

## Does Focal Confluent Hepatic Fibrosis in Cirrhotic Livers Change Over Time?

*Focal Confluent Fibrosis in Cirrhotic Liver: Natural History Studied With Serial CT.*

Brancatelli G, Baron RL, et al:

*AJR*; 192 (May): 1341-1347

Focal confluent hepatic fibrosis demonstrates an increasing degree of capsular retraction over time.

**Objective:** To evaluate for a change in the appearance of focal confluent hepatic fibrosis encountered in cirrhotic patients.

**Design:** Retrospective analysis.

**Participants:** 26 patients (19 men, 7 women).

**Methods:** The 3 inclusion criteria for the study were a diagnosis of cirrhosis, having undergone a contrast-enhanced CT, and having had a repeat CT of the liver at least 6 months after the initial study. Underlying causes for cirrhosis included alcoholism, primary sclerosing cholangitis, hepatitis C, HIV with hepatitis C, and HIV with hepatitis B and C. Cirrhosis was diagnosed on the basis of clinical findings in 11 patients and by liver biopsy or transplantation in the remaining 15 patients. CT examinations were performed with a single or multidetector unit. Unenhanced images were obtained followed by multiphasic contrast-enhanced images during the hepatic arterial dominant and portal venous dominant phases at 30 to 35 seconds and 65 to 70 seconds, respectively. Focal confluent fibrosis was present if there was a peripheral, wedge-shaped area that was of similar or lower attenuation than the adjacent liver on unenhanced images. The attenuation of this area was also compared to that of the liver on the hepatic arterial and portal venous phases. This area also had to have associated focal flattening or concavity of the hepatic surface contour. A total of 118 examinations were reviewed by 2 radiologists. They recorded the number, segmental location, attenuation, and size of capsule retraction associated with the focal confluent fibrosis. The greatest craniocaudal, transverse, and anteroposterior dimensions of the capsular retraction were measured. The volume of capsule retraction was calculated using the ellipsoid volume formula. Twisted and crowded vessels in the focal confluent fibrosis were defined as being "trapped," and were also recorded as a secondary sign of benign fibrosis. The change in extent of retraction was measured with a retraction index.

**Results:** The results showed that there were 41 focal confluent fibrosis lesions identified. One lesion was found in 12 patients, 2 in 13 patients, and 3 in 1 patient. Approximately 83% of these were found in segments IV, VII, or VIII. Trapped vessels were found in 15%; 78% were lower attenuation than the adjacent liver on unenhanced images. None of the areas of focal confluent hepatic fibrosis were of higher attenuation than the adjacent liver parenchyma on unenhanced CT. There was a significant increase in the retraction index over time, and capsule retraction developed in all of the lesions.

**Reviewer's Comments:** These results illustrate the rather dynamic evolution of focal confluent hepatic fibrosis with accompanying capsular retraction. This may aid in differentiating this finding from hepatocellular carcinoma. One of the limitations noted in this study was the retrospective design, which may have allowed for some selection bias.

**Additional Keywords:** Focal Confluent Fibrosis

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## What Are the Common Vascular Morphologic Features of Cirrhosis?

*Changes in Hepatic Venous Morphology With Cirrhosis on MRI.*

Zhang Y, Zhang XM, et al:

*J Magn Res Imaging*; 29 (May): 1085-1092

The presence of a minimally enlarged main portal vein in the setting of small intrahepatic portal and hepatic veins can be indicative of cirrhosis.

**Objective:** To determine if there are hepatic venous morphological changes common in patients with cirrhosis.

**Design:** Retrospective analysis.

**Participants:** This study was comprised of 74 patients with cirrhosis, who were compared to 85 liver donor candidates.

**Methods:** MR examinations were performed on a 1.5T system. A routine liver protocol was employed, which included a 3D spoiled gradient echo fat-suppressed sequence that was obtained prior to and at 15, 60, 180, and 300 seconds following IV contrast administration. The images were reviewed by 2 radiologists and 1 radiology resident. The maximal diameters of the hepatic veins, portal veins, superior mesenteric vein, splenic vein, and renal veins were recorded. The inferior vena cava (IVC) was measured at 3 locations: suprahepatic, just under the diaphragm; intrahepatic, at the midportion of the liver; and infrahepatic, just above the renal veins. The volumes of the caudate lobe, spleen, and entire liver were also calculated.

**Results:** The hepatic vein size and splenic volume measurements had the strongest correlation with cirrhosis. Using a right hepatic vein (RHV) measurement <7 mm, the specificity was 85% and the sensitivity was 88% for a diagnosis of cirrhosis. False negatives occurred in patients with congestive heart failure, with associated dilatation of the IVC and hepatic veins due to elevated central venous pressures. False positives occurred with donor patients who had either a large accessory RHV or middle hepatic vein (MHV) drainage of segment 8. When a RHV measurement cut off of 5 mm was used, there was 99% specificity and 59% sensitivity for cirrhosis. A donor with a large accessory RHV was the only false positive encountered with this 5-mm cut off measurement. The main portal vein, superior mesenteric vein (SMV), and splenic vein diameters as well as the caudate lobe, left lobe liver, and splenic volumes were all significantly increased in the cirrhotic group. The anterior and posterior right portal veins were smaller in cirrhotic patients, while the left portal vein was not significantly different from the donor group. However, if there was a recanalized umbilical vein present, the left portal vein was significantly larger than in cirrhotic patients without a recanalized umbilical vein. There was no difference in right renal vein diameter between the cirrhotic and donor groups. The left renal vein was significantly larger in cirrhotic patients, especially if there was a splenorenal shunt present.

**Reviewer's Comments:** The results of this study are useful in that they place emphasis on the vascular changes associated with cirrhosis as opposed to the parenchymal morphological findings classically described. A limitation reported in this study was that the liver transplant population had end-stage cirrhosis, and therefore, the utility of hepatic vein measurement might be better addressed using patients with various degrees of liver fibrosis.

**Additional Keywords:** Morphology

**print tag:** () Refer to original journal article.



## DW MRI Aids Evaluation of Patients With Gross Hematuria

*Bladder Cancer: Diagnosis With Diffusion-Weighted MR Imaging in Patient's With Gross Hematuria.*

Abou-El-Ghar ME, El-Assmy A, et al:

*Radiology*; 251 (May): 415-421

Diffusion-weighted MRI had excellent agreement with cystoscopy in the identification of bladder neoplasms.

**Objective:** To determine if diffusion-weighted (DW) MRI is useful in detecting bladder neoplasms in patients presenting with gross hematuria.

