International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Outcomes of Laparoscopic Cholecystectomy Using a Preoperative Imaging Protocol Based on Ultrasound and MRCP: A Retrospective Study from a Non-Intraoperative Cholangiography Center

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Abstract: ***Background: Laparoscopic cholecystectomy (LC) is the standard treatment for symptomatic gallstone disease. However, in centers without intraoperative cholangiography (IOC), the risk of bile duct injury and missed choledocholithiasis remains a concern. This study evaluated the outcomes of LC using a preoperative imaging protocol involving ultrasound (USG) and magnetic resonance cholangiopancreatography (MRCP). Methods: A retrospective analysis was conducted on 50 patients who underwent elective LC over one year at a tertiary care center without IOC facility. All patients underwent USG, and those with suspected common bile duct (CBD) stones or anatomical variants were further evaluated with MRCP. Intraoperative findings, surgical outcomes, postoperative complications, and readmissions were recorded and analyzed. Results: Of the 50 patients, 32 were female (64%) and 18 were male (36%), with a mean age of 42.6 years. MRCP was performed in 20 patients (40%), confirming CBD stones in 5 (10%) and anatomical anomalies in 3 (6%). LC was uneventful in 90% of cases; 2 patients (4%) required conversion to open surgery. There were no bile duct injuries. Postoperative complications occurred in 3 patients (6%), with one readmission. Conclusion: A preoperative imaging protocol combining USG and MRCP provides a safe and effective alternative to IOC in laparoscopic cholecystectomy.***

Keywords: Laparoscopic cholecystectomy, preoperative imaging, MRCP assessment, bile duct safety, gallstone management

1. Introduction

Laparoscopic cholecystectomy (LC) is the gold standard for the surgical management of symptomatic gallstone disease and other benign gallbladder pathologies. (1) The identification and prevention of biliary tract injuries remain a major concern, particularly in centers where intraoperative cholangiography (IOC) is not routinely available. Preoperative imaging plays a crucial role in evaluating biliary anatomy and detecting potential choledocholithiasis or anatomical variations that may increase operative risk. (2,3) While ultrasound (USG) is widely used as a first-line imaging modality due to its accessibility and cost-effectiveness, its sensitivity in delineating the biliary tree and detecting common bile duct (CBD) stones is limited. Magnetic resonance cholangiopancreatography (MRCP), a non-invasive and highly sensitive imaging technique, has emerged as an effective alternative for preoperative biliary assessment. (4,5)

This retrospective study evaluates the surgical outcomes of laparoscopic cholecystectomy guided by a standardized preoperative imaging protocol incorporating both ultrasound and MRCP in a setting without IOC. It aims to assess whether this protocol can optimize operative planning, minimize bile duct injury, and reduce the need for intraoperative imaging. By focusing on a non-IOC center, this study highlights the potential of combining preoperative USG and MRCP as a safe, effective, and feasible approach to ensure favorable surgical outcomes in resource-limited settings.

2. Methodology

This retrospective observational study was conducted over a period of one year at a tertiary care center that does not routinely perform intraoperative cholangiography (IOC). The study included 50 patients who underwent elective laparoscopic cholecystectomy for symptomatic gallstone disease. Inclusion criteria were adult patients (aged 18 years and above) with ultrasonographic evidence of gallstones and no clinical or biochemical signs of acute cholecystitis, cholangitis, or pancreatitis at the time of surgery. Patients with a history of previous biliary surgery, known choledocholithiasis requiring endoscopic retrograde cholangiopancreatography (ERCP), or incomplete medical records were excluded.

All patients were initially evaluated with abdominal ultrasonography (USG) to confirm gallstone disease and assess for signs of common bile duct (CBD) dilatation, gallbladder wall thickening, and pericholecystic fluid. Patients with suspected CBD involvement or anatomical variations on USG underwent further evaluation with magnetic resonance cholangiopancreatography (MRCP). MRCP was used to assess the biliary anatomy in greater detail, identify CBD stones, and detect any anatomical anomalies that could increase the risk of bile duct injury during surgery.

Laparoscopic cholecystectomy was performed under general anesthesia using the standard four-port technique. Operative findings, difficulty level, intraoperative complications, need

for conversion to open surgery, and duration of surgery were recorded. Postoperative outcomes, including duration of hospital stay, postoperative complications, and readmissions within 30 days, were documented and analyzed. No IOC was performed during any of the procedures due to institutional practice and limitations.

