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Evaluation of fundus first laparoscopic cholecystectomy in an obscured calot triangle: outcomes

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Abstract

Background: A fundus first laparoscopic cholecystectomy when performed by an experienced surgeon, provides the same level of safety and durability as an open cholecystectomy. When Calot's triangle cannot be safely dissected during laparoscopic cholecystectomy a rescue treatment is advised. Current revisions stress the importance of intraoperative observations in helping surgeons make a rescue decision and minimize additional harm.

Objective: To examines the fundus-first strategy in laparoscopic cholecystectomy in an indistinct Calot's triangle and the patient's clinical outcome.

Patients and Methods: This is a prospective study that was done in Rizgary Teaching Hospital from January 1st, 2020 to December 31st, 2022, on 68 cases who underwent laparoscopic cholecystectomy where Calot's triangle was difficult to distinguish during the operation. Fundus: first dissection of the gall bladder down to the infundibulum and after safe ligation of the gall bladder stump and good hemostasis of the liver bed, the gallbladder is removed via a 10-mm port. This research looked at the duration of operation, postoperative pain, rate of conversion to open surgery and duration of the hospital stay.

Results: Among 68 cases of fundus first laparoscopic cholecystectomy most of the patients were female 45(66.17%) and 23(33.82%) were male, majority of cases were between 31 and 50 years old, with a mean age of 39±10.44, and the majority of patients were complaining of inflammation with fibrosis at the site of the cystic duct. The duration of operation ranged from 45-60 minutes in 16(23.52%) and 60-80 minutes in 20(29.41%) cases and 130-140 minutes in 2(2.94%) cases. The majority of our cases remained in the hospital and ambulated on day 3-5, and the main hospital stay was 4.68±1.8 days. There was statistical significance in the age distribution with a P-value 0.04.

Conclusion: Fundus first laparoscopic cholecystectomy remains a feasible and safe procedure. Surgeon experience and judgement affects the operative time, conversion rate, morbidity and hospital stay in difficult and obscured Calot's triangle.

Keywords: Difficult Calot's, Fundus first laparoscopic cholecystectomy, Gall stones.

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Introduction

Laparoscopic cholecystectomy (LC) is now the gold standard for the management of symptomatic gallstones and acute cholecystitis unless there are major contraindications or patients with comorbidities. Biliary anatomy, as well as laparoscopic cholecystectomy's access and dissection procedures, may vary greatly. The fundus-first dissection method of open cholecystectomy was originally suggested by French surgeons. The current LC approach was developed in 1988, and it was available as an ambulatory option (1). Calot's triangle is the traditional starting point for LC, followed by porta hepatis structural identification and then dissection to the fundus (2). When at least half of patients have trouble dissecting because of fibrosis brought on by multiple inflammations or because their anatomy is different (3). A Common bile duct injury is the most dangerous complication of LC since it requires sophisticated operations to deal with such an injury and has substantial consequences for the patient's health (4,5).

When Calot's triangle is not possible to dissect first in cholecystectomy, and only the gall bladder's fundus is exposed, then a rescue treatment is advised (6,7). Current revisions stress the importance of intraoperative observations in helping surgeons make a rescue decision and minimize additional harm. When compared to open cholecystectomy, the safety and durability of fundus first laparoscopy for cholecystectomy (FFLC) are almost identical (8).

Previous reports from the United Kingdom quoted that cholelithiasis affects 10–15% of the adult population, with the vast majority displaying no symptoms (9). In the surgical management of symptomatic cholelithiasis, LC remains the gold standard. Indications include biliary colic, cholecystitis, common bile duct stones, and biliary dyskinesia (10). Severe complications may arise even during a routine cholecystectomy (11). Due to severe adhesions and fibrosis, difficulty distinguishing key anatomical structures from the critical view of safety increases surgical risk and is the most common reason for conversion to open cholecystectomy (12). In addition, technique conversion is associated with a significantly increased incidence of postoperative complications (13).

In the fundus-first (FF) approach, the dissection begins from the fundus of the GB to the infundibulum make identifying the structures within Calot's triangle simpler for the operating surgeon (14).

This study has the potential to help us minimize hospital burdens by shortening hospital stays, lowering bed occupancy rates, and speeding up surgical procedures (15,16). Junior surgeons lack open surgery expertise in the age of minimally invasive surgery.

This may cause an increase in the incidence of common bile duct (CBD) transection or resection (17).

