Annular pancreas in adults can be diagnosed when there is a complete as well as incomplete ring of pancreatic tissue surrounding the duodenum.

Objective: To describe the prevalence of and findings associated with annular pancreas on CT, MRI, and endoscopic retrograde cholangiopancreatography (ERCP).

Design: Retrospective analysis.

Participants: 42 patients with annular pancreas who underwent CT, MRI, or ERCP made up the study group. The control group consisted of 30 patients evaluated for nonspecific upper abdominal pain who had a normal pancreatic head on CT or MRI and normal ductal anatomy at ERCP.

Methods: 22 CT, 13 MRI, and 29 ERCP examinations were performed. CT examinations were performed with a 4- or 16-MDCT scanner. A 1.5T system was used for MRI examinations. Imaging sequences included T1-weighted in-phase and out-of-phase and T2-weighted turbo spin-echo. T1-weighted fat suppressed volumetric acquisition images were obtained before and during arterial, venous, and 3-minute phases following intravenous contrast administration. Other acquired images included 2D 40-mm thick slab MRCP, 3D navigator-corrected MRCP, and secretin-enhanced MRCP images. Two radiologists reviewed the CT and MRI images.

Results/Conclusions: In the study group, the indications for CT, MRI, and ERCP imaging included abdominal pain, gastric outlet obstruction, abnormal liver function tests, preoperative evaluation of pancreatic carcinoma or intraductal mucinous neoplasm, pancreatic head mass, hepatocellular carcinoma screening, liver lesion characterization, and weight loss. Patients in the control group had final diagnoses of no abnormality, biliary dyskinesia, and sphincter of Oddi dysfunction. Of the 42 patients with annular pancreas, 33 had a complete annular pancreas, and the remaining 9 patients had incomplete annular pancreas. The complete annular pancreas was diagnosed using ERCP (n=18) and with CT, MRI, or both (n=15). The complete annular pancreas always surrounded the second part of the duodenum. The presence of pancreatic tissue posterolateral to the duodenum was 92% sensitive and 100% specific for annular pancreas. The incomplete annular pancreas was confirmed at surgery in 3 patients and with ERCP in 6 patients. The configuration of the pancreatic head surrounding the duodenum was variable and was circular or triangular with a crocodile jaw appearance. The risk of gastric outlet obstruction was 33%, similar to that of complete annular pancreas. There was a higher prevalence of other pathologic conditions of the pancreas, most notably pancreas divisum and chronic pancreatitis.

Reviewer’s Comments: The results of this study are useful in demonstrating that an annular pancreas can be diagnosed when a complete or an incomplete ring of pancreatic tissue surrounds the duodenum. A limitation reported in this study was the retrospective study design. (Reviewer-John C. Sabatino, MD).

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Keywords: Annular Pancreas, Imaging Characteristics

Print Tag: Refer to original journal article
In patients with autoimmune pancreatitis, the enhancement patterns at dual-phase CT of the pancreas as well as that of masses differ from that of pancreatic carcinoma and the normal gland.

**Objective:** To describe and compare the enhancement pattern of autoimmune pancreatitis, pancreatic carcinoma, and the normal gland.

**Design:** Retrospective analysis.

**Participants:** 101 patients underwent dual-phase CT of the pancreas and included 43 patients with autoimmune pancreatitis, 33 patients with confirmed pancreatic carcinoma, and 25 patients with a normal gland.

**Methods:** Dual-phase CT examinations consisted of a pancreatic phase performed at 35 to 45 seconds after the start of the contrast injection and a hepatic phase performed at 60 to 70 seconds after the start of the contrast injection. Approximately 50% of patients also had unenhanced images. CT attenuation values were measured by placing a region of interest (ROI) in the head, body, and tail of the pancreas. The average attenuation value obtained from these 3 segments was considered the gland's CT attenuation value. When a focal low-density mass was present in patients with autoimmune pancreatitis or if the patient had pancreatic carcinoma, the ROI was placed over the low-density mass or neoplasm, and this value was considered to represent the attenuation of that gland segment. Delayed enhancement was defined as a >15 HU increase in the CT attenuation of a mass or segment between the pancreatic phase and the hepatic phase.

**Results:** The CT attenuation value of the pancreatic parenchyma during the pancreatic phase was significantly lower for autoimmune pancreatitis than for the normal pancreas. There was no significant difference found in the CT attenuation value on either unenhanced scans or in the hepatic phase. The focally enlarged segment or low-density mass of autoimmune pancreatitis had a significantly greater attenuation value during the hepatic phase when compared to pancreatic carcinoma. However, there was no statistically significant difference found on either unenhanced scans or in the pancreatic phase. A >15 HU increase in the CT attenuation of a mass or segment between the pancreatic phase and the hepatic phase was found in 50% of patients with autoimmune pancreatitis and in 15% of patients with pancreatic carcinoma.

**Reviewer's Comments:** The results of this study are useful in demonstrating the different enhancement characteristics of autoimmune pancreatitis and pancreatic carcinoma at dual-phase CT. Familiarity with the increasing attenuation that autoimmune pancreatitis demonstrates between the pancreatic and hepatic phases can assist in distinguishing this entity from pancreatic carcinoma. Limitations reported in this study were that the imaging protocols varied and a fixed scan delay rather than bolus tracking was used. (Reviewer-John C. Sabatino, MD).

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**Keywords:** Autoimmune Pancreatitis, CT Findings

**Print Tag:** Refer to original journal article
Small Renal Oncocytomas Exhibit CT Segmental Inversion

Segmental Enhancement Inversion at Biphasic Multidetector CT: Characteristic Finding of Small Renal Oncocytoma.

Kim JI, Cho JY, et al:

Radiology 2009; 252 (August): 441-448

Small oncocytomas exhibit a characteristic CT enhancement pattern which may distinguish them from renal cell carcinomas.

Objective: To determine if the segmental inversion enhancement pattern found at biphasic CT can differentiate between small renal oncocyto

Design: Retrospective analysis.

Participants: 98 with pathologically confirmed renal masses (oncocytomas, n=10; renal cell carcinomas, n=88).