**Design:** Prospective analysis.

**Participants/Methods:** This study was comprised of 130 patients who presented with gross hematuria and had a normal ultrasound of the upper urinary tract. Exclusion criteria included urinary tract trauma, upper urinary tract neoplasms or calculi, and contraindications to MRI or cystoscopy. Cystoscopy was performed within 48 hours of the MRI examinations, which were performed with a 1.5-T system. Imaging included T2-weighted MRI and DW MRI. DW MRI was acquired using  $b$  values of 0 and 800 seconds/mm<sup>2</sup>. The DW MRIs were reviewed by 2 radiologists without knowledge of the cystoscopic findings. The T2-weighted images were reviewed separately and also without knowledge of the cystoscopic findings. The bladder neoplasms had higher signal than the bladder wall and urine on the  $b$  value 800 DW images, as did prostatic and ureteric tumors. The bladder wall was defined as being thickened if it measured >3 mm. A urologist performed the cystoscopic examinations without knowledge of the MRI findings.

**Results:** Bladder neoplasms were found in 106 of the 130 patients using reference standard tests; 123 lesions were found by cystoscopy. On MRI, 98% of the posterior wall lesions, 100% of anterior wall lesions, and 90% of bladder dome lesions were detected on both T2-weighted and DW sequences. Lateral bladder wall lesions were detected slightly better with DW sequences than with T2. Of the 123 lesions, 121 were detected by DW images; the 2 false negatives were due to small polypoid neoplasms measuring 3 to 4 mm in diameter. Of the 123 lesions, 119 were detected by T2-weighted images. The 4 false negatives were due to small polypoid neoplasms measuring 3 to 6 mm in diameter. The detection of bladder neoplasms by DW images had 98% sensitivity, 92% specificity, 100% positive predictive value, 92% negative predictive value, and 97% accuracy. The detection of bladder neoplasms by T2-weighted images had 96% sensitivity, 86% specificity, 100% positive predictive value, 86% negative predictive value, and 94% accuracy. The causes for hematuria in the remaining 24 patients included cystitis, prostate adenocarcinoma, benign prostatic hyperplasia, ureteric neoplasm, and adherent colonic carcinoma. DW MRI had 98.5% sensitivity and 100% positive predictive value for detecting the cause of hematuria compared to 96.9% sensitivity and 100% positive predictive value provided by T2-weighted MRIs.

**Conclusions/Reviewer's Comments:** The results of this study are useful in demonstrating that DW MRI is a helpful technique that can aid in the evaluation of patients with gross hematuria and assist in bladder tumor identification. One of the limitations reported in this study was that it did not compare the DW MRI and T2-weighted MRI findings with regard to staging of the bladder neoplasms.

**Additional Keywords:** DW MRI

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## Prospective ECG Triggering Better Than Retrospective ECG Gating

*Whole-Chest 64-MDCT of Emergency Department Patients With Nonspecific Chest Pain: Radiation Dose and Coronary Artery Image Quality With Prospective ECG Triggering Versus Retrospective ECG Gating.*

Shuman WP, Branch KR, et al:

AJR; 192 (June): 1662-1667

For whole-chest CTA, 64-MDCT using prospective ECG triggering compared with retrospective ECG gating results in a significantly lower radiation dose and results in improved coronary image quality.

### Whole-Chest CTA

**Objective:** To compare whole-chest coronary CT angiography (CTA) using retrospective electrocardiography (ECG) gating with prospective ECG triggering with regard to radiation dose and coronary image quality.

**Design:** Prospective study.

**Participants:** 72 patients who presented to the emergency department (ED) with nonspecific chest pain. All patients had a low or moderate thrombolysis in myocardial infarction (TIMI) risk score.

**Methods:** All CTAs were performed on the same 64-MDCT. All included patients had a heart rate <75 bpm at the time of the examination, often with the use of beta blockers. Patients received sublingual nitroglycerine prior to the CTA. The first 41 patients underwent coronary CTA utilizing retrospective ECG gating employing ECG tube current modulation. Images were reconstructed from 0% to 90% of the R-R interval in 10% increments as well as at 75% of the R-R interval. The subsequent 31 patients underwent coronary CTA utilizing prospective ECG triggering. Images were reconstructed from 60% to 80% of the R-R interval in 5% increments. Since a whole-chest protocol was employed, a 3-phase bolus was used to get good contrast opacification of the coronary arteries, aorta, and pulmonary arteries. Seventy mL of iodixanol was followed by 50 mL of a 70%/30% iodixanol and saline solution mixture, followed by 50 mL of saline solution, all given at 5 mL/s. All images were analyzed on a 3D workstation. The coronary artery image quality was qualitatively graded on a 4-point scale. The radiation dose for each patient was also calculated.

**Results:** For patients who underwent retrospective ECG-gated CT, the average patient radiation dose was 31.8 5.1 mSv (range, 27.3 to 40.5 mSv). For patients who underwent prospective ECG-triggered CT, the patient radiation dose was 9.2 2.2 mSv (range, 7.2 to 11.6 mSv) ( $P < 0.001$ ). This difference resulted in an average radiation dose of the prospective ECG-triggered group that was 71% less than that of the retrospective ECG-gated group. Only 2 coronary artery segments out of 512 were not able to be evaluated because of poor image quality in the retrospective ECG-gated group and only 2 segments out of 394 were not able to be evaluated because of poor image quality in the prospective ECG-triggered group. For all patients, the coronary artery segment images obtained with prospective ECG triggering were 2.2 times as likely to have a higher image quality score compared with the images obtained with retrospective ECG gating (95% CI, 1.1 to 14.5;  $P < 0.05$ ).

**Conclusions:** For whole-chest CTA, 64-MDCT using prospective ECG triggering compared with retrospective ECG gating results in a significantly lower radiation dose and results in improved coronary image quality.

**Reviewer's Comments:** The authors have nicely demonstrated that prospective ECG-triggered coronary CTA is feasible in the ED setting provided patients' heart rates are <75 bpm.

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## Two-Phase Cardiac CT Accurate for Identification of LAA Thrombus

*Left Atrial Appendage Thrombi in Stroke Patients: Detection With Two-Phase Cardiac CT Angiography Versus Transesophageal Echocardiography.*

Hur J, Kim YJ, et al:

*Radiology*; 251 (June): 683-690

Cardiac CT, in which a 2-phase technique is employed and there is also a delayed phase of imaging, is accurate for detecting left atrial appendage thrombus.

**Objective:** To evaluate the ability of 64-MDCT to detect left atrial appendage (LAA) thrombi using a 2-phase technique compared with transesophageal echocardiography (TEE).

**Design:** Prospective study.

**Participants:** 55 patients who had a recent stroke and were clinically suspected of having LAA thrombi were included. All patients underwent both cardiac CT and TEE within 5 days of one another.

