

ROLE OF MAGNETIC RESONANCE CHOLANGIOPANCREATICOGRAPHY (MRCP) IN PREOPERATIVE EVALUATION OF BILIARY ANATOMY IN GALL STONE PATIENTS

General Surgery

Dr. Amey Tule* MBBS Junior Resident General Surgery, Narhe, Pune. *Corresponding Author

Dr Ameya Thakur MBBS MS General Surgery Pune.

Dr Bahar Kulkarni MBBS MS General Surgery, Warje Pune.

ABSTRACT

Cholecystitis is inflammation of the gall bladder that occurs most commonly because of an obstruction of the neck of the gallbladder due to cholelithiasis. Most of the cases involve stones in the cystic duct (i.e., Calculous Cholecystitis) and the remaining representing acalculous cholecystitis. Gallstone disease prevalence in general population is 3% - 20% of the total population worldwide. The prevalence of gallstone in adult population is about 4% in India. Approximately 1–2% of asymptomatic patients will develop symptoms requiring cholecystectomy per year, making cholecystectomy one of the most common operations performed by general surgeons. **Aims And Objectives-** 1. To study the role of MRCP in evaluation of biliary anatomy in gall stone patients. 2. To study the congenital malformations & anatomical variations of the Biliary System. 3. To find out the prevalence of undiagnosed silent common bile duct (CBD) Stones. 4. To evaluate the advantages of MRCP over other diagnostic modalities. **Material And Methods-** A total of 50 symptomatic / asymptomatic patients with acute or chronic gall stones pathology coming to our hospital were included in the study. MRCP was performed for all patients and then underwent cholecystectomy. **Results-** MRCP of gall bladder revealed calculous cholecystitis in 90% cases while remaining 10% cases had non-calculous cholecystitis. Adenomyomatosis was reported in 1 cases while GB variation was also observed in solitary case. Cystic duct was dilated in 16% cases while stone in cystic duct was reported in 18% cases. Cystic duct variations were seen in 14% cases. **Conclusion-** In the patients who are candidate for cholecystectomy, routine pre-operative MRCP is mandatory for confirmation of the already known pathologies, detection of other missed pathologies by ultrasonography as well as detection of anatomical variants of biliary tract. These findings will help the surgeon for re-planning and adjusting the surgical approach to preventing or at least decrease the probability of post-operative complications.

KEYWORDS

Biliary tree, MRCP, Cholecystitis, Gall Stones

INTRODUCTION

Cholecystitis is inflammation of the gall bladder that occurs most commonly because of an obstruction of the neck of the gallbladder due to cholelithiasis. Most of the cases involve stones in the cystic duct (i.e., Calculous Cholecystitis) and the remaining representing acalculous cholecystitis. Gallstone disease prevalence in general population is 3% - 20% of the total population worldwide. The prevalence of gallstone in adult population is about 4% in India.

Gall Stones are asymptomatic in the majority (> 80%). Approximately 1–2% of asymptomatic patients will develop symptoms requiring cholecystectomy per year, making cholecystectomy one of the most common operations performed by general surgeons.

Usually, the initial screening of choledocholithiasis is based on clinical suspicion associated with clinical findings such as biliary colic, jaundice, abnormal hepatobiliary biochemical index (elevated bilirubin and alkaline phosphatase levels), and imaging data obtained using abdominal ultrasonography (US) or computed tomography (CT). These indicators may be affected by other factors and none of them show conclusive diagnostic accuracy for CBD stones. Although detection of gallstones is over 95% accurate using US, detection sensitivity for choledocholithiasis varies between 50–80%. In addition, the accuracy for early detection of extra hepatic obstruction is low. Both CT and US infrequently provide sufficient detailed anatomical information of the biliary tract, which is necessary for surgical interventions.

Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive technique that can be performed rapidly without exposing patients to ionizing radiation or iodinated contrast materials. MRCP displays superior soft tissue resolution and possesses significant accuracy in the diagnosis of choledocholithiasis. It has evolved as an alternative or complementary method to endoscopic retrograde cholangiopancreatography (ERCP) in the diagnosis of patients with choledocholithiasis. However, its cost-effectiveness is under debate; the indication of MRCP for preoperative evaluation of choledocholithiasis remains unclear.