Clipping or cutting any structure before unequivocal identification of the structure is a mandatory component of the safe LC procedure, as is using the safest surgical technique (not the fastest) that is currently available, such as the critical view technique of Strasberg et al. with the circumferential dissecting of GB at the infundibulum to mimic the retrograde laparoscopic cholecystectomy (RLC) technique of the open era (18).

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However, conversion is linked to higher costs and both short- and long-term morbidity, thus a low threshold for conversion is not always indicative of efficient practice (19) . Retrograde or "fundus first" dissection was often utilized by surgeons during the days of open surgery, however, some surgeons only used it as a defensive measure in really difficult situations (20).

In most cases, retrograde dissection is used to turn a laparoscopic procedure into an open surgery. In the beginning of LC, when only fundamental instruments were available, RLC may have been underutilized. However, with the widespread availability of laparoscopic liver retractors, it is now possible to mobilize the gallbladder fundus-first while the liver is supported by a retractor and prevent the liver from traction during the procedure otherwise it will be difficult to use the fundus-first approach in LC (21).

This study aims to perform the fundus-first strategy in laparoscopic cholecystectomy when the calot's triangle is obscured and assesses its impact on the patient's clinical outcome.

Patients and Methods

This prospective study was done at Rizgary Teaching Hospital from January 1st, 2020 to December 31st, 2022 on 68 cases who underwent laparoscopic cholecystectomy during which it was difficult to define Calot's triangle.

Patients who were diagnosed with cholelithiasis were required to meet the inclusion criteria .

The criteria for exclusion include the age group known as pediatrics, individuals who are unsuitable for receiving general anesthesia, individuals who are suffering from choledocholithiasis and easy accessible laparoscopic cholecystectomies.

Patients underwent a full history and clinical examinations to find out risk factors like obesity, diabetes, thyroid diseases, ischemic heart disease, and chronic obstructive lung disease. These patients were subjected to routine and special laboratory and radiological investigations including CT and MRI. After a full explanation of the procedure, informed consent was taken and recorded and these patients were operated on under general anaesthesia. An appropriate dose of prophylactic antibiotics, 3rd generation cephalosporin and Metronidazole, was administered 30 minutes prior to the first incision of the skin.

In cases where the calot's triangle was obscured during laparoscopic cholecystectomy, the choice to proceed with the fundus-first method was made, and the underlying causes were documented. Hemostasis was performed using cautery or suturing, if needed, and the gallbladder stump was handled via cutting or trans-fixation sutures. In each instance, a subhepatic drain was placed. Fundus-first laparoscopic cholecystectomy indications, intraoperative complications and management, conversion to open cholecystectomy and reasons for conversion, postoperative pain assessment (VAS scale), oral feeding initiation, drainage, drain removal, ambulation, and length of hospital stay were all recorded. Patient's stay in the hospital and discharged when bowel sound is positive, the fully mobilized and drains are removed.

Patients were asked to put a finger on a scale from 0 to 10 (0= no pain and 10= severe pain) to rate their level of pain after surgery and

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throughout follow-up, with a high score indicating more severe pain.

Surgical Technique

In the FFLC, with the four-port technique, a telescope and camera monitor were used as standard in all cases and underwent the operations. Intraoperatively when Calot's triangle is obscured the fundus is first approached by elevating the liver with a liver retractor (Nathenson retractor). Dissection was performed by first incising the visceral peritoneum with a hook from the infundibulum away from Calot's triangle down the gallbladder bed to the fundus, and then working backwards from the fundus to the infundibulum. This procedure resulted in the cystic artery and duct leaving the gallbladder in a pedunculated position. The duct and the artery of the gall bladder were identified and stapled. The gallbladder is removed from the abdomen via the 10-mm port after good hemostasis of the liver bed.

Statistical Analysis

The data were tabulated on a specially designed questionnaire, collected and entered into a computer via a Microsoft Excel worksheet (Excel 2016) and then analyzed using an appropriate data system which is called Statistical Package for Social Sciences (SPSS) version 28 were compared between patients with different variables and a P-value of $\leq$ 0.05 was considered statistically significance. The results are presented as rates, ratio, frequencies, percentages in tables and figures and analyzed using t-test, and Chi square tests.

Results

Among 68 cases the majority of patients who were candidates for fundus first laparoscopic cholecystectomy were female 45(66.17%) and 23(33.82%) were male. The majority of cases were between 31 and 50 years old, with a mean age of 39±10.44 as shown in Table (1).