**Methods:** The CTs were performed with a 2-phase protocol. The early phase evaluated the coronary arteries and the presence of cardiac thrombus. The late phase was used to distinguish thrombus from circulatory stasis. All CTs used non-ionic contrast and employed retrospective electrocardiography (ECG) gating during the early phase. During the early phase, CT scanning was started 6 seconds after a threshold attenuation of 100 Hounsfield units (HU) was reached in the ascending aorta. In the late phase, CT scanning was started 30 seconds after the end of the first CT. The late phase employed prospective ECG gating in order to reduce radiation dose. Images were reconstructed with 0.6-mm section thickness and 0.4-mm increments. A thrombus was defined as a filling defect that was oval or circular in shape and present on both the early and later phase images. Circulatory stasis was defined as a filling defect within the left atrium that was only present on the early phase. TEEs were evaluated for both thrombus and spontaneous echo contrast (SEC), which is due to slow blood flow during atrial fibrillation. SEC was evaluated for on CT as well. An LAA-ascending aorta attenuation ratio was measured for both thrombus and SEC for both early- and late-phase CT.

**Results:** On TEE, 14 thrombi were visualized in 14 patients, all within the LAA. On CT, 25 filling defects were seen in the LAA; 15 of these were diagnosed as thrombi with or without circulatory stasis and 10 were diagnosed as circulatory stasis without thrombus. The sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of 2-phase CT for detection of LAA thrombus compared with TEE was 100%, 98%, 98%, 93%, and 100%, respectively. The average size of the thrombi seen on CT was 1.82 cm<sup>2</sup> compared with 1.95 cm<sup>2</sup> on TEE. The mean LAA-ascending aorta attenuation ratio was significantly different for thrombus (0.29 HU 0.12) and circulatory stasis (0.85 HU 0.12) on the late phase images.

**Conclusions:** 2-phase cardiac CT is sensitive for detecting thrombus in the LAA.

**Reviewer's Comments:** The authors have nicely demonstrated that CT can be very accurate for detecting LAA thrombus provided a delayed phase of imaging is employed, which can help distinguish true thrombus from a pseudodeflect.

**Additional Keywords:** Detection

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## Use Low kVp for MDCT Pulmonary Angiography

*Vascular Enhancement and Image Quality of MDCT Pulmonary Angiography in 400 Cases: Comparison of Standard and Low Kilovoltage Settings.*

Matsuoka S, Hunsaker AR, et al:

*AJR*; 192 (June): 1651-1656

Using a low peak kilovoltage technique on MDCT pulmonary angiography of 100 to 110 kVp compared with the standard 120 to 130 kVp will result in better pulmonary arterial enhancement without a subjective decrease in image quality.

**Objective:** To evaluate MDCT pulmonary angiography using a low peak kilovoltage (kVp) technique.

**Design:** Retrospective.

**Participants:** 400 patients clinically suspected of having pulmonary embolism (PE) were included.

**Methods:** CTs were either performed on a 16-MDCT or a 64-MDCT; all employed automatic tube current modulation. The first 200 patients had MDCT pulmonary angiography using a standard technique. The standard technique employed 130 kVp on the 16-MDCT and 120 kVp on the 64-MDCT. The subsequent 200 patients underwent MDCT pulmonary angiography with a low kVp technique in which 110 kVp was used on the 16-MDCT and 100 kVp was used on the 64-MDCT. All CTs were performed in a caudal-cranial direction and 125 mL of nonionic contrast was given intravenously at 3.5 to 4.0 mL/s. Iopromide (Ultravist 370) or iopamidol (Isovue 370) was used as the nonionic contrast. Images were analyzed on a PACS workstation (Centricity, GE Healthcare). Pulmonary arterial enhancement was quantitatively measured at 3 levels with the use of region of interest (ROI) attenuation values: the main pulmonary artery; the right posterior basal segmental and subsegmental pulmonary arteries; and the left apical segmental and subsegmental pulmonary arteries. Image noise was evaluated by measurement of the standard deviation (SD) of the attenuation value in an ROI in the main pulmonary artery. The quality of the pulmonary arterial enhancement was also evaluated subjectively on a 5-point scale.

**Results:** Pulmonary arterial enhancement objectively was significantly higher in attenuation in the low kVp technique group compared with the standard technique group ( $P < 0.0001$ ). The average attenuation in the low peak kilovoltage technique group was 376.1  $\pm$  102.9 Hounsfield units (HU) compared to 309.2  $\pm$  94.8 HU in the standard technique group. Within the segmental and subsegmental pulmonary arteries, the average attenuation in the low peak kilovoltage technique group was also significantly higher compared with the standard technique group. Image noise was significantly higher in the low peak kilovoltage technique group (25.3  $\pm$  8.0 HU) compared with 18.7  $\pm$  5.4 HU in the standard technique group ( $P < 0.0001$ ). There was no significant difference in the subjective quality of pulmonary arterial enhancement between the 2 techniques, being 3.9  $\pm$  1.0 in the low peak kilovoltage technique group versus 3.8  $\pm$  0.9 in the standard technique group.

**Conclusions:** Using a peak kilovoltage that is 20-kVp less than the standard technique results in better pulmonary arterial enhancement without a subjective decrease in image quality.

**Reviewer's Comments:** The authors note that decreasing the kVp by 20 from the standard technique will likely result in a 40% to 50% decrease in radiation dose based upon results from a prior study.

**Additional Keywords:** Standard vs Low Kilovoltage Settings

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## CO2 Dissection for Thermal Protection During Ablation Procedures

*Thermal Protection During Percutaneous Thermal Ablation Procedures: Interest of Carbon Dioxide Dissection and Temperature Monitoring.*

Buy X, Tok C-H, et al:

*Cardiovasc Intervent Radiol*; 32 (May): 529-534

CO2 dissection can be performed during any type of thermal ablation to ensure that non-target organs near a tumor are not damaged, and continuous monitoring can be performed with thermocouples.

**Background:** Percutaneous thermal ablation is used to treat tumors in many organs in the body. The different modalities include radiofrequency ablation (RFA), cryoablation, and laser ablation. The success rate with thermal ablation is high but is dangerous to perform if non-target tissues such as the gastrointestinal tract, the diaphragm, the ureter, or nerve roots are too close to the area being treated. There are several techniques that have been described to shield sensitive structures from the thermal effects of the treatments.

**Objective:** These researchers report their experience with using CO2 dissection and temperature monitoring during RFA, laser, and cryoablation.

**Methods:** 37 tumors were treated in 35 patients; 19 cases were in the abdomen, 11 cases were in the spine, and 7 cases were in the musculoskeletal system. RFA was used for 10 tumors, cryoablation for 23, and laser for 4 spinal procedures. The maximum temperature allowed at the nontarget vulnerable organ for RFA or laser ablation was 45 degrees C, and the minimum for cryoablation was 8 degrees C.

**Results:** In only 2 cases, air dissection was unsuccessful at insulating the non-target organ. The amount of CO2 insufflated was 10 cc to 1500 cc, and the global procedure time was 60 to 180 minutes, with the CO2 insufflation taking 15 minutes.

**Conclusions:** These researchers conclude that CO2 dissection is a safe way to decrease thermal injury to vulnerable non-target organs during CT-guided thermal ablations, with thermocouples monitoring the temperature continuously ensuring that safety. This will increase the numbers and locations that tumors can be safely treated.

