DW MRI Can Discriminate Between Neoplastic and Bland Thrombi in HCC Patients

Differentiation of Malignant Thrombus From Bland Thrombus of the Portal Vein in Patients With Hepatocellular Carcinoma: Application of Diffusion-Weighted MR Imaging.

Catalano OA, Choy G, et al:

Radiology 2010; 254 (January): 154-162

**Objective:** To assess the diagnostic potential of diffusion-weighted MRI in distinguishing between neoplastic and bland thrombus in patients with hepatocellular carcinoma (HCC).

**Design:** Retrospective analysis.

**Participants/Methods:** This study was comprised of 25 patients with pathologically confirmed HCC. All patients had accompanying portal vein thrombosis diagnosed on a contrast-enhanced biphasic multidetector CT study. The thrombus was considered malignant if it expanded the vein or demonstrated enhancement. MR examinations were performed with a 1.5-Tesla system. Imaging sequences including a respiratory gated echo-planar diffusion-weighted (DW) sequence were performed with b values of 50, 400, and 800 seconds/mm², which were also used in apparent diffusion coefficient (ADC) quantification. 3-D spoiled gradient-recalled echo images prior to and following dynamic administration of intravenous gadolinium were then obtained. The images were reviewed by 2 radiologists. The portal vein thrombus signal intensity was categorized as being higher than, equal to, or lower than that of the HCC on the b value 800 seconds/mm² DW images. ADC values of each were subsequently obtained.

**Results:** The mean size of HCC was 90 mm in patients with tumor thrombus and 54 mm in those with bland thrombus. There were 19 patients with tumor thrombus. Fifteen of 19 had signal intensity similar to the primary HCC on DW imaging (DWI). The other 4 had signal intensity lower than the HCC. The remaining 6 patients with bland thrombus had signal intensity lower than the HCC. The ADC values of the neoplastic thrombus and primary HCC were similar at 0.87 x 10⁻³ mm²/seconds and 0.88 x 10⁻³ mm²/seconds, respectively. Meanwhile, the ADC values of the bland thrombus and primary HCC were 2.89 x 10⁻³ mm²/seconds and 1.0 x 10⁻³ mm²/seconds, respectively. There was no statistically significant difference in ADC values between the neoplastic thrombus and primary HCC, or between the primary HCC in the neoplastic or bland thrombus groups. However, the ADC values of bland thrombus were significantly higher than those of the primary HCC. The thrombus:HCC ADC ratio in the bland group was also significantly higher at 2.9 compared to approximately 1.0 in the neoplastic group. A cut-off ADC value of 2.0 x 10⁻³ mm²/seconds and a thrombus:HCC ADC ratio of 2.0 allowed for discrimination of neoplastic from bland thrombus.

**Conclusions:** DWI enables discrimination between bland and neoplastic portal vein thrombi when the thrombus:HCC ADC ratio is <2 and when the thrombus shows similar signal intensity as the primary HCC when qualitative analysis is performed.

**Reviewer's Comments:** The results of this study are useful in demonstrating that employing DWI and calculating the ADC value and the thrombus:HCC ADC ratio are helpful in distinguishing between neoplastic and bland thrombus in patients with HCC. This could prove especially beneficial in patients who are not able to receive intravenous contrast. Therefore, one should consider including DWI in the routine MR evaluation of patients with HCC. A limitation noted in this study was the small sample size. (Reviewer-John C. Sabatino, MD, MSD).

**Keywords:** Liver, Diffusion-Weighted MRI, Neoplastic and Bland Thrombus, HCC

**Print Tag:** Refer to original journal article
In this study, obstructive symptoms were found in patients with a stomal diameter of ≤6 mm after adjustment of laparoscopically inserted gastric bands.

Objective: To determine if the results of barium studies after adjustments of laparoscopically inserted gastric bands aid the clinician in deciding if a band requires loosening.

Design: Retrospective analysis.

Participants/Methods: This study was comprised of 246 patients who underwent barium studies after a total of 668 adjustments of their laparoscopically inserted gastric bands. Forty-five of the 668 adjustments were considered too tight on the basis of the barium findings of a small stomal diameter, proximal dilatation, or slow emptying. Immediate readjustment was recommended. The images from 41 of 45 readjustments were reviewed as well as those from 41 control patients who underwent band readjustment. In addition, barium studies from 9 of 246 patients with obstructive symptoms before adjustment were also reviewed. Images were reviewed by 2 gastrointestinal radiologists. The stomal diameter at the level of the band, distal esophageal width, and gastric pouch height and width were measured.

Results: The barium studies from 41 readjustments showed a mean stomal diameter of 2.9 mm after initial adjustment and 8.1 mm after readjustment. The studies from 41 control patients showed a mean stomal diameter of 9.5 mm after initial adjustment. The studies from the 9 patients with obstructive symptoms showed a mean stomal diameter of 5.1 mm before band deflation. Thirty-nine of 41 studies with tight bands after initial adjustment demonstrated a stomal diameter <6.0 mm. Meanwhile, none of the 41 control patients had a stomal diameter <6.0 mm. Therefore, a stomal diameter of ≤6.0 mm would require a readjustment of the laparoscopically inserted gastric band.

Conclusions: A stomal diameter of <6 mm after routine adjustment of a laparoscopically inserted gastric band can cause obstructive symptoms, so the band should be loosened in these patients.

Reviewer's Comments: The results of the study are helpful in providing a stomal diameter threshold on barium studies below which readjustment of the laparoscopically inserted gastric band would be required to prevent the development of obstructive symptoms. Limitations reported in this study included selection bias and interpretation bias, which are inherent to retrospective studies. (Reviewer-John C. Sabatino, MD, MSD).

Keywords: Stomach, Barium Studies, Gastric Bands

Print Tag: Refer to original journal article
What Are the CT Findings of Sigmoid Volvulus?

Objective: To evaluate the CT findings of sigmoid volvulus.

Design: Retrospective analysis.

