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Original Research Article

Improving safety of laparoscopic cholecystectomy with use of pre-operative magnetic resonance cholangiopancreatography for management of patients with gall stones

Abhiyutthan Singh Jadaon[1]*, Chandra Pal Singh[2], Chitra Champawat[2]

[1]Department of Renal Transplant & Urology, ILBS, New Delhi, India
[2]Department of Minimal Access Surgery, Kota Heart Hospital, Kota, Rajasthan, India

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***Correspondence:**
Dr. Abhiyutthan singh Jadaon,
E-mail: abhiyutthan.singh@gmail.com

ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the gold standard surgical treatment of cholelithiasis. However, this surgery has its own known complications. Assessment of patients with preoperative MRCP for anatomical anomaly in biliary tree and common bile duct stones (CBDs), can prevent intraoperative and post operative complications.
Methods: Authors conducted retrospective randomized study at Kota Heart Hospital, Kota, Rajasthan between January 2014 and December 2024. Patients with the presence of symptomatic cholecystolithiasis undergoing LC without signs (i.e., jaundice) of cholestasis were included in our study. Patients were divided into two groups; Group I included 696 patients in whom pre-operative MRCP followed by laparoscopic cholecystectomy was done . Group II included 290 patients who underwent laparoscopic cholecystectomy and routine MRCP was omitted in their pre-operative workup. We measured intraoperative biliary injury and the incidence rate of postoperative complications in this study.
Results: The Study showed that all patients in Group I revealed smooth post-operative period and no incidence of residual CBD calculi. In group II, 9 patients developed early bile leakage and one developed jaundice after 7 months. Preoperative MRCP was able to diagnose biliary radicles abnormalities in 8 patients (1.1%) of group 1. Also the course of cystic duct was diagnosed tortuous in 29 cases (4.1%) of group 1.
Conclusions: Preoperative MRCP helps in visualization of the extrahepatic biliary tree and in identifying CBD stones. This provides surgeon information about possible anatomical variations. Which leads to decrease in incidence of intraoperative complications and residual CBD stones.

Keywords: MRCP, Pre-operative, Safe cholecystectomy

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the gold standard for surgical treatment of cholelithiasis.[1] However, severe intraoperative complications such as bile duct injury occur at a certain rate in LC.[2,3] Assessment of all patients with preoperative MRCP to prevent intraoperative complications is crucial. Predicting surgical difficulty due to severe inflammation and also predicting anatomical anomaly of the bile duct, such as an aberrant posterior sectoral hepatic duct (PHD), can prevent the most common causes of serious complications, such as bile duct injury, during LC.[2,4-6] Symptomatic gallstone patients may have associated CBDs in up to 10% of cases, which also get diagnosed with routine preoperative MRCP. Timely diagnosis and treatment of Choledocholithiasis may prevent from complications like post-operative biliary leakage, recurrent biliary colic,

cholangitis and pancreatitis.[7] Several studies were done to assess the importance of pre- operative MRCP in predicting surgical difficulty of LC and also reducing intra-operative and Post operative complications.[8] However, the role of routine use of pre-operative MRCP is still a matter of debate.[9-12] So we conducted this retrospective randomized study to evaluate this role.

METHODS

This retrospective single-institution study was performed to discern the association between Performance of preoperative MRCP and Prevention of surgical complications of LC in patients with AC at Kota Heart Hospital, Kota, Rajasthan between January 2014 and December 2024. All laparoscopic cholecystectomies were done by single laparoscopic general surgeon.

Patients

Authors collected patient information from the electronic medical records of institutional surgery database. The eligibility criteria were the presence of symptomatic cholecystolithiasis undergoing LC without clinical signs (i.e., jaundice) of cholestasis.

Exclusion criteria

Any patient with symptoms suggesting common bile duct stone was excluded (pancreatitis, cholangitis and obstructive jaundice). MRI examination contraindicated in few patients were also excluded (i.e., claustrophobic, pace maker or morbidly obese). The clinical suspicion of gallbladder cancer. All patients having gallbladder stones on preoperative ultrasound examination performed in all patients at our institution were included in this study. Patients were divided into two groups; Group I included 696 (284 males and 412 females) patients in whom pre-operative MRCP followed by laparoscopic cholecystectomy was done.

