

Research Article

Analyzing the Factors for Pre-operative Prediction of Problematic Laparoscopic Cholecystectomy: A Cross-sectional Exploratory Study

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A B S T R A C T

Background: Laparoscopic cholecystectomy is considered as the preferred treatment for symptomatic Cholelithiasis. Though laparoscopic cholecystectomies are considered a common surgical intervention, still 1-13% requires conversion to open cholecystectomy for various reasons. Pre-operative evaluation of such factors would be helpful to establish criteria that would assess the risk of conversion, hence the rationale for this study.

Materials and Methods: A cross-sectional study conducted among patients (n=100) reporting with gall bladder disease and requiring cholecystectomy (aged 10-60 years) not having peritonitis, malignancy, pregnancy and/ or a compromised immune system were recruited in the study. Factors of difficult laparoscopic were assessed by Socio-demographic factors, Inspection and Palpation and USG findings (wall thickness, pericholecystic collection, impacted stone and post ERCP status). Following this, the patient was subjected to laparoscopic cholecystectomy and conversion was noted. SPSSv15.0 was utilized for statistical analysis (*p<0.05).

Results: Study subjects with GB wall thickness >3mm, presence of pericholecystic fluid, appearance of WES sign, and subjects having multiple gall stones and/ or CBD stone had a significantly higher level of difficulty in gall bladder extraction, as well as higher chances of complicated bleeding. Overall, 13% subjects required a conversion from Laparoscopic Cholecystectomy to Open Cholecystectomy.

Conclusion: Pre-operative prediction of difficult laparoscopic cholecystectomy can help the patient as well as the surgeon to prepare better for the intra operative risk and risk of conversion to open cholecystectomy.

Keywords: Conversion, Gallstones, Laparoscopic cholecystectomy, Open cholecystectomy

Introduction

Cholelithiasis, or presence of calcified stones in the Gall Bladder, is the most common biliary pathology. Gallstones are present in 10 to 15% of the general population and asymptomatic in the majority (>80%).^{1,2} Studies report an increase in its prevalence in recent times in India, attributed to westernization and availability of advanced investigations in both rural and urban areas in accordance with socioeconomic structure.³

Approximately 1-2% of asymptomatic patients will develop symptoms requiring cholecystectomy (removal of Gall Bladder) per year.⁴ In 1992, The National Institute of Health (NIH) consensus development conference stated that laparoscopic cholecystectomy "provides a safe and effective treatment for most patients with symptomatic gallstones." The advantages of laparoscopic cholecystectomy over open cholecystectomy are quick recovery of bowel functions, minimal pain in postoperative period, minimal hospital stay, earlier return to normal activity, and decreased overall cost.⁵

At present, laparoscopic cholecystectomy is considered the treatment of choice for symptomatic Cholelithiasis. It has many advantages over open cholecystectomy in terms of minimal postoperative pain, shorter hospital stays, better cosmetics and early recovery.

However, of all Laparoscopic cholecystectomies, 1-13% requires conversion to an open for various reasons.⁶ Thus, for surgeons it would be helpful to establish criteria that would assess the risk of conversion preoperatively. Hence, this prospective study was undertaken and conducted to estimate clinical, biochemical and ultra-sonographical factors for difficult laparoscopic cholecystectomy.

Materials and Methods

The present study is a cross-sectional study conducted within a span of 2 years (August 2016 to July 2018) in a tertiary care hospital in North India. Patients reporting with gall bladder disease and requiring cholecystectomy (aged 10-60 years) were recruited in the study. Such patients had presenting symptoms and signs of Cholelithiasis/cholecystitis at the time of admission and were diagnosed by USG examination.

Inclusion Criteria

The patients aged between 10 to 60 years presenting symptoms and signs of Cholelithiasis/ cholecystitis and diagnosed by USG examination

- Adult patients (aged 10 years to 60 years) reporting first time/regularly associated with SIMS hospital for gall bladder disease are selected
- Such patients admitted for laparoscopic cholecystectomy were included
- Patients having no other relevant medical history

- Patients giving informed consent

Exclusion Criteria

Cases with the following findings will be excluded:

- The patient with suspected CBD stones on USG
- The patient having clinical or USG suspected diagnosis of Ca gall bladder
- Pregnancy
- The patients not fit for general anesthesia due to various medical illness and bleeding disorders.
- Peritonitis
- Patients refusing surgery

Using the findings of a previous study,⁷ the sample size was calculated to be approximately 100, which included a non-response rate of 20%. Ethical Approval was taken from the Institutional Ethical Committee after explaining the Aim and Objectives of the Study. A written Informed Consent was obtained from each subject before starting the procedure. The involvement of the subject was voluntary and deliberate.

