the BI-RADS lexicon.

**Objective:** To evaluate the reproducibility of mammographic breast density descriptions based on performance by community radiologists.

**Methods:** Data were mined from the Vermont-based registry of the Breast Cancer Surveillance Consortium, a National Cancer Institute-supported nationwide clinical, radiologic, and pathologic registry. Over a 10-year period, mammographic breast density on women undergoing screening mammography was recorded. For the purposes of this study, only postmenopausal women were included in the analysis and only screen-film mammography was evaluated. Those women on hormone replacement therapy or those taking tamoxifen were excluded from the study. The intra-observer agreement of mammographic breast density was assessed for these postmenopausal patients, and the same radiologist interpreted the yearly screening mammograms that were closest in interval time of acquisition.

**Results:** The average age of patients undergoing screening mammography was 66 years. Approximately 10% of patients were categorized as having predominantly fatty breasts, almost 61% were described as having scattered fibroglandular elements, and 30% were found to have heterogeneously dense or extremely dense breasts. For nearly 23% of women, the breast density was interpreted differently between the first and second mammograms in the mammographic pairs studied with a 77.5% intra-observer agreement found. Almost 50% of women who were originally interpreted as extremely dense were re-classified as heterogeneously dense on the subsequent mammogram. There was a wide variability between individual radiologists with 18% having only slight or fair agreement.

**Conclusions:** There is considerable intra-observer variation between radiologists interpreting mammographic breast density in the community setting.

**Reviewer's Comments:** The authors have demonstrated considerable intra-observer variability in the assessment of mammographic breast density as interpreted on screen-film mammography. With the wide adoption of digital mammography, there may be a day when we see similar variability documented on a future study or perhaps improvement in consistency due to digital technique. Nonetheless, this may be a task one day relegated to computer analysis. With studies such as this, there may be a push for efficient computer algorithms that may assess breast density on digital mammography with better consistency than that demonstrated in this study. (Reviewer-Basil Hubbi, MD).

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Keywords: Mammography, Mammographic Breast Density, Intra-Observer Variability

Print Tag: Refer to original journal article
Breast MRI Has Promising Potential as Follow-Up for High-Risk Lesions

High-Risk Breast Lesions at Imaging-Guided Needle Biopsy: Usefulness of MRI for Treatment Decision.

Londero V, Zuiani C, et al:

AJR Am J Roentgenol 2012; 199 (August): W240-W250

Breast MRI has a high negative predictive value for malignancy for those patients diagnosed with a high-risk lesion on core needle biopsy.

**Background:** High-risk lesions detected on breast biopsy include a heterogeneous group of lesions with uncertain malignant potential, which often warrant surgical excision when detected on image-guided core needle biopsy (CNB). Lesions such as radial scar, atypical ductal hyperplasia, and papilloma with atypia often fall into this category, although there is no universal consensus on the appropriate course of action when these are detected on CNB.

**Objective:** To evaluate the role of MRI follow-up for high-risk lesions detected on percutaneous core needle breast biopsy.

**Design/Methods:** The authors defined several categories of high-risk lesions, which included papillomas with or without atypia, atypical ductal hyperplasia, lobular neoplasia, and radial sclerotic lesions (radial scar). A retrospective review of percutaneous CNBs performed over a 7-year period was performed to identify those cases of high-risk lesion. Cases were included in the study if the patients had never been diagnosed with breast cancer previously and if they had undergone MRI as part of imaging follow-up. All cases had to have mammographic and sonographic imaging available. Follow-up MRI studies were retrospectively reviewed by 2 radiologists who resolved disagreements in imaging characteristics via consensus. Both morphologic and kinetic features of the lesions being analyzed were recorded based on the BI-RADS MRI lexicon.