The present study was thus undertaken to evaluate the role of MRCP in evaluation of biliary anatomy in Gall Stone patients and to find out the prevalence of undiagnosed Silent CBD Stones. We also aimed to evaluate the advantages of MRCP over other diagnostic modalities i.e. Ultrasonography and CECT Abdomen.

AIMS AND OBJECTIVES

1. To study the role of MRCP in evaluation of biliary anatomy in gall stone patients.
2. To study the congenital malformations & anatomical variations of the Biliary System.
3. To find out the prevalence of undiagnosed silent common bile duct (CBD) Stones.
4. To evaluate the advantages of MRCP over other diagnostic modalities.

MATERIAL AND METHODS

Study Area

Department of Surgery of a tertiary care Institute.

Study Population

Symptomatic and asymptomatic patients with acute or chronic gall stones pathology.

Study Design

A Prospective, observational, Clinical study

Sample Size

Consecutive type of non-probability sampling was used during the study. A total of 50 symptomatic / asymptomatic patients with acute or chronic gall stones pathology coming to our hospital were included in the study.

Inclusion Criteria

1. Symptomatic and asymptomatic patients with acute or chronic gall stones pathology on pre-operative USG.
2. Conscious oriented patients.
3. Age limit > 15 years indoor patients.

Exclusion Criteria

1. Patients with choledocholithiasis detected by abdominal ultrasonography.
2. Clinical or enzymatic pancreatitis (serum amylase > 90U/l).
3. Common bile duct diameter > 6.5mm at Ultrasonography
4. Unwilling patients.
5. Patient with cardiorespiratory compromise
6. Claustrophobic patients
7. Moribund patient which are difficult to ambulate on ventilator
8. Patients having metallic implants like cochlear implants, metal coils placed within blood vessels
9. Patients with cardiac defibrillators and pacemakers

Methodology

This Prospective Observational study included 50 patients undergoing laparoscopic cholecystectomy within the stipulated time period presenting with acute or chronic calculous cholecystitis. All laparoscopic cholecystectomies were done by single consultant general surgeon specialized in laparoscopic surgery.

All patients will undergo full history taking, general and abdominal examination. Abdominal ultrasound, liver function tests, random blood sugar and renal function tests will also be done. MRCP was performed for all patients on 1.5 T superconducting unit (Siemens Magnetom Symphony version, syngo, MR 2002A). All MRCP examinations will be performed before surgery.

Patient Preparation

Patients were kept nil by mouth for a minimum of 4 hours before the examination to promote filling of gall bladder and gastric emptying. Patients were instructed to obey commands and hold breath as directed (ask for time sequence). Since water and bile act as self-contrast, Inj. Gadolinium is not routinely used. It is only used in certain conditions like Acute Cholecystitis & Acute Cholangitis.

MRCP was performed for all patients using HASTE sequence and phased array body coil with breath-hold multi slice acquisition. Axial T2 fast spin-echo (FSE) MR examination of the upper abdomen was performed first, followed by maximum intensity projection (MIP) reconstruction to obtain 3D MRCP images with variable angle rotation.

Statistical Analysis

The quantitative data was represented as their mean $\pm$ SD. Categorical and nominal data was expressed in percentage. All analysis was carried out by using SPSS software version 21.

RESULTS

Mean age of the study subjects was 39.04 years with 58% of them were in the age range of 21-40 years. Only 14% were above 60 years of age. Female predominance was observed in the study group with 82% females to 18% males with female to male ratio of 4.55:1.

Mean age of the study subjects was 39.04 years and mean BMI was 23.55 Kg/m².