A Performa for study of all consecutive patients of Cholelithiasis were used; with presentation, clinical findings, duration, investigations, predictive factors for difficult laparoscopic cholecystectomy. These patients (confirmed by USG) were evaluated with following factors:⁸

1. Socio-demographic factors
2. Inspection and Palpation of abdomen for any abnormality
3. USG findings
 - Wall thickness
 - Pericholecystic collection
 - Impacted stone
 - Post ERCP status

Following this, the patient was subjected to laparoscopic cholecystectomy under general anesthesia with the presence of experienced anesthetist with intubation and controlled ventilation. Factors noted here were:

1. Time taken
2. Biliary/ stone spillage
3. Injury to duct/ artery
4. Conversion

Intra-operative analysis was done to assess factors, which would indicate the procedure as a difficult laparoscopic cholecystectomy. These factors included:

1. Operative time: Duration of surgery (in minutes) [Duration of surgery included the time from insertion of the Veress' needle to closure of the trocar insertion site, and was evaluated as a dichotomous variable (<90 min versus >90 min)]
2. Injury to CBD/ Duodenum/ small intestine/ large

intestine/ omentum/ liver.

3. Bleeding during surgery
4. GB bed dissection
5. Rupture of GB with spillage of stone/ bile
6. Difficult extraction
7. Conversion to open cholecystectomy

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) for Windows (version 15.0). Categorical variables were described as frequency (percentage), mean \pm standard deviation was used for continuous parameters. Differences between two groups were compared by the Student t-test. For non-parametric variables, the data are presented as median (min-max). In this case, the nonparametric Mann-Whitney test was used for statistical comparisons. For all analyses, a two-tailed p-value of <0.05 was considered statistically significant.

Result

The mean age of the study group was 41.33 ± 9.71 years with a range of 21-60 years. Majority of study subjects were females (88%). The mean BMI of study participants was 21.19 ± 1.58 ; mean body Temperature (in Fahrenheit) was $97.8 + 0.9$. The mean Blood Urea levels of study participants were 47.04 ± 14.0 , mean Serum Creatinine level was 2.25 ± 0.58 , mean SGOT levels were 35.68 ± 6.76 , and mean SGPT levels were 57.5 ± 11.7 (Table 1).

Reporting clinical symptoms, all patients had reported of pain (100.0%), however, only 33% patients had reported vomiting, 35% subjects reported having fever, and 55%

subjects reported having dyspepsia. Only 9% subjects had a previous abdominal surgery and nearly 63% subjects had a positive Murphy's sign (Table 2).

The intra-operative findings showed that nearly 61% study participants had a gall bladder wall thickness more than 3mm. Nearly 57% study participants had pericholecystic fluid collection. Also, nearly 51% study participants showed a positive WES sign. Surprisingly, nearly 57% study participants had stone or obstruction in Common Bile Duct.

The percentage of subjects wherein difficulty was encountered in accessing the abdominal cavity was 40%. Nearly 59% of Gall Bladders were distended. Nearly 44.1% subjects had single stone and 55.9% subjects had multiple stones. The mean size of largest stone was $1.02 + 0.58$ cm, with a range of 0.3 cm to 2.2 cm.

Nearly 77% study subjects had a normal GB dissection, and 91% subjects had a safe GB surgery. Approximately 24% subjects suffered a Bile spillage during the surgery, and 23% suffered a stone spillage during the surgery (Table 3).

Nearly 23% subjects had a difficult GB extraction, and 9% suffered a CBD injury. Approximately 20% study subjects suffered a Gut and Liver Injury during the surgery. Ten percent subjects suffered a bleeding during the surgery as a complication. Among them, 3 suffered an injury due to trocar insertion, 3 had portal hypertension and 4 had blood vessel injury. Overall, 13% subjects required a conversion from Laparoscopic Cholecystectomy to Open Cholecystectomy (Figure 1).

Table 1. Vital statistics distribution of study subjects

| Vital statistics | N | Mean | SD | SE | Minimum | Maximum |
|------------------|-----|--------|--------|--------|---------|---------|
| Hb | 100 | 10.507 | 1.0296 | 0.1231 | 9.0 | 12.3 |
| Blood urea | 100 | 47.04 | 14.003 | 1.674 | 25 | 81 |
| Serum creatinine | 100 | 2.254 | 0.5875 | 0.0702 | 1.3 | 3.2 |
| RBS | 100 | 116.03 | 11.440 | 1.367 | 98 | 130 |
| SGOT | 100 | 35.684 | 6.7695 | 0.8091 | 22.7 | 47.0 |
| SGPT | 100 | 57.50 | 11.700 | 1.398 | 34 | 73 |

Table 2. Symptoms among study sample

| Symptoms present | Frequency | Percent (%) |
|---------------------------------|-----------|-------------|
| Pain | 100 | 100.0 |
| Vomiting | 33 | 33.0 |
| Fever | 35 | 35.0 |
| Dyspepsia | 55 | 55.0 |
| H/ o Previous abdominal surgery | 9 | 9.0 |
| Positive Murphy's sign | 63 | 63.0 |