Table (1): Age and Sex Distribution

Age / Year	Male	Female	Total (Percentage)
21-30	3	3	6 (8.82%)
31-40 *	9	19	28(41.17%)
41-50 *	7	16	23(33.82%)
51-60	2	4	6 (8.82%)
61-70	2	3	5 (7.35%)
Total	23(33.82%)	45(66.17%)	68(100%)

* Significant correlation between Age group 31-50 to genders P value 0.04

Regarding the indication of shifting to the fundus first technique the majority of patients had inflammation with fibrosis at the site of the cystic duct. as illustrated in Table (2).

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Table (2): Fundus first technique according to the indications

Indications	Number of patients	Percentage
Mild inflammations and fibrosis at the cystic duct pedicle	45	66.17%
Obscured (CVS) because of disfigured anatomy	6	8.82%
A large stone in Hartman's pouch , adherence with the dilated cystic duct	7	10.29%
Contracted gall bladder or fibrosis	6	8.82%
Mirizzi syndrome	4	5.88%

*No significant correlations found between these indications P vale 0.055

The Mean operation time was 96.74±18.23 minutes and the duration of operation ranged from 45-60 minutes in 16(23.52%) and 60-80 minutes in 20(29.41%) cases and 130-140 minutes in 2(2.94%) cases as shown in Figure (1).

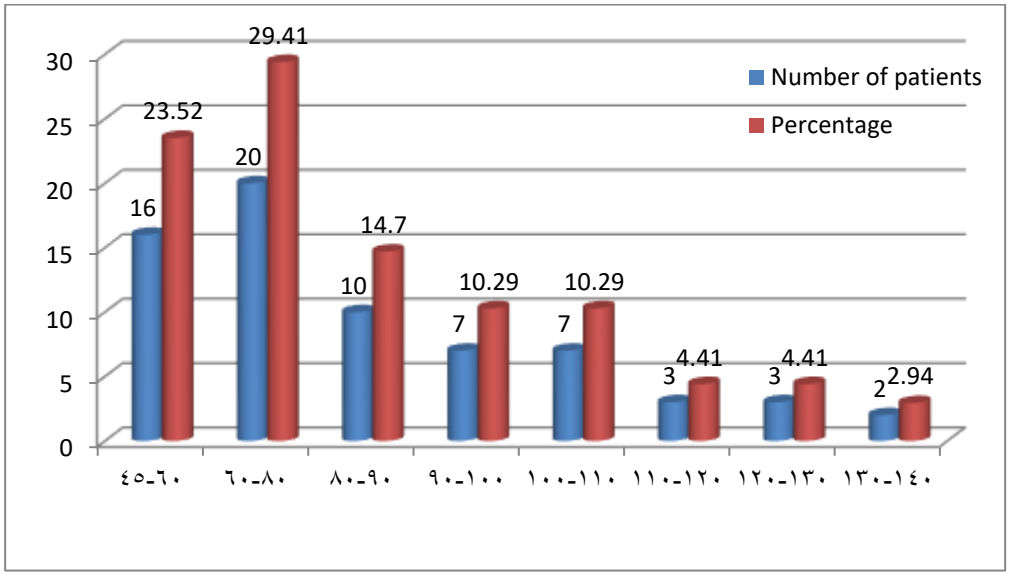

Figure (1): Distribution of Operation Times with Mean Duration

Twenty-six (38.23%) out of 68 cases were managed by subtotal cholecystectomy due to severe adhesions in the Calot's triangle or because of an acute attack of cholecystitis and three of them had Mirizzi syndrome. all these were done after we ensured that there was no stone in the remnant part of the gall bladder or the stump and their mucosa was cauterized by electrocautery. No cases of remnant stone in the stump, attacks of cholangitis, pancreatitis or stone in the biliary tree were not found during 6 monthly follow up of each patient.

In 4(5.88%) cases bile leakage was noted post operatively in the subhepatic drain that was left during the operation, 2 of them were stopped after 72 hours postoperatively and the remaining two cases needed ERCP and then bile leakage was stopped.

According to the visual analog scoring system, the majority of patients have experienced mild

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pain at rest, during mobility and during straining which is shown in Table (3).

Table (3): Arrangement of cases according to the pain perception on the 0th postoperative day following surgery

Visual analogue score	At rest	On Mobility	On straining
	Number of patients (Percentage)		
Mild (1-3)	49 (72)	38 (55.88)	34 (50.00)
Moderate (4-6)	17 (25)	23 (34.26)	25 (36.76)
Severe (7-10)	2 (2.94)	7 (10.29)	9 (13.24)
Total	68 (100)	68 (100)	68 (100)

*There is no association between the "Visual Analogue Score" and the different conditions. the p-value is 0.056

The majority of our cases remained in the hospital and ambulated at day 3-5, and the main hospital stay were 4.68±1.8 days as clarified in Table (4).

