

UVRA Physicians

Mark S. Asay, MD
 Carl M. Black, MD
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 David R. Cottam, MD
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 Kurtis R. Kendell, MD
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 Rodney C. Petersen, MD
 J. Daniel Rasband, MD
 Kimball B. Taylor, MD
 Gary M. Watts, MD
 John D. Wendel, MD
 S. Douglas Wing, MD, FACR

For questions, consultation or to schedule a procedure please contact Utah Valley Radiology Associates:

801.357.7056

24/7 Consultation

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Physician Highlights

Multihance in the Detection of Focal Nodular Hyperplasia

Focal Nodular Hyperplasia (FNH) is a benign tumor-like condition of the liver which is thought to be due to a hyperplastic response of the liver to a focal area of abnormal hepatic vasculature. It is composed of functional hepatocytes, abnormal biliary radicals, and Kupfer cells. It is the second most common tumor of the liver, and is most commonly found in young women.

The diagnosis of FNH can at times be difficult due to overlap of imaging characteristics with other hepatic masses. Ultrasound is not sensitive or specific for the diagnosis of FNH. Nuclear medicine sulfur colloid scan can accurately diagnose FNH due to uptake by Kupfer cells. However,

only 2/3 of lesions show uptake, and small lesions are difficult to detect. CT can be very specific for the diagnosis of FNH if the typical characteristics of hypervascular enhancement, rapid washout, and a central scar are present. However, many FNH are atypical either in appearance or enhancement making accurate CT diagnosis problematic. MRI has advantage over CT due to its tissue specific contrast from differences in T1 and T2 weighting. Along with gadolinium enhanced sequences, this allows higher sensitivity and specificity in the diagnosis of FNH.

Recently, it has been discovered that

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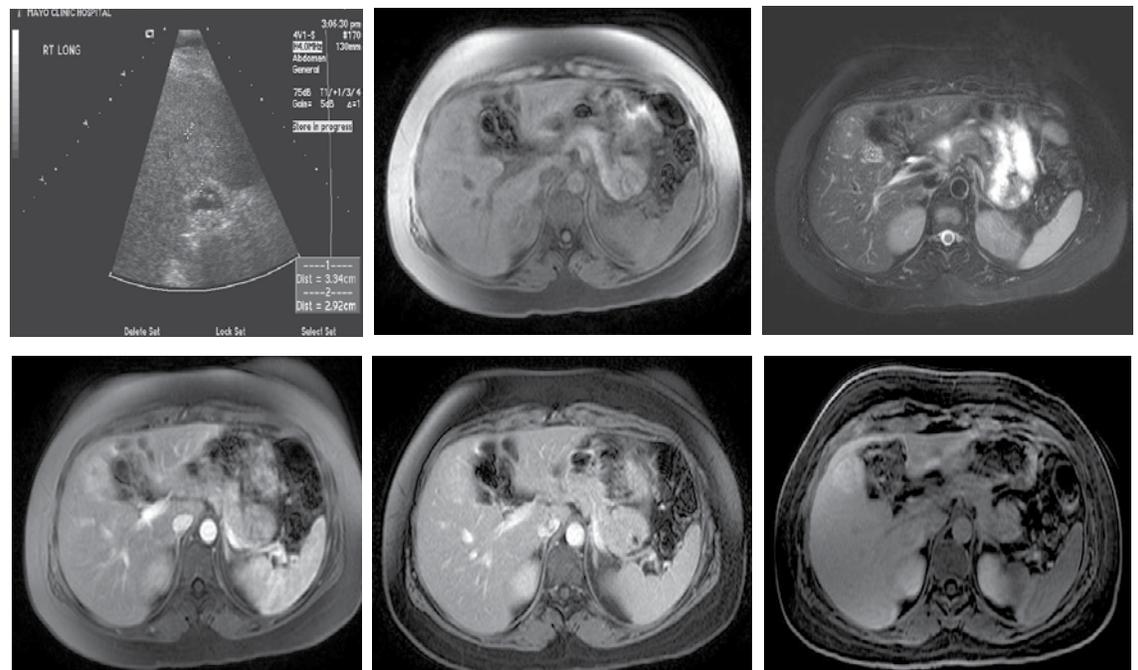


Fig. 1: Typical FNH- Nonspecific slightly hyperechoic lesion on ultrasound. Pre T1, T2 fat sat, and arterial, portal-venous, and 1 hour delay images of the liver. Subtle pre T1 and T2 FNH demonstrates hyperenhancement on arterial phase, washout on portal-venous phase, and hyperintensity on 1 hour delay images.

