MRCP: Practice and Pitfalls

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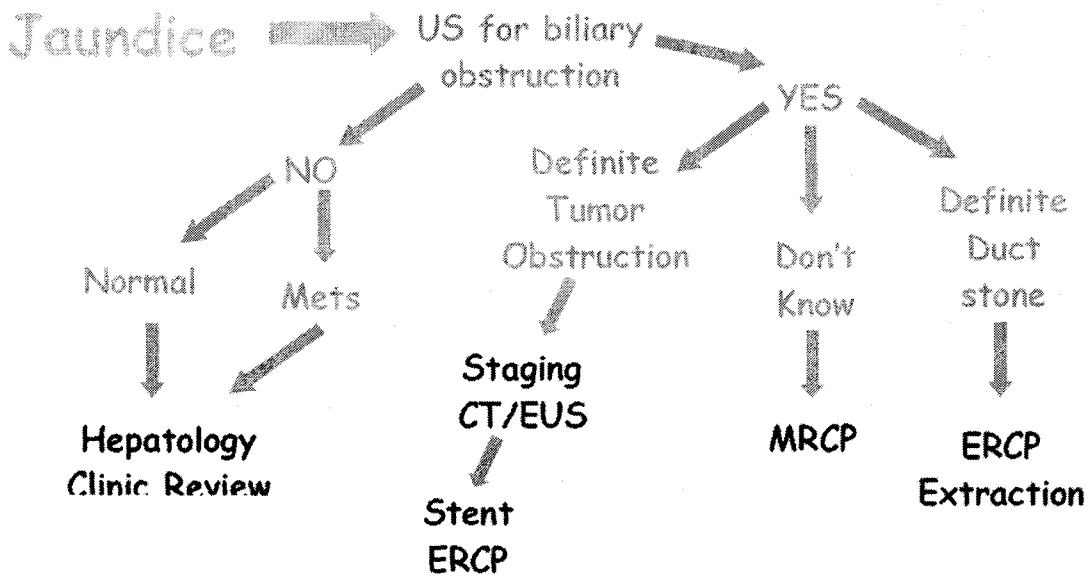
1. Patient Selection:

Initially MRCP was employed for imaging when ERCP had failed. Subsequent research has demonstrated the diagnostic performance of MRCP equals that of ERCP in many situations and increasingly ERCP is only being used where a therapeutic intervention is required.

In our practice MRCP is also used selectively in patients with jaundice and suspected mechanical bile duct obstruction. Ultrasound is used as the first line imaging test in jaundiced patients and MRCP in cases where obstruction appears likely but no definite cause has been identified. In practice this means many patients with a confident diagnosis at ultrasound of choledocholithiasis or an obstructing tumour do not require MRCP. Our strategy for jaundiced patients is outlined below:



Other indications include:

- Exclusion of choledocholithiasis following acute pancreatitis
- Suspected duct anomaly such as pancreas divisum
- Demonstration of pancreatic duct and pancreatic cystic abnormalities
- Detection of biliary duct leaks post trauma or surgery
- Demonstration of intra-hepatic biliary duct variations prior to surgery

2. Exam Preparation

Complete fasting for 3-4 hours helps to reduce the volume of bowel secretions and improves visualization, particularly of the pancreatic duct system although there is little published evidence to support this. Fasting is not essential in many patients provided modern sub-second imaging sequences are available along with interactive selection of imaging planes which avoids problems of overlapping fluid on the projection images.

Negative oral contrast media (iron or manganese agents) enjoyed some popularity in the 1990s as a means of reducing motion related artifacts from high signal secretions in the GI tract. In our experience this approach is not helpful diagnostically as fluid signal in intestinal lumen aids identification of the duodenum, the ampulla of vater, delineates the duodenal wall thickness and can help clarify the relationships of the distal common bile duct and pancreatic duct.

3. Typical MRCP Protocol -

1. 2D T2w single-shot FSE/TSE - TE 60ms*
2. 2D T1w Spoiled Gradient Echo*
3. 2D Thick axial ss FSE/TSE - TE 800ms*
4. 2D Thick coronal/oblique ss FSE/TSE - TE 800ms*
5. 2D Thin section ss FSE/TSE - TE 500ms*
6. 3D long TE ms FSE/TSE - TE 800ms#

* Breath-hold (or resp triggered)
\# Respiratory triggered

Series 1 and 2 are employed to provide a rapid T1w and T2w imaging and anatomical assessment of the upper abdomen. They are not sufficient for detecting small pancreatic tumors or liver metastases for which we would add further imaging sequences and gadolinium enhancement.

Series 3 are projection images used to identify the ducts for positioning the later series. Series 4 are projection images and these are repeated using 3 separate breath-olds at each of three positions – true coronal and a 30-45degrees oblique coronal rotated clockwise and anti-clockwise from the coronal plane.

Series 5 & 6 provide thin section imaging - and only one of these series is really required. Optimisation of the single-shot RARE (TSE, FSE) sequence is required to achieve acceptable image quality. Many factors may influence this sequence including: echospacing, receiver bandwidth, field of view, fat suppression, effective echo time, echotrain length, refocusing pulse flip angles.

4. Technique Variations

1. Secretin MRCP has been used improve visualization of the main pancreatic duct, variant anatomy and to evaluate exocrine function.
2. Cholecystokinin may improve visualization of the common bile duct and assist in the differentiation between functional and mechanical common bile duct dilatation.
3. Mangafodipir Trisodium (MnDPDP, Teslascan), a T1-shortening hepatobiliary contrast

agent, may improve visualization of both intrahepatic and extrahepatic bile ducts in patients with no duct dilatation. It can also confirm the presence of a suspected bile duct leak.

4. Gadolinium enhanced 3D GRE images should be acquired in cases of suspected hepatic, bile duct or pancreatic neoplasms. It should be considered in all sclerosing cholangitis patients who are routinely followed with MRCP or who have a worsening clinical picture.

5. Interpretation

1. Bile Ducts
   a. Normal, Variations, Artefacts
   b. Choledocholithasis
   c. Strictures
   d. Bile Leaks (following intravenous Mangafodipir Trisodium)

2. Pancreatic Duct
   a. Normal, Variations
   b. Obstruction
   c. Chronic Pancreatitis

6. Pitfalls

Interpretation problems in MRCP arise from the fact that the only contrast mechanism is from fluid. The absence of signal may be the result of several different situations.

The final part of this presentation will discuss the appearance of normal variants, and examples of both pseudostrictures and pseudocalculi from a variety of underlying causes.

The importance of reviewing the initial T1w and T2w imaging for other abnormalities is emphasized.