**Reviewer's Comments:** Thermal ablation is a reliable effective procedure to treat tumors in many locations of the body. The proximity of vulnerable structures (eg, bowel, gallbladder, urinary tract, nerves, and diaphragm) to the tumors has been what limits the use of thermal ablation in many cases. Decreasing the risk of thermal injury to non-target organs has been successful with dextrose solution for RFA; however, large amounts may cause fluid overload, as well as high glucose levels in diabetics. CO2 is relatively innocuous, cheap, nonallergic, and not nephrotoxic. It gets resorbed easily into the bloodstream with little effect other than a small rise in blood CO2 levels. The risks of CO2 insufflation largely come from inadvertent introduction of large amounts into the vascular system, causing hemodynamic compromise. To avoid this, a small amount of CO2 must be injected first to confirm the extravascular location. The thermocouples used during this procedure continuously monitored the vulnerable organ ensuring less damage. Metal-based thermocouples have to be used with caution with RFA, because if it is too close to the probe, arcing may occur. Laser thermocouples can be used in these cases.

**Additional Keywords:** Thermal Protection

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## CE-MRA Overestimates Stenoses

*Magnetic Resonance Angiography: Current Status in the Planning and Follow-Up of Endovascular Treatment in Lower-Limb Arterial Disease.*

Lakshminarayan R, Simpson JO, Ettles DF:  
*Cardiovasc Intervent Radiol*; 32 (May): 397-405

The major limiting factors of MRA are motion artifacts, metallic artifacts, and venous contamination.

**Background:** Magnetic resonance angiography (MRA) is evolving into an important modality for treatment and follow-up of vascular procedures.

**Objective:** To present a review of the literature and report on the current use of MRA in the management of lower-limb arterial disease.

**Time of Flight (TOF) and Phase Contrast (PC) MRA:** TOF image acquisition relies upon inflow of unsaturated blood. 3D acquisition has a higher signal-to-noise ratio, but it is more susceptible to saturation artifacts. Phase contrast, which uses a technique that eliminates the background signal, produces high contrast angiograms. It has problems when the blood flow changes direction into the nonencoded direction like the TOF technique.

**Contrast Enhanced MRA (CE)-MRA:** Gadolinium and bolus tracking produces good images of the vessel lumen with a limited field of view. Below the knee, even with good timing, there is degradation of the image because of venous contamination. In the literature, when compared to digital subtraction angiography (DSA), stenoses are overestimated with CE-MRA. With the advent of nephrogenic systemic fibrosis (NSF), the use of gadolinium chelates to get CE-MRA in patients with renal insufficiency has ended.

**MRA in Lower-Limb Arterial Intervention:** In the literature, CE-MRA has been shown to have a good accuracy in vessels >5.3 mm. CE-MRA has played a pivotal role, being the basis for either surgical or endovascular management. Contrast-enhanced MRA has been reported as better than duplex and even CT angiography in heavily calcified vessels. For infrainguinal disease, MRA is reported as better than ultrasound. Below-the-knee imaging of arterial vessels with CE-MRA has been challenging because of venous enhancement and motion artifact, particularly in patients with critical ischemia. Some reports show, however, that CE-MRA is superior in viewing distal vessels because MRA contrast is easy to see even diluted.

**Reviewer's Comments:** The Trans-Atlantic Intersociety Consensus group determined that CE-MRA was the ideal test to evaluate a patient in order to determine if conservative treatment versus either surgical or endovascular treatment is better. As for MRA post-procedure evaluation, the artifacts produced by many of the stents on the market make the pictures unhelpful. Therefore, overall, MRA, (particularly CE-MRA) is a useful modality for treatment planning that is reliable and comparable to DSA in many studies. The site and severity of peripheral artery disease is usually easily identified. The pitfalls of MRA are well known, with the overestimation of stenosis and the artifacts caused by metal and movement. NSF is also a concern when using gadolinium chelates, but new agents are being evaluated that may lead to better imaging quality overall. In the future, efforts will be made to image the characteristics of the walls of the vessels to determine the etiology of the vascular disease.

**Additional Keywords:** Lower-Limb Arterial Dz

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## Investigators Reveal Positive Predictive Factors for Vertebral Augmentation

*Predictors of Successful Palliation of Compression Fractures With Vertebral Augmentation: Single-Center Experience of 525 Cases.*

Jha RM, Yoo AJ, et al:

*J Vasc Interv Radiol*; 20 (June): 760-768

Positive predictive factors of pain relief after vertebroplasty, kyphoplasty, and sacroplasty include age >60 years and female sex. Patients with malignancy and multiple treatment levels have slightly lower rates of response to treatment.

**Background:** Vertebral fractures are common in the aging U.S. population and are a major source of pain and disability. They are caused by osteoporosis, neoplasm, or trauma. Conservative therapy does carry risks, such as immobility, bone resorption, and reactions to medications. Vertebroplasty, kyphoplasty, and sacroplasty are some less invasive methods used to treat these types of fractures, largely with high success rates and low complication rates. Most patients report pain relief; however, sometimes they get worse pain and this is hard to predict.

**Objective/Participants:** These researchers evaluated 525 of their patients to determine if there are predictors of outcome based upon patient or procedure characteristics.

**Methods:** In the researcher's institution, approximately 525 of 613 patients have follow up information. A retrospective chart review was performed. Patient characteristics, such as sex, age, fracture levels, and fracture etiology, were recorded. Procedure time, type, vertebral level treated, number of levels treated, and approach were noted. Follow-up dates and pain outcome were evaluated as follows; patient outcomes were put into 2 subcategories of responders or nonresponders. This was also subcategorized on a scale, with 1 being pain resolution and 4 being worsening pain. Complications were also noted.

**Results:** 89% of the patients were classified as responders, with 40% of all patients having complete pain resolution, and 49% having improvement in pain; 8% reported no change and 3% reported increasing pain. Multivariate analysis determined that sex and age were statistically significant predictors of response. None of the other variables (eg, type of procedure, cause of fracture, or location of treated levels) showed any significant difference in response. When sub-categorized to a pain scale of 1 to 4, only 4 variables were predictive of outcome; these included age, sex, malignancy, and number of levels. Clinically relevant complications were seen in 6 cases. The overall complication rate was 1.1%.

**Reviewer's Comments:** There is significant and effective pain relief in the vast majority of patients treated with vertebral augmentation with a very small risk of complications. Most of the patients (89%) were responders. In this study, the patients were mostly women between the ages of 70 and 89 years. The most common cause of the fracture was osteoporosis. There was a low complication rate of 1.1%. No difference was noted in the response rate among the different types of vertebral augmentation, and this was different than previously reported. In the binary model of responders versus nonresponders, the patient characteristics of female sex and older age were independent predictors of good response. This is good to note because some practitioners are reluctant to treat more elderly patients. This retrospective study did identify some characteristics that could be tested in randomized prospective studies.