**Results:** A total of 190 high-risk lesions were ultimately surgically excised. Of those, 16% were upgraded to malignancy on surgical excision, with 63% of those documented to be ductal carcinoma in situ. Notably, atypical ductal hyperplasia had the greatest rate of upgrade to malignancy (37%) on surgical excision and radial sclerosing lesions had the lowest rate of upgrade to malignancy on surgical excision (3%). Among preoperative breast MRI BI-RADS descriptors, no statically significant morphologic or kinetic feature was associated with an increased potential for malignancy. Regarding BI-RADS final assessment, only lobular neoplasia was associated with higher rates of upgrade when the mass-like enhancement on MRI was deemed to be a BI-RADS 4 or 5. Specific to the high-risk lesion studies on MRI, the breast MRI was found to be 93% sensitive and 36% specific for the detection of malignancy with a negative predictive value of 97%. Cancer probability was significantly higher for those lesions that enhanced with contrast than for those that did not.

**Conclusions:** Lack of contrast enhancement of a high-risk lesion on breast MRI allowed reliable exclusion of invasive carcinoma.

**Reviewer's Comments:** The findings in this study are promising for the potential use of breast MRI as a follow-up to high-risk lesions, particularly for lobular neoplasia. The lessons from the diagnostic performance of breast MRI as presented here can really only be applied to those patients refusing surgical excision, as this is still the standard of care. (Reviewer-Basil Hubbi, MD).

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Keywords: MRI, High Risk Lesion, Papilloma, Atypical Ductal Hyperplasia, Lobular Neoplasia, Radial Sclerosing Lesion

Print Tag: Refer to original journal article
See You in 6 Months -- Semi-Annual Follow-Up Mammo After Breast Conservation Tx

Benefit of Semiannual Ipsilateral Mammographic Surveillance Following Breast Conservation Therapy.
Arasu VA, Joe BN, et al:
Radiology 2012; 264 (August): 371-377

Semi-annual mammography follow-up detects recurrent carcinoma at an earlier stage than does annual follow-up.

**Background:** It has been documented that those patients who have been diagnosed with and treated for breast cancer are at an increased risk for recurrence, which has been described as 1% to 2% per year for 10 years. Due to a lack of sufficient data, there has been no universalized approach in the follow-up interval recommendations for patients who have been treated for breast cancer.

**Objective:** To compare the efficacy of semi-annual versus annual mammographic follow-up for patients who have been treated for breast cancer.

**Design/Methods:** Over a retrospective period of 11 years, patients who were undergoing mammographic surveillance after breast conservation surgery were identified in a database. The standard recommendations had been that patients undergo mammography every 6 months after treatment completion for a period of 5 years. After 5 years, as long as the patient remained asymptomatic, it was then recommended that she undergo yearly mammography. Comparison was then made between those patients who were compliant with the recommended semi-annual follow-up and those who were non-compliant with the annual follow-up recommendation. Semi-annual follow-up was defined as those patients who had sequential examinations within 274 days of each other, and non-compliant annual follow-up was defined as those patients who had sequential examinations between 275 and 548 days of each other. The last examination interval that resulted in detection of cancer was used to define the follow-up for a particular patient. For example, if a patient returned within 274 days for sequential mammograms and cancer was detected, she was considered part of the semi-annual follow-up cohort. If she had cancer diagnosed after returning for sequential mammograms performed between 274 and 548 days of each other, she was considered part of the annual follow-up cohort. Outcomes between the 2 different cohorts were compared and statistical analysis was utilized.

**Results:** A total of 8234 examinations were analyzed and 85% of those were in patients who were compliant with the semi-annual follow-up recommendations. Mean follow-up time for those in the semi-annual group was 190 days and 369 days for those in the non-compliant annual group. When identified, recurrent cancers at the semi-annual follow-up interval were found at an earlier stage than those cases identified at the annual follow-up rate. Stage I cancers comprised 90% of those detected under semi-annual surveillance and 64% of those detected under annual surveillance.

**Conclusions:** Semi-annual mammographic follow-up identified cancer recurrence at an earlier stage than did annual follow-up.

**Reviewer’s Comments:** The findings from this paper should not prompt radical changes to practice standards that have been established de facto through suggested follow-up from certain medical societies. Likely, the findings here may one day be integrated into recommendations that have yet to be galvanized by any guild. (Reviewer-Basil Hubbi, MD).

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Keywords: Mammography, Semi-Annual Follow-Up, Breast Conservation Treatment

Print Tag: Refer to original journal article