Methods: All patients had undergone a biphasic CT, and all had a mass size smaller than 4 cm. CT examinations were performed using multidetector systems. Unenhanced images were obtained followed by enhanced images during the corticomedullary phase (CMP) and early excretory phase (EEP) at 30- to 40-second and 120- to 180-second delays, respectively. Mass diameters and attenuation values from different areas within the mass were recorded. Segmental enhancement inversion in a mass was present when highly enhanced and less-enhanced regions on CMP images were reversed on the EEP. The attenuation of the segments was measured in a similar location on the unenhanced and enhanced images. Native renal parenchyma, calcifications, and intrallesional cysts were excluded from the region of interest measurement. The attenuation difference between the CMP and EEP was also calculated. If segmental enhancement inversion was not present, the homogeneity and pattern of enhancement were recorded.

Results: 8 of 10 oncocytomas and only 1 of 88 renal cell carcinomas showed segmental enhancement inversion. Therefore, this type of enhancement pattern had 80% sensitivity, 99% specificity, 89% positive predictive value, and 98% negative predictive value in differentiating between small oncocytomas measuring <4 cm and renal cell carcinomas. Pathologically, the highly enhanced segments seen during the CMP consisted of solid architecture comprised of tumor cells compactly arranged within scarce intervening stroma. The less-enhanced segments were comprised of tumor cells within abundant hypocellular stroma. The only renal cell carcinoma that showed segmental enhancement inversion was of the chromophobe subtype.

Reviewer's Comments: The results of this study are useful in demonstrating a practical enhancement pattern that may be evident at biphasic CT, which could potentially help distinguish between small oncocytomas and renal cell carcinomas. This distinction could allow for more conservative management options. A limitation reported in this study was that there was a small number of oncocytomas evaluated in comparison to the number of renal cell carcinomas. (Reviewer-John C. Sabatino, MD).

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Keywords: Small Renal Oncocytoma, CT Findings

Print Tag: Refer to original journal article
Combining PET-CT with conventional staging in patients with non-small-cell lung cancer reduces the number of futile thoracotomies but does not affect overall survival.

**Objective:** To evaluate preoperative staging of non-small-cell lung cancer (NSCLC) with PET-CT.

**Design:** Prospective study.

**Participants:** 189 patients with a new diagnosis or a high suspicion of NSCLC that was considered operable.

**Methods:** Patients were randomly assigned to 1 of 2 groups. Group 1 had PET-CT and conventional staging followed by invasive diagnostic procedures. Group 2 had conventional staging followed by invasive diagnostic procedures without PET-CT. Mediastinoscopy was performed in both groups. Together, a radiologist and a nuclear medicine physician interpreted the PET-CT scans and reached consensus. Lesions which had increased uptake in 3 planes were considered malignant. Lesions with standardized uptake values (SUVs) >2.5 were also considered malignant. TNM stage was determined in consensus by the pulmonologist and thoracic surgeon by using information from clinical history, initial CT, PET-CT (if performed), mediastinoscopy, and other invasive procedures. Positive findings on PET-CT were followed up with other imaging or diagnostic procedures, such as biopsy, on the judgement of the referring physician. A thoracotomy was considered futile if the pathologic finding was a benign lesion, tumor was present within mediastinal lymph nodes (stage IIIA [N2]), stage IIIB or IV disease was present, inoperable T3 or T4 disease was present, recurrent disease became present, or death occurred within 1 year.

**Results:** 98 patients were in group 1 and 91 patients were in group 2. In group 1 after PET-CT, 38 patients were considered inoperable. In group 2, 18 patients were considered inoperable. Sixty patients in the PET-CT group underwent a thoracotomy versus 73 in group 2. The thoracotomy was considered futile for 21 patients in the PET-CT group (35%) and for 38 patients in group 2 (52%). The average follow-up was 27 months. No significant difference in mortality was present between the 2 groups. Median survival was 31 months in the PET-CT group and was 49 months in group 2. At the end of the study, 56% of patients had died, including 61% in the PET-CT group and 51% in group 2.

**Conclusions:** PET-CT reduces the number of futile thoracotomies but does not affect mortality for patients with NSCLC.

**Reviewer's Comments:** The authors have demonstrated that PET-CT can aid patient care by helping to avoid futile surgery. However, the ultimate end point of improved patient care (improved mortality) was not demonstrated. (Reviewer-Vineet R. Jain, MD).

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**Keywords:** Lung Cancer, Preoperative Staging

**Print Tag:** Refer to original journal article
On 3 month follow-up after helical tomotherapy, radiation pneumonitis often manifests as irregularly shape ground-glass opacities surrounding target lesions in an eccentric manner, often with skip areas.

**Background:** Helical tomotherapy is a relatively new form of intensity-modulated radiation therapy that allows increased radiation dose and less lung toxicity. Obtaining images of megavoltage CT during tomotherapy every day allows correction of setup errors and treatment modification.

**Objective:** To describe the early CT lung findings of radiation pneumonitis (RP) within 3 months after completing helical tomotherapy for pulmonary malignancies.

**Design:** Retrospective review.

**Participants:** 25 patients who had undergone helical tomotherapy for pulmonary malignancies (a total of 77 target lesions).

**Methods:** CT was performed in all patients before initiation of therapy and within 3 months after therapy. Treatment response and pulmonary toxicity were evaluated by Response Evaluation Criteria in Solid Tumors and Common Toxicity Criteria for Adverse Events. Pulmonary toxicity was graded with a score of 0 (no increased pulmonary symptoms), 1 (pulmonary symptoms not requiring therapy), 2 (pulmonary symptoms requiring steroids), 3 (pulmonary symptoms requiring oxygen), or 4 (pulmonary symptoms due to radiation therapy causing intubation or death). RP was diagnosed based on clinical and imaging findings once infection had been excluded. On CT, a centripetal pattern of opacity was defined as having the densest opacity centrally, while a centrifugal pattern of opacity was defined as having the densest opacity peripherally.

