

Clinical evaluation of fundus first laparoscopic cholecystectomy in obscured calot's triangle

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Received: 09-06-2021 / Revised: 19-09-2021 / Accepted: 01-10-2021

Abstract

Background: During laparoscopic cholecystectomy dissection at the calot's triangle can be difficult due to dense adhesions, abnormal anatomy or mirizzi's syndrome. This increases the incidence of bile duct injuries resulting in conversion to open cholecystectomy and increased hospital stay and cost effectiveness and decreases the advantages conferred by laparoscopic cholecystectomy. Fundus first laparoscopic cholecystectomy offers the advantage of laparoscopic surgery without any increase in the incidence of bile duct injuries. This study was done to evaluate and observe the complications and clinical outcome of fundus first laparoscopic cholecystectomy. **Material Methods:** The prospective study was conducted on 30 patients undergoing fundus first laparoscopic cholecystectomy over a period of one year. Approval for the study was obtained from the institutional ethical committee. During laparoscopic cholecystectomy where ever the calot's triangle was found obscured, the decision of performing laparoscopic cholecystectomy using the fundus first technique was taken. Intraoperative and postoperative observations were made and complications were noted. **Results:** Fundus First Laparoscopic cholecystectomy was done in 30 patients among 138 patients undergoing Laparoscopic cholecystectomy. 73% of our patients had marked fibrosis at cystic pedicle. Operating time in our cases ranged from 80 to 140 minutes (mean, 106.73 \pm 16.85 minutes). We observed a mean hospital stay of 7.70 \pm 2.55 days in present study (range, 5 - 15 days). We had two cases of External biliary fistula due to leakage from stump and got settled with endoscopic retrograde cholangiopancreatography (ERCP) stenting. We had port site infection in 3 cases and drain site infection in 2 cases. **Conclusion:** Fundus first laparoscopic cholecystectomy is a better alternative and a bail out procedure in difficult cholecystectomy reducing incidence of bile duct injuries and offers the surgeon the same safety and versatility during laparoscopic cholecystectomy that it confers during open cholecystectomy

Keywords: Fundus first, Laparoscopic Cholecystectomy, Calots triangle, Adhesions, Bail out procedure.

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Introduction

Laparoscopic cholecystectomy has become the most standard procedure for management of symptomatic cholelithiasis or acute cholecystitis in patients without any specific contraindications. As variable as biliary anatomy is, so are the access and dissection techniques involved in laparoscopic cholecystectomy.

French surgeons initially proposed the fundus-first dissection technique as is done in open cholecystectomy. The currently used method for laparoscopic cholecystectomy was devised in 1988 and offered this procedure on an outpatient basis [1]. The traditional approach to laparoscopic cholecystectomy is to begin at Calot's triangle, identifying structures at porta hepatis, and thence proceeding with dissection towards the fundus [2].

The dissection is made difficult either by fibrosis in the region due to recurrent inflammation or normal variation in anatomy in at least 50% of the patients [3]. The most significant laparoscopic cholecystectomy morbidity is bile duct injury, which implies not only complex procedures of repair, but also serious impact on patient's outcome [4,5].

Rates of conversion to traditional laparotomy of up to 20% have been reported, especially when the gallbladder is severely inflamed [6,7].

If progress is not being made in difficult cholecystectomy like hepatobiliary triangle cannot be dissected, only dome of gall bladder is exposed, a bail out procedure is recommended. In current revisions, it is strongly recommended that surgeons make appropriate judgement and choose a bail out procedure based on intraoperative findings in order to avoid secondary damage.

Fundus first laparoscopic cholecystectomy offers the surgeon the same safety and versatility during laparoscopic cholecystectomy that it confers during open cholecystectomy [8].

Aim and objectives

1. To evaluate fundus-first method of laparoscopic cholecystectomy in obscured calot's triangle.
2. To study the clinical outcome in these patients.

Material and methods

The prospective study was conducted in department of General surgery ASCOMS and hospital for a period of one year from 1st November 2019 to 31st October 2020. Following inclusion and exclusion criteria were taken into consideration.

Inclusion criteria

- Patients suffering from cholelithiasis.

Exclusion criteria

- Pediatric age group.
- Not fit for general anesthesia.
- Patients with choledocholithiasis.