Their age ranged from 18 to 82 years. Group II consisted of 290 patients (which included 60 males and 230 female's patients), these patients were managed by laparoscopic cholecystectomy and the routine pre-operative MRCP was omitted in there pre-operative workup. The age range of our patients were from 20 to 75 years. In cases of a positive MRCP finding of choledocholithiasis, subsequent ERCP was performed within 24 h after MRCP. In total of 696 patients who underwent pre-op MRCP, all images were also reviewed for variants in the course of the cystic duct and the confluence in the common hepatic duct. Preoperative workup was done for all the patients included in this study.

It consisted of history, examination, whole abdomen ultrasonography (USG), liver functions test and blood tests for pre-anaesthetic workup were also done.

Magnetic resonance imaging

All patients underwent MRCP imaging using a 1.5-T superconducting unit (Magnetom Impact Expert; Siemens, Erlangen, Germany) with a standard circularly polarized (receive only) oval spine coil.

Image interpretation

Magnetic resonance cholangiograms were reviewed by our radiologist. The biliary tree was visualized and evaluated for the presence of CBD dilatation and/or CBD stones. CBD was labelled as dilated if it measured >6 mm in diameter.

Outcomes

Outcomes of the study were, intraoperative biliary injury and the incidence rate of postoperative complications. Post operative complications were graded based on Clavien–Dindo scoring.

All analyses were performed using SAS, version 11.4 (SAS Institute, Inc., Cary, North Carolina).

Ethics statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or National research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

RESULTS

Out of 696 patients of group I who underwent Pre-operative MRCP. Common bile duct stones were detected in 28 patients (4%). Pre-operative ERCP was done for all the 28 cases and extraction of the stones was accomplished. Significant MRCP findings that affected surgical procedure other than choledocholithiasis were: accessory cystic duct to the liver in 5 patients. In all these five patients, accessory cystic ducts were meticulously followed and identified with safe clipping. Abnormal insertion of cystic duct was present in 3 cases and CBD injury was prevented in all 3 cases. 29 patients had tortuous course of cystic duct on MRCP.

Laparoscopic cholecystectomy was done in all patients of group 1 and group 2. In group I, it was successful in all 696 cases. In Group II, laparoscopic cholecystectomy was also accomplished in 290 patients. All patients of Group I had an uneventful post-operative period, without any complications. i.e., Not a single patients developed any symptoms suggestive of residual CBD stones in Group I. In group II, 9 patients developed early bile leakage. Out of these, 5 patients underwent ERCP to remove missed CBD stone. In two patients with bile leak, ERCP showed no significant pathology but a stent was inserted and bile leak started to decrease gradually till

stopped on the 9th and 12th day respectively. Pathology suspected in that case was an injury to undetected accessory cystic duct. In remaining 2 patients, ERCP revealed a major leak from the side of the CBD with the contrast passing to the proximal biliary radicals. Exploration proved partial injury to the CBD so Roux en Y hepaticojejunostomy was done. In group 2, one patient developed jaundice after 7 months and MRCP revealed CBD stricture that was successfully treated with Roux-en- Y hepaticojejunostomy. The Complications rate in group II was significantly higher.

Table 1: Patient data and results.

	Group 1	Group 2
Number of patients	696	290
Pre operative asymptomatic CBD stone incidence	28 (4.02%)	-
Preoperative diagnosis of Accessory cystic duct	5 (0.7%)	-
Preoperative diagnosis of Abnormal insertion of cystic duct	3 (0.4%)	-
Postoperative early bile leakage	0	9 (3.10%)
Need of ERCP in Postoperative course	0	9 (3.10%)
Post operative leak form Biliary tract (corrected with ERCP postoperatively)	0	2 (0.6%)
Post operative major leak form Biliary tract (Requiring Roux en Y hepaticojejunostomy)	0	2 (0.6%)
CBD stricture	0	1 (0.3%)

DISCUSSION

In our study, Abnormalities in biliary radicles were diagnosed preoperatively in 8 patients (1.1%) of group 1. Also, the course of cystic duct was diagnosed tortuous in 29 cases (4.1%) of group 1.

An important and crucial step of laparoscopic cholecystectomy is that the dissection usually starts in the Calot's triangle. Therefore, preoperative knowledge by MRCP of these possible variants in the confluence between the cystic and hepatic ducts is important as these anatomic variations may not be easily recognized during laparoscopy and may result into damage to these important structures. Therefore, these preoperative findings allowed the surgeon to be more cautious during surgery and raises the operating surgeon's awareness of variants, especially in potentially difficult intraoperative situations (i.e., inflammation, adhesions), leading him to give more time in dissection of calot's triangle, doing more careful dissection to identify accessory cystic duct and finally tracing proper CBD insertion and doing careful and safe clipping.