**Additional Keywords:** Successful Palliation

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## Can MR Spectroscopy Predict Response to Neoadjuvant Chemotherapy

*Predicting Pathologic Response to Neoadjuvant Chemotherapy in Breast Cancer by Using MR Imaging and Quantitative 1H MR Spectroscopy.*

Baek H-M, Chen J-H, et al:

*Radiology*; 251 (June): 653-662

When using change in total choline signal as a predictor of response to neoadjuvant chemotherapy, MR spectroscopy is not as reliable as assessing change in tumor size.

**Objective:** Neoadjuvant chemotherapy is used to treat patients with inoperable locally advanced breast cancer and to decrease the size of the tumor when breast conservation surgery is desired. Traditionally, tumor size has been used to evaluate response to treatment, although tumor size has been shown to lag behind pathologic response.

**Objective:** MRI evaluated tumor size has a high correlation with pathologic tumor size and the purpose of this study was to use MR spectroscopy in an attempt to evaluate changes in total choline concentration as an adjunct to tumor size in order to assess response to neoadjuvant chemotherapy.

**Methods:** Over a 2.5-year period, patients who underwent neoadjuvant chemotherapy for breast cancer were identified. Those who also had baseline breast MRI and MR spectroscopy before treatment and also had at least 2 follow-up MRI studies were included in the patient population studied. Patients also had to have ultimately undergone surgery in order to correlate with histopathologic outcomes. Variables, including demographic factors as well as cancer type, stage, tumor size, and receptor status, were recorded. Chemotherapy was administered as per established institutional protocols. The first follow-up MRI and MR spectroscopy studies were performed after 1 to 2 cycles of chemotherapy and the second performed after 4 cycles or a modified version thereof. Surgical specimens were evaluated as per routine pathology and categorized into 3 categories defined as (1) residual malignancy, (2) no residual invasive cancer but presence of ductal carcinoma in situ [DCIS], and (3) residual invasive cancer. Pathologic complete response (pCR) was defined as no residual invasive cancer.

**Results:** 35 patients were included in the study; 49% showed pCR with the rest having residual disease. Of those who achieved pCR, MR spectroscopy showed that 71% had positive total choline levels before treatment, while 94% of those who did not achieve pCR had positive total choline levels. Only in the group that achieved pCR was the change in total choline levels before and after treatment much higher than the change in tumor size based on MR imaging. There was no statistically significant change in total choline signal after treatment for those patients who did not have pCR. Findings suggest that if the decrease in total choline signal is greater than the decrease in tumor size, pCR is likely. Overall, however, the greatest predictor of chemotherapy response was the change in tumor size after initial follow-up, corresponding to 1 to 2 cycles of chemotherapy.

**Reviewers' Comments:** A novel technique, although not too useful. Very recent literature has suggested that using the total choline integral rather than simply total choline signal is more accurate in correlating with underlying tumor. Perhaps this may improve accuracy in assessing response to chemotherapy as well.

**Additional Keywords:** Neoadjuvant Chemotherapy

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## Can Bayesian Network Increase Sensitivity of Mammography Interpretation?

*Probabilistic Computer Model Developed From Clinical Data in National Mammography Database Format to Classify Mammographic Findings.*

Burnside ES, Davis J, et al:

*Radiology*; 251 (June): 663-672

By using a common popular probability model, namely the Bayesian network, sensitivity and specificity of mammographic interpretation can be statistically improved.

**Background:** Bayesian probability is a popular form of probability that specifies some prior probability, which is then updated in the light of new relevant data. Bayesian networks are a listing of variables that, when determined to be interdependent, can be solved as complex sequences to aid in risk prediction. With respect to breast cancer detection, a Bayesian network can be used to calculate the risk of malignancy on multiple variables including demographic and imaging features as catalogued by the radiologist.

**Objective:** To utilize variables found in the National Mammography Database in order to train a Bayesian network to aid in radiologist classification of mammographic findings.

**Methods:** A Bayesian network was trained on existing mammography findings by collecting data on all screening and diagnostic mammography findings over a 5-year period. Demographic data and Breast Imaging Reporting and Data System (BI-RADS) assessment category were also used to populate the data set. All variables were essentially obtained from the PenRad system with relevant demographic information standardized to information obtained by the National Mammography Database maintained by the American College of Radiology with specific focus on variables predictive of breast cancer. Subsequent receiver operating characteristic (ROC) curves for all radiologists individually and in total were created. An ROC curve was also created for the Bayesian network. Sensitivity and specificity were determined for the radiologists and for the Bayesian network and were compared using the McNemar test, an established statistical tool.

**Results:** A total of 62,219 findings were included for analysis. The abnormal interpretation rate, as defined as BI-RADS categories 0, 4, and 5, for the radiologists in aggregate was 18.5%. The Bayesian network revealed interdependent relationships between many predictive variables; when applied to mammography findings, the area under the ROC curve showed statistically significant improvement. Compared to radiologist characterizations alone, use of the Bayesian network increased specificity from 88.1% to 93.0% and increased sensitivity from 85.3% to 90.0%. Overall, the greatest influence of the Bayesian network was to decrease BI-RADS 0 classification. Of note, the Bayesian network was successful only when the BI-RADS lexicon was used by point and click data entry into the PenRad system and when demographic information was complete for each patient.

**Reviewer's Comments:** We could be witnessing the future adjunct to breast imaging interpretation. By using a computer algorithm that can be added to a dictation program such as PenRad, perhaps the Bayesian network will improve sensitivity and specificity for mammographic interpretation. It is worth remembering that the study exemplified the importance of having complete demographic data as well as using reproducible characteristics from the BI-RADS lexicon for each patient.

**Additional Keywords:** Bayesian probability

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## Duct Excision Necessary Regardless of Imaging Findings

*Pathologic Nipple Discharge in Patients with Radiologically Invisible Mass: Review of 28 Consecutive Sub-Areolar Explorations.*

Kocdor MA, Sevinc AI, et al:  
*Breast J*; 15 (May/June): 230-235

Since up to 28% of patients who present with PND have been shown to have carcinoma or a high-risk lesion, ultimately duct excision will be necessary regardless of imaging findings.

**Objective:** To determine the frequency of cancer in cases of pathological nipple discharge (PND) where mammography and ultrasound are noncontributory.

**Design:** Retrospective study.

**Methods:** Patients who had initially presented with PND and subsequently underwent mammography and breast ultrasound were identified. Those who had normal mammographic and sonographic findings and ultimately underwent sub-areolar exploration and major duct excision were reviewed. PND was defined as unilateral, spontaneous, and originating from a single duct. Ductography was performed in cases where localization was not reliable based on physical examination alone. Postoperative histopathologic outcomes were reviewed.