Participants/Methods: This study was comprised of 21 patients with sigmoid volvulus. All patients underwent CT prior to an interventional procedure. Presenting symptoms included abdominal pain, abdominal distention, and constipation. CT examinations were performed. Coronal reconstructed images were obtained in 9 of 21 studies. Seventeen patients received intravenous contrast. Sixteen of 17 enhanced studies were acquired during the portal venous phase with a scan delay of 70 to 80 seconds, and the remaining case during the arterial phase at 30 seconds. Nineteen of 21 exams were performed with oral Gastrografin. The images were reviewed by 3 radiologists who knew that the diagnosis was a sigmoid volvulus. The CT scanograms were evaluated first, followed by the axial images. When available, coronal reconstructed images were also reviewed. CT scanograms were scrutinized for the following: disproportionate sigmoid dilatation, inverted U-shape of distended sigmoid, coalescence of medial walls of the ascending and descending colons forming a coffee bean appearance, location of distended loop apex, liver overlap sign, sigmoid extending to left hemidiaphragm, sigmoid colon extending cephalad to transverse colon (northern exposure sign), proximal colonic dilatation, and absence of rectal gas. Cross-sectional images were scrutinized for disproportionate sigmoid dilatation, degree of sigmoid dilatation, proximal colonic dilatation, rectal decompression, whirl sign, 2 crossing sigmoid transition points (X-marks-the-spot sign), and separation of sigmoid walls by mesenteric fat (split-wall sign).

Results: The most sensitive CT scanogram signs of sigmoid volvulus were absence of rectal gas in 90% and an inverted U-shape of distended sigmoid in 86%. Coalescence of medial walls of the ascending and descending colons forming a coffee bean appearance and disproportionate sigmoid dilatation were found in 76%. Sigmoid colon extending cephalad to transverse colon (northern exposure sign) was found in 57%. The most sensitive cross-sectional signs of sigmoid volvulus were presence of a transition point in 95% and disproportionate sigmoid dilatation in 86%. The whirl sign was present in 57%. Two crossing sigmoid transition points (X-marks-the-spot sign) were found in 43% and separation of sigmoid walls by mesenteric fat (split-wall sign) in 52%.

Reviewer's Comments: The results of this study are helpful in that they illustrate imaging characteristics of sigmoid volvulus on CT exams, in particular on the cross-sectional images. As encountered in other cases of possible small or large bowel obstruction, a transition point is the most sensitive sign, followed by the disproportionate sigmoid dilatation encountered with a sigmoid volvulus. The other less sensitive X-marks-the-spot sign and split-wall sign are additional findings that can aid in arriving at the diagnosis. One of the limitations reported in this study was the small sample size. (Reviewer-John C. Sabatino, MD, MSD).

Keywords: Colon, CT Findings, Sigmoid Volvulus

Print Tag: Refer to original journal article
CT and Echo Together Better Predicts Pulmonary Hypertension

Detection of Pulmonary Hypertension With Multidetector CT and Echocardiography Alone and in Combination.

Devaraj A, Wells AU, et al:

Radiology 2010; 254 (February): 609-616

A composite index of the ratio of the diameter of the MPA to the ascending aorta on CT and right ventricular systolic pressure obtained from transthoracic echocardiography is more strongly associated with pulmonary hypertension than either test alone.

Objective: To evaluate different anatomic features seen on CT and the ability to predict pulmonary hypertension and to also determine whether a combination of CT features and echocardiographic features could better predict pulmonary hypertension than each test alone.

Design: Retrospective study.

Participants: 77 patients who had undergone CT and right heart catheterization within 9 months of each other were evaluated. Transthoracic echocardiography was performed in 72 of these patients. Patients with congenital heart disease were excluded.

Methods: Pulmonary hypertension on right heart catheterization was considered a mean pulmonary artery pressure (mPAP) >25 mm Hg. On CT, the widest short-axis diameter of the main pulmonary artery (MPA) was measured on the axial images at the level of the carina. The cross-sectional area of the MPA was also measured just proximal to the carina using multiplanar reformats orthogonal to the long axis of the MPA. The widest short-axis diameters of the ascending aorta and thoracic vertebral body were measured at the same level as the diameter of the MPA was taken. The short-axis diameters of 4 segmental pulmonary arteries were taken as were the short-axis diameters of several subsegmental pulmonary arteries. On transthoracic echocardiography, tricuspid regurgitation was seen in 61 patients, which allowed a right ventricular systolic pressure (RVSP) to be obtained.

Results: Both the ratio of the diameter of the MPA to the diameter of the ascending aorta and the ratio of the cross-sectional area of the MPA to the diameter of the ascending aorta had equal moderately strong correlation with mPAP (both R2=0.45; P<0.001). The ratio of the diameter of the MPA to that of the thoracic vertebral body or diameters of segmental pulmonary arteries or subsegmental pulmonary artery to bronchus ratios did not strengthen the correlation of the simple MPA to ascending aorta diameter ratio for pulmonary hypertension. Of those who had tricuspid regurgitation on transthoracic echocardiography, the correlation between RVSP and mPAP was moderately strong (R2=0.44; P<0.001). A composite index of the ratio of the diameter of the MPA to the ascending aorta and RVSP obtained from echocardiography was more strongly associated with mPAP (R2=0.55; P<0.001) than either test by itself.

Conclusions: A combination of CT anatomic findings and transthoracic echocardiographic-derived findings is more predictive of pulmonary hypertension than either test by itself.

Reviewer's Comments: It was interesting to note that transthoracic echocardiography by itself is no more accurate for predicting pulmonary hypertension than CT. It will be interesting to see if some sort of composite index using both of these tests will ever be used clinically in the future to try to ascertain whether the patient has pulmonary hypertension. (Reviewer-Vineet R. Jain, MD).

Keywords: Pulmonary Hypertension, Anatomic Features, CT, Echocardiography

Print Tag: Refer to original journal article
Increased V/Q Scanning Does Not Compromise Patient Safety

Success of a Safe and Simple Algorithm to Reduce Use of CT Pulmonary Angiography in the Emergency Department.

Stein EG, Haramati LB, et al:

AJR Am J Roentgenol 2010; 194 (February): 392-397

By increasing the use of V/Q scanning and decreasing the use of CT pulmonary angiography in the ED, there is a reduction in mean effective radiation dose to patients without a compromise in patient safety.

Background: The total effective radiation dose from CT pulmonary angiography (CTPA) is approximately 5 times more than ventilation-perfusion (V/Q) scintigraphy. The dose from CTPA is 20 to 40 times greater to female breast tissue than V/Q scintigraphy.

Objective: To evaluate whether radiation dose could be safely lowered in patients presenting to the emergency department (ED) with suspected pulmonary embolism (PE) by increasing the use of V/Q scanning and decreasing the use of CTPA.

