**ORIGINAL RESEARCH**

# Diagnostic accuracy of computed tomography (CT) and magnetic resonance cholangiopancreatography (MRCP) in detecting calculi related obstruction in the common bile duct (CBD)

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**Abstract**

**Background:** Biliary obstruction commonly refers to blockage of the bile duct system leading to impaired bile flow from the liver into the intestinal tract. It has been exactly two decades since magnetic resonance cholangiopancreatography (MRCP) was first described. Hence; the present study was conducted for assessing the diagnostic accuracy of computed tomography (CT) and magnetic resonance cholangiopancreatography (MRCP) in detecting calculi related obstruction in the common bile duct (CBD).

**Materials & methods:** A total of 50 patients were enrolled. Inclusion criteria for the present study included patients admitted with biliary disease, with scleral and tegumentary jaundice and high bilirubin levels; patients may have had prior cholecystectomy. Examination of the patients was done by CT and MRCP. Postoperative findings were evaluated and histopathologicdiagnosis were analyzed.

**Results:** Mean age of the patients was 48.3 years. 82 percent of the patients were males while remaining were females. CT scan was able to detect caliculi in 78 percent of the cases while MRCP was able to detect in 100 percent of the cases. Sensitivity of CT and MRCP in diagnosing obstruction by calculi was 88.2 percent and 100 percent respectively while Specificity of CT and MRCP in diagnosing obstruction by calculi was 100 percent and 100 percent respectively.

**Conclusion:** The diagnostic accuracy of MRCP was higher than CT for assessing calculi related obstruction of common bile duct.

**Key words:** Computed tomography, Magnetic resonance cholangiopancreatography, Common bile duct



## Introduction

Biliary obstruction due to calculus commonly refers to blockage of the bile duct system leading to impaired bile flow from the liver into the intestinal tract. Bile is a substance that contains bile salts, bilirubin, and cholesterol and is continuously synthesized in the liver hepatocytes. Bile is then transported via the bile ducts into the second portion of the duodenum to assist with the metabolism of fats.[1, 2]Extrahepatic biliary obstruction, which is the scope of this article, can be divided into various benign and malignant etiologies. These include choledocholithiasis (gall stones in the common bile duct), choledochal cysts (dilation/cysts of bile ducts), Mirizzi syndrome (gall stones in cystic duct pressing on bile duct), benign structuring diseases like Primary sclerosing cholangitis (PSC), fibrotic strictures from gall stone passage or iatrogenic strictures from bile duct cannulation.[3, 4] It has been exactly two decades since magnetic resonance cholangiopancreatography (MRCP) was first described. Over this time, the technique has evolved considerably, aided by improvements in spatial resolution and speed of acquisition. It has now an established role in the investigation of many biliary disorders, serving as a non-invasive alternative to endoscopic retrograde cholangiopancreatography (ERCP). It makes use of heavily T2-weighted pulse sequences, thus exploiting the inherent differences in the T2-weighted contrast between stationary fluid-filled structures in the

abdomen (which have a long T2 relaxation time) and adjacent soft tissue (which has a much shorter T2 relaxation time). Static or slow moving fluids within the biliary tree and pancreatic duct appear of high signal intensity on MRCP, whilst surrounding tissue is of reduced signal intensity.[5- 7] Hence; the present study was conducted for assessing the diagnostic accuracy of computed tomography (CT) and magnetic resonance cholangiopancreatography (MRCP) in detecting calculi related obstruction in the common bile duct (CBD).

**Materials & methods**

The present study was conducted for assessing the diagnostic accuracy of computed tomography (CT) and magnetic resonance cholangiopancreatography (MRCP) in detecting calculi related obstruction in the common bile duct (CBD). A total of 50 patients were enrolled. Inclusion criteria for the present study included patients admitted with biliary disease, with scleral and tegumentary jaundice and high bilirubin levels; patients may have had prior cholecystectomy. Examination of the patients was done by CT and MRCP. Postoperative findings were evaluated and histopathologicdiagnosis were analyzed. All the results were recorded in Microsoft excel sheet and diagnostic accuracy of CT and MRCP was assessed. Analysis was done using SPSS software.

**Results**

Mean age of the patients was 48.3 years. 82 percent of the patients were males while remaining were females. CT scan was able to detect caliculi in 78 percent of the cases while MRCP was able to detect in 100 percent of the cases. Sensitivity of CT and MRCP in diagnosing obstruction by calculi was 88.2 percent and 100 percent respectively while Specificity of CT and MRCP in diagnosing obstruction by calculi was 100 percent and 100 percent respectively.