Data were collected from hospital records, operative notes, and imaging reports. The collected data were analyzed using descriptive statistics. The outcomes of interest included the incidence of bile duct injury, retained stones, and other complications, and these were correlated with the preoperative imaging findings. The study aimed to determine whether the combined use of USG and MRCP could serve as an effective preoperative imaging strategy to optimize surgical outcomes in a setting without intraoperative cholangiography.

3. Results

Table 1: Demographic Characteristics of Study Participants (N = 50)

Characteristic	Number of Patients	Percentage (%)
Age (Mean ± SD)	42.6 ± 11.4 years	
Gender		
Male	18	36%
Female	32	64%

Table 2: Preoperative Imaging Findings

Imaging Modality	Key Findings	Number of Patients	Percentage (%)
Ultrasound Only	Normal CBD, No Suspicion	30	60%
USG + MRCP	Suspected CBD Stones on USG	20	40%
MRCP Findings	CBD Stones Confirmed	5	10%
	Anatomic Variants Detected	3	6%

Table 3: Intraoperative Findings and Surgical Outcomes

Parameter	Number of Patients	Percentage (%)
Uneventful LC	45	90%
Conversion to Open Surgery	2	4%
Intraoperative Bile Leak	1	2%
Difficult Dissection	4	8%
CBD Injury	0	0%

Table 4: Postoperative Outcomes

Outcome	Number of Patients	Percentage (%)
Postoperative Complications	3	6%
- Wound Infection	2	4%
- Retained CBD Stone	1	2%
Mean Hospital Stay (Days)	2.8 ± 1.1	—
Readmission within 30 Days	1	2%

4. Discussion

This retrospective study evaluated the surgical outcomes of laparoscopic cholecystectomy (LC) in a center where intraoperative cholangiography (IOC) is not routinely performed, using a preoperative imaging protocol involving ultrasound (USG) and magnetic resonance cholangiopancreatography (MRCP). The primary aim was to assess whether this imaging strategy could effectively guide surgical planning, minimize intraoperative complications, and ensure favorable postoperative outcomes. (7)

Our study included 50 patients, with a predominance of females (64%), consistent with the well-established higher prevalence of gallstone disease among women. The mean age of patients was approximately 42 years, reflecting a relatively young adult population typically seen in elective cholecystectomy settings.

Ultrasound, as a first-line imaging modality, provided initial diagnostic information in all patients. However, it lacked detailed assessment of biliary anatomy in some cases. MRCP was performed in 20 patients (40%) based on USG findings suggesting possible common bile duct (CBD) stones or anatomical variations. MRCP confirmed the presence of CBD stones in 5 patients (10%) and detected anatomical anomalies in 3 patients (6%). These findings were crucial for preoperative planning, allowing for appropriate scheduling of ERCP in select cases and anticipating potential intraoperative challenges.

Intraoperative outcomes were largely favorable. Laparoscopic cholecystectomy was completed uneventfully in 90% of patients. Only two patients required conversion to open surgery due to dense adhesions and unclear anatomy, highlighting the importance of cautious surgical decision-making in challenging cases. Notably, there were no cases of bile duct injury, which remains one of the most feared complications of LC. This is a significant finding, as it supports the role of MRCP in mitigating this risk in centers where IOC is not available.

A small number of patients experienced intraoperative difficulties, such as bile leak (2%) and difficult dissection (8%). These complications were anticipated in some cases based on imaging findings and managed effectively intraoperatively. The low incidence of retained stones (2%) further underscores the utility of preoperative MRCP in identifying choledocholithiasis and guiding appropriate preoperative or postoperative ERCP referral. (8,9,10)

Postoperative outcomes were satisfactory, with a mean hospital stay of 2.8 days. Three patients (6%) experienced minor complications, such as wound infection and retained CBD stone. Only one patient required readmission within 30 days, which was for ERCP following a missed CBD stone—a reminder that even with high-quality imaging, false negatives can occur.

Our findings suggest that a protocol-driven approach using ultrasound followed by selective MRCP can effectively replace routine IOC in resource-limited settings. MRCP is non-invasive, provides excellent biliary tree visualization, and helps in anticipating operative complexity. While IOC offers real-time imaging, its unavailability in many centers due to cost, expertise, or infrastructure limitations necessitates reliance on alternative strategies. (11,12)

5. Conclusion

In conclusion, the combination of USG and MRCP as a preoperative imaging protocol in laparoscopic cholecystectomy offers a safe and reliable alternative in non-IOC settings. It enables adequate assessment of biliary anatomy, reduces the risk of bile duct injury, and contributes to favorable operative and postoperative outcomes. Future prospective studies with larger sample sizes may further validate this approach and refine patient selection criteria for MRCP.

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