**Results:** Within the first 3 months after therapy, RP developed around 34 of 77 lesions (44%) in 13 of 25 patients (52%). Five of these patients required steroid therapy, and the remaining required no therapy for pulmonary toxicity. RP manifested on CT as an irregular shape (18 of 34 lesions), as ground-glass opacity (19 of 34 lesions), and as no or minimal fibrosis (33 of 34 lesions). In addition, the location of the RP was eccentric in 22 of 34 lesions (65%), was centrifugal in pattern in 19 of 34 (56%), and had skip areas in 16 of 34 (47%).

**Conclusions:** On 3-month follow-up after helical tomotherapy, radiation pneumonitis usually did not produce significant clinical symptoms. CT findings included focal areas of irregularly shaped ground-glass opacities surrounding target lesions. Fibrosis, if present, was minimal. The appearance of RP was often that of a centrifugal pattern, with the densest opacity at the periphery away from the isocenter, often with skip areas. Also, RP was often away from the planned target volume, being eccentric in location relative to the target lesion.

**Reviewer's Comments:** The authors have nicely demonstrated the early expected CT findings of RP after helical tomotherapy. A follow-up study describing the findings at 1 to 2 years after helical tomotherapy in these same patients would be very interesting. (Reviewer-Vineet R. Jain, MD).

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Keywords: Lung Cancer, Helical Tomotherapy, Radiation Pneumonitis

Print Tag: Refer to original journal article
Careful management of technical parameters will yield diagnostic image quality of 64-MDCT coronary angiography in atrial fibrillation cases. Image quality is further improved as heart rate and heart rate variability decrease.

Objective: To evaluate 64-MDCT coronary angiography (CTA) in patients with atrial fibrillation (AF).

Design: Prospective study.

Participants: 60 patients with AF who underwent coronary CTA. All patients also underwent invasive coronary angiography at 1 to 3 days after CTA. Patients with stents or a history of coronary artery bypass graft were excluded.

Methods: On 64-MDCT, retrospective reconstructions were performed in 3 steps: auto best phase, multiple phase, and ECG edit. If automatic positioning of the R-wave indicators was unsuccessful, a radiologist positioned the indicators. Image reconstruction was based on absolute timing started at a defined time after the prior R wave. A reconstruction algorithm was employed where each axial section contained data from 1 to 5 R-R cycles. All images were reconstructed with a 0.5-mm section thickness and a 0.3-mm reconstruction increment. The axial images, multiplanar reformations, maximum intensity projections, and volume rendered images were evaluated for image quality and coronary stenosis. Patients did not receive additional beta-blockers for heart rate control prior to the CTA.

Results: On invasive conventional angiography, 3% of segments had a significant stenosis (stenosis ≥50%). Fifty-two patients had no significant stenosis. During 64-MDCT, the average heart rate was 90 beats per minute (bpm). Of 803 coronary artery segments, 26 (3%) were nonevaluable on 64-MDCT. The sensitivity, specificity, positive predictive value, and negative predictive value per evaluable coronary artery segment of 64-MDCT was 86.4%, 99.3%, 79.2%, and 99.6%, respectively. There was a very significant correlation between average heart rate and average image quality scores for all coronary artery segments. Image quality decreased significantly with an average heart rate >100 bpm or with a heart rate variability >24 bpm. No coronary segments were considered nonevaluable if the average heart rate was <75 bpm on 64-MDCT.

Conclusions: Coronary CTA using 64-MDCT in patients with AF is reliable, yields good image quality, and has a very high negative predictive value. Reducing heart rate and reducing heart rate variability will result in better image quality.

Reviewer's Comments: The authors have demonstrated that AF should not be a contraindication to coronary CTA with 64-MDCT. The authors acknowledge that the results of this study may have been influenced by the relatively low prevalence of significant coronary artery disease, as most patients needed to have coronary artery disease ruled out prior to cardiac surgery. (Reviewer-Vineet R. Jain, MD).

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Keywords: Atrial Fibrillation, Coronary CT Angiography

Print Tag: Refer to original journal article
Recombinant tissue-type plasminogen activator is safe to use to help drain loculated pleural effusions.

**Background:** Parapneumonic effusions (PPEs) develop in almost 50% of hospitalized patients in the United States, with some of them progressing to loculated, complicated collections that need further intervention. Fibrinolytic agents, such as recombinant tissue-type plasminogen activator (r-tPA), have been used to disrupt the loculations and make the fluid more liquid, allowing for adequate drainage.

**Objective:** To report the efficacy and safety of r-tPA for the treatment of loculated PPEs in adults.

**Design:** Prospective trial.

**Participants:** 25 consecutive patients with clinical pneumonia and loculated PPEs.

**Methods:** Under image guidance, size 10 to 24 F chest tubes were placed in the largest accessible pocket. After 2 hours of suction, 6 mg of r-tPA in 50 mL of normal saline was injected into the tube, which was then clamped for 2 hours. Then the tube was reconnected to suction for at least 8 hours. This whole process was repeated an additional 3 times as necessary. A repeat CT scan was performed 16 to 24 hours after the tube was inserted. If the collection was not resolved, then the patient was treated with video-assisted thoracoscopic surgery (VATS).

**Results:** The median duration of the indwelling tubes was 5.5 days. One dose of r-tPA was given to 2 patients, while 5 patients received 2 doses, 5 received 3 doses, and 13 received 4 doses. With each dose of r-tPA given, a decreasing amount of fluid was retrieved. No hemorrhagic or drug-related complications occurred. All pleural fluid was exudative in nature, and bacteria were cultured in only 4 patients. No characteristic of the fluid was predictive of outcome. After fibrinolytic therapy, 7 of the 25 patients required VATS.

**Reviewer's Comments:** Usually, pleural effusions caused by pneumonia will resolve with appropriate antibiotic therapy. Cases that progress to the fibrinopurulent stage become complicated and need drainage. Multiloculated collections do not allow the fluid to drain well. Because r-tPA lyases the fibrin, the loculations break, thus allowing more fluid to drain, leading to resolution. The viscosity of purulent collections, both effusions and abscesses, is decreased by r-tPA, thus improving drainage through a tube. The use of fibrinolytics has been reported in the past, but generally with urokinase and streptokinase. In this study, there was no statistically identifiable characteristic for patients who eventually required surgery. Further studies are needed, including larger randomized trials, that may identify predictive factors. At this point, because of the low risk, the researchers recommend r-tPA as a good first-line therapy for treating adults with complicated PPEs. (Reviewer: Sharon Gonzales, MD).

