# Fast 3D Dynamic Contrast-Enhanced MRI Pre- and Post-Secretin for Evaluating the Severity of Chronic Pancreatitis

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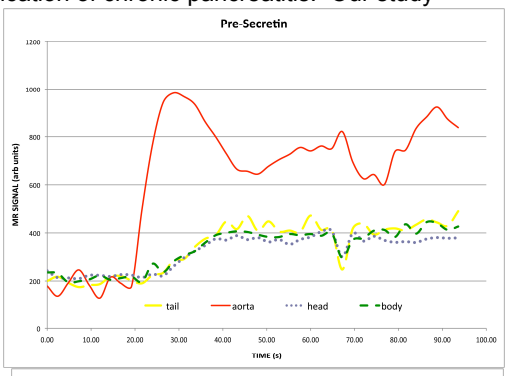
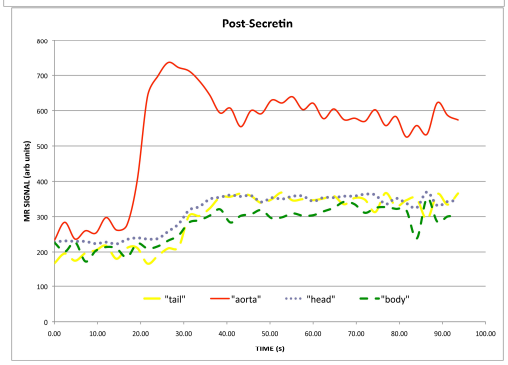
**Introduction :** Chronic Pancreatitis can be a debilitating disease with little clear defined criteria for staging. The ability to stage patients with chronic pancreatitis could theoretically lead to earlier intervention and prevention of metabolic decline. It has been suggested in prior studies that the inflammatory cascade that leads to destruction of the pancreas may also affect the surrounding vasculature. This vascular remodeling and fibrosis may lead to impaired hemodynamics within the organ. Furthermore, it has been suggested in preliminary research that secretin stimulation may further lead to a distortion of these properties and thus could be used as a tool for screening patients. Currently, secretin stimulation is utilized in MRCP Cambridge classification of chronic pancreatitis. Our study intends to correlate pre- and post-secretin pancreas perfusion with a more precise classification of chronic pancreatitis.




**Purpose:** To assess the ability of pre- and post-secretin MR measurements of regional pancreas perfusion to provide a more precise classification of chronic pancreatitis.

**Methods:** Subjects with varying degrees of chronic pancreatitis as assessed by clinical criteria and MRCP Cambridge classification underwent contrast-enhanced, 3D Dynamic T1 weighted MR imaging of the pancreas pre- and 5 minutes post-secretin administration on a 3.0 T scanner (Phillips Healthcare) as part of their clinical workup (IRB approved, HIPPA compliant). The contrast-enhanced MR perfusion scans were performed using a 3D T1 weighted turbo field echo pulse sequence with linear Cartesian k-space ordering, partial-Fourier phase-encoding in both slice and phase directions, and SENSE encoding in the phase encoding direction. Half of the prescribed contrast dose (0.1 mmol/kg) was injected during the pre-secretin dynamic scan, and half plus an additional 2 ml of the prescribed contrast dose was injected during the post-secretin dynamic scan. Both injections were performed at a rate of 2 ml/s. Patients were coached to hold their breath as long as possible, and then to breath and hold subsequent breaths as long as possible until the end of the MR scanning (typically 60 s). The geometry of the 3D volume was prescribed as an angled axial volume that would include the majority of the pancreas in a single 6 mm slice at the center of the 10 slice 3D volume. Contrast-pass curves were obtained by placing elliptical ROI's in the aorta, and the head, body and tail of the pancreas. The peak wash-in ($WR_{in}$) and wash-out ($WR_{out}$) rates[1] were calculated for each curve pre- and post-secretin. In order to account for contrast delivery we also calculated the ratio of the arterial-to-tissue $WR_{in}$, and arterial-to-tissue $WR_{out}$ for each pancreatic region and the average of the three regions. We then compared perfusion metrics with MRCP staging. Our hypothesis is that the ratio of arterial-to-tissue wash-in and wash-out rates will increase with increasing severity of pancreatitis due to impaired hemodynamics within the organ.

**Results:** Six subjects have successfully undergone our pancreas MR perfusion protocol. The pre- and post-secretin contrast-pass curves are shown for a subject presenting as a Cambridge grade 3 with normal exocrine function. Comparison of Cambridge grade 3 and grade 1 subjects with normal exocrine function demonstrate a significant difference in regional and average (shown in the table below) arterial to tissue $WR_{in}$ and $WR_{out}$ rates. The ratio of pre- to post-secretin average artery-to-tissue $WR_{out}$ is significantly greater for the Cambridge grade 3 subject.

**Conclusion:** Contrast-enhanced MRI shows promise as a staging technique for chronic pancreatitis. This technique may provide an even more precise classification of chronic pancreatitis and lead to earlier intervention in the future to retard progression of disease and improve quality of life for these patients.

1. Coenegrachts K, VanSteenbergen W, DeKeyzer F et al. JMRI 2004; 20:990-997.

| SUBJECT | Pre- Avg (art/tis) $WR_{in}$ | Post- Avg (art/tis) $WR_{in}$ | Ratio (pre/post) | Pre- Avg (art/tis) $WR_{out}$ | Post- Avg (art/tis) $WR_{out}$ | Ratio (pre/post) | Cambridge Grade | Exocrine Function |
|---|---|---|---|---|---|---|---|---|
| 1 | 3.4 | 2.3 | 1.48 | 5.7 | 4.1 | 1.39 | 1 | Normal |
| 2 | 4.9 | 3.2 | 1.53 | 6.3 | 5.9 | 1.07 | 1 | Normal |
| 3 | 4.5 | 3.9 | 1.15 | 2.7 | 2.1 | 1.29 | 1 | Normal |
| 4 | 2.6 | 1.5 | 1.73 | 2.2 | 1.4 | 1.57 | 1 | Normal |
| 5 | 3.4 | 2.3 | 1.48 | 5.7 | 4.1 | 1.39 | 1 | Normal |
| 6 | 7.9 | 5.7 | 1.39 | 8.9 | 4.6 | 1.93 | 3 | Normal |