Correlation of T1-weighted Gradient Echo (GRE) Signal Intensity and Decreased Exocrine Function in Suspected Early Chronic Pancreatitis

Temel Tirkes[1], Chen Lin[1], Jordan K Swensson[1], Zachary E Ballenger[2], Chenkun Wang[3], Evan Fogel[4], Kumaresan Sandrasegaran[5], Alex Aisen[1], and Fatih Akisik[1]

[1]Diagnostic Radiology and Clinical Sciences, Indiana University School of Medicine, Indianapolis, Indiana, United States, [2]Indiana University School of Medicine, Indianapolis, Indiana, United States, [3]Department of Biostatistics, Indiana University School of Medicine, Indianapolis, Indiana, United States, [4]Department of Gastroenterology, Indiana University School of Medicine, Indianapolis, Indiana, United States, [5]Diagnostic Radiology and Clinical Sciences, Indiana University School of Medicine, Indianapolis, IN, United States

TARGET AUDIENCE
Radiologists and gastroenterologists.

PURPOSE
Determine if pancreatic signal variations on T1-weighted fat-suppressed pre-contrast GRE image correlate with decreased exocrine function.

METHODS
A retrospective analysis was performed on 42 suspected chronic pancreatitis (CP) patients who had both IntraDuctal Secretin Test (IDST). IDST involves collection of fluid from the pancreatic duct after stimulation with secretin (16 mcg IV over one minute) at the time of Endoscopic Retrograde Cholangiopancreatography (ERCP)[1]. Fluid is assessed for bicarbonate concentration (HCO3) as a measure of exocrine pancreatic function. There were 29 patients with normal and 13 patients with decreased exocrine function by IDST criteria. By ERCP, 40 patients were categorized as normal and 2 patients as mild CP based on the Cambridge classification [2]. MRCP was performed on 1.5T (n=34) or 3T (n=8) scanners. A volume interpolated 3D GRE sequence was used to acquire T1-weighted pre-contrast images using minimal TE, TR range of 4.0 – 6.55 ms and flip angle of 12 for 1.5T, and TR range of 4.0 – 5.0 ms and flip angle of 9 for 3T scanners. Two reviewers independently performed region of interest (ROI) measurements (~1cm^2) from the pancreas (head, body and tail) and the spleen. Signal intensity ratio (SIR) was calculated by dividing the average pancreas signal by the spleen. Pearson's correlation coefficient was calculated to assess the correlation between HC03 concentration and SIR. Logistic regression was used to determine the cut-off in SIR between normal and decreased group as well as the variability of measurements between 1.5T and 3T scanners.

RESULTS
There was significant difference in the SIR of the pancreas between the normal (mean 1.41, SD: 0.27) and decreased exocrine function group (mean 1.05, SD: 0.21) ($p < .0001$). Inter-observer correlation was excellent (kappa=0.90, p <0.0001). A significant positive correlation was found between pancreatic fluid HC03 level and SIR (r=0.53, p <0.0001). Similar results were found on both the 1.5T and 3T scanners (p=0.70). Patients would be considered to have decreased exocrine function if the SIR is less than 1.19 (sensitivity=0.77, specificity=0.76).

CONCLUSION
There was significant correlation between the decreased exocrine function (measured by the IDST) and lower signal on T1-weigthed fat-suppressed pre-contrast GRE images. Pancreas-to-spleen SIR of less than 1.19 can be used as an indicator of decreased exocrine function in patients with suspected mild chronic pancreatitis.

REFERENCES
1. Comparison of Endoscopic Ultrasound and Endoscopic Retrograde Pancreatography for the Prediction of Pancreatic Exocrine Insufficiency. Dig Dis Sci (2008) 53:1146–1151
2. Endoscopic retrograde cholangiopancreatography in chronic pancreatitis. Cambridge classification. Radiol Clin North Am. 1989 Jan;27(1):39-50.

T1 signal vs HCO3 concentration of the Pancreas