Methods: At the authors' institution in 2007, it was mutually decided by the departments of radiology, nuclear medicine, and emergency medicine that stable patients who were suspected of having PE would have a chest radiograph. If the chest radiograph demonstrated no pleural or parenchymal abnormality, a V/Q scan would be ordered. If there was abnormality on chest radiography and PE was still suspected, a CTPA would be ordered. The final decision about which tests to order was made by the clinician. CTPAs were either read as positive or negative for PE. If the final reading was equivocal, it was considered nondiagnostic. V/Q scans were considered positive if they were read as high probability and were considered negative if they were read as normal, very low probability, or low probability. Intermediate and indeterminate scans were considered nondiagnostic. For the purposes of this study, examinations were considered falsely negative if they were read as negative for PE but the patient had a follow-up diagnosis of PE or deep vein thrombosis within 90 days after the initial negative result.

Results: In 2006 before the decision to increase the use of V/Q scanning was made, there were 1234 CTPAs and 745 V/Q scans in the ED. In 2007 after the decision was made, there were 920 CTPAs and 1216 V/Q scans. This resulted in a mean effective radiation dose reduction of 20% from 8.0 mSv in 2006 to 6.4 mSv in 2007 in patients in the ED being evaluated for PE. In 2006, there was no significant difference in age between patients who underwent CTPA or V/Q scanning. In 2007, patients who underwent V/Q scanning were significantly younger than those who had CTPA (mean, 50.8 vs 56.7 years). The false negative rate of the examinations did not significantly change between 2006 and 2007 (range, 0.8% to 1.2%).

Conclusions: There was a significant reduction in mean effective radiation dose to patients suspected of having PE in the ED by increasing the use of V/Q scanning instead of CTPA using chest radiography as a triage tool. This change did not result in an increase in false negative examinations.

Reviewer's Comments: It is very interesting that at the authors' institution they have managed to reverse the national trend of increasing CTPA and decreasing V/Q scanning. (Reviewer-Vineet R. Jain, MD).

Keywords: CT Pulmonary Angiography, Ventilation-Perfusion Scanning, Radiation Dose, PE

Print Tag: Refer to original journal article
Bedside portable chest radiography in ICU patients is reliable for detecting large pleural effusions but often misses or misdiagnoses small and medium pleural effusions as pulmonary parenchymal opacity.

**Objective:** Using CT as a reference, to evaluate the ability of bedside chest radiography to detect pleural effusions in ICU patients.

**Design:** Retrospective study.

**Participants:** 100 consecutive patients in the ICU who had a chest CT within 24 hours of portable chest radiography were evaluated. Exclusion criteria included any interim thoracic procedure between the examinations.

**Methods:** The bedside chest radiographs were evaluated for pleural effusions and parenchymal opacity on a 5-point scale where 5 = definitely present, 4 = probably present, 3 = possibly present, 2 = probably not present, and 1 = definitely not present. The presence of meniscus, apical cap, or lateral band was considered a 5 for the presence of a pleural effusion, and presence of a gradient opacity, layering opacity, or subpulmonic opacity was considered a 4 for the presence of a pleural effusion. Presence of air bronchograms was considered a 5 for parenchymal opacities and presence of heterogenous opacities was considered a 4 for parenchymal opacities. If a moderate or large pleural effusion was present, an assumption was made that passive atelectasis was also present. For the purposes of this study, no differentiation was made between atelectasis and other causes of focal parenchymal opacity. If a hemithorax was completely opaque, ipsilateral mediastinal shift indicated parenchymal opacity and contralateral shift indicated probable pleural effusion. A mediastinum that was not shifted indicated possible pleural effusion and possible parenchymal opacity. CTs were also evaluated for pleural effusions and parenchymal opacity. Pleural effusions were labeled as small, moderate, or large based on their maximum anteroposterior dimension relative to the diameter of the hemithorax (<15%, 15 to 30%, >30%).

**Results:** There were 117 pleural effusions seen on CT. The sensitivity of bedside chest radiography for pleural effusion was 66% (53% for small, 71% for moderate, and 92% for large pleural effusions). The specificity of bedside chest radiography for pleural effusion was 89%. The sensitivity and specificity of bedside chest radiography for parenchymal opacity was 65% and 89%, respectively. Meniscus, apical cap, lateral band, and subpulmonic opacity had high specificity, but each characteristic by itself had low sensitivity for detecting pleural effusion. The presence of homogenous opacity, including gradient opacity or layering opacity was the most sensitive sign for the presence of pleural effusion.

**Conclusions:** Bedside chest radiography is reliable for detecting large pleural effusions and can exclude them with high confidence. Small and medium pleural effusions are often not seen or misdiagnosed as pulmonary parenchymal opacities.

**Reviewer's Comments:** What was very interesting about this study was that reader sensitivity and specificity for detection of pleural effusions on bedside chest radiography did not significantly change between a thoracic radiology attending, thoracic radiology fellow, fourth-year radiology resident, and second-year radiology resident. (Reviewer-Vineet R. Jain, MD).

**Keywords:** Pleural Effusion, Bedside Chest Radiography, ICU Patients

**Print Tag:** Refer to original journal article
Osteoid Osteomas in Hard to Reach Places – Is RFA Still in the Offering?

Osteoid Osteomas in Common and in Technically Challenging Locations Treated With Computed Tomography-Guided Percutaneous Radiofrequency Ablation.

Mylona S, Patsoura S, et al:

Skeletal Radiol 2010; Online First Article (January 12): epub ahead of print

RFA ablation is an excellent treatment option for osteoid osteomas, including those in "technically challenging" locations.

**Background:** Since radiofrequency ablation (RFA) is transitioning to becoming a primary treatment for osteoid osteomas, the ease and success by which it is performed has thus far only been questioned in difficult cases.

**Objective:** To determine the efficacy of RFA for osteoid osteomas in "technically challenging" locations using computed tomographic (CT) guidance. In particular, articular and spinal osteoid osteomas were of greatest concern.

**Design/Participants:** Retrospective review of 23 patients with osteoid osteomas treated with percutaneous RFA under CT guidance. In total, 60% of lesions (14 cases) were in characteristically infrequent locations. After documenting an appropriate coagulation and platelet profile, patients underwent CT localization and conscious sedation. Via an 11G needle, ablations were performed using the RITA 1500 electrosurgical generator for a maximum time of 10 minutes, with average temperatures in the nidus reaching 80 to 100° Celsius.