Table 3. Intra-operative complications of GB surgery

| Intraoperative complications | | Frequency | Percent |
|------------------------------|-----------|-----------|---------|
| GB Dissection | Normal | 77 | 77.0 |
| | Difficult | 23 | 23.0 |
| GB Rupture | No | 91 | 91.0 |
| | Yes | 9 | 9.0 |
| Bile Spillage | No | 76 | 76.0 |
| | Yes | 24 | 24.0 |
| Stone Spillage | No | 77 | 77.0 |
| | Yes | 23 | 23.0 |

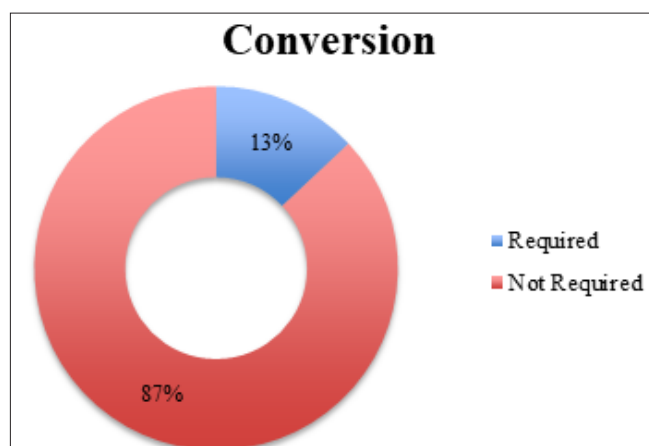


Figure 1. Conversion required

No significant difference was seen between age groups and both genders in regards to Conversion required. Study subjects with GB wall thickness >3mm, presence of pericholecystic fluid, appearance of WES sign, and subjects having multiple gall stones and/ or CBD stone had a significantly higher level of difficulty in gall bladder extraction, as well as higher chances of complicated bleeding ($p < 0.05$).

Discussion

Laparoscopic surgery is commonest surgery performed for cholelithiasis. However, the conversion rate of Laparoscopic cholecystectomy to open cholecystectomy is still 1.5 to 19%. It is pertinent to study predictors or factors, which are responsible for difficult laparoscopic cholecystectomy. Hence the present study was undertaken.

We and some other authors did not notice age to be associated with conversion rate.^{9,10} In our study though 6 patients in the age group of 41-40 years required conversion as against 2 requiring in the age group of 21-40 years but statistically they were not different from each other ($p=0.477$). Similarly, no gender wise difference was notice regarding conversion to open cholecystectomy. Liu et al., did not notice sex to be associated with conversion.¹¹ Many

investigators have reported higher incidence of difficult Laparoscopic cholecystectomy and higher conversion rate in male patients.¹²⁻¹⁴

Many investigators have reported that thick-walled GB was strongly associated with higher conversion rate during Laparoscopic cholecystectomy.^{15,16} The intra-operative findings of the present study showed that nearly 61% study participants had a Gall Bladder wall thickness more than 3mm. Minimal GB wall thickness beyond which there is increased incidence of conversion was reported to be 4mm, by Kumar et al. and others.^{6,16}

While only 9% suffered a rupture, nearly 24% study subjects suffered a Bile spillage during the surgery and only 23% subjects suffered a stone spillage during the surgery in the current study. These complications were higher than reported by studies elsewhere.^{17,18} It is well known that surgeon experience is a predictor of the safe and efficient performance of Laparoscopic cholecystectomy.

Impacted stones at Hartmann's pouch makes dissection difficult because of difficulty in holding Gall Bladder at Hartmann's pouch. Collection of peri-cholecystic fluid also presents as difficulty thereby contributing to conversion to open cholecystectomy. In our study, presence of these fluid caused conversion in 15% of cases. This is comparable to studies done elsewhere.

Adhesion in Calot's triangle results in disturbed anatomy of the area where difficulty occurs in identifying the cystic artery and cystic duct. Various authors have reported incidence of 27.9% to 78.9% conversion rate in presence of adhesions in Calot's triangle and inability to identify anatomy correctly.^{19,20}

Chances of injury to GB during surgery occur due to inability to hold GB with grasping forcep because of oedematous, friable or thin walled GB. Incidence of spillage of bile and dropped stones has been reported as 0.57% to 7% in literature. Though spillage of bile and dropped stones leads to difficulty in Laparoscopic cholecystectomy, however conversion is rarely required.^{20,21}

Conclusion

Pre-operative prediction of difficult laparoscopic cholecystectomy can help the patient as well as the surgeon to prepare better for the intra operative risk and risk of conversion to open cholecystectomy. Study subjects with GB wall thickness >3mm, presence of pericholecystic fluid, appearance of WES sign and subjects having multiple gall stones and/ or CBD stone had a significantly higher level of difficulty in gall bladder extraction, as well as higher chances of complicated bleeding. Overall, 13% subjects required a conversion from Laparoscopic Cholecystectomy to Open Cholecystectomy.

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