

Assessment of Bile Duct Anomalies in Gall Stone Patients Using MRCP

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ABSTRACT:

Background: Gallstone disease is the commonest disorder affecting biliary system. Gallstones or cholelithiasis occurs due to delayed and sluggish emptying of bile from the gallbladder. Magnetic resonance cholangio pancreatography (MRCP) plays a vital role in diagnosing various biliary disorders, serving as a non-invasive tool. The objective of the current study was to assess the role of MRCP in diagnosing bile duct anomalies before surgery among patients with gallstones.

Methods: This is a kind of observational study done on 200 patients with gallstones at Fathima Institute of Medical Sciences, Kadapa, Andhra Pradesh, India. Patients for whom magnetic resonance imaging (MRI) is contraindicated were excluded from the study. Demographic variables, surgery duration, intraoperative findings, single or multiple stones, bile duct injuries were assessed. MRCP findings were compared with preoperative findings.

Results: Most of the patients were aged 41-50 years, most of them were females. Multiple gallstones were seen commonly. Operation time was below 1 hour for most of the patients. Sensitivity of MRCP in detecting gallbladder stone was 97.67%, specificity was 85.7%. Overall accuracy was 96%.

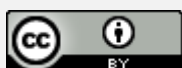
Conclusion: MRCP plays vital role in detecting gallstones and hence the need for conversion to open surgery can be decreased to a greater extent.

Keywords: Bile duct anomalies, gall stones, MRCP, cholelithiasis, biliary obstruction, colicky pain

INTRODUCTION:

Gallstone disease is the commonest disorder affecting biliary system. Gallstones or cholelithiasis occurs due to delayed and sluggish emptying of bile from the gallbladder. When bile is

not completely drained from the gallbladder, it can form sludge, which may later form gallstones. Biliary obstructions like strictures or tumours can also cause gallstones. Precipitation of cholesterol is the commonest cause of gallstones. Most of the gallstones are asymptomatic. In some patients, they



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cause colicky pain. In the United States, the incidence of gall bladder disease ranges from 5.3% to 8.9% among males and 13.9% to 26.7% among females². A study done in north India showed an incidence of 13.44% asymptomatic gallstone disease in Varanasi and 11.14% symptomatic gallstones³. The prevalence increases with age. Gallstones have various compositions and aetiologies.⁷ Acute cholecystitis raises the rate of duct injuries of bile (BDI) due to linked inflammation, gallbladder wall thickening, adhesions, and more bleeding.¹ Routine intraoperative cholangiography decrease the incidence of BDI. In cases of uncertain anatomy, an intraoperative cholangiogram (IOC) or another alternative method is recommended.²⁻³ If there is a BDI, cholangiography must be done to delineate anatomy and plan treatment.⁴ If patients present after surgery, an abdominal ultrasound (US) can detect fluid collection or ductal dilation, along with abdominal pain, hyperbilirubinemia which indicates bile leak. ERCP helps to provide interventions through stenting. MRCP can help diagnose a biliary leak, and its level. MRCP acts as a non-invasive alternative option to ERCP.⁵ It uses heavily T2-weighted pulse sequences. Heavily T2-weighted images (T2WI) were achieved initially through the gradient-echo steady-state precession technique. Fast spin-echo sequence was introduced later,⁶ with the advantage of higher signal-to-noise ratio with less incidence of artefacts. Modified FSE sequences include rapid acquisition with RARE, HASTE, and FRFSE sequences.⁷⁻⁹ In view of less literature on role of MRCP on biliary disorders in India, this study was undertaken. The objective of the current study was to assess the role of MRCP in diagnosing bile duct anomalies before surgery among patients with gallstones.

MATERIALS AND METHODS:

Type of study and study site:

This is a kind of observational study done on 200 patients with gallstones who came to the

outpatient unit or were admitted in the departments of surgery, medicine and gastroenterology, referred to the department of radiology for MRCP at Fathima Institute of Medical Sciences, Kadapa, Andhra Pradesh, India
Study duration: The study was done for 6 months from July 2022 to December 2022.

Sampling method: Convenience sampling

Sample size calculation:

As per **Khuroo et al**¹⁰., the prevalence of Gallstones among adults was 6.12%

The sample size is calculated as per epi-info software 7.2.5 (population proportion mode) as:

$$N = Z^2 PQ / E^2$$

N-sample size

P-Prevalence

$$P = 6.12\%$$

$$Q = 1 - P$$

E-Error: 3%,

90% confidence limits

$$N = 174$$

174 is the minimum sample size.

So, we included 200 patients in the current study, considering a few losses to follow-up cases.

