

THE SECRETORY FLOW OF PANCREATIC JUICE IN THE MAIN PANCREATIC DUCT: VISUALIZATION BY MEANS OF MRCP WITH SPATIALLY SELECTIVE INVERSION RECOVERY PULSE

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Purpose: Visualization of the secretory flow of the pancreatic juice will be important to assess the pathophysiology of the pancreas, especially pancreatic exocrine functions. Secretin-stimulated MRCP may help assess the pancreatic juice flow by the caliber change of main pancreatic duct before and after secretin administration. However, this method is invasive, and observes non-physiologic information. Additionally, this method can not visualize the pancreatic juice flow directly. The purpose of this study is to visualize the physiological flow of pancreatic juice non-invasively by means of non-pharmacological MRCP with spatially selective inversion recovery pulse, and to evaluate the feasibility of this technique for the assessment of pancreatic exocrine functions.

Methods and Materials: Eight healthy volunteers without a history of pancreatic diseases and 3 patients with pancreatitis were included. At first, breath-hold, thick-slab 2D MRCP image was obtained to depict the main pancreatic duct in the oblique-coronal plane as a reference image (Figure 1). Imaging parameters were as follows; TR/TE=4000/500msec, slice thickness=50mm, matrix=320x320, FOV=32x32cm. Then, a spatially selective inversion recovery pulse (inversion time=2200msec) with 20mm width was placed on the pancreas head perpendicular to the main pancreatic duct to null the static pancreatic juice signal (Figure 2) using the same MRCP sequence. Imaging time was 4 seconds. In this method, inflow of the pancreatic juice is expected to be observed as high signal within the tagged area when the pancreatic juice runs through the main pancreatic duct. MRCP with a spatially selective inversion recovery pulse were repeatedly performed every 15 seconds during 10 minutes (a total of 40 series). MR images were evaluated for 1) the visibility of the inflow high signal of the pancreatic juice, 2) the frequency that the pancreatic juice flowed (inflow high signal), and 3) the distance that the pancreatic juice flowed within the tagged area (grade1= less than 5mm, grade2= 5-10mm, grade3= 11-15mm, grade4= more than 15mm).

Results: The pancreatic juice inflow was observed in all healthy volunteers (Figure 3) while it was seen in 2 of 3 patients with pancreatitis. Regarding the frequency of the pancreatic juice inflow, it was observed 29-38 times (average: 33.0 ± 3.8 times) in 40 series in healthy volunteers while it was seen 0-11 times (average: 4.3 ± 5.8 times) in 40 series in patients with pancreatitis, indicating that the pancreatic juice has more frequently flowed in healthy volunteers than in patients with pancreatitis ($P = 0.017$). The distance that the pancreatic juice flowed was significantly longer in healthy volunteers (averaged grade=2.71 \pm 0.39) than that in patients with pancreatitis (averaged grade=0.13 \pm 0.18) ($P = 0.017$).

Conclusions: The physiological flow of the pancreatic juice can be visualized non-invasively by means of non-pharmacological MRCP with spatially selective inversion recovery pulse. This technique may have the potential to evaluate the pancreatic exocrine functions in patients with pancreatitis.

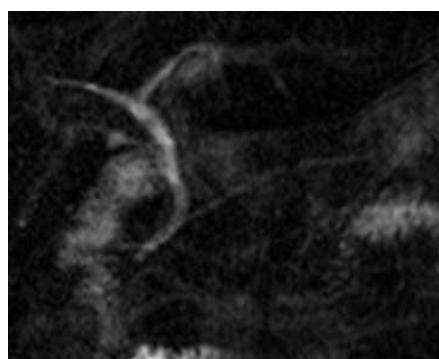


Figure1. MRCP (reference image)

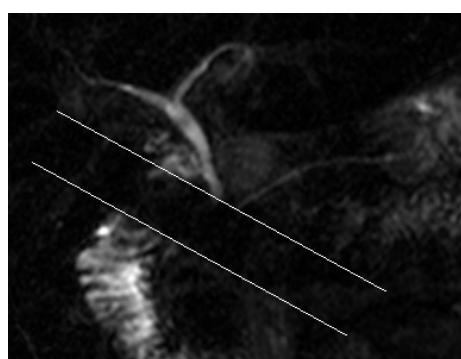


Figure2. MRCP with a spatially selective inversion recovery pulse. Static pancreatic juice signal in the tagged area was nulled and the pancreatic duct in this area was shown as low signal intensity.



Figure3. MRCP with a spatially selective inversion recovery pulse. The secretory inflow of the pancreatic juice was observed as high signal (arrow) within the tagged area. The distance of pancreatic juice inflow was categorized as grade 4.