Focal Nodular Hyperplasia

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Milan, Italy) offers a distinct advantage over other gadolinium agents in the diagnosis of FNH due to its pharmacokinetics. It can also be used as a traditional gadolinium agent because of its vascular-interstitial distribution in the first few minutes. It differs from other agents in that it is a liver specific contrast agent which is partially (2-4%) taken up by functioning hepatocytes and excreted into the biliary system. Due to the abnormal bile ducts within FNH the functioning hepatocytes have delayed clearance of Multihance as compared to the remainder of the liver. This is seen as a hyperintense mass on delayed images. Thus, Multihance can be used to image the hypervascular (arterial) and washout (portal-venous) phases of FNH, as well as the abnormal

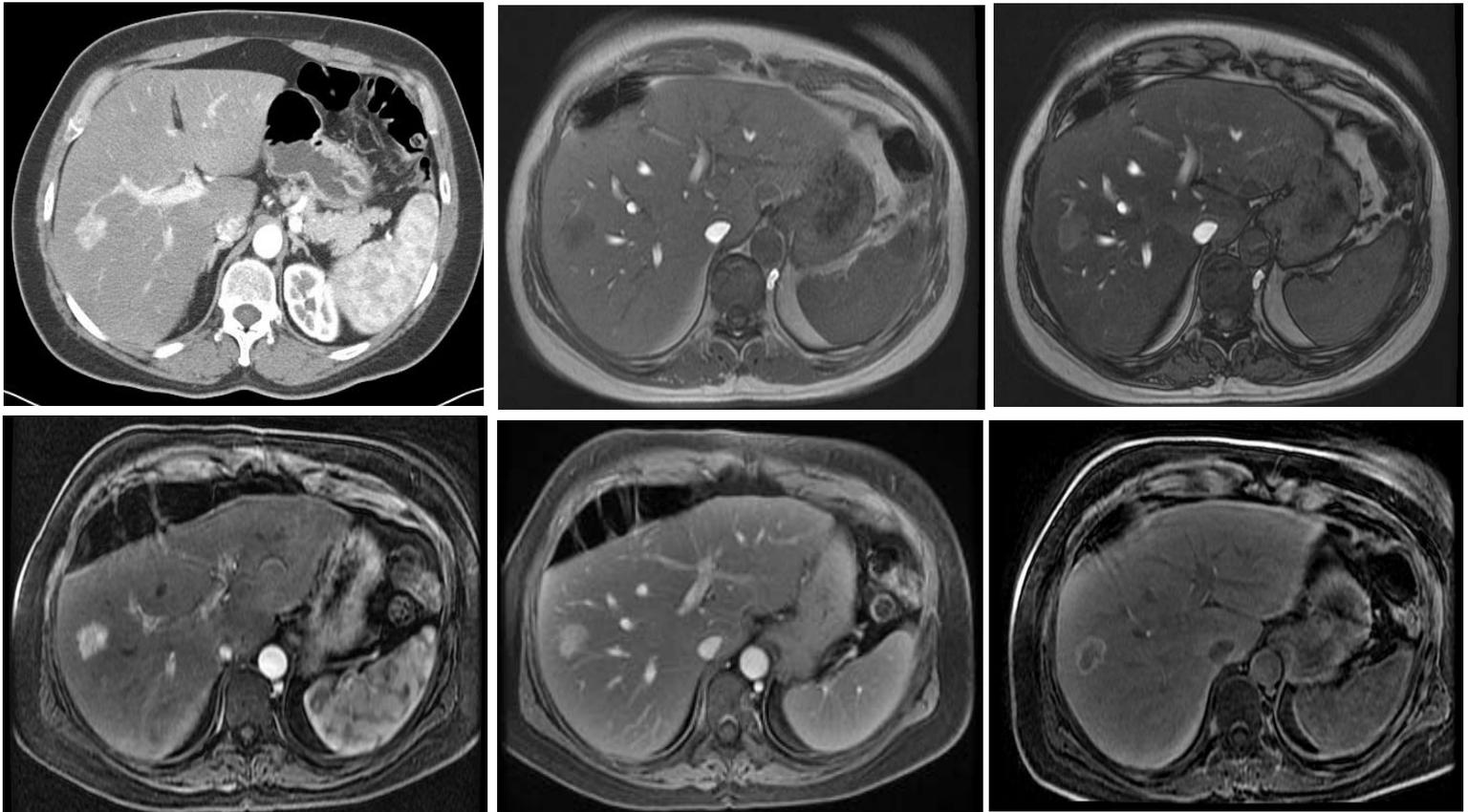
physiology it exhibits on delayed images (1-2 hours).