Inclusion criteria

- Patients with gallstones referred to the department of radiology for MRCP
- Patients aged above 18 years of any gender
- Patients who provided informed consent

Exclusion criteria

Patients for whom MRI is contraindicated (patients with metallic implants, pacemakers, ear implants, artificial limbs, hearing aids, stents, claustrophobia, dental implants, tissue expanders, medication patches, who underwent colonoscopy).¹¹

Material used: MRI was done using 1.5 Tesla Signa Excite systems. (General Electrical medical systems) with a phased array body coil.

MRCP findings were compared with preoperative findings and sensitivity analysis was done.

Parameters assessed:

- Age, Gender
- MRCP findings:
 - Presence of stones-single or multiple
 - Presence of sludge
 - Cystic duct insertion
 - Stone in common bile duct (CBD)
- Scopy time
- Surgery duration
- Bile spill, Stone spill
- Sensitivity of MRCP in detecting abnormalities by comparing with peroperative findings.

Ethical considerations:

The permission from the IEC attached to the Fathima Institute of Medical Sciences was taken before conducting the study. All patients were explained the complete process and benefits of their data for the study. After he/she accepts, an ICF was provided in the local language or and the person was asked to sign it or put a thumb impression.

Statistical analysis: Data analysis was done using Epi Info software version 7.2.5. The results were expressed as mean \pm S.D, percentages.

Results: Age: 22% were aged 21 to 30 years. 10% were aged 31 to 40 years. 34% of patients were aged 41-50 years. 12% were aged 51 to 60 years. 14% were aged 61 to 70 years. 8% were aged 71 to 80 years. The mean age was 47.8 ± 10.4 years

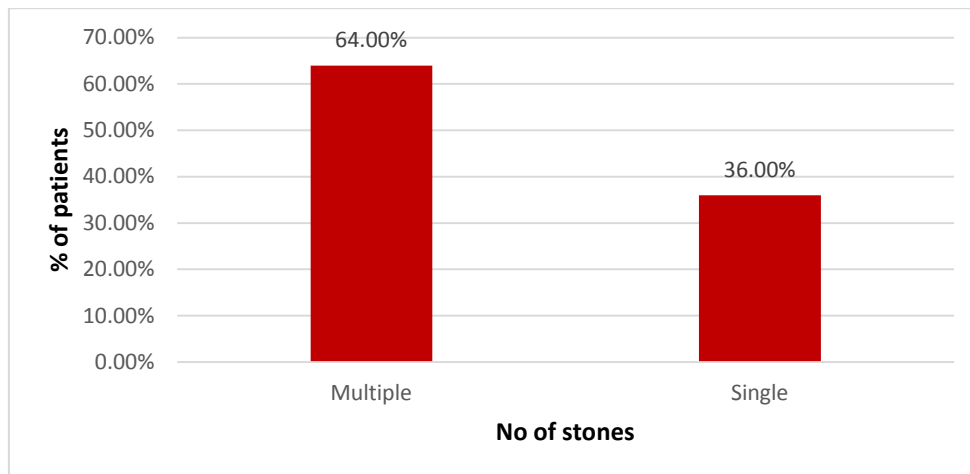
Table 1: Age distribution of patients

AGE GROUP	Frequency	Percent
21-30	44	22.00%
31-40	20	10.00%
41-50	68	34.00%
51-60	24	12.00%
61-70	28	14.00%
71-80	16	8.00%
Total	200	100.00%

Gender: 68% of patients were females.

No of gall stones: 64% of patients had multiple calculi.

Graph 1: No of gall stones among patients



Gallbladder sludge: It was seen in 78% of patients

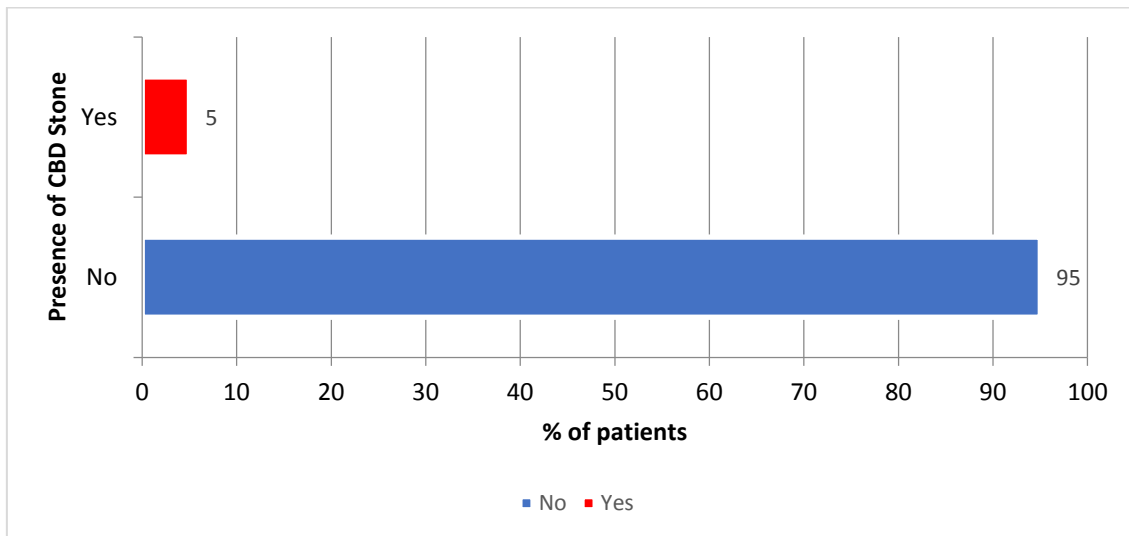
Insertion of cystic duct: Right lateral insertion was the commonest presentation, followed by anterior spiral and posterior spiral insertions. High insertion, low insertion was seen rarely.