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Keywords: Parapneumonic Effusions, Treatment

Print Tag: Refer to original journal article
C-arm cone beam CT helps operators place translumbar central venous catheters with more confidence and less risk.

**Background:** Central venous access is difficult in patients who have central venous occlusions. In these patients, access via a translumbar route directly into the inferior vena cava (IVC) is the next available route. With the advent of C-arm cone beam CT (CBCT) technology and the 3D overlay technique, placement of translumbar central venous catheters (CVCs) has been made safer and easier.

**Objective:** To present a case series of translumbar venous access procedures performed using C-arm CBCT.

**Methods:** 3 patients with blockage of the thoracic central veins by lymphoma presented for central venous line (CVL) placement for chemotherapy and/or bone marrow transplant. The planned target (the infrarenal IVC) and skin entry points were marked on orthogonal reconstruction images in a path that would minimize kinking. The software computed the proper C-arm positions for the placement of the needle and drove the C-arm to the proper position to begin the needle placement using a bull's-eye view. The 10 F Hickman catheter was tunneled laterally to the right flank and inserted into the IVC up to the level of the right atrium-IVC junction.

**Results:** Access was obtained into the IVC on the first needle pass in all 3 patients. The procedure time was <1 hour for all patients, and the fluoroscopy time ranged from 5.4 to 17.5 minutes. No intraprocedural complications occurred. In 1 patient, the catheter became dislodged after 6 weeks, but it was successfully exchanged.

**Reviewer's Comments:** The imaging information given by C-arm CBCT gives operators more confidence and has altered the way procedures are done in the places where it is available. The addition of CT imaging and needle-guidance techniques to the fluoroscopy suite enhances patient care. For translumbar CVL placement, the soft tissue detail achieved by C-arm CBCT reduces the need for placement of a catheter in the IVC or the use of contrast to demonstrate the position of the IVC during the procedure. The overlay technique allows for real-time imaging during access of the IVC, which results in proper placement of the puncture site to avoid catheter kinking. Using this technique, the potential complications of puncturing the right renal artery, right kidney, colon, or ureter are greatly reduced. Limitations of this technique include patient motion, which can be decreased by proper sedation, respiratory motion, and prolonged procedure time caused by reconstruction and planning, but this will become minimal as the operators become more familiar with the software and the machine. (Reviewer-Sharon Gonzales, MD).

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**Keywords:** Central Venous Lines, Translumbar, C-Arm CBCT

**Print Tag:** Refer to original journal article
Endovascular Therapies Decrease Morbidity of Extensive DVT

*Endovascular Treatment Options in the Management of Lower Limb Deep Venous Thrombosis.*

Nazir SA, Ganeshan A, et al:

Cardiovasc Intervent Radiol 2009; 32 (September): 861-876

Endovascular therapies decrease the incidence of postthrombotic syndrome in patients with extensive deep venous thrombosis.

**Background:** The reported annual incidence of deep venous thrombosis (DVT) ranges from 60 to 180 per 100,000 patients. Currently, DVT patients are treated with low molecular weight heparin (LMWH) followed by a 6-month course of Coumadin®. In patients with severe and extensive clot, additional procedures may be performed to aid in clot removal before *phlegmasia cerulea dolens* (venous gangrene) or pulmonary embolism (PE) occurs. **Catheter-Directed Thrombolysis (CDT):** With CDT, thrombolytic agents are delivered directly into the thrombus with the aim of removing the clot much faster than can the body's thrombolytic mechanisms. Patients should be young, functional, and otherwise healthy with a normal life expectancy. The clot should be acute (<10 days old). Patients with failure of anticoagulation, extension to the inferior vena cava (IVC), large thrombus burden, IVC thrombosis after filter placement, and high risk of fatal PE are also potential candidates. Tissue plasminogen activator tends to be the agent of choice because of its specificity to fibrin. **Percutaneous Mechanical Thrombectomy (PMT):** PMT is direct extraction of thrombus using a variety of devices. The goals of this technique are to decrease clot burden, hospitalization times, and the risk of postthrombotic syndrome. It is often used in conjunction with CDT and results in shorter lysis times. **Adjuvant Angioplasty and Stenting:** This approach is indicated in patients who have anatomic stenoses or occlusions causing the thrombosis of the limb, such as May-Thurner syndrome (left iliac vein compression syndrome), or in patients who cannot tolerate thrombolysis. It also can be used to treat stenosis caused by malignancies, surgery, or radiation therapy. **IVC Filters:** Placement of a filter should be performed in patients who are a high risk for PE, which is fatal in up to 25% of patients. IVC filters are indicated in patients with a contraindication to anticoagulation who have documented DVT, who have a complication of anticoagulation, or who have recurrent or worsening DVT despite anticoagulation. Sometimes filters are used in conjunction with CDT or PMT to prevent clinically significant PE.

**Reviewer's Comments/Conclusions:** Based on the current data, the endovascular strategies demonstrate superior short-term venous patency rates, which should translate into decreasing postthrombotic syndrome. Aggressive endovascular therapy should be utilized in younger, healthier patients who will benefit the most. Patients may undergo CDT, with or without PMT, possibly under the protection of an IVC filter. Therapeutic anticoagulation should be given as possible. Patients with contraindications to anticoagulation should be considered for IVC filter placement alone. Well-designed prospective randomized trials are needed to validate the use and safety of these endovascular procedures in the future. (Reviewer-Sharon Gonzales, MD).

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Keywords: Deep Venous Thrombosis, Endovascular Treatment

Print Tag: Refer to original journal article
Whole brain echo-planar diffusion-weighted imaging with parallel acquisition improved diagnostic confidence in all cases of orbital abscess and allowed for confident diagnosis of abscess without contrast in most cases.

**Objective:** To determine the usefulness of echo-planar (EPI) diffusion-weighted imaging (DWI) with parallel acquisition in the diagnosis of orbital abscess.

