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Original Article

A Cross-Sectional Study of One-Year Analysis of Fundus First and Calot's First Approaches of Laparoscopic Cholecystectomies in a Tertiary Care Centre

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ABSTRACT

Background: Laparoscopic cholecystectomy is routinely approached in two ways: the Calot's first approach (CFA) and the fundus first approach (FFA). CFA is routinely used when the critical view of safety can be established safely, fundus first approach is useful when the anatomy is obscured due to frozen Calot's.

Methods: This is a prospective record of all laparoscopic cholecystectomies performed in Sunshine Hospitals, from 2019-2020. Intraoperatively, routinely Calot's first approach was used and resorted to the fundus first method when difficulties were encountered with exposure of Calot's triangle. Data was analyzed using a student's t test and Pearson correlation.

Results: Out of the 151 patients, 64 patients (44%) underwent fundus first and 87 patients (56%) had Calot's first approach. Mean operative time for FFA (60.23mts ± 25) was similar to CFA (57.18mts ± 25) (P-Value-0.9). Bleeding during surgery was more for FFA (9%) than CFA (7%), though not statistically significant. There were no bile duct injuries, bowel injuries, or conversions. The mean hospital stay was 1.2 days (1-4 days) for FFA and 1.3 days (1-4 days) for CFA. Though, post-operative complications were more with FFA than CFA, [minor bile duct leak (CFA-2% vs FFA-4%), intra-abdominal collection (CFA-3% vs FFA-4%)] the difference was not statistically significant.

Conclusion: Calot's first method is a useful approach in elective cases, with well-defined anatomy, but it is difficult in cases with severe inflammation in Calot's, or adhesions leading to frozen anatomy. Fundus first approach was extremely useful in these conditions and could avoid subtotal cholecystectomies, cholecystostomies, and open conversion without bile duct injuries.

KEYWORDS: Laparoscopic cholecystectomy, Calot's first approach, Fundus first approach, Gallbladder.

Introduction

Laparoscopic cholecystectomy (LC) is the 'gold standard' treatment for symptomatic gallstone disease[1]. It is associated with 0.1% to 0.5% mortality and 2-3% morbidity[2]. Advantages of laparoscopic surgery over open cholecystectomy (OC) include small incisions, less pain, and shorter period of hospitalization. Despite the advantages, LC is associated with a slightly higher rate of bile duct injury and hepatic artery injury. Biliary leak rate with LC is around 0.5-3%[3] which is higher compared to OC (between 0.1-0.5%). The biliary injuries are very serious complications which if not appropriately managed result in life-threatening complications like cholangitis, secondary biliary cirrhosis, and portal hypertension.

The technique of cholecystectomy has evolved to prevent these biliary injuries. To improve the safety of the procedure the critical view of safety (CVS) technique, described by Strasberg and colleagues is used[4]. In the Calot's first approach (CFA) cephalad fundic traction is given, and the neck of the gall bladder is retracted towards the right iliac fossa to expose the Calot's triangle. Dissection is then proceeded to achieve CVS, the detection of the two structures entering the gallbladder (cystic duct and cystic artery). Then the cystic duct is clipped and the gall bladder is separated. Other methods used for the safe procedure include using various landmarks (Rouviers sulcus, Calot's node), and various dissection techniques (infundibular, antegrade, etc.). Identification of Calot's triangle is essential to avoid vascular or biliary damage and conversion is adopted norm when the anatomy is unidentifiable[5].

During distorted or obscured biliary anatomy achieving CVS is challenging. Few articles have mentioned doing cholecystostomies, open conversion, and sub-total cholecystectomies (bail-out procedures) as alternatives[16], but in our study, we did complete cholecystectomies without any statistically different post-operative complications using the Fundus first approach (FFA). FFA is a routinely used procedure during open cholecystectomies[6,7] and is used as a defensive technique for difficult cases during LCs. Though it's feasible during laparoscopy, it has not been widely practiced, possibly because of the usage of rudimentary instrumentation in the early days. Few articles have mentioned that the fundus technique is difficult to apply in LC because of the loss of traction on the liver when the fundus is mobilized[8]. With the availability of laparoscopic liver retractors, mobilization of gallbladder using the fundus first method is made easy. In this study, we tried to compare the effectiveness and safety of the fundus first approach and Calot's first approach during LC using various parameters.

