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Original Research Article

Advantage of fundus first method over conventional approach in difficult laparoscopic cholecystectomy: a prospective study

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ABSTRACT

Background: Fundus first method is a widely accepted and practiced procedure in open cholecystectomy to deal the difficult cases but laparoscopic surgeons still have reserved opinion regarding use of fundus first approach in difficult laparoscopic cholecystectomy (DLC). As in open cholecystectomy fundus first laparoscopic cholecystectomy (FFC) can have advantages over conventional laparoscopic cholecystectomy (CLC) in DLC. So many preoperative, intraoperative, postoperative information were collected in both CLC and FFC and compared to evaluate whether FFC has any advantage over CLC in difficult laparoscopic cholecystectomy.
Methods: A total 73 cases were included in the study that underwent laparoscopic cholecystectomy (LC) for gall stone diseases and intraoperatively found to be difficult cases. They were distributed into 4 classes i.e. Class I, Class II, Class III and Class IV according to the type of difficulty encountered during surgery.
Results: Out of the 73 patients 24 were male and 49 were Female. Age of patient ranged from 14 to 70 years with mean age of 42.64 years. Out of 38 cases operated with FFC 6 cases (15.78%) needed conversion to open cholecystectomy as compared to 26 out of 35 (71.14%) cases that underwent CLC where conversion was done. Mean duration of hospital stay is 4.19±3.053. Mean hospital stay in FFC is 2.58±1.869 days and that of CLC is 5.14±3.143 which is clearly much higher and statistically significant ($p< 0.001$) than mean hospital stay in case of FFC.
Conclusions: FFC has advantages over CLC in difficult LC i.e. reduced conversion rate, lesser hospital stay and less duration of antibiotic use.

Keywords: Conversion, Difficult laparoscopic cholecystectomy, Fundus first method

INTRODUCTION

Since the first laparoscopic cholecystectomy (LC) by Erich Mühe in Böblingen, Germany [on September 12 1985 this surgical procedure has evolved a lot over the period and wide acceptance by both surgeons and patients has made it the gold standard for treatment of symptomatic gall stone disease by 2014.[1-3] Laparoscopic cholecystectomy has generally accepted advantages like more comfort, better cosmesis, less post-operative pain and less hospital stay. Even after invention of so many effective advance instruments for laparoscopic surgery, the experience and skill of the surgeons contribute the most towards a successful laparoscopic cholecystectomy. The basic technique in LC is approaching the Calot's triangle to identify and isolate Cystic duct and cystic artery followed by separate ligation and transaction of both, separation of Gall bladder from liver surface and its delivery to out of abdominal cavity through the port site incision. But all surgeons face intraoperative difficulties in few cases of LC which can be termed as "difficult laparoscopic cholecystectomy (DLC)". Although there is no universally accepted definition and grading of difficult laparoscopic cholecystectomy, publication by Orhan Bat

found to be useful.[4] He classified DLC into 4 classes i.e. Class I difficulty: Adhesion of omentum and hollow viscus to fundus of the gallbladder, Class II difficulty: Adhesions of Calot's triangle causing difficult dissection of cystic artery and cystic duct, Class III difficulty: Difficulty in dissection of gallbladder from liver surface, Class IV difficulty: Difficulty to approach fundus of gall bladder or Calot's triangle due to intra-abdominal adhesions and technical problems. In many cases of difficult laparoscopic cholecystectomy, after initial attempt surgeons opt for conversion to open cholecystectomy to complete the cholecystectomy and to avoid injury to surrounding viscera. But it nullifies the advantages of laparoscopic surgery for both the surgeon and patient. In these difficult cases it becomes cumbersome to approach the Calot's triangle and to isolate cystic artery and cystic duct without injuring surrounding structures like common bile duct.

Fundus first cholecystectomy is a well accepted method in open cholecystectomy where dissection starts from the fundus and continued in retrograde manner. After separation of it from the liver bed gall bladder hangs with the support of cystic duct and cystic artery. This results in better visualisation of the anatomy to complete cholecystectomy. But surgeons have reservation towards routine use of fundus first approach in LC while approaching difficult cases.

The present study is an attempt to evaluate the usefulness of "fundus first approach" in difficult laparoscopic cholecystectomy by comparing different preoperative, intraoperative and postoperative parameters with that of conventional laparoscopic cholecystectomy in difficult cases.

METHODS

This prospective study was conducted in our institution from 2016 to 2018. Cases of symptomatic gall stone disease those underwent laparoscopic cholecystectomy and found to have intraoperative difficulties were included in the study.

Inclusion criteria

- Patients with USG proven calculous cholecystitis who underwent elective laparoscopic cholecyst-ectomy and found to have intraoperative difficulties.