**Design:** Retrospective study.

**Participants:** 6 patients with orbital abscess and 3 with orbital cellulitis.

**Methods:** 3T or 1.5T MRI conventional whole-brain images, including whole-brain DWI, were obtained for each patient. Orbital sequences consisted of T2 fast spin-echo, unenhanced T1, enhanced T1, and 3-plane fat suppressed postcontrast imaging. Two neuroradiologists evaluated all noncontrast images, except for DWI, and reported the likelihood of abscess as "certain," "probable," "possible," "unlikely," or "highly unlikely." Following this, assessment was made when DWI with apparent diffusion coefficient (ADC) was added, and a third assessment was made using postcontrast images. In a separate analysis, ADC values of the abscesses were compared with normal white matter (ADC ratio).

**Results:** On DWI images, artifact was present in the orbits, particularly along the floor and apex, and was worst with 3T. The mean ADC of the 6 abscesses was 0.80 mm²/second with an ADC ratio of 0.95. The ADC values range from 0.46 to 1.24. The reviewers reported that DWI increased confidence in all cases. In 3 cases of abscess, reviewer 1 was certain of abscess on unenhanced images and reviewer 2 rated two cases as "probable" and one as "possible." After DWI, both reported increased confidence, and reviewer 2 upgraded each reading. After contrast, the reviewer 2 upgraded the last case to "certain." In another three cases, both reviewers initially believed that abscess was "possible," and with DWI, reviewer 1 upgraded all three cases to "certain." With DWI, reviewer 2 upgraded two cases to "certain" and one to "probable." Among the three cellulitis cases with no abscess, the final diagnosis for one case was "certain abscess" (incorrect) for both reviewers. In this case, there was fluid signal on unenhanced images with restricted DWI signal and irregular rim enhancement. In another cellulitis case, reviewer 1 rated "probable abscess" on all three readings (incorrect), and reviewer 2 rated the same case as "unlikely" after DWI and contrast. In this case, there was mild hyperintensity on DWI but no restricted diffusion (T2 shine-through). In a third case, both readers went from "probable" or "possible" to "highly unlikely."

**Conclusions:** Whole-brain EPI DWI with parallel acquisition improved the diagnostic confidence in all cases of orbital abscess and allowed for confident diagnosis of abscess without contrast in most cases.

**Reviewer's Comments:** There were false-positive findings with contrast and DWI, and the limited specificity was not addressed by the authors. However, this study does provide radiologists with some added confidence in diagnosis, particularly in patients with renal insufficiency in whom contrast is contraindicated. ADC values should be nearly equal to or slightly lower than white matter. (Reviewer-Yaron Lebovitz, MD).

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Keywords: Orbital Abscess, Imaging

Print Tag: Refer to original journal article
Overall, the presence of hemorrhage in posterior reversible encephalopathy syndrome (PRES) is unrelated to severity of hypertension.

**Background:** Posterior reversible encephalopathy syndrome (PRES) occurs in hypertension cases, preeclampsia/eclampsia cases, certain chemotherapeutic agents, and immunosuppressive drugs, and others situations. The most common finding is bilateral white matter and gray matter edema. Hemorrhage is occasionally seen in association with these findings.

**Objective:** To assess the clinical and imaging features of patients with PRES and hemorrhage.

**Participants:** 151 patients with PRES were retrospectively identified.

**Methods:** Chart review was used to record all associated clinical data, including blood pressure. Coagulation state was categorized into "normal," "intrinsically abnormal," or "therapeutic" or "subtherapeutic anticoagulation."

**Results:** 23 of 151 patients (15.2%) demonstrated hemorrhage in the setting of PRES. Overall, etiology had borderline relationship to the presence of hemorrhage ($P=0.07$). Evidence of hemorrhage was seen in 22% of PRES patients with immunosuppression, 16.7% of patients undergoing autoimmune therapy, 10% of those on chemotherapy, and 5.6% of those with eclampsia. Of the 9 patients with an unknown etiology of PRES, 22.2% had hemorrhage. Among immunosuppressed patients, hemorrhage occurred in 47% of those who underwent allogenic bone marrow transplantation (allo-BMT) and in 11.8% of patients with solid-organ transplants ($P=0.02$). The blood pressure level was unrelated to the presence of hemorrhage, except that hemorrhage in the allo-BMT group was primarily in those with severe hypertension (HTN; mean arterial pressure $\geq 116$ mm Hg). In fact, if this group was ignored, severe HTN was underrepresented in other patients. In patients following allo-BMT, the proportion of focal hematomas increased when compared with sulcal or minute hemorrhage (<5 mm). Otherwise, the type of hemorrhage was not associated with blood pressure level or PRES etiology. Coagulation state generally was statistically significant for the presence of hemorrhage, except that patients with therapeutic anticoagulation were overrepresented in the hemorrhage group (17.4%) compared with the nonhemorrhage group (6.7%).

**Conclusions:** Hemorrhage was most common in patients who had undergone allo-BMT, and these patients were also more likely to have focal hematomas than were other patients. The incidence of hemorrhage was more common in patients with therapeutic coagulation. Severe hypertension did not affect the frequency of hemorrhage.

**Reviewer's Comments:** This well-analyzed study provided an interesting discussion of etiologies of PRES and hemorrhage. The authors gave figures for outcomes associated with PRES, but they did not evaluate how this compared to the outcomes of cases without hemorrhage. They point out that, sometimes, the hemorrhage was delayed. Because not all patients had delayed studies, the figures may underrepresent hemorrhage in PRES. (Reviewer-Yaron Lebovitz, MD).

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Keywords: Posterior Reversible Encephalopathy Syndrome, Hemorrhage

Print Tag: Refer to original journal article
Occipital condyle fractures are not infrequent, require prompt neurosurgical intervention, and should incite a vigorous search for additional injuries that increase long-term morbidity.

**Objective:** To identify how often occipital condyle fractures occur, how they are treated, and what clinical outcomes typically result.

**Design:** Retrospective and prospective study.

**Participants:** 65 patients who sustained blunt trauma and had occipital condyle fractures were selected for a prospective evaluation. Only 24 patients completed the study.