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Patients were subjected to detailed clinical history and examination and findings were recorded. Risk factors – obesity, hypertension, diabetes mellitus, chronic obstructive pulmonary disease, thyroid disorders were optimized. These patients were made to undergo routine investigations like blood, urine, chest X-ray and ECG. Special radiological investigations i.e. CT scan/MRI were done in some patients when required. After explaining the procedure to the patient, informed and written consent was taken for the procedure and recording, and these patients were operated under general anesthesia. Patients were advised to take light dinner on night before surgery and were kept fasting 8-10 hours prior to surgery. Patients were asked to micturate prior to surgery, others were catheterized if required. Orogastric tube was inserted in all cases to decompress the stomach before pneumoperitoneum was created. Appropriate dose of prophylactic antibiotic, 3rd generation cephalosporin or Piperillin + Tazobactam (in diabetics) was administered 30 minutes prior to skin incision.

During laparoscopic cholecystectomy where ever the calot's triangle was found obscured, the reasons of which were recorded, the decision

of performing laparoscopic cholecystectomy using the fundus first technique was taken. The stump of gallbladder in this method was managed by transfixation sutures and hemostasis was achieved by ultracision/cautery or suturing as per requirement. Subhepatic drain was used in all the cases. The observations were made in terms of reasons for performing fundus-first laparoscopic cholecystectomy, intraoperative complications and management, conversion to open cholecystectomy and reasons for conversion, postoperative pain assessment (VAS scale), start of oral feeds, drainage and postoperative removal of drain, ambulation and hospital stay. Pain postoperatively as well as on follow up was assessed using visual analog scale (VAS) taking a scale marked from 0-10 and asking the patient to place a finger over it and then classifying it as mild, moderate or severe.

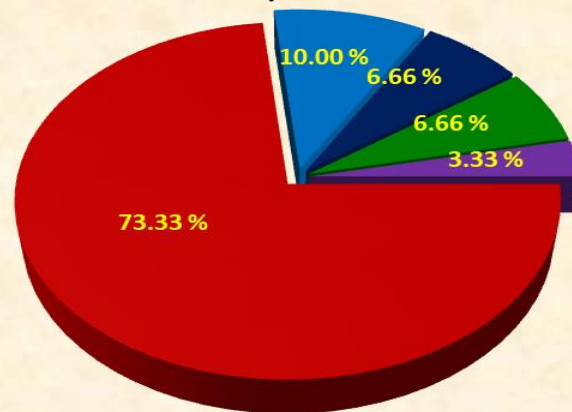
All data was tabulated, graphical analysis was made and statistical analysis in the form of ratios and percentages was done. The data is depicted into as mean \pm standard deviation or n (%) for continuous and descriptive data respectively. The suitable statistical test was applied to the available data for subgroup analysis.

Observations and results

Table No. 1: Distribution of cases according to indication for fundus first technique.

Indication	Number of cases	Percentage
Marked inflammation and fibrosis at cystic pedicle	22	73.33
Critical view of safety could not be assessed due to distorted anatomy	03	10.00
Large stones in the hartmann's pouch and adhesions with wide cystic duct	02	06.66
Fibrosed and contracted GB	2	06.66
Mirizzi syndrome	1	03.33
Total	30	100

Distribution of cases according to indication for fundus first technique



- Marked inflammation and fibrosis at cystic pedicle
- Critical view of safety could not be assessed due to distorted anatomy
- Large stones in the hartmann's pouch and adhesions with wide cystic duct
- Fibrosed and contracted GB

Table 2: Distribution of cases according to operating time.

Operating time (minutes)	Number of patients	Percentage
80-90	05	16.66
90-100	08	26.66
100-110	06	20.00
110-120	04	13.33
120-130	03	10.00
130-140	04	13.33
Total	30	100
Mean Operating time (min.) \pm SD	106.73 \pm 16.85	