Methodology

This is a cross-sectional study conducted in the Department of Surgical Gastroenterology, Sunshine Hospitals, Secunderabad. In this study, we included all patients who underwent elective and emergency laparoscopic cholecystectomies done between a period of 6 months (2019-2020) with 1 month post-operative follow-up. The study was approved by the institution's ethical committee of Sunshine Hospitals, Secunderabad, India. (EC/NEW/INST/SUNSHINE/0215/2022.)

Material and Methods

All patients with symptomatic gallstone disease were evaluated with hematological, and biochemical investigations. Imaging in the form of ultrasonography, magnetic resonance cholangiopancreatography (MRCP), computed tomography (CT), and endoscopic retrograde pancreatography (ERCP) were performed when required. All patients were counseled and consent was taken prior to surgery.

Operative Techniques

We have been using the standard 4 port technique for LC, with a 10 mm camera port and three 5 mm working ports (**Figure 1,2**). Calot's first approach is chosen if the anatomy is clear to establish CVS, clipping cystic artery, duct and then dividing it. Fundus first method (FFA) is opted in cases of difficult calot's dissection. In this technique, we start by dissecting the gall bladder from bed up to the hepatocystic triangle followed by anterior delineation of Hartmann's followed by dissection of the cystic duct, and artery. They are then clipped and divided. Drains were not routinely used but when faced with

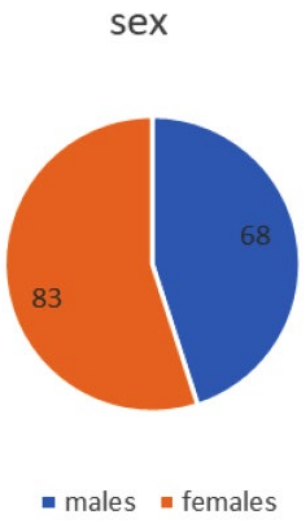

Figure 1: Sex distribution among laparoscopic cholecystectomies.

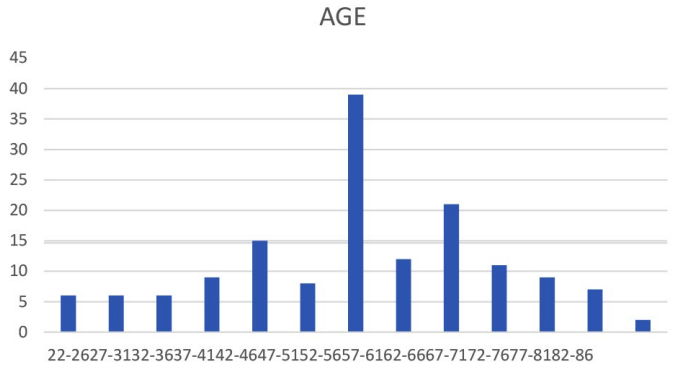

Figure 2: Age distribution among laparoscopic cholecystectomies.

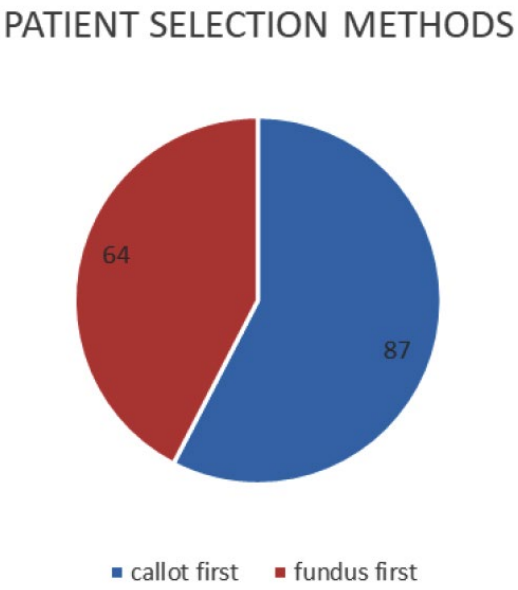

Figure 3: Distribution of patients who underwent FFA Vs CFA.

difficult procedure drains were placed. An extra port was placed 3 cm down to the left subcostal margin to retract the omentum over the gallbladder whenever required.