**Results:** In total, 28 patients were included in the study. Of these patients, 25% underwent ductography, which was diagnostic for filling defects. When examining the histopathologic results, carcinoma was present in 21% of cases with 42% of the cases consisting of a single papilloma or papillomatosis. Atypical ductal hyperplasia was diagnosed in 7% of those cases reviewed. Only 2 of those patients studied were ultimately diagnosed with invasive carcinoma, corresponding to 7% of the study population. In total, 28% were diagnosed with a high-risk lesion or carcinoma.

**Reviewer's Comments:** Nipple discharge is not an uncommon indication for breast imaging and it is also not uncommon to discover no abnormality on mammography or ultrasound. What this study does not mention is the role of breast MRI in evaluation of nipple discharge. As per the American Cancer Society guidelines for breast MRI, nipple discharge is an indication for either routine breast MRI or MR ductography. What this study does reinforce, however, is the importance of a duct excision regardless of imaging findings. Imaging will only guide the surgeon's hand but will not preclude the inevitable surgery that ensues when a patient presents with PND.

**Additional Keywords:** Mass

**print tag:** () Refer to original journal article.

## MR Spectroscopy May Decrease Need for MR-Guided Biopsy

*In Vivo Proton MR Spectroscopy of the Breast Using the Total Choline Peak Integral as a Marker of Malignancy.*

Sardanelli F, Fausto A, et al:

*AJR*; 192 (June): 1608-1617

When using the absolute peak integral of the total choline peak as a reference value, breast MR spectroscopy can offer good diagnostic performance.

**Background:** Proton MR spectroscopy (MRS) allows molecular analysis of tissues secondary to the different chemical shifts of different nuclei in a given magnetic field. Essentially, the difference in chemical shifts is a function of different electron density for different nuclei in a given volume. MRS characterizes breast tissue based on choline-containing metabolites as assessed as a total choline-containing peak. In particular, tumors exhibit abnormalities of choline metabolism, resulting in an elevated total choline peak. Prior studies have assessed the total choline peak by comparing it to a threshold deemed statistically significant, while others have examined the peak with respect to an internal or external standard of reference.

**Objective:** To correlate total choline peak integral, rather than the absolute peak value, and thus determine an optimal threshold for total choline in evaluating breast lesions on a 1.5-T magnet.

**Methods:** Inclusion criteria were: >18 years old and at least 1 contrast-enhanced mass >1.0 cm in size on a prior breast MRI. Exclusion criteria included recent breast interventional or surgical procedure, presence of metallic clips, and general contraindications for MRI. All MR examinations were performed as per a standard protocol. Morphologic and dynamic assessment of the lesions was performed as per the BI-RADS lexicon for MRI. MRS analysis was obtained off a water and fat suppressed sequence performed 15 minutes after contrast injection, an established protocol. The volume of interest was a rectangular prism placed by a radiologist with 2 years experience. All lesions were diagnosed at surgical or core needle biopsy. Receiver operator curves were utilized to determine the optimal threshold for peak integrals, with optimization corresponding to the best compromise between sensitivity and specificity.

**Results:** 42 patients were prospectively evaluated including 2 men. In total, 48 MRS measurements were obtained from the 42 patients. Three of these cases were excluded from the analysis based on technical factors resulting in a failure rate of 6%. The median diameter of tissues studied was 1.3 cm. The volumes of interest ranged from 1 to 64 mL with a median of 2.2 mL. Pathologically, 19 of the lesions analyzed were malignant and 26 were nonmalignant. The difference between the median normalized total choline peak integral of malignant lesions was statistically significantly elevated with respect to non-malignant tissues. The optimal threshold for the absolute total choline peak integral was determined to be 1.90 Arbitrary Units resulting in a sensitivity and specificity of 89.5% and 92.3%, respectively. The results of these authors in terms of sensitivity and specificity are similar to 8 prior studies.

**Reviewer's Comments:** How could this possibly help the breast imager daily? Perhaps this will decrease the need for MR guided biopsy.

**Additional Keywords:** Choline Peak Integral

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## Oblique Imaging Increases Specificity of MRI in ACL Injuries

*Which Oblique Plane Is More Helpful in Diagnosing an Anterior Cruciate Ligament Tear?*

Kwon JW, Yoon YC, et al:

*Clin Radiol*; 64 (March): 291-297

In evaluating anterior cruciate ligament injury, additional oblique imaging in either the sagittal or coronal plane improves the specificity and diagnostic accuracy of MRI.

**Background:** Given the oblique orientation of the anterior cruciate ligament (ACL), it has been suggested that accurate imaging of ACL pathology extends beyond standard imaging in the sagittal and coronal planes. Oblique imaging in coronal and sagittal projections may therefore be obtained.

**Objective:** To determine if (1) additional oblique imaging is useful in evaluating suspected ACL injury, and (2) to determine which oblique plane is superior.

**Design:** Retrospective study.

**Participants:** 101 patients underwent MRI of the knee.

**Methods:** Sagittal, coronal, oblique sagittal, and oblique coronal planes were obtained. All patients had clinical histories that suggested ligamentous and/or meniscal injury warranting investigation. As a reference standard, every patient also underwent arthroscopic evaluation of the knee joint. Blinded to arthroscopic results and clinical history, 2 radiologists interpreted MRIs in (1) sagittal and coronal planes only; (2) sagittal, coronal, and oblique sagittal planes; (3) sagittal, coronal, and oblique coronal planes; and (4) sagittal, coronal, oblique sagittal, and coronal planes.

**Results:** Sensitivities were essentially similar among all methods of MRI interpretation. However, methods using either oblique sagittal or oblique coronal, or both, demonstrated statistically significantly higher specificities and accuracies compared with sole interpretation in sagittal and coronal planes. Oblique imaging reduced the number of false-positive diagnoses of ACL injury. As a caveat, specificities among imaging methods using oblique planes did not demonstrate significant differences between sagittal or coronal projections.

**Conclusions:** Oblique imaging of the ACL increases specificity in diagnosing ligamentous injury. Either oblique plane (sagittal or coronal) is effective in increasing diagnostic accuracy; however, concurrent use of both oblique planes was redundant and demonstrated no added value.

**Reviewer's Comments:** ACL injury is one of the most common afflictions of the knee joint. Given its pivotal role as a knee stabilizer, treating ACL tears is of paramount importance to orthopedic surgeons. However, their ability is often limited to clinical assessment, and it becomes the radiologist's responsibility to provide as much information as possible regarding the integrity of the ligament. Since there are scenarios that lend a hand to false-negative and false-positive diagnoses, the authors have demonstrated that additional oblique imaging, in either coronal or sagittal projections, will provide more complete visualization of the ACL. Unnecessary or unwarranted treatment has its associated morbidities, aside from just incurring additional health care costs. By reducing the number of false-positive diagnoses, radiologists can augment delivery of more accurate and tailored care to patients with clinically suspected ACL injury. I believe oblique imaging (in either plane) should be a standard component of MRI of the knee.