**Methods:** Parameters, such as mechanism of injury, initial Glasgow Coma Scale (GCS) score, and Injury Severity Score (ISS), were all selected for evaluation. The traditional Anderson and Montesano classification was used to grade occipital condyle fractures. The prospective evaluation included CT assessment of atlantoaxial and atlantooccipital joint stability, fracture healing, and clinical follow-up.

**Results:** The total incidence of occipital condyle fractures was 1.7 per 1000 patients per year during a 3-year study interval. Among patients with an occipital condyle fracture, the most significant long-term disabilities are reported to occur in those patients who have multiple traumatic injuries. Median GCS score initially was 13, corresponding to minor brain injury. Motor vehicle accidents caused the largest percentage of injuries. There were 12 Type I, 5 Type II, and 7 Type III occipital condyle fractures. Associated cervical spine injury was observed in 42% of patients. In 8 patients, halothoracic bracing was employed. In the remaining 16 cases, prolonged cervical collar immobilization was utilized. Anatomic alignment and healing was rated as excellent in 88% of patients, and none of these patients had severe neck pain/disability at follow-up. Of the few patients who reported "moderate-to-severe" pain, there were extensive and significant coexisting injuries (body and facial trauma). Similarly, no patients reported "severe" disability; patients with multiple traumatic injuries documented the most significant disabilities.

**Conclusions:** Although occipital condyle fractures are not frequent among injuries to the head and neck, they are not uncommon. There is a significant association between occipital condyle fractures and other injuries, such as intracranial hemorrhage and cervical spine fractures. Although no cranial nerve injuries were found in this study, there is well-documented evidence that condyle fractures place patients at higher risk. Depending on the grade of fracture, treatment can include cervical collars or halothoracic immobilization.

**Reviewer's Comments:** With the advent of fast and accurate CT scanning, diagnosing fractures and malalignment of cervical spine and skull base has become easier. Established neurosurgical treatments are essential to prevent death and reduce long-term morbidity from such trauma. However, the first step in management lies in our hands—the ability to detect and describe the imaging findings before us. Although, the effective sample size of this study was small, the importance of occipital condyle fracture characterization cannot be underestimated. Furthermore, such injuries should prompt an exhaustive search of the frequently associated injuries that ultimately contribute to long-term patient morbidity and dysfunction. (Reviewer-Rahul Pawar, MD).

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Keywords: Occipital Condyle Fracture, Treatment & Outcomes

Print Tag: Refer to original journal article
A simple methodical approach to evaluating low-energy ankle trauma can foster consistent and accurate diagnoses using plain film evaluation.

**Objective:** To describe a simple approach for identifying ankle trauma (chip fractures, avulsion fractures, osteochondral defects) in patients who present with low-impact or low-energy injuries.

**Design:** Yu and Cody propose a simplified approach for identifying ankle trauma that uses 11 anatomic sites at the ankle joint. The anatomic sites they designate are especially vulnerable to fracture and/or osteochondral injury. The initial diagnosis is based on plain film evaluation—the standard anteroposterior (AP), lateral, and mortise (internal rotation) views. Additional views are suggested where necessary.

**Results:** At the medial and lateral malleoli, avulsion fractures are typically horizontal resulting from tension on the collateral ligament complexes. Anterior tibial tubercle fractures are difficult to visualize, but mortise views can be pivotal. The lateral projection is the optimal view to identify posterior malleolar fractures. Talar dome fractures differ medially and laterally, although both are well seen on the AP and mortise projections. Lateral talar dome fractures are more common than medial talar dome fractures, the result of impaction against the tibial surface from forced inversion and plantar flexion. Soft tissue swelling about the lateral malleolus on the AP projection may be the only indicator of a lateral talar process fracture. Shallow and external rotation oblique projections may augment diagnosis of subtle and often missed posterior talar process fractures. The lateral view is ideal for documenting the presence of avulsion fractures of the talar head/neck region, often secondary to tension upon the joint capsule and/or talonavicular ligament. Lateral and, occasionally, oblique views of the foot are critical in identifying fractures of the anterior calcaneal process, which is the attachment site of the extensor digitorum brevis. The fracture often is confused for an os peroneum, and the AP projection is often diagnostic in these cases. Horizontal fractures at the fifth metatarsal base are most easily appreciated on the AP view and are most commonly due to tension within the peroneus brevis tendon and plantar fascia.

**Conclusions:** A methodical approach to the ankle series can help the radiologist make prompt diagnoses that facilitate early treatment.

**Reviewer's Comments:** As a radiologist with special interest in musculoskeletal radiology, I find the existing fracture classifications for ankle trauma cumbersome. In a busy clinical practice, remembering such details, although important, often times is overshadowed by the need to make correct diagnoses consistently. In my opinion, there is no better approach than to use anatomic landmarks as a guide to identify subtle findings. For the general radiologist, this article is also particularly helpful in demonstrating the use of nontraditional projections to expose overlapping anatomic structures. (Reviewer-Rahul Pawar, MD).

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Keywords: Ankle, Low-Energy Trauma, Fracture

Print Tag: Refer to original journal article
Image contrast is the most common reason cited for improved visibility of breast cancer on digital mammography with respect to screen-film mammography.

**Background:** The Digital Mammographic Imaging Screening Trial (DMIST) was a multi-institutional study sponsored by the American College of Radiology and the National Cancer Institute. This study compared screen-film mammography with digital mammography. Reports from that study reveal a superior diagnostic performance for digital mammography for women with dense breasts, age <50 years, and premenopausal or perimenopausal status.

**Objective:** To determine which factors led to the cancer detection results.

**Methods:** At a single institutional participant in DMIST, those patients who had ultimately been diagnosed with breast cancer and had undergone both digital and screen-film mammography as part of the trial were included in the analysis. A total of 307 cases were enrolled. Because 13 of those cases had 2 cancers, a total of 320 cancers were studied. One radiologist recorded the location of each cancer, the size of the lesion, and the structural characteristics such as calcifications, architectural distortion, mass, or focal asymmetry. Nine other radiologists read the studies with the screen-film and digital mammograms displayed simultaneously, adjacent to each other, although the digital mammograms were read as soft copy images. The readers were all aware that the cases included known malignancies. The readers rated the visibility of the known cancers on each modality using a 5-point scale. If there was a perceived difference in visibility between the screen-film and digital mammograms, the readers recorded their reason as to why there was a perceived difference by choosing from an extensive checklist or providing a reason not otherwise found on the available checklist.