Patient demographics, operative details (fundus first or Calot's first approach, operative time), length of stay, and complications (immediate, delayed) were recorded.

Statistical Analysis

Data was entered in a Microsoft Excel spreadsheet and analyzed using SPSS software with common descriptive statistics mean, median, mode, and standard deviation. The p-value was analyzed from the Chi-square test and student's t test.

Results

Baseline Demographic Details

A total of 151 patients underwent LCs during this period. Of those who participated, 68 were males and 83 were females (**Figure 1**) with the age group of population ranging from 22 yrs to 86 yrs (**Figure 2**). Of these 87 patients (37 males and 50 females) underwent LC with conventional CFA and 64 patients (31 males and 33 females) underwent LC with FFA (**Figure 3**).

Comparison of indications of surgery (Acute/Chronic Cholecystitis) with respect to FFA/CFA

A total of 77 patients had acute cholecystitis of which 24 patients underwent cholecystectomy with fundus first approach and the rest 53 underwent with calot's first approach (58 patients within 5 days of onset of pain, the rest all after 5 days). 57 Patients had chronic cholecystitis of which 36 patients underwent a fundus first approach and the rest 21 underwent Calot's first approach. The indication for remaining patients was symptomatic gall stone disease.

The mean operative time was 57.18 mins (min 30 and max 90 mts) for CFA and 60.23 mins (30 min and 120 max) for FFA (**Table 1**), which was similar (p=0.9).

Emergency vs Elective Surgeries

Among the 151 LCs, 66 cases were emergency surgeries (FFA-36 and CFA - 30) and 85 patients underwent elective surgery (FFA - 28 and CFA - 57). FFA is a preferred approach during emergency LC, as can be seen in our study where this approach was utilized successfully in 54% of emergent cases but only in 32% of elective cases.

Injuries

Intraoperatively there were no bile duct injuries, and no bowel injuries were encountered with either of the procedures. This indicates the safety of both approaches concerning these life-threatening injuries. Both the procedures were successful with no conversion to open procedure and FFA was useful when CFA was not possible or when difficult dissection was contemplated. FFA prevented conversion to open procedure in these difficult cases. In 40 of 67 cases of FFA, the dissection began as CFA but as the Calot's anatomy was not clear it was later changed to FFA. (**Figure 3**)

Complications

Bleeding

13 patients (6 patients with CFA, and 7 patients with FFA) had bleeding during dissection but none required additional measures like transfusion. This was observed in patients with severely inflamed gallbladder which could have contributed to bleeding, and increased duration of surgery.

Incidence of Bile Leak and Duration of Hospital Stay

The median hospital stay was 1.2 days (1-4 days) for FFA and 1.3 days (1-4 days) for CFA, (p=0.05). Five patients with FFA (7.8%) and 2 patients with CFA (2.2%) had bile leaks during the postoperative stay (p=0.33). This was a gall bladder bed leak which was managed conservatively with the drain placed intraoperatively. They were discharged with a drain and during follow-up, the drains were removed after confirming the absence of collections. The duration of postoperative hospital stay in these patients was not affected by the biliary leakage. Higher biliary leak in FFA can be attributed to cases with increased inflammation with altered anatomy in the FFA group, though this had no statistical significance (**Figure 4**). (**Table 1**)

Delayed Complications

Six people (3 in FFA and 3 in CFA) had intraabdominal collection during follow-up and on evaluation were found to have minor cystic duct leak, for which ERCP and CBD

