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Preoperative prediction of a difficult laparoscopic cholecystectomy: Experience at our medical college in Mewat region, Faridabad

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Abstract
Introduction: Laparoscopic Cholecystectomy is the gold standard treatment for the management of benign gall stone disease. In this study we share our experience of laparoscopic Cholecystectomies done in a single unit in our medical college the difficulties encountered & complications faced to establish a correlation between pre & intraoperative variables & degree of difficulty in surgery resulting in increased duration of surgical procedure and possible conversion to open cholecystectomy.
Methods: All laparoscopic Cholecystectomies done for benign gall stone disease in a single unit in department of General surgery in our medical college from November 2019 to June 2021(18 months)
100 cases were evaluated & preoperative & intraoperative variables were assessed
Results: A total of 100 patients were evaluated out of which 81 were females.
We found that: Impacted stone at GB neck
BMI > 25 kg/m.square: Intraoperative complications like cystic artery bleeding were significant factors & increased the duration of surgery (from 40 to 60 minutes whereas aberrant anatomy & male gender were inconsequential in our study.
Discussion: After studying these 100 cases we could find some reliable correlation between the preoperative and intraoperative findings & the difficult laparoscopic Cholecystectomy so that the surgeon beforehand knows about the difficult procedure and is prepared for it though there' s a need to further explore & find some more strong evidence to predict a forthcoming difficult laparoscopic Cholecystectomy and its possible conversion to open cholecystectomy.

Keywords: laparoscopic cholecystectomy; variables; predicting difficult laparoscopic cholecystectomy
Abbreviations: LC Laparoscopic Cholecystectomy; BMI: Body Mass Index; GB: Gall Bladder; OC: Open Cholecystectomy; CBD: Common Bile Duct; POD: Post-Operative Day

Introduction

Gall stone disease is the most common disease of the gall bladder & the biliary tree & Laparoscopic Cholecystectomy (LC) has been recognized as the gold standard for the treatment of benign gall stone diseases. This procedure is the most commonly performed procedure worldwide [1]
There are several advantages of LC over OC (Open Cholecystectomy) which have been well documented & include earlier return of bowel function, lesser post-operative pain, better cosmetically due to smaller scars, shortened hospital stay so lessening the burden on hospital bed occupancy & earlier return to full activity & decreased overall cost [2]. However, sometimes due to dense adhesions at the Calot's triangle & aberrant anatomy, the surgeon may face difficulty while dissection leading to increased chances of injury to surrounding structures, bile & stone spillage or injury to vessels & so increasing the chances of conversion to Open Cholecystectomy. These factors together constitute a difficult laparoscopic Cholecystectomy & pose a challenge to the surgical skills of a surgeon.

So here it becomes clear the aim of this study

The aim of this study is to establish a correlation between the preoperative & intraoperative findings & the intraoperative operative difficulties & complications faced so that a would be difficult laparoscopic Cholecystectomy can be predicted & the surgeon can be well prepared.
But with increasing experience of the surgeon & continuously improving technology there has been a significant fall in the number of conversions from laparoscopic to open Cholecystectomy (01% - 22% to approximately 01% - 05%) [3]. In this study we share our experience of 100 cases of laparoscopic cholecystectomies performed in 18 months by a single surgeon in a single unit in our General Surgery department of Al Falah school of medical sciences & Research Center, Dhauj (Faridabad), Haryana.

Body of the Paper Aims and Objectives

a. To evaluate the preoperative variables in patients undergoing elective laparoscopic cholecystectomy
b. To evaluate the difficulties & per operative complications encountered during LC.
c. To find the correlation with some of the preoperative & intraoperative variables with the difficulty of surgery.
d. To find the correlation of the perioperative variables with the intra & post-operative complications & the postoperative length of stay.