**Results:** In all locations characterized as "uncommon" by the authors, there was a 100% success rate for RFA. For osteoid osteomas found in more typical locations, the success rate was approximately 78%. Overall, 91% of patients with osteoid osteomas were successfully treated with RFA with significant pain relief. No adverse complications were documented in any case included in this study.

**Conclusions:** Compared with success rates in the literature, the authors achieved similar results with their investigation. Significant pain relief was achieved in nearly all cases, and furthermore, lesion location did not affect outcome. All lesions in locations deemed "challenging" by the authors were successfully ablated without adverse events. Of note, lesions that were not ablated entirely at first attempt underwent successful re-ablation.

**Reviewer's Comments:** At the present time, RFA is becoming the mainstay of treatment for osteoid osteomas. Traditional management has either involved conservative treatment (NSAIDs, observation) and/or surgical resection. Both outcomes have proven successful, however, at different rates and with considerable consequences. For resection or even image-guided drilling procedures, patients may report symptom relief, yet the underlying architectural stability of the bone may be compromised, increasing the risk of insufficiency fracture. More invasive methods also entail longer post-treatment rest periods, whereby patients are instructed to limit vigorous activity. For a young individual, such restrictions can be frustrating. With regard to ablative techniques, there are several other methods employed for a variety of diseases (ie, cryoablation, laser or microwave ablation, etc). Comparatively, RFA has documented success rates with an overall favorable risk-benefit profile. And, in case you were doubtful, these authors have demonstrated that RFA is an optimal treatment strategy for osteoid osteomas – even in those "hard to reach" places. (Reviewer-Rahul Pawar, MD).

**Keywords:** Osteoid Osteoma, Radiofrequency Ablation, CT Guidance

**Print Tag:** Refer to original journal article
Pelvic fractures have a strong association with patient mortality, especially in combination with other predictors of adverse clinical outcome.

Objective: To determine how strongly associated pelvic fractures are with mortality, what other factors contribute to mortality, and what effect pelvic fractures have on these independent variables.

Design/Participants: Retrospective study of 67,826 patient records from 2 Level I trauma centers.

Methods: Relative risk was assessed by determining the odds ratio for pelvic fractures and inpatient mortality. Comparisons were made with other variables including age ≥60 years, systolic blood pressure (SBP) ≤90 mm Hg, Glasgow Coma Scale (GCS) score ≤8, and Abbreviated Injury Scores (AIS) of the abdomen, head/neck, extremities, and chest that were independently ≥1.

Results: 2102 and 1194 pelvic fractures were sustained by patients in groups A and B, respectively. Statistical analysis demonstrated that in both groups, there was a significant association between pelvic fractures and mortality. With pelvic fractures, both groups registered mortality rates of 8.4% and 13.6%, and odds ratios of 2.4 and 2.0, respectively. Overall, the highest odds ratios for mortality were associated with SBP, GCS, age, and AIS head/neck scores. Pelvic fractures also had a statistically significant association with mortality when combined with other variables, with 1 notable exception—in patients with severe head and neck injuries and accompanying hypovolemic shock, pelvic fractures demonstrated a negligible association with patient mortality.

Conclusions: This study reaffirmed the strong association between pelvic fractures and in-hospital patient mortality. By and large, pelvic fractures add to the relative risk of patient mortality along with the other independent variables (ie, low SBP, low GCS score, etc). In the setting of severe head and neck injury and shock, however, mortality appears to be so high that the compound effect of pelvic fractures is statistically insignificant.

Reviewer's Comments: As a radiologist practicing at a Level I center, I have had the experience of interpreting many imaging studies for the trauma service. Whether it is a high-speed motor vehicle accident or fall from height, pelvic fractures are ominous radiographic findings. Relaying the significance of the fracture types requires an in-depth knowledge of pelvic anatomy, as well as the visceral structures at risk. Acute pelvic hemorrhage, as the authors mention, may be one of the most important contributing factors to patient mortality. This study is not necessarily groundbreaking, yet conveys a critical message to all radiologists. Diagnosing pelvic fractures is a fundamental step toward reducing the likelihood of death in trauma patients. Many of the myriad variables attributed to mortality are clinical findings; nevertheless, in many emergency departments, imaging is completed even before a thorough physical examination. A discerning eye on our behalf may ultimately help see a patient through the proverbial valley of death. (Reviewer-Rahul Pawar, MD).

Keywords: Pelvic Fracture, Mortality, Traumatic Pelvic Injury

Print Tag: Refer to original journal article
In this preliminary study of patients with IUD who had UAE, there were no infectious complications noted in up to a 20-month follow-up.

**Background:** Uterine artery embolization (UAE) is a safe, valuable alternative to medical or surgical treatment of symptomatic fibroids. In the past, contraindications to UAE have included the presence of an intrauterine device (IUD), which was considered a risk for post-procedural infection. Many physicians preferred to remove the IUD before a UAE.

**Objective:** To report 20 women with IUD who had UAE in the authors’ institution.

**Design/Methods:** This was a retrospective study of 712 women treated for symptomatic fibroids by a UAE. Twenty of these women had an IUD in place at the time. Two of these patients had adenomyosis. All patients had a contrast-enhanced MRI before the UAE and 3 months later. The infarction rate and size of the uterus was recorded per patient. The embolization was performed in the standard fashion with microspheres. The patient filled out the Uterine Fibroid Symptom and Quality of Life (UFS-QOL) questionnaire at baseline and at 3 months. An additional questionnaire was given in January 2009 to these 20 women.

**Results:** Of 18 patients treated for fibroids alone, the mean dominant fibroid volume reduction was 30%. The mean uterus volume reduction was 25% of the initial mean volume. The mean infarction rate was 97% and the overall uterine infarction rate was 98%. As for the UFS-QOL questionnaire, the patients showed improvement in all of the scales: symptoms severity, concern, activities, energy and mood, control, sexual activity, and self-consciousness. No adverse reactions occurred during the hospital stay and none of these 20 patients with IUD developed an infectious complication during the 20.5-month follow-up. One patient underwent a hysterectomy 6 weeks after UAE because of persistent pain. No infection was noted. Three other patients experienced minor adverse events without the need for medical attention. Two other patients had short-term intermittent pain and 1 other patient had spontaneous fibroid expulsion.