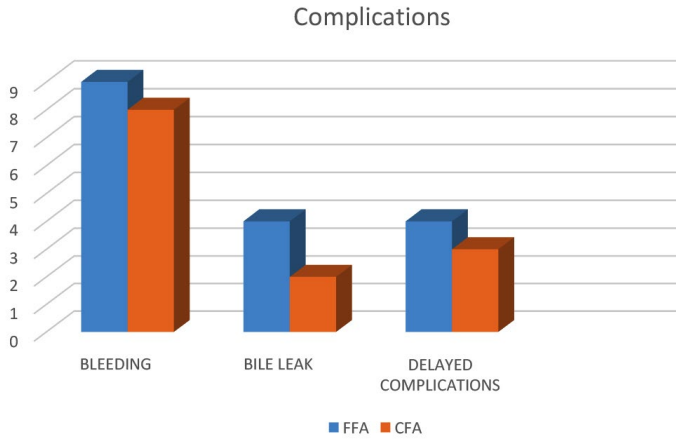

Figure 4: Comparison of bleeding, duration of hospital stay, bile duct injuries between CFA and FFA.

Table 1: Comparison of operative time, bleeding, hospital stay, and bile duct injuries between CFA and FFA.

	N	CFA (n=87)	FFA (n=64)	P-Value
Operative time (minutes), mean + standard deviation		57.2 ± 14.1	60.2 ± 17.5	0.9
Bleeding, n	13	6	7	0.12
Hospital stay, mean		1.3 Days (Mean)	1.2 Days (Mean)	0.05
Bile duct injuries, n	7	5	2	0.33

stenting, followed by USG-guided drainage was done. There were no readmissions during the follow-up and no major complications during the study.

Discussion

Calot's first method and fundus first method are two principal approaches to laparoscopic cholecystectomy. Calot's first method, a standard technique used worldwide, depends on achieving a critical view of safety (identification of biliary anatomy) before division of cystic duct. Challenges encountered during distorted or obscured biliary anatomy require FFA[9]. Common reasons for conversion include fibrotic adhesions at Calot's triangle, fibrosed GB, empyema, and gangrene of GB (the reasons for unclear anatomy at Calot's triangle)[10]. An alternative to avoid conversion to open surgery is to use the fundus first method to divide the GB. We performed this study to look into the effectiveness of both the approaches, and also the effectiveness of FFA in difficult cases to avoid cholecystostomies, open conversion, and bail-out procedures.

54% of emergency surgeries (where the level of inflammation is high) and 32% of elective LCs were successful with the FFA in our series. At the same time, 46% of emergency surgeries and 68% of elective surgeries were successful with CFA. This brings us to the point that Calot's approach is safe and the best method available to use during elective LC with well-defined anatomy. Though the use of CFA during emergency surgeries is well-defined, the obscured anatomy due to increased inflammation is a hindrance to this method. This can be changed to the Fundus approach successfully avoiding conversion to open procedures and minimizing the bile duct injuries.

In contrast to Saeed et al[11], whose reports on the comparison of fundus first vs. conventional dissection in LC, stated a lower duration of surgery in the fundus first group compared to Calot's first group, our series showed similar duration of surgery for FFA (60.23 minutes) vs Calot's first group (57 minutes). This can be explained by the fact that they excluded patients with acute cholecystitis, and those with a history of abdominal surgeries, all of which were included in our study.

Various authors have suggested a decline in the rate of bile duct injury[12] with the fundus first approach. Mahmud et al reported decreased conversion rate potential of FFA from 5.2 to 1.2%[13]. In our series, there were no bile duct injuries or bowel injuries with both methods indicating the importance of these methods in preventing these serious complications. The postoperative hospital stays of both procedures were comparatively the same.

Our data infers that, though FFA had more complications compared to CFA (bleeding, bile leak, abdominal collections), the difference was insignificant, and none were life-threatening and all those complications were managed conservatively.

LikeTuveri et al. who reported one of the largest series of fundus first cholecystectomy with a success of 80%[14], our study had a 100% success rate with the fundus first method during difficult Calot's anatomy with minor complications that could be managed conservatively and prevented conversion to open procedure[15].

To conclude, both Calot's first method and fundus first method are safe and effective approaches during laparoscopic cholecystectomy. Calot's method is a useful approach in elective cases, with well-defined anatomy, but it is difficult in cases with severe inflammation in Calot's (or) adhesions, leading to frozen anatomy. Fundus first approach is extremely useful in these circumstances, and can avoid subtotal cholecystectomies, cholecystostomies, and open conversion without bile duct injuries.

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