Table 1. Distribution Of Study Cases As Per Clinical Presentation

Clinical Presentation	N	%
Abdominal Pain	30	60.0%
Jaundice	21	42.0%
Biliary Colic	7	14.0%
Asymptomatic	5	10.0%

Table 2. Distribution Of Study Cases As Per MRCP Findings Of Gall Bladder

MRCP Findings (Gall Bladder)	N	%
Non Calculous Cholecystitis	5	10.0%
Calculous Cholecystitis	45	90.0%
Adenomyomatosis	1	2.0%
GB mass	0	0.0%
GB variant	1	2.0%

Cystic duct was dilated in 16% cases while stone in cystic duct was reported in 18% cases. Cystic duct variations were seen in 14% cases.

Intra-hepatic biliary radicles were dilated in 58% cases while its variations were seen in 6% cases.

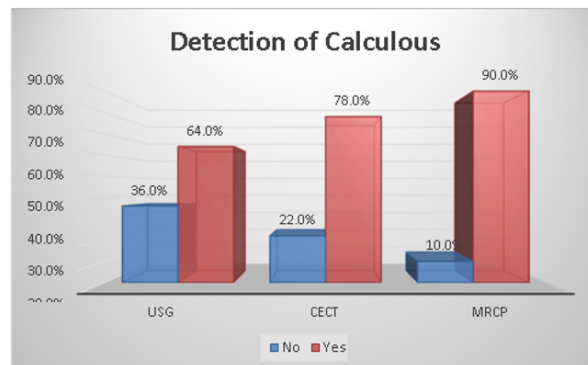
Common hepatic duct was dilated in 54% cases while stones were reported in 8% cases. We also observed 1 case each with stricture and Mirizzi type I syndrome.

Table 3. Distribution Of Study Cases As Per MRCP Findings Of Common Bile Duct

MRCP Findings (CBD)	N	%
Dilated	31	62.0%
Dilated with stones	16	32.0%
Silent stones	3	6.0%
Choledochal type IV	1	2.0%
Stricture	4	8.0%
CBD Variations	0	0.0%

Table 4. Detection Of Calculous On USG, CECT And MRCP

Detection of Calculous	N	%
USG		
No	18	36.0%
Yes	32	64.0%
CECT		
No	11	22.0%
Yes	39	78.0%
MRCP		
No	5	10.0%
Yes	45	90.0%



DISCUSSION

Minimal invasive surgery brought a revolutionary change in the treatment of patients with gallbladder stones. Today, Laparoscopic cholecystectomy is considered worldwide the “gold standard” in the surgical treatment of symptomatic gallbladder lithiasis and acute cholecystitis, because it offers well-known and more definite advantages in comparison with the laparotomy procedure.

Usually, the initial screening of choledocholithiasis is based on clinical suspicion associated with clinical findings such as biliary colic, jaundice, abnormal hepatobiliary biochemical index (elevated bilirubin and alkaline phosphatase levels), and imaging data obtained using abdominal ultrasonography (US) or computed tomography (CT). These indicators may be affected by other factors and none of them show conclusive diagnostic accuracy for CBD stones. Although detection of gallstones is over 95% accurate using US, detection sensitivity for choledocholithiasis varies between 50–80%. In addition, the accuracy for early detection of extrahepatic obstruction is low.

Both CT and US infrequently provide sufficient detailed anatomical information of the biliary tract, which is necessary for surgical interventions. Nagral reported that anatomical facts are of relevance to the performance of a safe cholecystectomy. Misinterpretation of normal anatomy and anatomical variations contribute to the occurrence of major postoperative complications like biliary injuries following a cholecystectomy, the incidence being higher with laparoscopic cholecystectomy. A look at the basic anatomy is therefore important for biliary and minimally invasive surgeons. This includes normal anatomy and variations of the biliary apparatus as well as the arterial supply to the gallbladder.

Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive technique that can be performed rapidly without exposing patients to ionizing radiation or iodinated contrast materials. MRCP displays superior soft tissue resolution and possesses significant accuracy in the diagnosis of choledocholithiasis. It has evolved as an alternative or complementary method to endoscopic retrograde cholangiopancreatography (ERCP) in the diagnosis of patients with choledocholithiasis. CBD stones, if identified on MRCP, cannot be removed, necessitating additional therapeutic procedures such as ERCP or common bile duct exploration. Conversely, if MRCP is negative, the complications associated with these more invasive procedures can be avoided. The current study thus aimed to clarify the importance of MRCP as a preoperative imaging modality in candidate patients for cholecystectomy, to know the anatomical pattern of their intra as well as extra-hepatic bile ducts and also to detect any silent CBD pathologies missed to be diagnosed by primary imaging techniques as ultrasound.

Demography

Mean age of the study subjects was 39.04 years with 58% of them were in the age range of 21-40 years. Only 14% were above 60 years of age. Female predominance was observed in the study group with 82% females to 18% males with female to male ratio of 4.55:1.

Clinical Presentation

Most common clinical presentation was abdominal pain (60%) and jaundice (42%). Biliary colic was seen in 14% cases while 10% cases were asymptomatic. Most of the similar studies observed abdominal pain and jaundice as the chief presenting complaint. Prevalence of asymptomatic gall stones ranges from 10% and 20%.

Role of MRCP

Biliary anatomy and its common and uncommon variations are of considerable clinical significance when performing radiological interventions in hepatobiliary system, and laparoscopic cholecystectomy. Intrahepatic and extra hepatic bile duct variations are commonly seen. Normal biliary anatomy is seen in only 58% of the population.

In present study, Phrygian cap on gall bladder was seen in a single case (2%) while no case had a duplicated gall bladder. Jaba et al. stated that, the incidence of duplicated gall bladder was ranged 1:3000 to 1:12000. They reported Phrygian cap in 6% cases of their study.

In present study, Cystic duct variations were seen in 7 (14%) cases. Parallel course low inserted cystic duct to CHD was reported in 3 of these cases (6%) while medially low inserted cystic duct to CHD was seen in remaining 4 cases (8%). Turner and Fulcher found that, (10.6 %) of their study group with parallel course low inserted cystic duct to CHD, (18.4 %) with medially low inserted cystic duct to CHD and (71%) with normal laterally inserted cystic duct to the middle third of CHD.

By observing the anatomy of intrahepatic bile ducts, the current study found that, 47 (94%) cases with normal anatomical pattern of IHBR as right anterior and posterior sectoral ducts were joined to form the right hepatic duct that joined to left hepatic duct to form CHD. Variations were observed in three cases (6%) with trifurcation of the right anterior duct with the left hepatic duct. Blumgart reported that, the incidence of normal anatomical pattern of IHBR in 57% of his cases, trifurcation pattern were detected in (12%), the right posterior duct drained to the left hepatic duct were detected in (21%), the right posterior duct drained directly to the common hepatic duct were detected in (4 %), segmental (segment VI) intrahepatic biliary duct drained to the cystic duct were detected in (2 %) and (4%) were related to the right anterior ducts variants.

In present study, overall Calculous detection was possible in 90% cases by MRCP, 78% by CECT and 64% by ultrasonography. Mibang N et al. in their study observed stone detection rate of 97.4% by MRCP. The accuracy of CT and MRCP for detection of gallbladder stones showed no significant difference, however, accuracy of MRCP for detection of extra hepatic duct stones were superior to those of CT. Similarly, Virzi V et al. assessed the role of ultrasound (US) and MRCP in the detection of choledocholithiasis. Study concluded that MRCP is a reliable evaluation for the detection of common bile duct (CBD) stones, reducing the misdiagnosis of retained choledocholithiasis with normal biochemical predictors and US examination.

In present study, gall bladder stones were detected in 45 cases (90%) while 19 cases (38%) also had CBD stones. In the current study, 32 cases (64%) of our study group had extra hepatic bile duct stones.

In the present study, 5 out of 32 cases (15.6%) cases with extra hepatic bile duct stones were asymptomatic (silent) stones and were reported as normal cases by USG. In a similar study by Salama M et al., two (12.5%) of sixteen cases with extra hepatic bile duct stones were asymptomatic (silent) stones and were reported as normal cases by USG.