**Conclusions:** Presence of an IUD might not be considered a contraindication for UAE.

**Reviewer’s Comments:** IUDs are used widely around the world. The risk for pelvic inflammatory disease in patients with IUD is very low. Nevertheless, the presence of foreign body in the uterine cavity has concerned most practitioners. Therefore, most patients had their IUD removed prior to UAE. These authors did not routinely remove the IUD prior to embolization because they thought it would aggravate bleeding. None of these 20 patients with an IUD developed an infectious complication post-procedure. The patients had a single dose of antibiotics before the UAE along with lifestyle change guidelines upon discharge. These preliminary findings indicate that the risks of IUD removal before UAE may outweigh the benefits. Larger studies may be needed to show that this is truly safe. (Reviewer-Sharon Gonzales, MD).

Keywords: Uterine Artery Embolization, IUD, PID, Uterine Fibroids, Infections

Print Tag: Refer to original journal article
Semiautomated volumetric measurement of liver lesions before and after RFA shows good correlation with manual measurements.

**Background:** Image-guided radiofrequency ablation (RFA) has become more important in the treatment of resectable and non-resectable liver metastasis. After RFA, accurate follow-up is necessary to evaluate efficacy. The newest multidetector CT scans have very high spatial resolution, and accurate 3-dimensional datasets can be acquired. Computer algorithms have been designed to assist in the measurement of these lesions in a semiautomatic fashion.

**Objective:** To authors compare semiautomatic volumetric measurements of liver metastasis from either breast or colon cancer before and after ablation.

**Design/Methods:** This was a retrospective review of studies performed on 25 patients with 50 known liver metastases that was treated with RFA. The investigators compared the CT scan performed before RFA to the CT scan performed 4 months afterwards. Manual measurements were compared with semiautomated measurements. In addition, the maximal 3-dimensional diameter and Hounsfield units (HU) were reported. The concordance between manual and semiautomatic measurements was displayed using Bland-Altman plots and by calculating Lin's concordance correlation coefficient. Perfect concordance is +1 and perfect discordance is -1.

**Results:** The mean volume of the untreated liver metastasis was 5.5 mL for manual and 5.4 mL for semiautomated measurements. The concordance correlation coefficient was 0.98. At 4-month follow-up, the mean volume measurements of the ablation zone were 22.4 mL for manual and 23.7 mL for semiautomated measurements. The concordance correlation coefficient was 0.99. HUs for the untreated liver metastases ranged between 26 and 111 for manual and 41 to 144 HU for semiautomated measurements and the concordance correlation coefficient was around 0.90. The ablation zone at 4-month follow-up ranged from 18 to 66 HU for manual and 25 to 68 HU for semiautomated measurements, with a correlation coefficient of 0.76.

**Conclusions:** Compared with manual measurements, semiautomated volumetric assessment of liver metastases before and after RFA demonstrated a high degree of correlation.

**Reviewer's Comments:** RFA is a good therapeutic option for patients who are not candidates for surgical resection with liver lesions ≤5 cm and ≤5 in number. These lesions tend to shrink during follow-up. Any focal enhancing lesion within the ablation zone or rim enhancement is suspicious for recurrence or local progression. Also, any increase in size is considered local tumor progression; therefore, volumetric evaluation is essential. Manual volumetric evaluation is time consuming, and semiautomatic measurements would be helpful. This study demonstrates good correlation before RFA and after 4 months between manual and semiautomated measurements. The correlation was not as good for the post-treatment HU measurements between manual and semiautomated measurements. The authors feel that the semiautomated HUs are more representative of the entire tumor. It is hoped that semiautomated quantification may decrease inter- and intra-observer variability. (Reviewer-Sharon Gonzales, MD).

Keywords: RFA, Liver Metastatic Disease, Measuring

Print Tag: Refer to original journal article
In patients with chronic kidney disease, small-bore central catheters have the same low infection rate when placed with or without a cuff.

**Background:** In patients with chronic kidney disease, small-bore central catheters (SBCCs) are often used as an alternative to peripherally inserted central catheter (PICC) lines to decrease damage to arm veins. These catheters are tunneled subcutaneously, much like long-term tunnel catheters. There is a lack of information about the difference between infections in tunneled SBCCs with or without a polyester cuff.

**Objective:** To present the authors’ results from their studies in infection and colonization of cuffed and non-cuffed tunneled SBCCs.

**Design:** Randomized, prospective controlled trial.

**Participants:** 84 patients with chronic kidney disease were enrolled; 42 had cuffed and 42 with non-cuffed SBCCs. Patients had to have required IV therapy for >2 weeks.

**Methods:** Procedures were done the same way. Patients were followed up in clinic or with telephone interview. All catheters were removed after the required time and sent for culture. Patients were followed up for infections and the incidence of venous thrombosis.

**Results:** Mean catheter dwell time was 32 days for cuffed catheters and 29 days for non-cuffed catheters. One device was removed because of poor function, and there was 1 dislodgement. Suspected infection was the cause for removal of 14% of catheters, but only 1 non-cuffed catheter caused documented bloodstream infection. The overall infection rate was 0.4 per 1000 catheter-days: 0% for cuffed catheters and 3% for non-cuffed catheters. One cuffed catheter and 2 non-cuffed catheters were positive for colonization, which was not statistically significant. Partial or complete jugular thrombosis occurred in 13% of patients in the cuff group and 4% in the non-cuffed group, but this also was not statistically different.

**Reviewer’s Comments:** PICC lines should not be used in patients who may need to undergo hemodialysis eventually because of the risk of venous thrombosis in an arm that could be used for fistula or arteriovenous graft formation. The Kidney Diseases Outcomes Quality Initiative recommends that arm PICCs not be used in chronic kidney disease stages 4 to 5. In this prospective study, the infection rate was much lower than the documented 2% in previous studies. Fourteen percent of these catheters were removed because of suspected infection; however, the actual infection rate was much lower. This study failed to show a benefit in the presence of a polyester cuff in SBCCs, with respect to the infection rate. The removal of the cuff catheter involved local anesthesia in most patients and a trip back to the hospital. The lack of a cuff would allow easier removal by caregivers. More cuffed catheters led to thrombosis of the vein it was in, and the cause of that is unknown. This is worrisome because the patency of jugular veins is important in the chronic kidney disease population as well. (Reviewer-Sharon Gonzales, MD).

**Keywords:** Tunneled Catheters, Infections, Venous Thrombosis, Complications

**Print Tag:** Refer to original journal article
Obtaining a CT prior to vertebroplasty may help determine subsequent fractures in the spine in adjacent as well as remote sites.

**Objective:** To determine if multidetector CT (MDCT) can predict patients at risk for subsequent fractures after vertebroplasty.

