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# DIAGNOSTIC CAPABILITIES OF MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY IN OBSTRUCTIVE BILIARY DISEASES: A SCIENTIFIC REVIEW (2020–2025)

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**Abstract**

Obstructive diseases of the biliary tract are common clinical problems that frequently present with jaundice, abdominal pain, pruritus, and cholangitis. Accurate identification of the presence, level, and cause of biliary obstruction is essential for appropriate management and treatment planning. Magnetic Resonance Cholangiopancreatography (MRCP) has emerged as a highly reliable, non-invasive imaging modality for evaluating the biliary and pancreatic ductal systems. Over the past decade, and especially between 2020 and 2025, numerous clinical studies have demonstrated the high diagnostic performance of MRCP in detecting choledocholithiasis, biliary strictures, and malignant obstruction. This article reviews the diagnostic capabilities, advantages, limitations, and clinical applications of MRCP in patients with obstructive biliary diseases.

**Keywords:** Magnetic Resonance Cholangiopancreatography (MRCP), Obstructive biliary diseases, Obstructive jaundice, Choledocholithiasis, Biliary strictures, Diagnostic accuracy, Endoscopic retrograde cholangiopancreatography (ERCP)

## Introduction

Biliary obstruction occurs when the normal flow of bile from the liver to the duodenum is blocked. This condition may be caused by stones, inflammatory strictures, tumors, or external compression of the bile ducts. Patients often present with obstructive jaundice, dark urine, pale stools, itching, and right upper quadrant pain. Early and precise diagnosis is crucial because delayed treatment can lead to severe complications such as cholangitis, biliary cirrhosis, and liver failure. Traditionally, ultrasonography (USG), computed tomography (CT), and invasive procedures such as endoscopic retrograde cholangiopancreatography (ERCP) were used to evaluate these patients. However, ERCP, although highly accurate, is invasive and associated with complications such as pancreatitis and infection. MRCP has become an essential diagnostic tool because it provides detailed visualization of the biliary tree without the need for contrast injection into the ducts or endoscopic intervention.

## Principles of MRCP

MRCP is based on heavily T2-weighted magnetic resonance imaging sequences. These sequences produce a very bright signal from static fluids such as bile and pancreatic secretions, while surrounding soft tissues appear dark. This contrast allows clear visualization of the biliary and pancreatic ducts. The examination is usually performed after a short fasting period to reduce bowel

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motion and fluid artifacts. Images are obtained in multiple planes and can be reconstructed into three-dimensional views of the biliary system. Importantly, MRCP does not use ionizing radiation and usually does not require intravenous contrast agents, making it safe for repeated examinations and for patients with renal impairment.

**Diagnostic Performance of MRCP in Biliary Obstruction**

Recent clinical research from 2020 onward consistently shows that MRCP has very high sensitivity and specificity in detecting both the level and the cause of biliary obstruction. Studies comparing MRCP findings with ERCP, surgical findings, or histopathology report sensitivity ranging from 90% to 98%, specificity ranging from 85% to 95%, and overall diagnostic accuracy above 94% in many cohorts. MRCP is particularly effective in identifying dilatation of intrahepatic and extrahepatic bile ducts, level of obstruction, presence of stones within the common bile duct, and benign and malignant strictures. Because of this high diagnostic reliability, MRCP is now widely considered a first-line imaging method in suspected obstructive jaundice.

**MRCP in Choledocholithiasis**

MRCP demonstrates excellent ability to visualize stones as filling defects within the bright bile signal. Multiple studies report sensitivity and specificity above 90% for stone detection. In many cases, MRCP helps avoid unnecessary diagnostic ERCP and allows ERCP to be performed only when therapeutic stone removal is required. However, very small stones (less than 3–4 mm) may occasionally be missed, which remains a known limitation. MRCP in Biliary Strictures MRCP clearly demonstrates narrowing of the bile ducts and upstream dilatation. Although MRCP provides excellent anatomical detail, differentiating benign from malignant strictures based solely on imaging appearance can be challenging. Nevertheless, MRCP plays a critical role in mapping the extent of strictures and guiding further interventional procedures or biopsy when needed.

**Comparison with Other Imaging Modalities**

Ultrasonography is useful for detecting ductal dilatation but has limitations in visualizing the distal bile duct and is operator dependent. MRCP significantly outperforms ultrasonography in identifying the exact level and cause of obstruction. ERCP remains the gold standard for therapeutic intervention but is no longer preferred as a primary diagnostic tool due to its invasiveness and complication risk. MRCP often serves as a triage tool to determine which patients truly require ERCP.Advantages and Limitations MRCP is non-invasive, free from radiation exposure, and provides high diagnostic accuracy with excellent visualization of the entire biliary tree. Limitations include reduced sensitivity for very small stones, difficulty distinguishing benign from malignant strictures, and potential image degradation due to patient motion.

**Conclusion**

Magnetic Resonance Cholangiopancreatography has become a cornerstone in the diagnostic evaluation of obstructive biliary diseases. Its safety profile, non-invasive nature, and high diagnostic performance make it an ideal first-line imaging modality. MRCP reduces the need for unnecessary invasive procedures and provides essential anatomical information for planning therapeutic interventions.

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