**Table 1: MRCP assessment of presence or absence of calculi**

| Calculi | Number | Percentage |
|---|---|---|
| Present | 50 | 100 |
| Absent | 0 | 0 |
| Total | 50 | 100 |

**Table 2: CT assessment of presence or absence of calculi**

| Calculi | Number | Percentage |
|---|---|---|
| Present | 39 | 78 |
| Absent | 11 | 22 |
| Total | 50 | 100 |

**Table 3: MRCP assessment of size of calculi**

| Calculi | Number | Percentage |
|---|---|---|
| Less than 3 mm | 12 | 24 |
| 3 to 10 mm | 35 | 70 |
| More than 10 mm | 3 | 6 |
| Total | 50 | 100 |

**Table 4: CT assessment of size of calculi**

| Calculi | Number | Percentage |
|---|---|---|
| Less than 3 mm | 0 | 0 |
| 3 to 10 mm | 21 | 42 |
| More than 10 mm | 18 | 36 |
| Absent | 11 | 22 |
| Total | 50 | 100 |

**Table 5: Comparison of diagnostic accuracy**

| Diagnostic accuracy | Sensitivity | Specificity |
|---|---|---|
| CT | 88.2 | 100 |
| MRCP | 100 | 100 |

**Discussion**

Bile duct injuries (BDI) take place in a wide spectrum of clinical settings. The mechanisms of injury, previous attempts of repair, surgical risk and general health status importantly influence the diagnostic and therapeutic decision-making pathway of every single case. A multidisciplinary approach including internal medicine, surgery, endoscopy and interventional radiology specialists is required to properly manage this complex disease. BDI may occur after gallbladder, pancreas and gastric surgery, with laparoscopic cholecystectomy responsible for 80%-

85% of them.[8-10] Laparoscopic cholecystectomy (LC) is one of the most frequently performed procedures worldwide in general surgery. Annually, more than 750,000 procedures are performed in the US.2 Bile duct injury (BDI) represents the most serious complication of LC, with an incidence of 0.3%–0.7%, resulting in a significant impact on quality of life (QoL), overall survival, and frequent medico-legal liabilities. The incidence of iatrogenic BDI has significantly gone up since LC became the "gold standard" in the treatment of symptomatic cholelithiasis. It has been demonstrated that the primary cause of BDI is the misinterpretation of biliary anatomy in 71%–97% of all cases.[11-13] Hence; the present study was conducted for assessing the diagnostic accuracy of computed tomography (CT) and magnetic resonance cholangiopancreatography (MRCP) in detecting calculi related obstruction in the common bile duct (CBD). Mean age of the patients was 48.3 years. 82 percent of the patients were males while remaining were females. CT scan was able to detect caliculi in 78 percent of the cases while MRCP was able to detect in 100 percent of the cases. Sensitivity of CT and MRCP in diagnosing obstruction by calculi was 88.2 percent and 100 percent respectively while Specificity of CT and MRCP in diagnosing obstruction by calculi was 100 percent and 100 percent respectively. Petrescu, I et al demonstrated the diagnostic accuracy of computed tomography (CT) and magnetic resonance cholangiopancreatography (MRCP) in detecting calculi related obstruction in the common bile duct (CBD) and the possibility of establishing the lithiasic nature of the obstruction. A retrospective analysis was analyzed during an interval of 18 months that included jaundice patients admitted in the General Surgery Department of "Coltea" Clinical Hospital. They were examined by CT scanning and by MRCP, being suspected of choledocholithiasis. 63 patients were included in the study, 34 females and 29 males. 33 CT scans and 30 MRCP exams were performed. CT scan was useful in detecting residual or iterative choledocholithiasis in patients after cholecystectomy, contrast enhanced CT (CECT), being able to differentiate between lithiasic and non-lithiasic obstruction.[9] Magnetic resonance cholangiopancreatography is comparable to ERCP for the detection of choledocholithiasis and is superior to CT and USG, as it can detect calculi as small as 2 mm in size, which are seen as filling defects surrounded by T2 hyperintense bile. For further characterization of stones, routine T1 and T2 weighted sequences are needed, on which pigmented stones appear hyperintense on T1 as compared to cholesterol stones which appear hypointense. Air bubbles are a common diagnostic pitfall but usually can be differentiated from stones by their smooth, rounded appearance and their tendency to cluster together and rise to the nondependent surface. At CT, biliary calculi can have variable appearance, ranging from highly calcified lamellated radio dense calculi to low-density calculi due to cholesterol content. Air bubble can be easily differentiated from calculi on CT depending on its HU value. Local irritation caused by the stone or associated cholangitis may lead to findings of wall thickening, mucosal enhancement, and periductal fat stranding. However, in the presence of mural enhancement possibility of malignancy should be considered.[12, 13] Chen W et al evaluated the diagnostic accuracy of magnetic resonance cholangiopancreatography (MRCP) in patients with choledocholithiasis. A total of 25 studies involving 2310 patients with suspected choledocholithiasis and 738 patients with CBD stones met the inclusion criteria. The average inter-rater agreement on the methodological quality checklists was 0.96. Pooled analysis of the ability of MRCP to detect CBD stones showed the following effect estimates: sensitivity, 0.90; specificity, 0.95; positive likelihood ratio, 13.28; negative likelihood ratio, 0.13; and diagnostic odds ratio, 143.82. The area under the receiver operating characteristic curve was 0.97. Significant publication bias was not detected. MRCP has high diagnostic accuracy for the detection of choledocholithiasis. MRCP should be the method of choice for suspected cases of CBD stones.

## Conclusion

The diagnostic accuracy of MRCP was higher than CT for assessing calculus obstruction of common bile duct.

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