**Additional Keywords:** MRI

**print tag:** () Refer to original journal article.



## Degree, Patterns of Osteoporosis in SCI Patients Are Distinct

*Role of Peripheral Quantitative Computed Tomography in Identifying Disuse Osteoporosis in Paraplegia.*

Coupaud S, McLean AN, Allan DB:

*Skeletal Radiol*; (March 10): epub ahead of print

Peripheral quantitative CT better evaluates patterns of osteoporosis in spinal cord injury (SCI) patients and highlights increased vulnerability of female paraplegics and lumbar SCI patients to fragility fractures.

**Background/Objective:** Since dual-energy x-ray absorptiometry (DEXA) measures bone mineral density (BMD) in locations suitable for a general population, the authors of this study sought to evaluate the role of peripheral quantitative CT (pQCT) in evaluating osteoporosis in spinal cord injury (SCI) patients.

**Design:** Prospective study.

**Participants/Methods:** 47 patients with SCI involving the thoracic and/or lumbar spine were evaluated with pQCT. pQCT measurements essentially correspond to hydroxyapatite concentration and enable assessment of trabecular and cortical bone mineral density (BMD) as separate parameters. Trabecular BMD and bone mineral content (BMC) of the femoral and tibial epiphyses were calculated. Total bone cross-sectional area of the femoral and tibial diaphyses and total muscle cross-sectional areas were calculated for the same regions. All values were grouped and analyzed with regard to gender, classification of SCI, and time since injury.

**Results:** At the distal femur and tibia, the BMC was lower for female patients compared to males with SCI. Patients with lumbar SCI demonstrated lower trabecular BMD compared to patients with thoracic SCI. Muscle cross-sectional area evaluation showed that flaccid muscles (seen with lumbar SCI) generally result in lower BMD. Muscle spasticity (typically seen with thoracic SCI) correlates with higher BMD. Trabecular BMD also diminishes at differential rates for the femur and tibia as time elapses.

**Conclusions:** The findings in this study are generally similar to those of a previous study examining a Swiss SCI group - degree and patterns of osteoporosis of SCI patients are distinct from those of the general population. The distal epiphyses of the femur and tibia are uniquely prone to fracture from accelerated bone loss in SCI patients. Furthermore, pQCT, by means of targeting BMD values for trabecular bone, cortical bone, and BMC, is a more accurate means of evaluating SCI patients. Females and patients with lumbar SCI demonstrated generally lower pQCT measurements, placing them at higher risk for osteoporotic fractures.

**Reviewer's Comments:** A previous study from 2004 examining a Swiss population of SCI patients initially demonstrated many of the findings put forth in this article. Nevertheless, these authors have taken the analysis a step further by asserting that female patients and those with lumbar SCI are most vulnerable to fractures secondary to disuse osteoporosis. They have shown the necessity for increased utilization of pQCT in evaluating SCI patients. Perhaps their most important contribution underscores the need to discover new and/or improved means of preventative or therapeutic medical care for these patient subgroups. I agree with the authors that performing pQCT on healthy patients causes them to be subjected to unnecessary radiation, and more tailored studies in the future should focus on female paraplegics and lumbar SCI patients to further characterize their patterns of accelerated bone loss.

**Additional Keywords:** CT

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## Multidetector CTA Shows Promise for Detecting Acute Lobar Hemorrhage

*Multidetector Row CT Angiography in Spontaneous Lobar Intracerebral Hemorrhage: A Prospective Comparison With Conventional Angiography.*

Yoon DY, Chang SK, et al:

*AJNR*; 30 (May): 962-967

Multidetector CT angiography is not currently sensitive enough to replace digital subtraction angiography (DSA) for diagnosing underlying vascular etiologies of lobar hemorrhage, but it may eliminate the need for conventional DSA in selected cases.

**Background:** Multidetector CT angiography (CTA) has become a prevalent method of evaluating the cerebral vasculature. Multidetector technique has resulted in scans that can be obtained quickly and cover the entire brain with high resolution. Traditionally, this has been evaluated with digital subtraction angiography (DSA). Multidetector CTA does not require sedation, is very fast, and is noninvasive.

**Objective:** To evaluate the performance of multidetector CTA compared with DSA to diagnose underlying vascular etiologies of lobar hemorrhage.

**Design:** Prospective study.

**Participants:** 78 patients with lobar hemorrhage.

**Methods:** 16-row multidetector CT was used, and images were evaluated as source images, coronal and sagittal multiplanar reformations, and volume-rendered images. Intra-arterial DSA was performed with standard technique within 36 hours of CTA.

**Results:** Noncontrast CT demonstrated 44 patients had pure lobar hemorrhage, and the remainder had coexisting subarachnoid, intraventricular, or subdural hemorrhage. Twenty-two vascular abnormalities were detected on DSA. CTA detected 21 of 22 underlying vascular abnormalities with a sensitivity, specificity, positive-predictive value, negative-predictive value of 95.5%, 100.0%, 100.0%, and 98.2%, respectively. Abnormalities consisted of 9 proximal aneurysms, 7 arteriovenous malformations (AVMs), 4 cases of Moyamoya disease, and 2 distal aneurysms. Diagnoses for the remaining patients were not diagnosed by DSA and were considered to be the following: hypertension in 29, coagulopathy in 11, amyloid angiopathy in 4, and no diagnosis in 14. CTA correctly diagnosed all aneurysms. The smallest aneurysm was 2.0 mm in the distal middle cerebral artery (MCA). The neck-to-dome ratios of aneurysms matched DSA in all cases but 1, where CTA over estimated it by 1 grade. Other characteristics of the aneurysm such as orientation, lobularity, relationship to adjacent vessels, and presence of vasospasm all matched DSA. Mean size of AVMs was 11.8 5.0 mm and the smallest was 4.0 mm. There was a 4.0-mm AVM without enlarged feeding or draining vessels that could not be detected on CTA, even in retrospect. CTA detected the remaining AVMs. In 1 patient with AVM, the nidus and feeders were detected only by DSA, but CTA detected the enlarged draining vein. In another patient, arterial feeders were not detected. In 4 patients with Moyamoya disease, the internal carotid artery or MCA occlusions were all detected by CTA, but it did not demonstrate fine collateral vessels in the basal brain in 2 patients.

**Conclusions:** Multidetector CTA is not currently sensitive enough to replace DSA, but it may eliminate the need for conventional DSA in selected cases.

**Reviewer's Comments:** Multidetector CTA is highly sensitive in evaluating vascular abnormalities although, as shown in this study, may miss small AVMs, especially given the absence of dynamic vascular information such as early venous filling. In cases where CTA is negative, DSA may still be indicated for further evaluation.

