Upper Abdominal MRI - From Sequences To Applications

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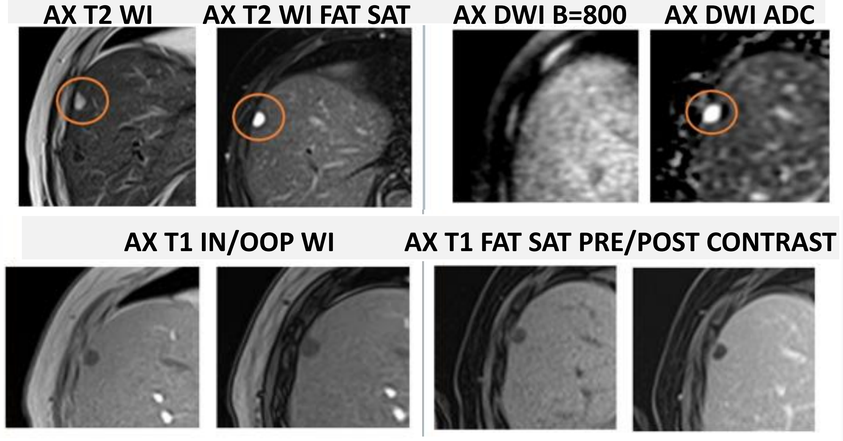
➢ INTODUCTION

Magnetic Resonance Imaging (MRI) is an important **non-invasive imaging technology** used in initial detection phase and as a complementary technique for a more complex characterization of pathologies. To improve detection sensitivity, eliminate artifacts, and increase patient comfort, state-of-the-art MRI systems have been implemented and applications have been developed to deal with pulse sequences, image reconstruction, and data analysis. Nevertheless, performing an ***abdominal MRI*** examination can be challenging, and a thorough understanding of the ***sequences***, along with the ***trade-offs between various parameters***, is essential for acquiring interpretable images without compromising the detection of pathologies. These aspects are important in the characterization of hepatic lesions where the appropriate selection of sequences and parameters plays a crucial role in differentiating benign from malignant lesions and establishing an ***accurate diagnosis***. The present study examines the impact of sequences selection and parameters optimization on image quality and highlights how the resulting images with different contrast mechanisms (e.g., T1-weighted, T2-weighted, In-phase/Out-of-phase, Water-Fat separation) contribute to the differentiation of various pathologies. By analyzing these contrasts, we aim to provide a comprehensive understanding of their distinctive imaging characteristics, which can aid in improving diagnostic accuracy.

