

# DIFFERENTIATION OF MALIGNANT THROMBUS FROM BLAND THROMBUS OF THE PORTAL VEIN IN PATIENTS WITH CIRRHOSIS: APPLICATION OF INTRAVOXEL INCOHERENT MOTION DIFFUSION-WEIGHTED MR IMAGING

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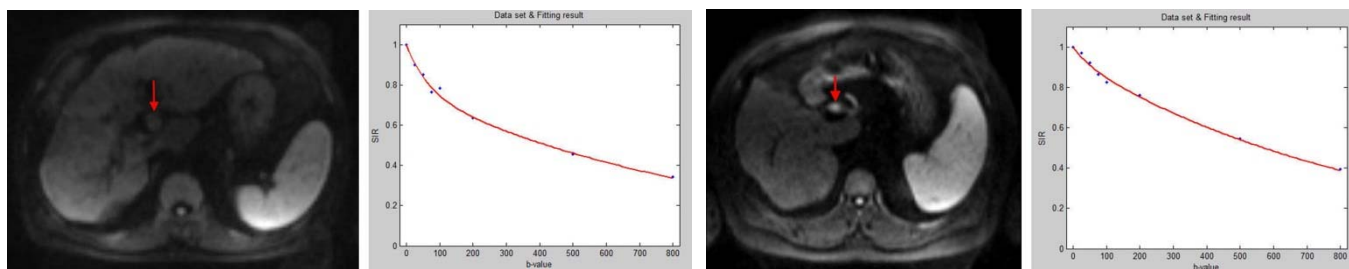
**Target Audience:** Abdominal Imaging Radiologists

**Background:** Recently, parameters extracted from the intravoxel incoherent motion (IVIM) theory [1] have been reported to be of use to differentiate abdominal lesions [2,3]. The IVIM theory predicts an additional component to the monoexponential signal decay measured with diffusion weighted imaging (DWI) due to perfusion.

**Purpose:** To investigate the utility of IVIM diffusion-weighted (DW) MR imaging in distinguishing bland thrombus from neoplastic thrombus in the portal vein in patients with cirrhosis or hepatocellular carcinoma.

**Methods:** A retrospective search of MRI database of examinations performed during last 3 years for “cirrhosis” or “hepatocellular carcinoma” and “portal vein thrombus” was performed. The imaging results in 43 patients with portal vein thrombosis (malignant thrombus  $n = 29$  and bland thrombus  $n = 14$ ) who were examined with gadoxetic acid-enhanced MR imaging including IVIM were reviewed. A thrombus was considered neoplastic if it expanded the vessel or enhanced on MR images. A thrombus was considered bland if the extent of thrombus was reduced or not progressed at follow-up imaging or the thrombus was detected in patients without hepatocellular carcinoma. IVIM DW imaging was acquired with free-breathing axial single-shot echo-planar two-dimensional imaging sequence and the following eight  $b$  values: 0, 25, 50, 75, 100, 200, 500 and 800  $\text{sec/mm}^2$ . Diffusion coefficient ( $D$ ), pseudo-diffusion coefficient ( $D^*$ ), and perfusion fraction ( $f$ ) were calculated and compared between neoplastic and bland thrombi using t-test.

**Results:** The mean  $D$ ,  $D^*$ , and  $f$  of malignant thrombi were  $1.03 \times 10^{-3} \text{mm}^2/\text{sec}$ ,  $67.51 \times 10^{-3} \text{mm}^2/\text{sec}$ , and 18.47%, and those of bland thrombi were  $1.35 \times 10^{-3} \text{mm}^2/\text{sec}$ ,  $9.31 \times 10^{-3} \text{mm}^2/\text{sec}$ , and 18.46 %.  $D$  of bland thrombus was significantly higher than that of malignant thrombus ( $p = 0.014$ ). However, the mean  $D$  difference between the two thrombi was relatively small.  $D^*$  of malignant thrombus was significantly higher than that of bland thrombus ( $p < 0.001$ ). There was no significant difference in  $f$  between malignant and bland thrombi.



**Fig 1. A neoplastic thrombus (arrow) & Biexponential decay** **Fig 2. A bland thrombus (arrow) & Biexponential decay**

**Conclusion:** IVIM DW imaging appears to be a promising method for the discrimination between bland and neoplastic portal vein thrombi. Pseudo-diffusion coefficient ( $D^*$ ) of neoplastic thrombus was significantly higher than that of bland thrombus, which might be due to capillary blood flow within neoplastic thrombus.

## References

- [1] Le Bihan D et al., Radiology 1988;168(2):497-505.
- [2] Luciani A et al., Radiology. 2008;249(3):748-52.
- [3] Woo S et al., Radiology.2013;270(3):758-767