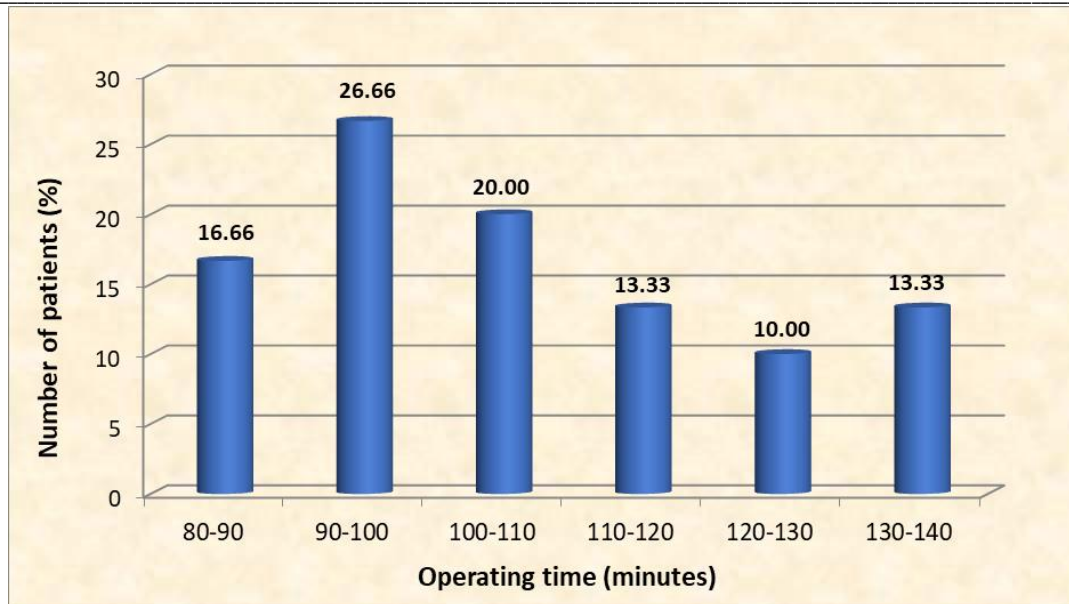


Table 3: Distribution of cases according to pain perception on 0th Postoperative day following surgery.

Visual Analogue score	At Rest	On Mobility	On Straining
	Number of patients (Percentage)		
Mild (1-3)	21 (70.00)	16	14
Moderate (4-6)	08 (26.66)	11	10 (33.33)
Severe (7-10)	01 (03.33)	03 (10.00)	06 (20.00)
Total	30 (100)	30 (100)	30 (100)

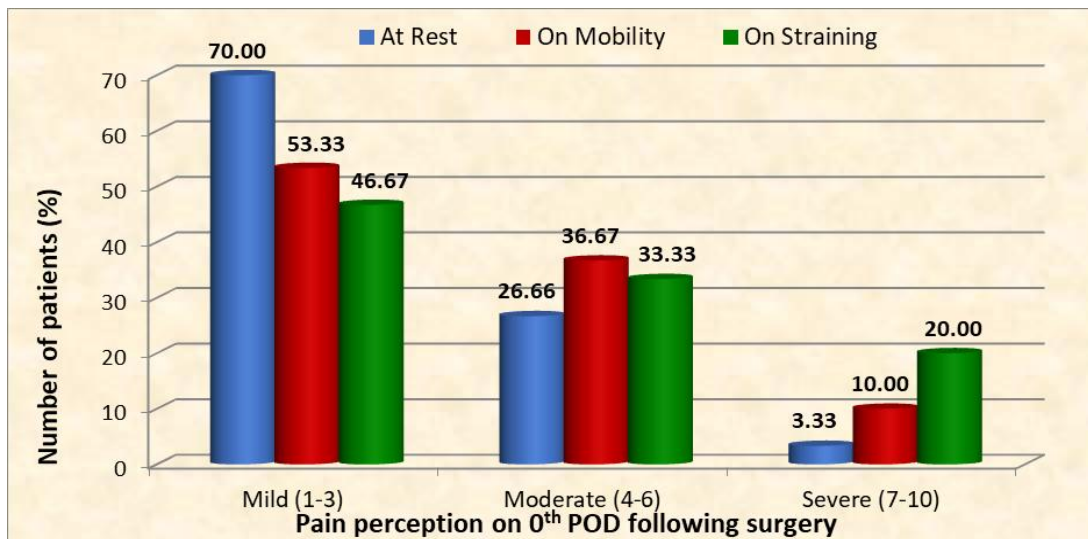


Table 4: Distribution of cases according to duration of hospital stay.

Hospital stay (days)	Number of cases	Percentage
0-5	6	20.00
5-10	22	73.33
11-15	02	06.66
Total	30	100
Mean hospital stay (days) ± SD	7.70 ± 2.55	

Results

We had 70% of patients in age group of 30 to 50 years (mean age 42.30 ± 10.60 years) with 73.33% females in our study. 16 patients (53.33%) had associated co morbidity in present study. Diabetes mellitus in 5 cases, 8 cases of Hypertension, two cases of

