Cirrhosis results from chronic hepatic inflammation and is characterized by replacement of the normal hepatic parenchyma with a mixture of parenchymal nodules and fibrosis. Cirrhotic nodules are particularly important as they represent the early and intermediate stages in the stepwise progression of carcinogenesis leading to hepatocellular carcinoma (HCC). Other malignancies including mass-forming cholangiocarcinoma and mixed phenotypic tumors (HCC and cholangiocarcinoma) may also occur in the cirrhotic liver at a much lower rate than HCC.

MR imaging is used to identify malignant nodules and distinguish them from benign nodules. This distinction is based on the signal characteristics and enhancement profile of the nodules. Cirrhotic and malignant nodules have overlapping signal characteristics on unenhanced T1-weighted imaging, but only malignant nodules and infarcted benign nodules are hyperintense on T2-weighted imaging. Malignant nodules impede diffusion and therefore, have higher signal intensity than background liver on diffusion-weighted imaging (DWI) but sensitivity of HCC detection on DWI decreases with increasing severity of cirrhosis and HCC differentiation. Both HCC and cirrhotic nodules may contain intracellular lipid. The enhancement profile of nodules is therefore basis of their characterization as benign or malignant. A classic HCC nodule is hyperenhancing relative to liver parenchyma in the arterial phase, becomes hypointense in the venous and / or delayed post contrast phases (washout feature), and may have a delayed enhancing capsule / pseudocapsule. The combination of arterial hyperenhancement and venous / delayed washout feature has a sensitivity of approximately 60% and a specificity of 96-100% for the diagnosis of HCC measuring 2 cm or less.

Because of the high specificity of this enhancement profile for the diagnosis of HCC, biopsy confirmation of HCC in the cirrhotic liver is no longer required if a nodule displays classic enhancement characteristics. Biopsy is reserved for indeterminate nodules with atypical enhancement characteristics on imaging. These non-invasive criteria for the diagnosis of HCC were adopted by the American

Association for the Study of Liver Diseases (AASLD), the United Network for Organ Sharing (UNOS) / Organ Procurement and Transplant Network (OPTN) and the LIver Reporting And Data System (LIRADS).

Contrast agents with hepatocyte specific properties exploit the cellular properties of nodules. They help improve sensitivity of detection of HCC and high risk nodules that at risk of transforming into HCC, and distinguish pseudolesions (perfusion abnormalities) from HCC.

While classic HCC is easy to diagnose based on the classic enhancement pattern, many nodules in the cirrhotic liver have atypical and overlapping signal and enhancement characteristics, and can be difficult to characterize. The LIRADS algorithm helps classify these nodules according to their likelihood of being HCC by using a combination of size and signal/enhancement characteristics. The LIRADS system was created to standardize reporting of HCC on CT and MRI, and reduce image interpretation variability and errors.

In this presentation, we will explore the range of MRI appearances of cirrhotic nodules, HCC and other tumors including intrahepatic cholangiocarcinoma and mixed phenotypic tumors, and we will apply the LIRADS algorithm to classify these nodules. We will also explore the role of hepatobiliary contrast in the characterization of nodules in the cirrhotic liver.