In the present study, the USG couldn't detect anatomical variants in any case (0%), while MRCP had detected anatomical variants in 11 cases (22%) out of fifty. In the study by Salama M et al. too, USG couldn't detect anatomical variants in any case while MRCP detected anatomical variants in eight cases (26.7 %) out of thirty. MRCP also detected different pathologies in 8 (16%) out of fifty cases, most of

whom were missed on USG. At the end of current study, we are totally agreeing with them, as there were five cases with asymptomatic (silent) extra hepatic bile duct stones were reported as normal cases by US as well as eleven cases with different biliary tract anatomical variants who were not detected by US; however, these findings were detected by MRCP, which means that, MRCP has added important information that modified the surgical planning in these cases.

CONCLUSION

In the patients who are candidate for cholecystectomy, routine pre-operative MRCP is mandatory for confirmation of the already known pathologies, detection of other missed pathologies by ultrasonography as well as detection of anatomical variants of biliary tract. These findings will help the surgeon for re-planning and adjusting the surgical approach to preventing or at least decrease the probability of post-operative complications.

REFERENCES

1. Clarence J Schein. Acute cholecystitis. 1st ed. New York: Harper & Row;1972. P.629-57.
2. Shaffer EA. Epidemiology and risk factors for gallstone disease: has the paradigm changed in the 21st century?. Current gastroenterology reports. 2005;7(2):132-40.
3. Desai H, Pandit B. Treatment of Asymptomatic Gallstones. JAPL.2003 Oct; 51: 999-1000.
4. Williams N, Bulstrode C, O'Connell, editors. Bailey & Love's Short Practice of Surgery. 25th ed. London: Edward Arnold; 2008. P.1119.
5. Wong HP, Chiu YL, Shiu BH, Ho LC. Preoperative MRCP to detect choledocholithiasis in acute calculous cholecystitis. J Hepatobiliary Pancreat Sci 2012;19:458-464
6. Surlin V, Sa'fioiu A, Dumitrescu D. Imaging tests for accurate diagnosis of acute biliary pancreatitis. World J Gastroenterol 2014;20:16544-16549
7. Chen W, Mo JJ, Lin L, Li CQ, Zhang JF. Diagnostic value of magnetic resonance cholangiopancreatography in choledocholithiasis. World J Gastroenterol 2015;21: 3351-3360.
8. Ward WH, Fluke LM, Hoagland BD, Zarow GJ, Held JM, Ricca RL. The role of magnetic resonance cholangiopancreatography in the diagnosis of choledocholithiasis: do benefits outweigh the costs? Am Surg 2015;81:720-725.
9. Standring, Susan. Gray's Anatomy: The anatomical basis of clinical practice, expert consult. 41st ed. Elsevier Health Sciences; 2015. p. 1239-67.
10. Demartines N, Eisner L, Schnabel K, et al. Evaluation of magnetic resonance cholangiography in the management of bile duct stones. Arch Surg 2000; 135:148-152.
11. Mibang N et al. The Role of Magnetic Resonance Cholangio-Pancreatography (MRCP) In Predicting Common Bile Duct Stone in Symptomatic Gall Stone Disease. 2013; 6(6):84-90.
12. You MW, Jung YY, Shin JY. Role of Magnetic Resonance Cholangiopancreatography in Evaluation of Choledocholithiasis in Patients with Suspected Cholecystitis. Journal of the Korean Society of Radiology. 2018 Mar 1;78(3):147-56.
13. Salama M, Essam M, Abd Elkader H, Mohamed Hussein A. Role of MRCP in The Assessment of Patients Undergoing Cholecystectomy. Egyptian Journal of Hospital Medicine. 2018 Jul 8;72(2).
14. Virzi V, Ognibene NM, Sciortino AS, Culmone G, Virzi G. Routine MRCP in the management of patients with gallbladder stones awaiting cholecystectomy: a single-centre experience. Insights into imaging. 2018 Oct 1;9(5):653-9.
15. Nagral S. Anatomy relevant to cholecystectomy. Journal of Minimal Access Surgery.2005;1(2): 53.