Exclusion criteria

- Acalculous cholecystitis
- Cholangitis
- Bilioenteric fistula
- Carcinoma of the gallbladder
- Common bile duct stone
- Diabetes mellitus
- Ischemic heart disease
- Congestive cardiac failure
- Chronic renal diseases

Patients were categorised into 4 classes of difficulties (Class-I, II, III, IV) according to the intraoperative findings and difficulties encountered by the surgeons. Every surgeon has experience of conducting more than 250 LC. In our institution usually the delayed laparoscopic cholecystectomy procedure is followed except the emergency cases. Total 73 patients were included in the study. Patients were subjected to either fundus first LC (FFC) or conventional LC (CLC) as per the preference of the surgeons. The surgical procedure followed was totally the decision of the operating surgeon and was not influenced by the present study. Different preoperative, intraoperative and postoperative parameters were collected and compared to find out whether FFC has any advantage over CLC in difficult laparoscopic cholecystectomy.

Statistical analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS version 22). A value of $p<0.05$ was considered statistically significant derived by Chi-square test.

RESULTS

Out of the 73 patients 24 were male and 49 were Female. Age of patients ranged from 14 to 70 years with mean age of 42.64 years. Most of the difficult cases are in the age group of 31-50 years i.e. 48 cases out of which 35 are female and 13 are male (Table 1).

Table 1: Age and sex distribution.

Age in years	Male	Female
11-20	0	1
21-30	3	5
31-40	7	20
41-50	6	15
51-60	5	3
61-70	3	5
Total	24	49

Cases were classified into different predefined categories as per the type of difficulty causing hindrance to conduct laparoscopic cholecystectomy. 3 cases fell under category I, 52 cases under class II, 8 cases under class III and 10 cases under class IV.

Table 2: Distribution of cases according to difficulty category and sex distribution.

Difficulty level	Male	Female	Total	Percentage
I	2	1	3	4.1
II	14	38	52	71.23
III	2	6	8	~11
IV	6	4	10	13.69

Class II difficulty i.e. difficult Calot's triangle was found to be the most commonly encountered difficulty during the study (71.23 %) majority of which contributed by female patients and the least encountered difficulty was class I (Table 2).

Out of the 73 cases 38 cases underwent FFC and 35 cases underwent CLC. Out of 38 cases operated with fundus first approach 6 cases (15.78%) needed conversion to open cholecystectomy as compared to 25 out of 35 cases (71.14%) that underwent conventional laparoscopic cholecystectomy and needed conversion to either FFC or open cholecystectomy. In category-I all 3 cases (both CLC and FFC) did not need any conversion. In class II which comprises the largest number of patients in the study, conversion was done in 23 cases out of 52 cases in total. In conventional laparoscopic cholecystectomy falling under class II, 21 cases out of 25 cases (84%) needed conversion to open laparoscopic cholecystectomy as compared to 2 cases out of 27 cases (7.4%) of class II patients who underwent Fundus first laparoscopic cholecystectomy and needed conversion. So conversion rate is significantly low in class II patients undergoing FFC as compared to those class II cases undergoing CLC (p value <0.001). In Class III patients there is no need of conversion in both CLC and FFC.

In class IV there is no difference in conversion rates between CLC and FFC as it was difficult in all class-IV cases to approach the liver bed to start the cholecystectomy, but in 3 cases out of 10 cases in this category where ultrasonic shear was used did not need any conversion in both CLC and FFC. Considering the rate of conversion it can be concluded that conversion is significantly low in FFC in difficult laparoscopic cholecystectomy as compared to CLC in difficult laparoscopic cholecystectomy (p<0.001).

Out of 49 females in the study 18 needed conversion i.e. 36.73% and out of 24 males conversions were recorded in 13 cases i.e. 54.16% (Table 3).

Table 3: Conversion rate in CLC and FFC.

	CLC			FFC		
Grades of difficulty	**Total**	**Conversion**	**Percentage**	**Total**	**Conversion**	**Percentage**
I	1	0	0	2	0	0
II	25	21	84	27	02	07.4
III	4	0	0	4	1	25
IV	5	4	80	5	3	60
Total	35	25	71.14	38	6	15.78

Table 4: Gall bladder injury and bile spillage.

	Conventional laparoscopic cholecystectomy			Fundus First laparoscopic cholecystectomy		
Grade of difficulty	**Total**	**GB injury/bile spillage**	**Percentage**	**Total**	**GB injury/ bile spillage**	**Percentage**
I	1	1	100	2	0	0
II	25	8	32	27	6	22.22
III	4	2	50	4	4	100
IV	5	0	0	5	0	0
Total	35	11	31.42	38	10	26.31

Mean time taken for LC in the study is 67.64±12.06 minutes. Mean time taken for cholecystectomy by CLC is 67.48±10.43 minutes and for cholecystectomy by FFC is 67.44±13.52 minutes.