Table (4): Period of stay in hospital and ambulation

Hospital stays (Days)	Number of cases	Percentage
0-3	19	27.94
3-5	47	69.11
6-10	2	2.94
Total	68	100
Mean Hospital stay (days) ± SD	4.68±1.8	

Most of the cases were in difficulty category II and our conversion rate to open cholecystectomy was 7 (10.29%), in which 4 cases (2 male and 2 female) were in category IV level of difficulty. which is shown in Table (5).

Table (5): Difficulty category to sex distribution with conversion to open cholecystectomy

Difficulty level	Male	Female	Total(percentage)	Conversion (Percentage)
I	4	2	6 (8.82)	0
II	12	30	42 (61.76)	1 (1.47)
III	2	8	10 (14.7)	2 (2.94)
IV	5	5	10 (14.7)	4 (5.88)

* No significant correlations found between difficulty levels according to gendres to the conversion rates. P value was 0.055

There were major difficulties during surgery mainly in the form of bleeding, bile leakage and stone spillages to the peritoneal cavity. In 3(4.41%) cases of severe bleeding from the gall bladder bed in the liver, each required one pint of blood transfusion. The majority of gallbladder injuries and spillage were found in grade II as shown in Table (6).

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Table (6): Gall bladder injury and bile spillage according to grades of difficulty

Grades of difficulty	Number of cases	Gallbladder injury cases	Percentage
I	6	0	0
II	42	9	13.23
III	10	3	4.41
IV	10	0	0
Total	68	12	17.64

* No significant correlations found between Grades of difficulty to the gall bladder injuries. P value was 0.057

Discussion

Fundus first laparoscopic cholecystectomy has been successfully adapted in complicated cases when dense adhesions or fibroses and chronic inflammation of the Calot's triangle are observed. The fundus first approach is typically performed. As an alternative to reverting immediately to an open approach, fundus first (dome down) laparoscopic gall bladder removal allows for the completion of laparoscopic cholecystectomy without inflicting bile duct damage. Research has shown that taking a fundus-first approach can decrease both conversion and completion rates (22).

A fundus first cholecystectomy was performed in the following conditions; dense adhesions, impacted stones in Hartmann's pouch, a short dilated cystic duct, Mirizzi syndrome, a constricted gallbladder, and swelling and hardness at the junction of the common and cystic ducts (16,23,25).

According to this study, the gender and age distribution of patients were 66.17% female and 74 % of the age group of 30-50 respectively, which predicts an increase in difficulty in identifying the critical view of safety as in Mir et al about 73% female patients and 74% at the age of 30-50 years underwent fundus first laparoscopic cholecystectomy (24).

The degree of difficulty in cholecystectomy as classified by Orhan Bat into 4 classes, our results were: class I about 8.82%, class II about 61.76%, class III about 14.7% and class IV about 14.7%, this indicates a greater frequency of class II difficulty (adhesions of Calot's triangle resulting in the difficult dissection of the cystic artery and cystic duct) among the patients with laparoscopic cholecystectomy, which needs a fundus first approach, as its mimic Mishra BM et al. study about 71% in class II (25).

According to Neri, RLC cut down the period of operation and was simpler to carry out. They advocated for it to become the norm, rather than an exception made solely in exceptional circumstances (26).

The mean duration of the operative time in our study was about 96.74%± 18.23 while Cengiz et al reported a mean operation time of about 66.7 and a mean hospital stay of 4.68±1.8 the same as M. Kelly et al about 1/2 to 5 days (mean 2.2) due to the usage of a Ligasure shearing device in calot s triangle dissection (23,27).

In our study, the conversion rate from fundus first to open cholecystectomy was higher in grade IV, at 5.88%, Conversion to open

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cholecystectomy is necessary for several reasons, including impacted stones, Mirizzi syndrome, and bleeding that cannot be controlled laparoscopically. The rate at which patients required open surgery was reduced from 5.2% to 1.2% when the FF approach was used in the study by Mahmud (28).

Regarding gall bladder injury and bile, spillage depends on the degree of difficulty, but most bile injury and spillage was in grade II about 13%, while in the Cengiz study, was about 4% which explains the usage of ultrasonic devices rather than mechanical closure (23).

Conclusions

Fundus first laparoscopic cholecystectomy remains a feasible and safe procedure in the hands of experienced surgeons and the surgeon's judgment affects the operative time and need for conversion, which would subsequently impact the morbidity rate and hospital stay in difficult and obscured Calot's triangle.