**Participants:** 26 consecutive patients with osteoporotic compression fractures in 58 vertebrae were prospectively studied. There were 18 women and 8 men, with a median age of 74 years. All patients had back pain refractory to conservative treatment with compression fractures diagnosed on MRI.

**Methods:** On the day prior to vertebroplasty, a 64-slice MDCT with multiplanar reformation was performed. Pre-procedural height of treated vertebrae was measured in the midsagittal plane. Wedge angles of treated vertebral bodies and adjacent disks as well as CT values of treated, adjacent, and non-fractured remote vertebrae were also measured. Post-procedural MRI was performed to evaluate new fractures approximately 3 months after treatment or if patients had recurrent pain. This MRI was compared with baseline examinations obtained 1 day before and 2 days after treatment. Patients were routinely observed up to 24 months after treatment.

**Results:** Post-procedural fractures were noted in 14 adjacent vertebrae (12.1%) in 13 patients and 14 remote vertebrae in 6 patients (23.1%). Post-vertebroplasty fractures in adjacent vertebrae tended to occur in small vertebrae before treatment. Steroid medication was used in 9 of 26 patients. Low CT values in non-fractured vertebrae were associated with subsequent fractures in remote vertebrae. Further collapse of treated vertebral bodies was noted in 10 patients without identified associated findings or cause.

**Conclusions:** This paper concluded that MDCT is a useful imaging tool in the pre-procedural planning to determine patients at risk of subsequent fractures in adjacent as well as remote sites.

**Reviewer's Comments:** Determining patients who are more likely to develop subsequent fractures after percutaneous vertebroplasty, a known complication, may help stratify higher-risk patients for earlier treatment and to prevent further complications. The main finding of this study was that the small size of treated vertebrae is a risk fracture to subsequent fractures in adjacent vertebrae, and MDCT can be used for this assessment. This finding may reflect the overall severity of compression fractures and alterations in the biomechanics at the fracture site. Additionally, steroid use and low CT values of non-fractured vertebrae on preoperative MDCT may be associated with subsequent fractures in remote vertebrae. This was not unexpected as steroid use is a known major cause of secondary osteoporosis. Despite more precise information obtained with MDCT compared to x-rays, there are several disadvantages of using CT, which include increased exposure to radiation, increased costs, and increased length of examination. Of mention, limitations of this study include the short follow-up period as well as the small number of patients included. (Reviewer-Maureen T. Barry, MD).

Keywords: Vertebroplasty, Multidetector CT

Print Tag: Refer to original journal article
The results of this study suggest that contrast-enhanced multidetector CT may be as accurate as MRI in determining the cause and severity of neural foraminal stenosis, with better interobserver agreement than MRI.

Objective: To determine and compare the accuracy of contrast-enhanced MDCT and MRI in evaluating the severity and cause of neural foraminal stenosis in symptomatic patients.

Participants/Methods: 18 patients with cervical radiculopathy underwent contrast-enhanced MDCT and MRI. Contrast-enhanced MDCT scans were acquired at 1-mm thickness and reconstructed in 2 planes using 2-mm sections parallel to the disk space and perpendicular to neural foramen. MRI sequences obtained included sagittal T1-weighted, fast spin-echo (FSE) T2-weighted, 3D FSE T2-weighted, axial T2-weighted, and 3D gradient-recalled echo. Using a 4-point scale, 3 neuroradiologists rated the severity and cause of neural foraminal stenosis, while 1 of 3 surgeons rated the severity and cause of neural foraminal stenosis using the same scale. Interobserver and intraobserver agreement were also evaluated.

Results: Sensitivities and specificities in evaluating the severity of neural foraminal stenosis were similar for contrast-enhanced MDCT and MRI. The sensitivity of contrast-enhanced MDCT was 91%, and for MRI, 96%; while specificity of contrast-enhanced MDCT was 54%, and for MRI, 46%. In the evaluation of the cause of neural foraminal stenosis, accuracies of contrast-enhanced MDCT and MRI were similar (85% and 79%, respectively). Interobserver agreement on severity of neural foraminal stenosis was moderate to perfect for contrast-enhanced MDCT as well as MRI. Interobserver agreement of the cause of neural foraminal stenosis was moderate to substantial for contrast-enhanced MDCT but fair for MRI. Intraobserver agreement was very high for severity as well as cause of neural foraminal stenosis with contrast-enhanced MDCT and MRI.

Conclusions: MRI is the preferred cross-sectional imaging study of choice for presurgical planning of symptomatic radiculopathy. This study suggests that contrast-enhanced MDCT may be as accurate in determining the cause and severity of neural foraminal stenosis with better interobserver agreement than MRI.

Reviewer's Comments: MRI has several limitations, including evaluation of small osteophytes, sensitivity to patient motion, and overestimation of severity of neural foraminal stenosis. Despite these limitations, MRI is the imaging method of choice in cervical radiculopathy because it has excellent soft tissue evaluation as well as spinal cord pathology evaluation. Several advantages of contrast-enhanced MDCT include shorter examination time, low cost, and ability after data acquisition to reformat images. With MRI, imaging planes are determined before image acquisition. Additionally, imaging time is longer with MRI, which is challenging to patients, including those with claustrophobia. Disadvantages of contrast-enhanced MDCT include exposure of ionizing radiation, anaphylactic reactions, and renal toxicity with iodinated IV contrast, beam-hardening artifacts due to shoulders, and the inability to evaluate spinal cord lesions. There are several limitations of this study, namely small sample size, exclusion of patients with mild neural foraminal stenosis due to lack of correlative surgical findings, and selection bias toward MRI-positive cases. (Reviewer-Maureen T. Barry, MD).

Keywords: Neural Foraminal Stenosis, Cervical Radiculopathy
Kidney Characteristics in Children Show Age-Related Trends

Renal Measurements, Including Length, Parenchymal Thickness, and Medullary Pyramid Thickness, in Healthy Children: What Are the Normative Ultrasound Values?

Kadioglu A:

AJR Am J Roentgenol 2010; 194 (February): 509-515

This study has established normal dimensions of certain morphologic characteristics of kidneys and age-related trends in children.

**Background:** Currently, established standards in monitoring renal morphologic change in children is centered on quantitative measure of renal size. Other variables that have been previously evaluated with different imaging modalities include renal parenchymal thickness, medullary pyramid thickness, and renal length.