**Additional Keywords:** Multidetector CT Angiography

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## Normal Hyperintensities on FLAIR Brain Imaging on 3T and 1.5T

*Normal Findings on Brain Fluid-Attenuated Inversion Recovery MR Images at 3T.*

Neema M, Guss ZD, et al:

*AJNR*; 30 (May): 911-916

3T detects a greater number of hyperintensities in normal patients on FLAIR imaging than 1.5T. Hazy deep parietal hyperintensity is seen exclusively on 3T. Additional findings are seen equally on both.

**Background:** Prior studies have demonstrated increased sensitivity of detecting hyperintense lesions on 3T MRI of the brain with FLAIR.

**Objective:** To describe brain hyperintensities on FLAIR imaging in healthy patients that may be seen on 3T MRI of the brain, to demonstrate whether 3T is more sensitive to hyperintensities than 1.5T, and to determine association of hyperintensities and age.

**Design:** Prospective study.

**Participants:** 22 adult self-reported healthy volunteers aged 30 to 53 years.

**Methods:** 15 patients were scanned on both 1.5T and 3T. Seven were scanned only on 3T, and 2- to 3 mm-axial thick images were utilized. Hyperintense foci were evaluated quantitatively. Capping of the ventricles, diffuse white matter hyperintensity, septal hyperintensity, corticospinal tract hyperintensity, and ventricular CSF flow artifacts were also evaluated.

**Results:** There were 10.68 14.39 average discrete foci on 3T, which were small and punctate, linear, or curvilinear. Lesions seen on 3T and 1.5T were of equal size, but 3T detected more lesions. Therefore, total volume of foci was larger on average on 3T. On 3T, length of lesions on average was 2.92 1.28 (range, 0.91 to 9.89); on 1.5T average length was 2.75 1.22 (range, 1.24 to 8.36)--not a statistically significant difference. There was a strong correlation between age and foci number and volume on both modalities ( $r=0.69$  for 1.5T and  $0.74$  for 3T). All foci were localized in the deep or periventricular supratentorial white matter—none were juxtacortical, cortical, callosal, or infratentorial. None directly abutted the ventricular ependyma. Capping hyperintensity immediately anterior to the frontal horns of the lateral ventricles was present on all scans with a range of 0.90- to 2.54-mm thickness and was not statistically different between the 2 modalities. A thin line and hazy area of hyperintensity were seen adjacent to the lateral ventricles on all 3T FLAIR studies; this was faintly visible on 1.5T as well. All 3T images demonstrated a diffuse posterior parenchymal white matter hyperintensity, which was not seen on any patients with 1.5T. The following were seen on all cases: hyperintense flow artifacts in the third and fourth ventricles, thin line around lateral, third, and fourth ventricles and cerebral aqueduct, hyperintensity in the septum pellucidum, and symmetric hyperintensity of the corticospinal tracts.

**Conclusions:** 3T FLAIR detects a greater number of discrete white matter hyperintensities than 1.5T imaging, as well as hazy parietal white matter hyperintensity that is not visualized on 1.5T in healthy volunteers. Additional findings are commonly found on both modalities. Radiologists should be familiar with these findings which may be in the range of normal, rather than pathologic findings.

**Reviewer's Comments:** This is an important paper for radiologists who are new to imaging with 3T and to review commonly seen "lesions" on both 1.5T and 3T that may not need to be reported.

**Additional Keywords:** 3T vs 1.5 MRI

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## Inadvertent Exposure to Tc-99m Scintigraphy in Early Pregnancy Safe for Fetus

*Fetal Outcome After Technetium Scintigraphy in Early Pregnancy.*

Schaefer C, Meister R, et al:

*Reprod Toxicol*; (May 12): epub ahead of print

This study shows that inadvertent exposure of pregnant women to Tc-based radiopharmaceuticals did not lead to an elevated incidence of birth defects.

**Objective:** To use observational data to confirm low risk to the fetus following exposure to technetium-99m (Tc-99m) radiopharmaceuticals during pregnancy.

**Design:** Prospective observational cohort study.

**Participants:** Cohort of pregnant women exposed to Tc-99m scintigraphy of the thyroid (in 102 patients) or bone scintigraphy (20 patients) compared to those of a non-exposed control group of 366 patients.

**Methods:** Patients were included in this study following inquiries to the Berlin Institute for Clinical Teratology. Patients received a structured questionnaire at their first contact and a follow-up questionnaire was completed 8 weeks following the expected date of delivery, including details of a structured pediatric examination, which included anatomical features and developmental milestones.

**Results:** The major birth defect rate was 3.7% in both exposed and control cohorts. Limited to first trimester exposure, the values were 2.9% in the birth cohort and 3.7% for the exposed group, and were likewise non-significant in difference. The spontaneous abortion rate, rate of preterm deliveries, and birth measurements of newborns were also not significantly different than controls. No specific pattern of birth defects was found. Of note, no disorders of thyroid function were noted on the routine newborn testing of thyroid stimulating hormone.

**Conclusions:** Inadvertent exposure to Tc-99m scintigraphy in early pregnancy is relatively safe for the fetus and there is no indication for termination of pregnancy or for any additional prenatal diagnostic procedures.

**Reviewer's Comments:** Much information is known regarding radiation exposure and risk of bad fetal outcome based on extensive modeling of radiation exposure and risk from large population exposures, including atomic bomb blasts and from laboratory experiments. These authors have looked at their center's actual 18-year experience with pregnant patients who were administered technetium-containing radiopharmaceuticals and directly observed any adverse effects as compared to a control group of unexposed patients. What is unusual about this paper is that it basically operates outside the usual field of radiation dosimetry, and instead seeks to empirically observe the effect of Tc exposure.

**Additional Keywords:** Dosimetry

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## What Are We Doing to Improve Regulation of Radiology Fellowships?

*The Trouble With Fellowships: Part 2 of 2.*

Stephen Baker, MD

-Special Presentation; ( ):

Fellowship interviews will now take place at the RSNA Annual Meeting, sparing the applicant the cost of additional travel.

In this second part of my critique of fellowships in Radiology, culprits are considered for the problems elucidated in Part I. Recall that approximately 50% of those in fellowships are in programs that have no regulation by virtue of their being outside of Accreditation Council for Graduate Medical Education (ACGME) surveillance. Partially to blame are the Chairs for their lack of attention, the Association of Program Directors in Radiology for not more carefully and comprehensively educating fellowship program directors, and the American Board of Radiology for not being more aggressive in extending the Certificates of Added Qualification's to fellowships beyond Pediatrics, Neurology, and Interventional Radiology. What can be done, given that the majority of trainees in fellowship programs in Radiology are beyond the scope of the ACGME surveillance? For one thing, interviews for fellowships could take place at the Radiology Society of North America Annual Meeting, sparing the applicant the cost of additional travel. Also, with restructuring of the qualifying exam at the end of the third year, the fellowship interview season could move into the fall of the fourth year. A prescribed interval for interviews should be agreed upon. Moreover, to give every applicant a fair shot, fellowship positions should not be reserved for homegrown residents, and the correct number of competitive slots should be announced on a common date.

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