Table 2: Insertion of cystic duct

INSERTION	Frequency	Percent
A-Right lateral	110	55.00%
B-Anterior Spiral	44	22.00%
C-Posterior spiral	40	20.00%
E-High insertion	4	2.00%
D-Low insertion	2	1.00%
Total	50	100.00%

CBD stone: CBD stone was seen in 5% of patients

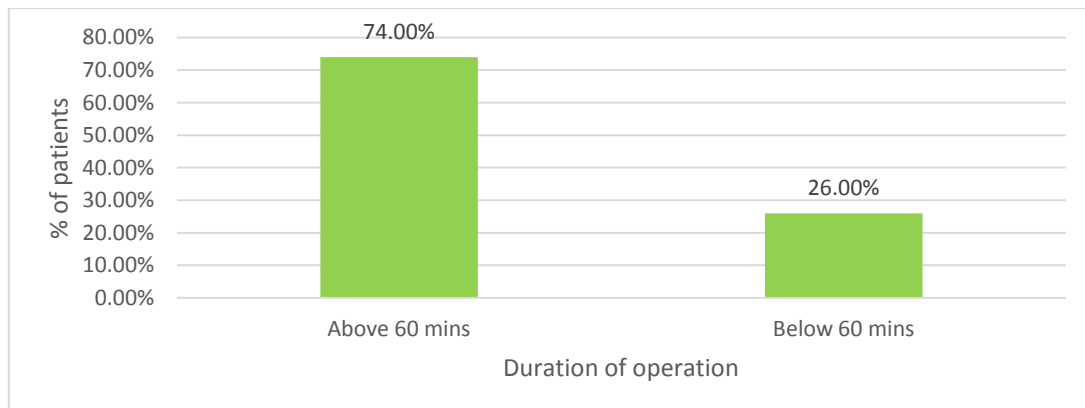
Graph 2: CBD stone presence



Scopy time: The mean scopy time was 68.1 ± 22.3 seconds.

Operation Time: Operation time was below 1 hour in 74% of patients.

Graph 3: Operation time for patients



Bile duct anomalies: Biliary atresia was not seen in any patient. choledochal cyst was seen in 2 patients

Bile spill: One patient had bile spill among 200 patients during surgery.

Stone spill, bleeding, bile duct injury: No patient had bleeding, stone spill, bile duct injury and conversion to open surgery. This indicates MRCP plays vital role in reducing the conversion to open surgery.

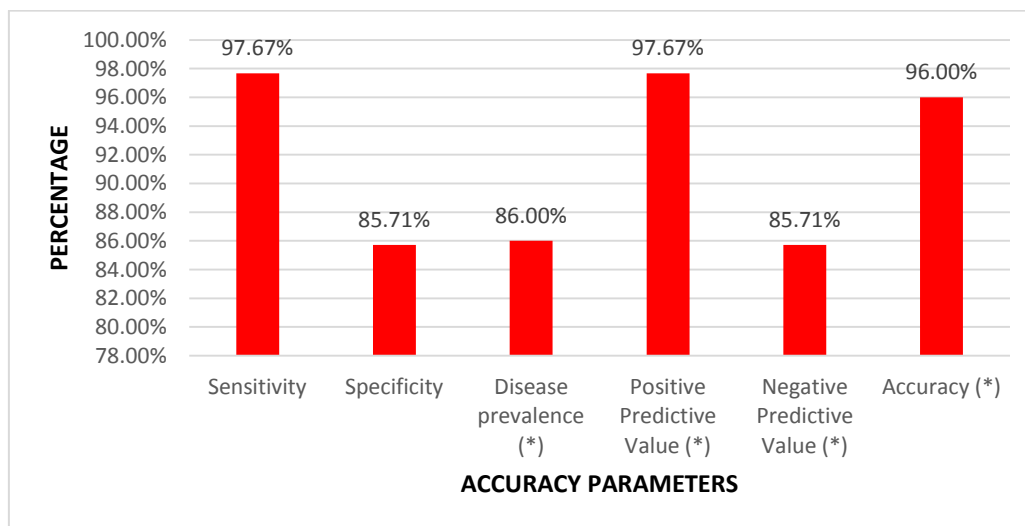
MRCP comparison with per operative findings:

Sensitivity of MRCP in detecting gallbladder stone was 97.67%, specificity was 85.7%. Overall accuracy was 96%. There were 168 true positive cases, 4 false positive, 4 false negative, 24 true negative cases.

Table 3: Accuracy of MRCP in detecting gall stones

Statistic	Value	95% CI
Sensitivity	97.67%	94.15% to 99.36%
Specificity	85.71%	67.33% to 95.97%
Positive Likelihood Ratio	6.84	2.76 to 16.95
Negative Likelihood Ratio	0.03	0.01 to 0.07
Disease prevalence (*)	86.00%	80.41% to 90.49%
Positive Predictive Value (*)	97.67%	94.43% to 99.05%
Negative Predictive Value (*)	85.71%	69.24% to 94.11%
Accuracy (*)	96.00%	92.27% to 98.26%

Graph 4: Accuracy of MRCP in detecting gall stones



DISCUSSION:

This was an observational study conducted at Fathima Institute of medical sciences, a tertiary care centre with well-equipped facilities on 200 patients with gallstones scheduled for surgery and preoperative findings were compared using MRCP.

Comparison with other studies:

Most of the patients were aged 41-50 years. Mean age was 47.8 years. Most of the patients

were females. **Perales SR et al.**¹² did a retrospective cohort study, which included 76 patients with gallstones. 48 patients were females and 27 were males. Females were more common compared to males, similar to our study. The mean age was 47.7±19.1 years. The mean age was also similar to our study.

Right lateral insertion was the commonest presentation, followed by anterior spiral and posterior spiral insertions. High insertion, low

insertion was seen rarely. Bile duct injuries were not seen in any patient in our study.

In the study done by **Bahram et al.**¹³ authors wanted to analyse the effect of per-operative MRCP in managing patients with gallstones. Their randomized, prospective was done on 250 patients. MRCP screening showed silents tones in CBD in 4% patients, accessory cystic duct in 1.6% patients, and abnormal cystic duct insertion in 0.8% of patients. Postoperatively, bile duct injury was seen in 1 patient only in group 1. Bile duct injuries were more common in patients in group 2, who didn't undergo prior MRCP.

Sensitivity of MRCP in detecting gallbladder stone was 97.67%, specificity was 85.7%. Overall accuracy was 96% in our study. **Makmun et al.**¹⁴ wanted to know the accuracy of MRCP in detecting choledocholithiasis. Their retrospective study was done on 62 patients with suspected choledocholithiasis patients. The accuracy of MRCP was compared with ERCP as a gold standard. Male to female ratio was 3:2. Males were more compared to females, in contrast to our study. The mean age was 47.25 years, which is almost same like our study. Sensitivity, specificity, positive predictive and negative predictive values of MRCP were 81%, 40%, 68%, 74%. These scores were less compared to our study.

One patient had bile spill among 50 patients
No patient had bleeding, stone spill conversion to open surgery and bile tree injury in our study. **Radunovic et al.**¹⁵ did a retrospective analysis on 740 patients.13.1% of patients had complications during surgery, Perforation of gallbladder was the commonest complication, seen in 5.27% of patients. Bleeding from abdominal cavity was seen in 3.64% of patients, biliary duct leaks were seen in 1.8% of patients. Surgery was converted to open surgery in 3.91% of patients. **Bahram A**¹³ et al's study showed bile ductal injuries in 3 patients, total 8 complications were seen among 250 patients

included. Some studies indicated that MRCP has a sensitivity of 91-100% in diagnosing strictures.¹⁶ But ERCP is more sensitive than MRCP in identifying early changes in cholangitis and MRCP is useful in the follow-up of established cases.¹⁷

CONCLUSION:

Our study proved that MRCP had more accuracy in detecting gallstones. There was no bleeding, and no conversion of laparoscopic surgery to open surgery. Hence, we recommend performing this non-invasive, easily available, accurate mode of assessment (MRCP) for all patients, who were posted for laparoscopic cholecystectomy.

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Declaration:

The study is self-sponsored.

There were no conflicts of interest.

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