Grazioli et al demonstrated in his initial study that 93 of 100 pathologically proven FNH were either hyperintense or isointense on delayed imaging, while only 7 lesions were hypointense. Delayed patterns of enhancement were homogeneous, heterogeneous, or peripheral. More importantly, 19 of 21 lesions classified as atypical showed delayed hyperintensity or isointensity allowing for an accurate diagnosis in 90% of atypical FNH.

In a follow-up prospective study comparing the accuracy of differentiating FNH from adenoma using Multihance, Grazioli found that accurate

differentiation of the two was not possible with precontrast or dynamic phase imaging alone. Using delayed imaging with Multihance, 124 of 128 FNHs were hyperintense or isointense, while 107 of 107 hepatic adenomas were hypointense. Overall accuracy was 98.3%.

Fig. 2: Atypical FNH: Arterial phase CT, in and out of phase T1, and arterial, portal-venous, and 1 hour delayed images of the liver. Hyperenhancing FNH on CT and MRI shows ring hyperintensity on 1 hour delay images. Note the atypical hyperintensity of the FNH on the out of phase image and portal venous phase image due to drop out of liver signal in the setting of fatty infiltration.



- References**
1. Focal Nodular Hyperplasia: Morphologic and Functional Information from MR Imaging with Gadobenate Dimeglumine. Grazioli et al., Radiology, Dec. 2001.
 2. Accurate Differentiation of Focal Nodular Hyperplasia from Hepatic Adenoma at Gadobenate Dimeglumine-enhanced MR Imaging: Prospective Study. Grazioli et al., Radiology July 2005.

Feridex in Splenic Imaging

Feridex is a liver specific contrast agent in a group of agents known as superparamagnetic iron oxide particles (SPIO). It is taken up in the reticuloendothelial system of the liver (Kupffer cells), spleen, and bone marrow. It is sometimes used to increase sensitivity in detection of liver metastasis or splenic lymphoma. After administration of Feridex, signal in the RES containing organs is decreased due to distortions of the local magnetic field, particularly on long TE sequences such as T2 and gradient echo. A similar appearance is seen in disease processes where iron deposition in the liver, spleen, and other organs is increased, such as hemochromatosis and hemosiderosis. Since hepatic tumors and metastasis do not have RES cells they remain high signal, and contrast

between the liver/spleen and the lesion is increased. Feridex is given as a slow infusion, and dynamic imaging cannot be performed.

One specific problem area where Feridex can be used is in the setting of indeterminate pancreatic masses and regenerating splenic tissue. Often small accessory spleens or regenerating splenules can be seen in or near the pancreatic tail and can be confused with solid pancreatic neoplasms. With Feridex administration splenic tissue will decrease in signal on longer TE sequences while true pancreatic masses will show no signal change.