Hypothyroidism and one case of chronic obstructive pulmonary disease (COPD). Regarding operating indication for Fundus First cholecystectomy, 73% of our patients had marked fibrosis at cystic pedicle. For dissection during surgery, we used Ultracision in 22 cases (73%) and cautery in 8 cases. We had in one case of bleeding

from liver bed which could be managed but required one pint of blood transfusion. Operating time in our cases ranged from 80 to 140 minutes (mean, 106.73 ± 16.85 minutes). 18 out of 30 patients underwent subtotal cholecystectomy had severe acute cholecystitis with dense adhesions, and one case of Mirizzi's syndrome, we were careful and made it sure that there was no stone in the stump and always cauterised the mucosa before closure of stump. Sub hepatic drain was put in these cases. We had two cases of External biliary fistula due to leakage from stump and got settled with endoscopic retrograde cholangiopancreatography (ERCP) stenting. Mean 6 months follow-up of patients subjected to subtotal cholecystectomy was short to comment on stump left. We did cauterize the mucosa of stump and made it sure that no residual stones were there in the stump. We did not notice any patient coming back with symptoms of cholecystitis, cholelithiasis, choledocholithiasis and jaundice, pancreatitis or carcinoma arising from stump. Similarly, no case of incidental gallbladder cancer was reported in the specimens removed or in the gallbladder remnant. Out of 30 cases, 28 cases had acute cholecystitis and we observed complications in 26.66% cases. We did not convert any case to open cholecystectomy. We did not have any case of bilioma and peritonitis. There was no case of residual stones in our study. There was no CBD injury. We had no case of postoperative prolonged ileus in our study. We had 3 cases of adhesions with duodenum and one with Hepatic flexure of colon and we were able to separate gut without injury and did not require conversion. We had to induce perforation in Hartmann's pouch in one case to remove stone to ease dissection. We had two cases of contracted gall bladder which could be managed without conversion to open cholecystectomy. We had port site infection in 3 cases and drain site infection in 2 cases. We had one case of intraoperative bleeding from liver bed which required one unit of blood transfusion but was managed without conversion. We carried out Fundus First Laparoscopic cholecystectomy in 30 patients among 138 patients undergoing Laparoscopic cholecystectomy and did not convert any case to open. We observed a mean hospital stay of 7.70 ± 2.55 days in present study (range, 5 - 15 days).

Discussion

Cholecystectomy today is the commonest major abdominal surgery performed by general surgeons throughout the world. The first laparoscopic cholecystectomy was performed by Muhe, a German surgeon in 1985, however, the first laparoscopic cholecystectomy in medical literature was performed by Philip Mouret in 1987 in Paris, France. Since the time Philippe Mouret performed the first laparoscopic cholecystectomy on a human patient (Mouret P, 1991), we have come a long way and today laparoscopic cholecystectomy is regarded as a gold standard for cholecystectomy [9,10]. The traditional approach to laparoscopic cholecystectomy is to begin at Calot's triangle, identifying structures at porta hepatis, and thence proceeding with dissection towards the fundus [2]. The dissection is made difficult either by fibrosis in the region of Calot's triangle due to recurrent inflammation or normal variation in anatomy in at least 50% of the patients [3]. This increases chances of biliary tract injuries. In presence of inflammation, adhesions or in patients who are obese, visualization and dissection of calot's triangle can be difficult and the distortion of anatomy produced by traction upon the fundus, especially in the thin young patient, may lead to clipping and division of the bile duct in the belief that it is the cystic duct [11].

The potential benefits of laparoscopic surgery may be lost if conversion to an open operation is necessary whereas conversion usually following severe iatrogenic injury or bleeding and is associated with higher morbidity and mortality [12]. If progress is not being made in difficult cholecystectomy like hepatobiliary triangle cannot be dissected, only dome of gall bladder is exposed, a bail out procedure is recommended. In current revisions, it is strongly recommended that surgeons make appropriate judgement and choose a bail out procedure based on intraoperative findings in order to avoid secondary damage. Lahey and Pyrtok proposed a modification to the surgical technique – proceeding from fundus to porta hepatis. It is the

procedure in which the separation of gall bladder from the liver starts at the fundus, without initially visualizing cystic artery and cystic duct in the calot's triangle. The various terminologies used are "Fundus first", "Fundus down", "Dome down", "Retrograde cholecystectomy". Cholecystectomy from fundus to cystic duct may be advantageous when cystic duct exposure becomes difficult due to adhesions in calot's triangle. The fundus first is the most commonly used technique if a difficult case with severe inflammation of the calot's triangle is encountered. Fundus first laparoscopic cholecystectomy with subtotal cholecystectomy may offer an option that enables the completion of laparoscopic cholecystectomy while avoiding bile duct injuries as an alternative to immediate conversion to open cholecystectomy. It has been reported in literature that fundus first approach helps in reducing the conversion rates and rate of completion [13]. Fundus first laparoscopic cholecystectomy offers the surgeon the same safety and versatility during laparoscopic cholecystectomy that it confers during open cholecystectomy [8].