**Results:** Radiologists who participated gave varied opinions regarding the visibility of the cancers. For those cancers more readily visible on the digital mammogram, the most common reason for discrepancy of visibility between the 2 modalities was contrast differences. For those women with dense breasts, radiologist-described contrast differences accounted for the reason associated with greater visibility 72.8% of the time. Similar results were obtained for those women with fatty breasts. Notably, in those patients where screen-film mammography provided better visibility, contrast was also cited as the most common reason, with positioning cited as the second most common reason.

**Reviewer's Comments:** The results serve to support the idea that differences in visibility may be more a function of the machine used rather than the radiologist reading the study. Perhaps this study may aid manufacturers in focusing technology on display and acquisition characteristics, particularly in regards to image contrast. (Reviewer-Basil Hubbi, MD).

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Keywords: Screen-Film vs Digital Mammography

Print Tag: Refer to original journal article
MR spectroscopy and diffusion-weighted imaging have yet to mature as reliable predictors of the histopathology for breast lesions.

**Objective:** To determine if MR spectroscopy (MRS) and diffusion-weighted imaging (DWI) can be helpful in characterizing breast lesions.

**Design:** Retrospective study.

**Methods:** During a retrospective 9-month study interval, patients who had undergone breast MRI at a single institution were identified. Those who had MRI performed for preoperative staging, post-biopsy assessment, or evaluation after chemotherapy were excluded. Patients who were evaluated for indeterminate lesions on MRI and subsequently had undergone image-guided biopsy formed the study population. Routine MRI with DWI and MRS had been performed on each patient as part of routine protocol. One radiologist with 15 years’ experience in breast MRI evaluated the lesions and assigned characteristics and impressions based on the Breast Imaging Reporting and Data System (BI-RADS) MRI lexicon. Category 4 lesions were subcategorized into 4a and 4b only. For the DWI sequences, a lesion was defined as being positive for malignancy if an area of high signal on DWI corresponded to an enhancing lesion on contrast-enhanced MRI. Regarding MRS analysis, a choline peak at 3.27-3.28 ppm was defined as benign, whereas a peak resonance at 3.22-3.23 ppm assigned to phosphocholine was defined as malignant. Histopathology was determined by core biopsy, vacuum-assisted stereotactic biopsy, ultrasound-guided vacuum-assisted biopsy, excisional biopsy, or MRI-guided vacuum-assisted biopsy.

**Results:** Of 171 lesions included in the study, 91 were determined to be malignant on histopathology. Most lesions were characterized as mass lesions. The rate of malignancy among those categorized as BI-RADS 4a, 4b, and 5 were 18%, 34%, and 95%, respectively. The sensitivity and specificity for MRS for mass lesions was 50% and 87%, respectively. In regards to MRS analysis, the average size of the false-negative mass lesions was 13 mm, while the true-positive lesions averaged 25 mm. All of the mass lesions which were classified as negative on DWI resulted in benign histology. When taken altogether, findings showed a specificity of 30% for DWI.

**Reviewer’s Comments:** Recent data regarding DWI and MRS for characterizing breast lesions have been mixed. Findings from this article are somewhat discouraging. Prior research has shown a greater specificity for particular breast cancer histopathology, notably mucinous carcinoma, when using DWI. The data coming from this particular institution intimate that the distinction between benign and malignant lesions is poorly defined on the basis of MRS and DWI. (Reviewer-Basil Hubbi, MD).

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Keywords: Suspicious Nonmass Lesions, MR Spectroscopy

Print Tag: Refer to original journal article
Variability in Breast MRI Protocols Affects Diagnostic Accuracy

Kinetic Curves of Malignant Lesions Are Not Consistent Across MRI Systems: Need for Improved Standardization of Breast Dynamic Contrast-Enhanced MRI Acquisition.

Jansen SA, Shimauchi A, et al:
AJR Am J Roentgenol 2009; 193 (September): 832-839

In contrast-enhanced breast MRI, diagnostic accuracy may potentially be lost due to variability in kinetics depending on the breast MRI acquisition protocols and the systems used.

Objective: To determine whether malignant breast lesions demonstrate similar morphologic and kinetic characteristics across different MRI systems.

Design: Retrospective study.

Methods: At a single institution, breast MRI had been performed utilizing 3 different MRI machines during a 5-year interval. All MRI-detected lesions that had correlative final pathology reports were identified. The MRI imaging protocols had been held as constant as possible across different manufacturers under the guidance of staff radiologists and MRI physicists. For all patients, the contrast-enhanced images were acquired 20 seconds after intravenous injection of 20 mL of 0.5 M of gadodiamide followed by a standard saline flush. For system 1, kinetic curves were derived from radiologist-determined regions of interest. Kinetic curves acquired under manufacturer systems 2 and 3 were derived from commercially available computer-aided detection systems (CADstreamTM version 5.0). These curves were subsequently modified by the radiologist if deemed necessary. The last time point was fixed across all systems and was used to define the delayed phase. Kinetic behavior of each lesion was characterized by the radiologist as per established Breast Imaging Reporting and Data System (BI-RADS) lexicon descriptors.

Results: Of 682 lesions in 601 patients studied, 497 were malignant and 185 were benign. Most lesions had been imaged with system 1. Most of the malignant lesions were characterized as invasive ductal carcinoma (IDC) and 20% were ductal carcinoma in situ (DCIS). For all 3 systems, malignant lesions showed greater washout curves than did benign lesions. The actual frequency of BI-RADS descriptors varied among all systems. Only 47% of IDC cases were classified as having a washout portion to the kinetic curve on system 3, while 74% and 75% of IDC cases imaged with systems 1 and 2 were described as such. The descriptors washout and plateau (generally considered suggestive of malignancy) yielded variable sensitivities among systems 1, 2, and 3 of 88%, 93%, and 85%, respectively. The specificity was 41%, 45%, and 37%, respectively, for systems 1, 2, and 3. Overall, system 3 was judged to show lower initial uptake and few washout curves for malignant lesions when compared with systems 1 and 2.