Recommendations

We recommend to provide concise steps for the laparoscopic cholecystectomy, emphasize adherence to ethical guidelines, outline the four ports technique and specify concise step-by-step description of the fundus-first approach.

Source of funding: The current study was funded by our charges with no any other funding sources elsewhere.

Ethical clearance: The patient selection and data-gathering methods were authorized by the Ethical Committee of Hawler Medical University's College of Medicine. The patients provided written informed permission for the surgical operation, research participation, and publishing of the results and any accompanying photos. The study adhered to the ethical criteria set by the institutional and national research committees, as well as the 1964 Helsinki Declaration. (Document no. 2024AJN840).

Conflict of interest: Nil

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تقييم عملية استئصال المرارة بالناظور بدءاً من القاع في حال كون مثلث كالوت مبهماً: النتائج

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الملخص

خلفية الدراسة: عندما يُجرى استئصال المرارة بالمنظار مع التركيز على الجزء السفلي للمرارة أولاً، يوفر هذا المستوى نفس مستوى السلامة والمتانة كما في الجراحة المفتوحة عند إجرائها من قبل جراح متمرس. وعندما لا يمكن تمييز مثلث كالوت بأمان أثناء جراحة استئصال المرارة بالمنظار، يُنصح بإجراء علاج إنقاذ. تؤكد المراجعات الحالية على أهمية الملاحظات داخل الجراحة في مساعدة الجراحين على اتخاذ قرار الإنقاذ وتقليل الأذى الإضافي

اهداف الدراسة: تهدف هذه الدراسة إلى استكشاف استراتيجية التركيز على الجزء السفلي أولاً في استئصال المرارة بالمنظار في حالات عدم وضوح مثلث كالوت وتأثيرها على نتائج العلاج للمرضى.

المرضى والطرائق: هذه دراسة استطلاعية أُجريت في مستشفى رزكاري التعليمي من ١ يناير ٢٠٢٠ إلى ٣١ ديسمبر ٢٠٢٢ على (٦٨) حالة أجريت لها جراحة استئصال المرارة بالمنظار حيث كان من الصعب تمييز مثلث كالوت خلال العملية. يتم في هذا البحث تحليل تشريح الجزء السفلي للمرارة حتى القاعدة الجذعية وبعد ربط قاعدة المرارة بشكل آمن وضمان التوقف الجيد للنزف في الكبد، يتم إزالة المرارة عبر فتحة ١٠ ملم. درس هذا البحث مدة العملية، وآلام ما بعد العملية، ومعدل التحويل إلى جراحة مفتوحة، ومدة البقاء في المستشفى.

النتائج: من بين ٦٨ حالة تم إجراء استئصال المرارة بالمنظار مع التركيز على الجزء السفلي أولاً، كان معظم المرضى من الإناث ٤٥ (٦٦.١٧٪) و٢٣ (٣٣.٨٢٪) من الذكور، وكانت غالبية الحالات في الفترة العمرية بين ٣١ و٥٠ عامًا، مع متوسط عمر يبلغ ٣٩ ± ١٠.٤٤ عامًا، وكانت غالبية المرضى يشتكون من التهاب مع تليف في موقع القناة المرارية. تراوحت مدة العملية بين ٤٥-٦٠ دقيقة في ١٦ حالة (٢٣.٥٢٪) وبين ٦٠-٨٠ دقيقة في ٢٠ حالة (٢٩.٤١٪) وبين ١٣٠-١٤٠ دقيقة في ٢ حالة (٢.٩٤٪)، وبقيت غالبية حالاتنا في المستشفى وتم التنقل في اليوم الثالث إلى الخامس، وكانت مدة البقاء الرئيسية في المستشفى ٤.٦٨ ± ١.٨ أيام. كان هناك تفاوت إحصائي في توزيع الأعمار فقط قيمة P ٠و٠٤.

الاستنتاجات: يظل استئصال المرارة بالمنظار مع التركيز على الجزء السفلي أولاً إجراءً آمنًا وقابلاً للتطبيق. يؤثر خبرة الجراح وتقديره على مدة العملية، ومعدل التحويل، والمضاعفات، ومدة البقاء في المستشفى في حالات مثلثات كالوت الصعبة والمعتمة.

الكلمات المفتاحية: مثلث كالوت الصعب، استئصال المرارة بالمنظار مع التركيز على الجزء السفلي أولاً، حصوات المرارة.

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تاريخ استلام البحث: ٢ نيسان ٢٠٢٤

تاريخ قبول البحث: ٢ حزيران ٢٠٢٤

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