The difference is not significant statistically. Out of total 73 cases in 21 cases gallbladder injury was reported with spillage of bile into peritoneal cavity and out of these 21 cases of gall bladder injury spillage of gall bladder stone occurred in 15 cases. Out of 35 cases who has undergone conventional laparoscopic cholecystectomy gall bladder injury occurred in 11 (31.42%) cases as compared to 10 out of 38 (26.31%) cases in fundus first laparoscopic cholecystectomy. The difference is not found to be statistically significant (Table 4). Mean duration of hospital stay is 4.19 + 3.053 Mean hospital stay in FFC is 2.58 + 1.869 days and that of CLC is 5.14±3.143 is clearly much higher and statistically significant (p <0.001) than mean hospital stay in case of FFC.

Mean duration of antibiotic use in the total study is 2.26±1.353 days. Mean duration of antibiotic use in CLC and FFC are respectively 3.11±1.278 days and 1.47±0.862 days which is statistically significant with p <0.005.

DISCUSSION

Due to its proved benefits over open cholecystectomy, now a day's laparoscopic cholecystectomy is considered as the gold standard for management of symptomatic gall stone diseases.1Still it has many limitations in difficult

cases including injury to gall bladder and bile spillage, injury to viscera, injury to CBD and last but not the least i.e. conversion to open procedure. Fundus first approach is a well accepted and widely practiced method in open cholecystectomy. But many laparoscopic surgeons still have reservation in using fundus first approach in laparoscopic cholecystectomy. There are multiple studies like Kama et al with an attempt to predict chances of difficulty in performing laparoscopic cholecystectomy using few preoperative factors but there are no universally accepted predicting factors to be followed.[5] So only tool for laparoscopic surgeon to confirm difficulty is the initial intraoperative findings after insertion of camera/laparoscope intraperitoneally. After initial attempt to approach gall bladder and Calot's triangle, operating surgeon decides whether it is feasible to continue laparoscopic cholecystectomy or opt for an conversion to open cholecystectomy. Out of 73 cases of difficult laparoscopic cholecystectomy 49 were female and 24 were male. Many investigators have reported higher incidence of difficult LC and higher conversion rate in male patients.[5-7] But in our study we found females constituted the major part of the study group (67.12%) which is contrary to the cited studies. It can be contributed to the higher incidence of gall stone disease in female. We found class II i.e. adhesion in Calot's triangle and difficulty in dissection of cystic artery and cystic duct to be the most common type of difficulty encountered during laparoscopic cholecystectomy.

Rate of conversion from laparoscopic cholecystectomy to open cholecystectomy is the main statistical data that we wanted from this study. According to the study by Livingston in USA conversion rate in LC was found to be 5-10%.[8] We could not find any study analysing conversion rate in DLC cases and effect of surgical approach (CLC or FFC) on conversion rate. Out of the 73 cases of DLC 31 cases needed conversion i.e. 42.46%. Conversion rate in CLC and FFC are 71.14% and 15.78% respectively confirming advantage of FFC over CLC statistically in relation to conversion. In class-I category there is no conversion. In class-IV difference in conversion rate between CLC and FFC is statistically not significant. In class II cases conversion rate in CLC is 84% which is much higher than that in FFC i.e. only 7.4% which is statistically significant ($p < 0.001$). Different authors have reported incidence of 27.9% to 78.9% conversion rate in presence of adhesions in Calot's triangle (class II) and inability to identify anatomy correctly.[9,10] So in class II difficulty FFC seems to have statistically significant advantage i.e. conversion rate of 7.4% in our study. In Class-III cases no conversion was noted in CLC but conversion rate was 25% in FFC (1 out of 4 cases of FFC). In our study the outcome is mostly contributed by low conversion rate in FFC as compared to CLC in class-II difficulty.

FFC was found to have no statistically significant advantages over CLC with regard to gall bladder injury, bile and stone spillage, CBD injury. The same is in case of duration of surgery where FFC has no statistically significant advantage over FFC.

But in case of duration of hospital stay and duration of antibiotics use FFC has statistically significant advantage over CLC ($p < 0.005$).

CONCLUSION

In our study of difficult laparoscopic cholecystectomy we found lesser conversion rate in fundus first laparoscopic cholecystectomy as compared to conventional laparoscopic cholecystectomy. This also has other advantages like lesser duration of hospital stay and duration of use of antibiotics, which can be contributed to lesser conversion rate in fundus first approach. So our study concluded that Fundus first laparoscopic cholecystectomy has surgical advantages over conventional laparoscopic cholecystectomy in difficult cases, but surgeon should always have a liberal consideration for conversion to open cholecystectomy to avoid possible morbidity and mortality.

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