Reviewer’s Comments: Given the proprietary variability of protocols among different manufacturers, if studies continue to show variability in diagnostic accuracy, we may see this progress in 2 different directions. Will the manufacturers cite these data to push their products and protocols as superior to others? Will these data be used to arm the American College of Radiology in developing quality standards much like those implemented for mammography? (Reviewer-Basil Hubbi, MD).

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Keywords: Breast Cancer, MRI Protocols

Print Tag: Refer to original journal article
Kinetic characteristics which yield persistent enhancement have a high predictive value of benign status for lesions found on breast MRI.

**Objective:** To determine which morphologic and kinetic characteristics found on breast MRI can reliably be defined as BI-RADS 3 (Breast Imaging Reporting and Data System).

**Design:** Retrospective study.

**Methods:** A database was searched to identify those MRI lesions categorized as BI-RADS 3 during a 3-year study interval. The indication and date of the examination were recorded. Pathologic and clinical data were reviewed when available. Histopathology was definitive for outcome, and lesions were classified as benign if there had been no significant change in 18 months. Lesions were categorized as malignant if the study lesion was identified in the Consortium Oncology Data Integration project maintained by the National Cancer Institute as a malignant correlate within 12 months of the initial MRI. The date of the follow-up MRI and pathology results were recorded. MRI interpretation was based on the BI-RADS MRI lexicon. Morphology and kinetic characteristics were recorded.

**Results:** 362 lesions had received a BI-RADS 3 categorization, which was 10.1% of all the examinations performed during the study interval. Most patients had one BI-RADS 3 lesion, while 21 patients had three or more lesions meeting the BI-RADS 3 assessment. Of all the lesions assessed, 46% were defined morphologically as foci and 36% were defined as nonmasslike enhancement. Only 17% were described as masses. Seventy percent of the lesions were smaller than 1 cm. Most nonmasslike enhancement lesions were focal or diffuse in distribution, and most were described as heterogeneous or clumped. Homogeneous enhancement was found in 65% of lesions, and 78% had smooth margins. In terms of kinetics, 60% showed persistent enhancement, 17% showed a plateau, and 23% showed washout. Of all these lesions, 93% were downgraded to a BI-RADS 1 or 2 on subsequent MRI, and 7% remained as BI-RADS 3. There was no subsequent diagnosis of malignancy in any patients whose lesions were downgraded to BI-RADS 1 or 2. Only two cancers, both ductal carcinoma in situ, were diagnosed in the studied cohort, rendering a cancer rate of 0.85%. Both of these lesions had been found in breasts that already had a biopsy proven malignancy, although these lesions had been categorized separately from the overall study BI-RADS. Of the lesions that had persistent enhancement, 100% were benign.

**Reviewer’s Comments:** The characteristics assigned to those lesions studied in this article, which defined a BI-RADS 3 category, appear to yield a diagnosis of cancer well below the allowed 2% threshold for the BI-RADS 3 category. The authors provide an excellent framework for guiding the use of this category. (Reviewer-Basil Hubbi, MD).

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Keywords: Breast MRI, BI-RADS 3

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Many Thyroid Cancer Patients Receive Radioiodide Treatment at Home

A Revolution in Monitoring and Treatment of Thyroid Cancer Using Nuclear Medicine Techniques.

Lionel S. Zuckier, MD

Lionel S. Zuckier, MD - Special Presentation

Patients can now be treated with I-131 NaI at home, provided that no one in the patient's environment is exposed to ≥500 mrem.

On December 7, 1946, Seidlin and coworkers published a landmark paper on use of I-131 for therapy of functioning metastases of thyroid adenocarcinoma. In this manner, the field of therapeutic nuclear medicine began, heralded by what some have called the most important paper ever published in nuclear medicine. The area of monitoring and treating thyroid cancer using nuclear medicine techniques has metamorphosized over the last decade, though the changes may not be as well known to individuals who are not intimately involved in the practice of nuclear medicine. New developments include the use of I-124 for PET scanning of thyroid cancer, the cloning and analysis of the sodium iodide symporter, the concept of stunning of the thyroid, use of recombinant thyroid stimulating hormone for diagnostic and possibly therapeutic administration of I-131, the ability to treat patients outside of the hospital with I-131, the possibility of performing dosimetry measurements prior to therapy, and the use of FDG-PET as an adjunct to I-131 scintigraphy. Radioactive iodide can be used for treatment of thyroid tissue based on the beta emission of I-131. A huge change in treatment of thyroid cancer during the past decade is the ability to treat patients outside of the hospital. Several years ago, any patient administered >30 mCi had to stay within the confines of the hospital until their retained activity dropped below this level. Today, the Nuclear Regulatory Commission has shifted to a dosimetry based method. Patients can be sent home as long as no one in their environment will be exposed to ≥500 mrem. This allows many independent patients the ability to be treated with large doses of radioiodide at home. Additionally, I-131 is frequently used to image thyroid tissue prior to therapy. Dr. H. M. Park of Indiana popularized concern for the so-called "stunning of the thyroid." It is postulated that doses of I-131 as small as 1 to 2 mCi can render the thyroid relatively refractory to subsequent therapy. In concert with this concept, according to the newly published Thyroid Guidelines, pretherapy scans should utilize low-dose I-131 (1 to 3 mCi) or I-123-Nal. It is worthwhile to review the statement produced by The American Thyroid Association Guidelines Taskforce entitled "Management Guidelines for Patients With Thyroid Nodules and Differentiated Thyroid Cancer" (Thyroid. 2006; 16 [February]:109-142).

Reviewer's Comments: Based on all the recent changes which occurred during the last decade, it is a good juncture to review the treatment and monitoring of thyroid malignancy using nuclear medicine techniques, with both a review of the historical past and an emphasis on new understanding and methodology.

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Keywords: Thyroid Cancer, Nuclear Medicine, Monitoring & Treatment

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