

Pancreatic duct visualisation: Secretin MRCP compared with 2D and 3D MRCP Techniques, initial results

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Introduction

Diagnostic accuracy of magnetic resonance cholangiopancreatography (MRCP) is comparable to that of endoscopic retrograde cholangiopancreatography (ERCP) in the evaluation of biliary duct anatomy and pathology, particularly for biliary obstruction. The performance of MRCP in respect of the pancreatic duct has been less impressive. Although changes in the duct morphology may be clearly seen in established chronic pancreatitis, in early disease the changes may be subtle and pancreatic duct visualisation can be limited owing to both the small volumes of fluid in the ducts and the intrinsically low signal to noise ratio (SNR) of each image. Detection of pancreatic duct variants such as pancreas divisum, which is considered a potential aetiological factor in recurrent pancreatitis, is likely to be compromised as a result. Several studies have reported the use of intravenous secretin (1,2) to improve visualisation of the pancreatic duct, its side branches and variant anatomy. Secretin stimulates the exocrine pancreas to secrete fluid and bicarbonate which improves filling of the ducts and improves overall visibility of the duct system [2], but also adds a small risk of inducing pancreatitis and an additional cost to an MRCP examination.

Recent developments in MRCP techniques that improve SNR and may improve duct visibility include an adaptive averaging technique [4] and the use of 3D respiratory triggered methods, both using fast recovery FSE sequences [5]. This work investigates the performance of these techniques and standard projection 2D MRCP compared with that of secretin MRCP (sMRCP) for the demonstration of the pancreatic duct, side branching and anatomical variants.

Material and Methods

Six patients (age range 30-73, M:F 4:2) with previous acute, recurrent acute or chronic pancreatitis referred for routine MRCP investigation underwent high-resolution projection imaging using both the conventional and the adaptive interactive sequences. The patients were fully fasted for 6 hours prior to the examinations which were performed on a 1.5T whole body MR system (LX, GEHT Milwaukee) with a torso phased array coil. All the 2D images of the pancreatic duct were acquired at the same matched location. This was initially selected using an interactive fluoroscopic SSFSE sequence [3] to demonstrate the pancreatic duct optimally, avoid overlying bowel and achieved using the book-marking and prescription facility of the interactive interface. An identical field of view (20cm), matrix (256x256) and section thickness (40mm) was used for all three 2D techniques. A standard 2D projection MRCP image was obtained initially using respiratory triggering. The adaptively averaged image was generated from twenty serial images at the desired location using respiratory triggering and a TR interval of at least 8 seconds. These images were subsequently 'adaptively averaged' by means of a cross-correlation method implemented in IDL (RSI, Boulder, Co). The 3D technique used a 3D FRFSE sequence (respiratory triggered with TE_{eff}=560msec, FOV 34x34, 1.6mm thick slices, acquired at 256x224 with 24 slices interpolated to 512x512 and 48 slices) with a true coronal acquisition covering the pancreatic duct. Dynamic MRCP was performed as the last part of the examination with the same 2D SSFSE sequence positioned to match the earlier 2D techniques with images obtained before and every 30 seconds for 8 minutes following intravenous secretin administration at a dose of 1 unit per kg body weight.

The 4 sets of images of the pancreatic duct in each patient were compared on a workstation. Qualitative visual analysis was performed by two experienced observers in consensus, blinded to the patient data and techniques as far as practicable. Blinded evaluations of the following were made with the image sets randomised: 1. Assessment of main duct visibility. A three-point scale was used to grade visibility (not visible, partially visible or fully visible). 2. Number of side branches visualised in each patient. 3. Pancreatic duct anatomy. Four options were used - normal duct, accessory duct, pancreas divisum and other anomaly. 4. A direct two-way comparison in each patient of the standard, adaptive and 3D technique with the secretin technique (used as the reference) was made to evaluate main pancreatic duct visualisation.

Results

A complete imaging set (consisting of all four techniques) was successfully obtained in five patients. In the remaining patient, there was technical failure (respiratory triggering failed) of image acquisition of the 3D technique. All four techniques allowed either partial or full visualisation of the main pancreatic duct. In 4 patients the visualisation of the pancreatic duct was the same regardless of the technique. Side-branches were only demonstrated in 2 patients using the 3D technique and 1 patient using the sMRCP. An accessory duct was demonstrated in 1 patient on all techniques.

In the two-way comparisons, in 4 patients secretin performed equal to or better than standard and adaptive averaging techniques. In two patients both adaptive averaging and the standard technique were rated more favourably than sMRCP. However, the 3D technique was better than (2 patients) or equal to (3 patients) sMRCP in the 5 patients with successful 3D MRCP.

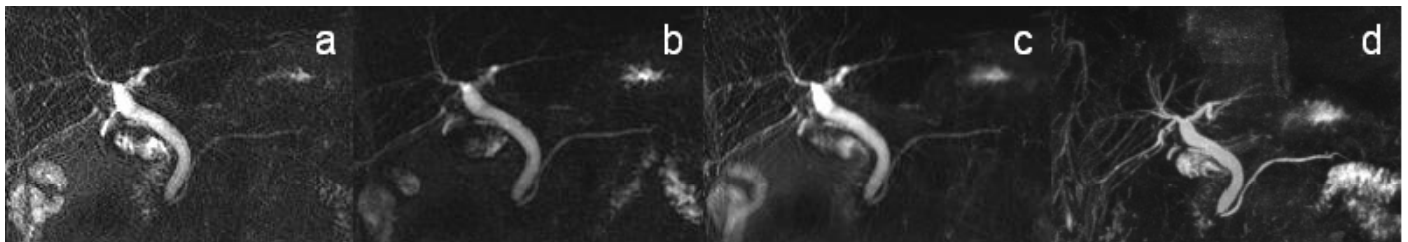


Figure 1: Images from a single patient to demonstrate the four techniques utilised: (a) sMRCP, (b) standard MRCP (c) adaptively averaged MRCP and (d) maximum intensity projection of 3D MRCP. The pancreatic duct is best visualised with the 3D technique.

Conclusion

These initial data yielded mixed results for the 2D conventional and adaptively averaged techniques. However, the 3D MRCP matched or exceeded the performance of sMRCP in all cases where 3D MRCP was successful. If these results are maintained with the planned full study cohort (25 patients) then use of the 3D approach may avoid the need for, expense and potential side effects of secretin.

References

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