➢ DISCUSSION

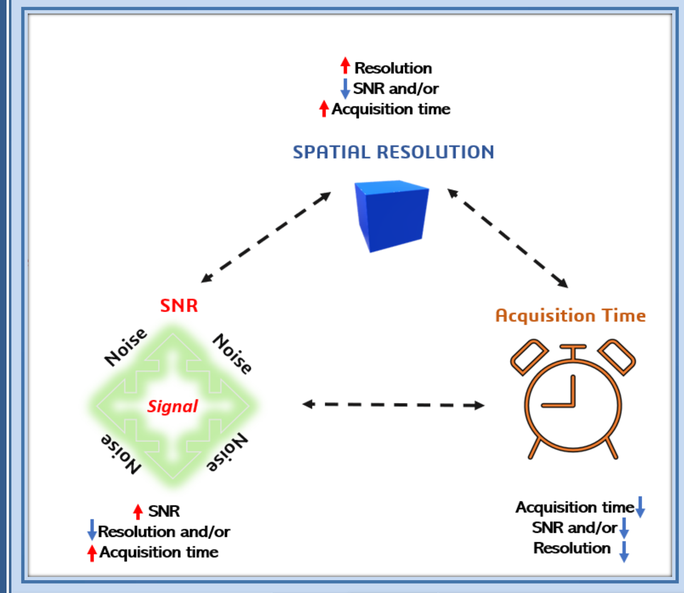
BENIGN LESION

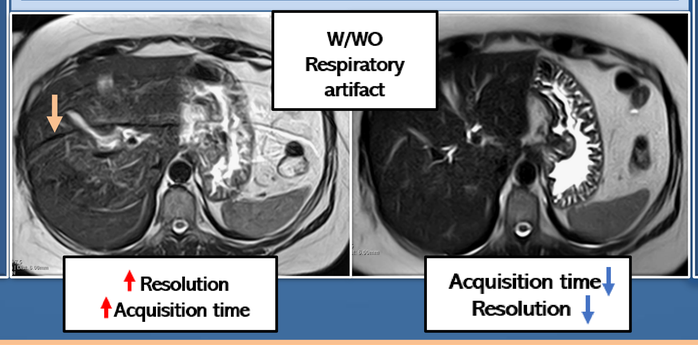
HEPATIC CYST



A hepatic cyst is a commonly encountered lesion, often found incidentally during abdominal MRI examinations. It appears well-defined on all sequences, with hyperintense signal on T2-WI and ADC, and is absent on b=800 due to the free diffusion of water molecules within its fluid content, indicating a non-restrictive nature. On in-phase and out-of-phase sequences, it does not exhibit notable changes indicating the absence of intracellular fat.
After contrast administration, it shows no enhancement, confirming its benign nature

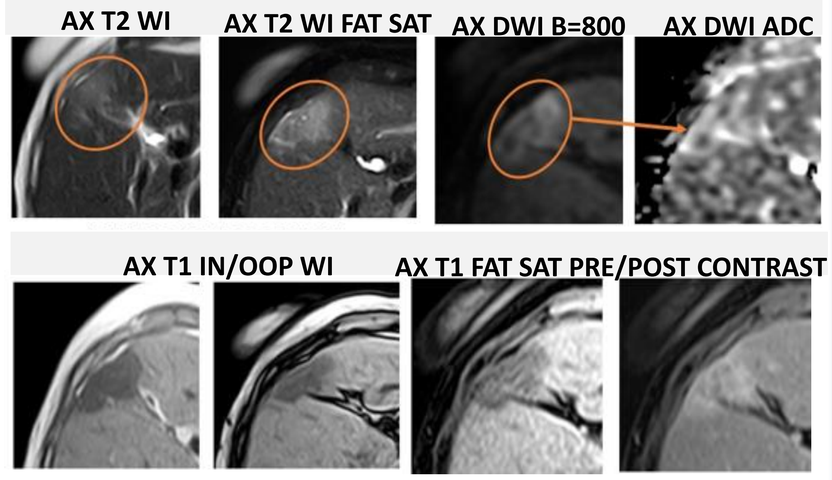
IMAGE QUALITY





MALIGN LESION

CHOLANGIOCARCINOMA



Compared to the benign lesion, the malignant lesion lacks a well-defined shape, exhibiting irregular margins and heterogeneous signal intensity. It appears mildly hyperintense on T2-WI, with areas of restricted diffusion on b=800 and corresponding low signal on ADC. The lesion reveals a significant drop-out in the out-of-phase sequence, suggesting the presence of intracellular fat. After contrast administration, it demonstrates progressive, heterogeneous enhancement, a characteristic feature of cholangiocarcinoma.

➢ CONCLUSIONS

Image quality is an important factor in ***the accurate diagnosis of abdominal MRI***. Various artifacts, including respiratory motion, susceptibility effects, and improper parameter selection, can compromise the investigation image, hide pathological findings or may be confused with a pathology. The application of T1-WI, T2-WI, T1-in/out of phase, water-fat separation and diffusion-weighted imaging (DWI) sequences plays an ***important role in lesion characterization***, facilitating the differentiation between ***benign and malignant lesions***. Although MRI is a non-invasive technology that provides significant diagnostic value, a comprehensive understanding of the ***physical principles of image acquisition and contrast generation*** is essential for optimizing image quality and ensuring diagnostic accuracy.

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