**Objective:** To evaluate and establish the normative value of these specific morphologic characteristics of kidneys in children.

**Design:** Prospective study.

**Participants/Methods:** Over a 6-month prospective period, children without lower urinary tract symptoms or known underlying kidney pathology were recruited for study. Exclusion criteria included prior surgery, prior use of steroids, premature birth, history of malignancy, vesicoureteral reflux, hydronephrosis, or congenital anatomic anomalies. All children were evaluated with a curved or linear array transducer, and measurements obtained included renal length, parenchymal thickness, and medullary thickness. Parenchymal thickness was defined as the distance between the cortex margin and the sinus. Medullary thickness was the distance between the apex and the base of the medullary pyramid. Medullary and parenchymal thickness lines were drawn parallel to each other and perpendicular to the long axis of the kidney. Mean measurements were then calculated for each age group, with children aged <1 year stratified into monthly groups.

**Results:** 292 children were included in the study, 53% of whom were girls. Mean age was 6.1 years. The smallest parenchymal thickness in newborns was measured to be 0.8 cm. Medullary pyramid thickness decreased in older children with respect to younger children, and the ratio of medullary pyramid thickness to parenchymal thickness decreased as age increased. As would be expected, renal length increased with age, with more of a plateau of length measurements from age 10 to 16 years. When all data were viewed together, left kidneys tended to be longer, with thicker medullary pyramids and thicker parenchyma, a finding that was statistically significant.

**Reviewer's Comments:** The author has created a comprehensive list of normal measurements of kidney morphology in children to be used as a reference standard. Not unintentionally, use of a relatively inexpensive and nonionizing modality was sought to make the data useful and universally applicable. (Reviewer-Basil Hubbi, MD).

Keywords: Pediatric, Medullary Thickness, Parenchymal Thickness, Renal Length, Normal Values

Print Tag: Refer to original journal article
There is at least an 8% positive-predictive value of malignancy for a solitary dilated duct as discovered on mammography.

**Background:** In the most recent BI-RADS atlas, a mammographically evident unilateral solitary dilated duct is treated as a special case, with a consensus that the finding is minor clinical significance if unassociated with other suspicious clinical or mammographic findings.

**Objective:** To report clinical and pathologic outcomes of patients diagnosed with a solitary dilated duct on screening or diagnostic mammography.

**Design:** Retrospective study.

**Participants/Methods:** Over a retrospective 22-year period, patients who had been diagnosed with a solitary dilated duct on screening mammography were identified. In addition, over a 9-year retrospective period, patients diagnosed with the same finding on diagnostic mammograms were identified. Those patients documented to have had symptoms and those who were asymptomatic were all included in the study, so long as a solitary dilated duct had been found. It was determined that all descriptions conformed to BI-RADS content, even those patients who were evaluated prior to the initial BI-RADS edition. The study set was established by searching a database to find patients reported to have a solitary dilated duct with no additional suspicious associated finding. Follow-up radiologic and pathologic records were reviewed. Further reference was done with the regional tumor registry to identify any patients who may have been diagnosed with cancer at an outside institution.

**Results:** Of 264,476 consecutive screening and diagnostic mammograms, 21 patients were identified as being diagnosed with a solitary dilated duct and no other associated suspicious finding on mammography. Nine patients came from the screening pool and 12 from the diagnostic pool. Patients were either asymptomatic or had nonspecific symptoms such as breast tenderness or unilateral breast enlargement. Subsequent follow-up revealed that 1 case from the screening pool and 1 from the diagnostic pool were ultimately diagnosed with an associated breast cancer, both of which was described as ductal carcinoma in situ. Patient characteristics such as age, family history of breast cancer, or personal history of breast cancer did not correlate with increased risk of malignancy. The positive-predictive value of a solitary dilated duct was determined to be 11% on screening mammography and 8% on diagnostic mammography.

**Reviewer's Comments:** A troubling report. The authors suggest that the risk of malignancy for this finding is >2%, precluding classification as a "probably benign" finding. So what do we do with this finding, even though it's extremely rare? What do we recommend, and what should we suggest? Hopefully, the authors of the BI-RADS atlas who have promised us a new edition in 2010 will offer some direction. (Reviewer-Basil Hubbi, MD).

**Keywords:** Solitary Dilated Duct, Malignancy, Positive-Predictive Value

**Print Tag:** Refer to original journal article
Background: As MRI of the breast has become widely used, the limited specificity of breast MR findings has prompted the development of MR-guided biopsy. This technique has been shown to be costly and time-consuming, especially when compared with the duration and cost of alternative methods such as ultrasound-guided tissue sampling.

Objective: To evaluate the value of MR-directed ultrasound of lesions detected on breast MRI.

Design: Retrospective study.

Participants/Methods: Over a 35-month retrospective period, patients who underwent breast MRI at a single institution were identified. Those patients who had unexpected, abnormal enhancing lesions were identified. Of these patients, those who had mammographically occult nonpalpable lesions were recruited for a "second-look" ultrasound. Ultrasound examinations were performed with targeted attention to the area detected on MRI. Only lesions detected that correlated exactly with position and approximate lesion size were included. None of the MR-evident lesions studied had been previously detected on mammography, ultrasound, or physical examination. Presence or absence of an ultrasound correlate was noted. Pathologic results from those lesions that ultimately underwent biopsy were also documented. Of note, biopsies were performed by ultrasound guidance, MR guidance, or non–image-guided surgical excision. For lesions that did not undergo biopsy, MR or ultrasound follow-up was instituted to ensure stability over 24 to 60 months.

Results: 202 lesions were included in the study. Exact ultrasound correlation for MR-detected lesions was present 57% of the time. Of those lesions, 29% were malignant. Of 43% that were not correlated on ultrasound, 13% were malignant. Overall, malignant lesions showed significantly higher sonographic correlation, approaching 75%, and invasive cancers had a higher correlation rate than did ductal carcinoma in situ. As lesion size increased, correlation also increased for both benign and malignant masses. Of mass lesions without sonographic correlation, 89% were benign. Overall, non-mass lesions had a poor sonographic correlation.

Reviewer’s Comments: Findings are not significantly different from those of a recently reviewed article published by Meissnitzer et al in AJR (reviewed in this series in Volume 36, Issue 12). Again, we see a correlation with mass-like MRI findings and increased conspicuity on second-look ultrasound. (Reviewer-Basil Hubbi, MD).