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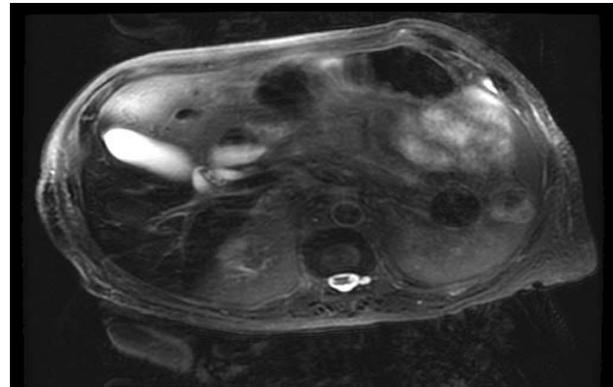
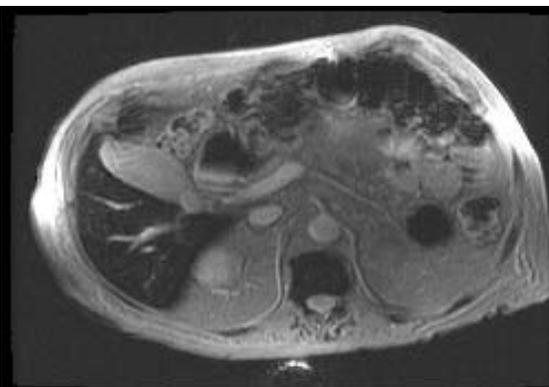
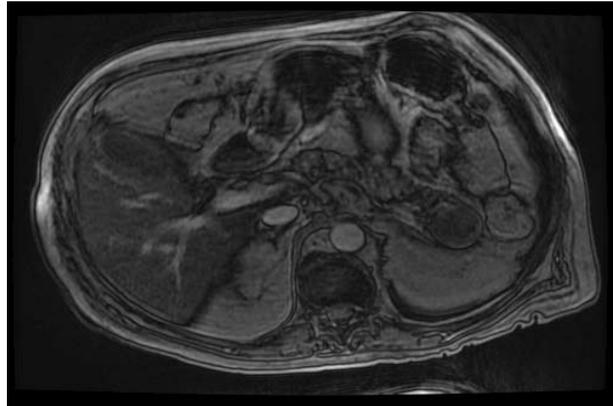
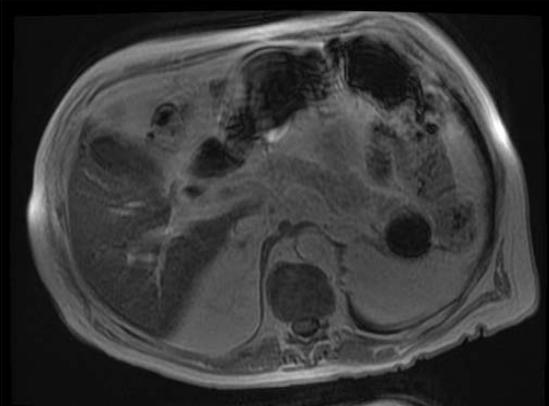
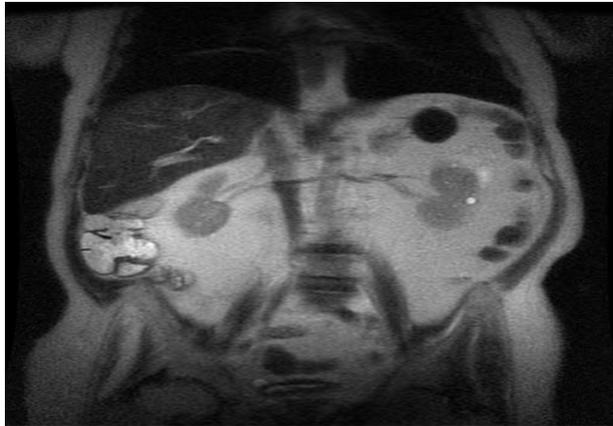
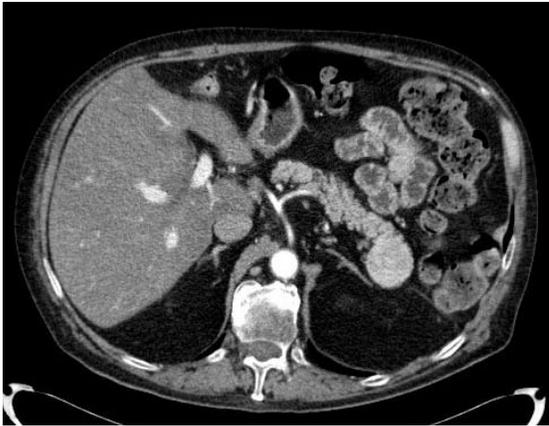


Fig 1: Intrapancreatic splenule. CT shows enhancing mass in pancreatic tail thought to be a solid pancreatic neoplasm in this patient with prior splenectomy. Coronal T2 SSFSE, axial T1 in and out of phase, and axial gradient and T2 images after Feridex administration. Notice very low signal in the liver and intrapancreatic splenule on SSFSE, gradient, and T2 images. Also notice lower signal in splenule on in phase T1 compared to out of phase T1 due to the longer TE of the in phase sequence. Incidentally the liver does not lose as much signal as expected on the in phase T1 image due to fatty infiltration of the liver in this patient. Phase T1 compared to out of phase T1 due to the longer TE of the in phase sequence.