Thus, decreasing intraoperative complications of LC. Study by Nebiker et al stated that they diagnosed accessory bile ducts in 2.4% of patients, aberrant hepatic ducts in 0.4% and an atypical entry to the common bile duct in 0.9%.[10] They pointed out that recognizing this anatomical variant preoperatively helped the surgeon to operate with more caution. This number of anatomical variations was very high in the series described by Ausch et al which showed 9.5% patients had cystic duct variants.[11] They also had similar opinion that pre-operative recognition of variations of the cystic duct were helpful in preventing bile duct lesions.

In the literature, variations of the cystic duct have been reported in 3–5% of patients.[12] However, in our study had only 1% of our patients' observed variations of the cystic duct course and confluence in the CBD. The study, indicated the importance of pre-operative MRCP, in significantly decreasing the incidence of CBD injury when both groups in our study were compared.

Second important finding of our study was significant reduction in residual stones after cholecystectomy between group 1 and group 2, which leads to reduction in risk of recurrent gall stones-associated disease, as early biliary leakage, recurrent biliary colic, cholangitis and pancreatitis and ultimately preventing from patient's dissatisfaction. Therefore, MRCP was suggested to detect CBD stones and target them for elimination before the operating.[14-16] Consequently, the European Association for Endoscopic Surgery (EAES) consensus development conference committee recommends common bile duct investigation to rule out choledocholithiasis in all patients with symptomatic cholelithiasis.[17]

Imaging tests, particularly abdominal US, are used routinely to screen these patients but the distal CBD may not routinely be examined if there is no extrahepatic biliary dilatation.[13] In our study 4.1 % with normal USG patients in harbored stones in non-dilated CBD that were diagnosed preoperatively by MRCP in group I. The gold standard procedures in the diagnosis of choledocholithiasis are still the more invasive procedures like ERCP, intra-operative cholangiogram (IOC) and operative CBD exploration. They carry a significant morbidity and mortality. Furthermore, a high level of expertise is required in their performance.[7]

Magnetic resonance cholangiopancreatography (MRCP) being a non-invasive examination is superseding diagnostic ERCP for the purpose of initial assessment of patients with suspected biliary obstruction. Mostly ERCP is being reserved for the removal of confirmed stones in choledocholithiasis.[18] There has been enough evidence in form of studies stated in our report here, to prove that MRCP can be an ideal tool for pre-operative bile duct examination with a sensitivity and specificity comparable to those of ERCP or intra-operative cholangiography. Further, these studies have proven the significant advantage of accurately demonstrating intra and

extraductal biliary anatomy preoperatively by MRCP and subsequently decreasing the complications.[19,20] In the study, pre-operative MRCP was able to diagnose silent CBD stones in 4.1% of cases. Similarly, two independent group of investigators found these clinically silent stones in 4% and 6% of their studied populations and they recommended MRCP as a screening technique before laparoscopic cholecystectomy.[10,11] In the contrary, Jendersen et al had less than 1% asymptomatic CBD stones and therefore denied its significance as a routine investigation.[13] In our study, we reduced the incidence of post-operative residual stone in Group I down to zero compared with 2% in Group II. Nebiker et al, reported residual stones after cholecystectomy in only two cases (0.4%).[10]

The cost of MRCP is a major concern especially in developing countries like INDIA. As it is slightly more expensive than intra-operative cholangiography. However, when compared to ERCP, MRCP has a clear advantage by decreasing patient's hospital stay and avoiding any type of sedation. For this reason, preoperative MRC was performed on a routine basis in our patients of group 1. It proved to be a reliable and reproducible armamentarium to visualize extrahepatic biliary tree and its possible anatomical variations to the surgeon. Given its high sensitivity and specificity in identifying CBD stones, we recommend the routine use of MRCP preoperatively wherever this technology is available.

CONCLUSION

Pre-operative MRCP prior to laparoscopic cholecystectomy is a reliable and reproducible method for Preoperative visualization of the extrahepatic biliary tree and for providing operative surgeon with valuable information about possible anatomical variations. Leading to significantly decreasing incidence of intraoperative complications. Also Given its high sensitivity and specificity in identifying CBD stones, we recommend the routine use of MRCP preoperatively wherever this technology is available as it decrease the incidence of residual stone CBD stones.

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