Bleeding from gallbladder bed of liver trickling down and obscuring the view is a theoretical problem. Although it was not a significant problem in our study. Extra care should be taken near the neck of gall bladder as bleeding may occur from cystic artery. The surgeon undertaking the difficult cases needs to be comfortable dealing with bleeding laparoscopically. In fundus first laparoscopic cholecystectomies uncontrollable bleedings from liver bed if occurs warrants prompt conversion to the open operation [14].

Patients with a 'hostile gallbladder' still pose a challenge for laparoscopic management. Identification and isolation of the cystic duct-Hartmann's Pouch junction is the key to safe cholecystectomy. The operative view and approach to Calot's triangle are of great importance, but can be impaired by severe inflammation and adhesions between the gallbladder and surrounding organs, and fibrosis between the gallbladder bed and the liver. The traditionally held view was that conversion to open surgery facilitated direct visualization and better manipulation and therefore allowed performance of a total cholecystectomy whilst avoiding bile duct injury. Conversion to open surgery does not however always provide better results [15]. Many expert surgeons believe that conversion to open surgery does not guarantee avoidance of a vasculobiliary injury [16]. Surgery is dependent on the operator's skill and experience, and some surgeons, in particular the newer generation, who perhaps have limited experience in open cholecystectomy, may find open cholecystectomy equally or perhaps even more challenging than the laparoscopic approach.

We accept that in certain situations, conversion to open cholecystectomy is necessary, for example in situations where there is uncontrollable haemorrhage, however in the case of a hostile gallbladder it is suggested that open surgery may not provide better visualization and a safer dissection, and could actually increase patient morbidity. Open sub-total cholecystectomy has proven to be a safe procedure when faced with a severely inflamed and fibrotic gallbladder where one cannot safely delineate the anatomy of Calot's triangle [16]. With increasing laparoscopic experience, Fundus First laparoscopic cholecystectomy has become a safe and feasible alternative procedure to open cholecystectomy when faced with a 'hostile gallbladder' [17].

It has been reported that partial cholecystectomy and the fundus first technique resulted in decreased rate of complications [18]. Subtotal cholecystectomy is a definitive operation that prevents recurrent gallstone formation, as no residual diseased gallbladder mucosa is left in continuity with the biliary system. It provides a simple, safe option in patients in whom cholecystectomy could be hazardous.

We should consider subtotal cholecystectomy when the critical view cannot be established and when it is not considered safe to continue with a laparoscopic total cholecystectomy. This rationale is to recommend Fundus First with subtotal cholecystectomy which has shown to reduce bile duct injury, severe intra-operative haemorrhage and conversion to open surgery. Dome down cholecystectomy is not performed routinely, but is used in cases when the cholecystic dissection is difficult to approach with the standard technique giving a

safer dissection with a proper exposure of the elements of the cystic hilus.

Laparoscopic cholecystectomy from fundus downward is desirable when exposure of the cystic duct is difficult and hazardous. First, the cystic duct and artery are exposed and clipped, and the artery is divided. This affords better visualization of the cystic duct and common bile duct (CBD) with less chance of common bile duct injury.

The general approach in difficult cholecystectomy is performing fundus first or conversion to open approach. In our study, we performed the fundus first technique before proceeding with conversion. We accomplished successful cholecystectomy in all the patients using the fundus first approach and avoided the potential complications of in these patients.

Conclusion

Fundus First Laparoscopic cholecystectomy remains a safe option when dealing with patients with difficult anatomy at the Calot's triangle and a scarred porta hepatis. Its use contributes significantly to a substantial reduction of the conversion rate in patients who otherwise were candidates for conversions of the laparoscopic procedure due to an unclear anatomy. In turn, especially in these cases, Fundus First Laparoscopic cholecystectomy would become a technically demanding procedure, even in experienced hands, and its adoption needs good surgical judgment. Subtotal cholecystectomy is an important tool for general and hepatobiliary surgeons facing complex intraoperative situations at high risk of postoperative complications. Subtotal cholecystectomy is not a replacement for total cholecystectomy however, when necessary, it achieves morbidity rates in difficult gallbladders comparable to those reported for total cholecystectomy, especially regarding common bile duct (CBD) injuries.

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Conflict of Interest: Nil

Source of support: Nil