Featured Physicians of Utah Valley Radiology Associates



John D. Wendel, MD

Dr. John D. Wendel's primary professional area of focus is pediatric radiology. Dr. Wendel focuses on diagnosis of diseases which affect children while working to minimize radiation exposure. He is also skilled in interpreting and acquiring medical imaging using such clinical imaging techniques such as ultrasonography (US), computed tomography (CT), magnetic resonance imaging (MRI), fluoroscopy, projection radiography (x-ray), and other imaging tools. In addition to his pediatric radiology work, Dr. Wendel maintains a faculty appointment at the University of Texas Medical Branch where he returns periodically to lecture.

After graduating from the University of Utah, Dr. Wendel acquired his medical degree from the Mayo Medical School in Rochester, Minnesota. He then completed an internship at the University of Missouri, followed by a diagnostic radiology residency and then a pediatric radiology fellowship, both at the University of Texas Medical Branch (UTMB) in Galveston.

His professional associations include the Society of Pediatric Radiology, Society of Pediatric Neuroradiology, Radiological Society of North America, the American College of Radiology, and the American Roentgen Ray Society.



David R. Cottam, MD

Dr. David R. Cottam's primary professional area of focus is in cross-sectional and body imaging. He is skilled in interpreting and acquiring medical imaging using such clinical imaging techniques as magnetic resonance imaging (MRI), fluoroscopy, positron emission tomography (PET), projection radiography (x-ray), computed tomography, ultrasound, and other imaging tools. Dr. Cottam is fellowship trained and board certified in diagnostic radiology.

Graduating summa cum laude in his undergraduate work, Dr. Cottam attended the Medical College of Wisconsin in Milwaukee. After receiving his medical degree, he enrolled for a transitional year of internship at the LDS Hospital in Salt Lake City. This was followed by a diagnostic radiology residency at Duke University Hospital in Durham, North Carolina. He then completed a body MRI/cross-sectional imaging fellowship at the Mayo Clinic in Scottsdale, Arizona. His professional associations include the Radiological Society of North America, the American College of Radiology, the American Medical Society, and the Alpha Omega Alpha Honor Medical Society.

Feridex in Splenic Imaging

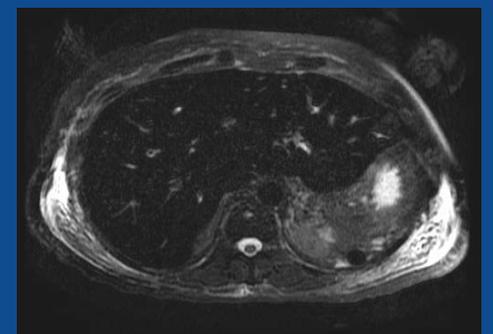
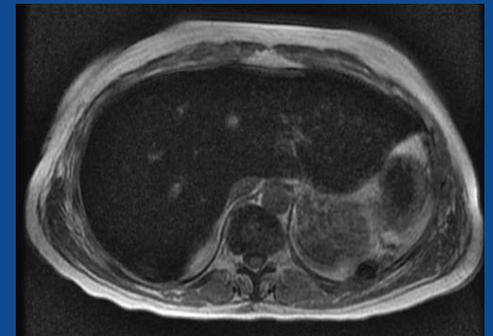
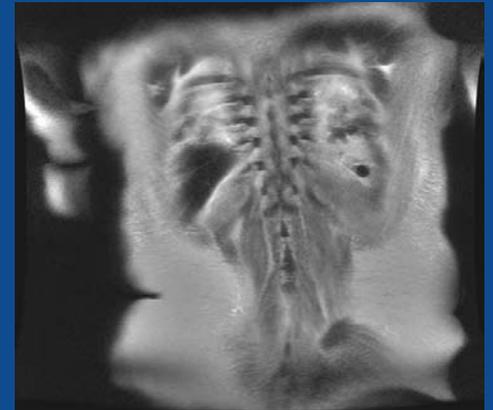


Fig. 2: Recurrent splenule. Axial contrast enhanced CT scan in a patient with recurrent anemia and thrombocytopenia shows a small soft tissue nodule in the left upper quadrant. Patient has had prior splenectomy for treatment of anemia. Due to the recurrence of anemia clinical suspicion was high for regenerating splenic tissue, however subsequent sulfur colloid scan was negative (probably due to the very small size). Coronal SSFSE, axial in-phase T1, and axial T2 images nicely demonstrate the very low signal of the splenule and the liver in this patient with hemosiderosis.