Keywords: MRI-Detected Lesions, Second-Look Ultrasound

Print Tag: Refer to original journal article
Factors That Impact the Duration of MRI-Guided Core Needle Biopsy.
Noroozian M, Gombos EC, et al:
AJR Am J Roentgenol 2010; 194 (February): W150-W157

Patient-related or target-related variables do not impact procedure time for MRI-guided biopsy of the breast.

**Background:** Recent evidence has shown that MRI-guided biopsy of breast lesions carries a high rate of technical success and is considered an appropriate alternative to surgical excisional biopsy. Overall, data have also shown that duration of MRI-guided biopsy is relatively long, with an average duration of ≥35 minutes.

**Objective:** To establish which variables may impact total duration of a biopsy.

**Design:** Retrospective study.

**Participants/Methods:** Over a 14-month retrospective period, women who underwent successful MRI-guided breast biopsy procedures at a single academic institution were identified. Women who had complete datasheets available were included in the study. Data that were reviewed included procedure duration, which was determined from the hospital information system that tracks start and finish times for all procedures. In this study, procedure duration included total time that the MRI suite was occupied, including the time taken for patient positioning and post-IV removal hemostasis. Time to place IV access and to give the patient post-biopsy care instructions was not included in the analysis, since these functions occur outside of the MRI suite. Variables incorporated into the analysis included number of imaging acquisitions, number of times the patient was moved in and out of the magnet, magnet strength, and presence or absence of a breast-imaging fellow.

**Results:** 75 patients were included in the analysis. Average procedure duration was 57.9 minutes for single-target core biopsy, with imaging time averaging 41 minutes. Increased operator experience did not shorten duration of procedure. Most specific patient-related variables did not affect duration, including patient age, breast size, or breast thickness. A factor that led to increased procedure time was depth from the nipple; the closer the lesion was to the nipple, the longer the procedure took. There was no statistically significant difference between procedure times for those lesions targeted via a medial or lateral approach, and target morphology and size did not affect the procedure time. The assistance of a breast-imaging fellow decreased duration time by approximately 10 minutes. Duration of procedure increased with increased image acquisition, as would be expected.

**Reviewer’s Comments:** Interestingly, presence of a breast-imaging fellow decreased overall procedure time in this study. Other studies have shown residents to decrease radiologist productivity. An important lesson from these data is the proper positioning of patients in anticipation of image acquisition. If the radiologist can be involved in patient positioning to minimize the anticipated amount of acquisitions they will subject the patient to, then duration of procedure may be decreased substantially. (Reviewer-Basil Hubbi, MD).

Keywords: Cancer, MRI, MRI-Guided Procedure, Breast Biopsy

Print Tag: Refer to original journal article
What Causes Metabolic Flare on FDG PET-CT?

Flare Phenomenon in Positron Emission Tomography in a Case of Breast Cancer--A Pitfall of Positron Emission Tomography Imaging Interpretation.
Tu D-G, Yao W-J, et al:


The "flare" phenomenon in FDG PET refers to transiently noted false-positive studies due to post-therapy changes.

Background: Worsening of appearance of lesions on FDG PET can transiently occur following successful treatment of metastases, which has been termed a "metabolic flare" by some nuclear medicine researchers.

Case Report: A 47-year-old woman had invasive lobular cancer, 1.3 cm in diameter, which was removed by breast-sparing surgery with axillary lymph node dissection. Three of 15 level III right axillary lymph nodes were positive on pathologic examination, while other level lymph nodes were negative. CT examination at that time did not show metastatic disease, and the patient received 6 courses of chemotherapy over the next 3 months. Four months after completion of chemotherapy, she underwent an FDG PET-CT scan, which surprisingly demonstrated mildly increased uptake in her right axillary lymph nodes (standardized uptake value [SUV], 2.7) and bilateral pulmonary hilar nodes (SUVs, 2.6 to 3.3). There was no evidence of lymphadenopathy on CT. At that time, the surgeon is stated as believing that the findings were due to a metabolic flare rather than residual malignancy, as there was no clinical evidence of recurrence. Interval follow-up CT scan 6 month later remained normal. Follow-up FDG PET-CT 17 months after the first PET-CT appeared normal as the uptake in the right axilla and bilateral lung hila had resolved.

Conclusions: The authors reviewed various case reports and guidelines regarding the follow-up of treatment with FDG PET. Some experimental studies suggested that FDG activity associated with inflammatory responses of normal tissue peak at about 6 months but can be seen for at least 1 year. In many clinical guidelines, an interval of 2 weeks was suggested as being an appropriate waiting time following therapy to reimage the patient, which is a tradeoff between waiting long enough for post-therapy artifacts to resolve and obtaining information in a useful time frame. The authors' case occurred 4 months following chemotherapy.

Reviewer's Comments: I believe the topic is important; however, I am not convinced that the present case actually is due to flare. I wonder whether other explanations would be more plausible such as infiltrated injection leading to axillary uptake, which is a well-known phenomenon, and transient viral or inflammatory lung disease affecting the hila. (Reviewer-Lionel S. Zuckier, MD).

Keywords: Breast Cancer, FDG, PET, Artifacts

Print Tag: Refer to original journal article
Providing a Voice for Radiology Trainees

Regulation Without Representation.

Stephen R. Baker, MD

Perhaps board membership allotted to at least 1 junior diplomate of the American Board of Radiology can provide a voice for the financially challenged and currently unrepresented trainee in Radiology.

Just as issues of inadequate representativeness can be raised when differences exist between policymakers and policy followers with respect to geography, nationality, ethnicity, and gender, so too such a disconnect applies to differences in age. The average age of members among all specialty boards in American medicine is between 55 and 60 years, whereas the average age of first-time applicants for initial certification by those same boards is 30 years. Yet, for each individual board member of the American Medical Association and the Association of American Medical Colleges, there is a student with full voting rights. Similarly, all Resident Review Committees (RRCs) of the Accreditation Council for Graduate Medical Education have at least 1 resident member, also with full voting rights. The organizational dichotomy between the accrediting body in Radiology, its RRC, and the certifying body, the American Board of Radiology (ABR), is striking. The ABR requires upfront payment for beginning residents for initial credentialing to take place in 2011, 5 years after beginning residency, in effect making the poor subsidize the well off. Perhaps board membership allotted to at least 1 junior diplomate of the ABR can provide a voice for the financially challenged and currently unrepresented trainee in our specialty. (Reviewer-).

Keywords: Regulations, Resident Review

Print Tag: Refer to original journal article