Materials and Methods

It was a retrospective study done in a single unit of department of General surgery of Al Falah School of medical sciences & Research Center at Dhauj (Faridabad), Haryana from November' 2019 to June'2021 (18 months). All LCs were done by a single surgeon with a formal training in laparoscopic surgery. Observations made on a total of 100 patients were reviewed retrospectively from the hospital records of the patients. Patients of both sexes above the age of 18 years with benign gall stone disease undergoing laparoscopic Cholecystectomy were studied but some subgroups of patients like

a. Patients with gall bladder malignancy
b. Patients with associated ventral hernias
c. Patients with concurrent choledocholithiasis
d. Patients requiring emergency LC
e. And patients with other contraindicatios for LC were not included in the present study.

Different data pertaining to these patients like patients demographic data, clinical and radiological data, co-morbid conditions, intraoperative findings and complications were recorded in a prestructured proforma.
The diagnosis of cholelithiasis was confirmed by ultrasonography & the status of liver & condition of gall bladder (GB) like overdistended or contracted gall bladder, gall bladder wall thickness, number of stones were noted. Also any evidence of acute cholecystits & condition of CBD was noted & also if there was any pericholecystic fluid. Laparoscopic Cholecystectomy was performed under general anaesthesia using the conventional American 4 port technique on a 4K HD system. Pneumoperitoneum was created by closed technique and the intraabdominal pressure was kept between 12-14 mm of Hg. Operative steps included dissection at the Calot's triangle; cystic duct & the cystic artery were dissected, delineated & clipped. GB was dissected from the liver bed and extracted using laparoscopic GB extractor through the epigastric port. Duration of surgery was recorded from the time of incision at the umbilicus for the umbilical port till skin closure of the last port. The patients were allowed orally 6 hours post-surgery and discharged on the next day and advised for follow up after a week for suture or staple removal.

Results

1. Age and Sex distribution

A total of 100 patients who underwent elective LC were evaluated over the course of 18 months from November' 2019 to June' 2022 out of which 81 were females & 19 were males. Mean age of the patients was 42 yearz; the youngest being 18 years old & the oldest being a 75 years old female.

2. Comorbid conditions

18 patients in the study had associated comorbidities like diabetes, hypertension & hypothyroidism and 45 patients had a BMI of >25 Kg/m.sq.

3. History of previous surgery

Out of 100 patients none of the males had undergone previous surgery while 8 females gave a history of open abdominal hystrectomy, 12 of them had undergone LSCS, 7 cases had laparoscopic tubal ligation & one case had undergone right nephrectomy in view of non- functioning kidney.

4. History of recent attack of acute Cholecystits

Around 32 patients gave a history of recent attack of severe pain in the right hypochondrium suggesting acute Cholecystits within the last two weeks.

5. Ultrasonographic findings

On ultrasonographic examination a single calculus was found in 40 cases, increased GB wall thickness was seen in 5 cases, impaction of stone at neck of GB in 21 cases and dilated CBD in 3 cases which was found to be of normal caliber intraoperative in all 3 cases.Prophylactic antibiotic coverage was given by a second generation cephalosporin an hour before the skin incision. The camera port was inserted via a supraumbilical incision in 92 cases except in 8 cases where it was inserted via infraumbilical incision owing to the presence of scar of laparoscopic tubal ligation. Pneumoperitoneum was created by closed technique using Veress needle in all cases.

The operative steps were

- Dissection at the Calot' s triangle

- Delineation of the cystic duct & cystic artery
- Clipping & cutting them, the duct being clipped & cut before the artery.
- The GB was separated from the liver bed by sharp dissection by a laparoscopic hook & taken out via the 10 mm epigastric port in all cases.

During operation it was observed that around 27 cases had dense adhesions at the Calot' s triangle. These adhesions were cleared by meticulous dissection leading to increased duration of surgery. The adhesions were cleared by sharp dissection at the Calot' s triangle to visualize the cystic duct & cystic artery. However in 11 cases there was injury to cystic artery due to dense fibrous adhesions leading to bleeding which was controlled successfully.

6. Aberrant anatomy found intraoperatively

Aberrant anatomical features seen at the Calot's triangle were

Short & posteriorly placed cystic artery in 7 cases

Cystic duct traversing alongside the common hepatic duct before entering it in 1 case In 2 cases aberrant cystic artery was seen arising from common hepatic artery.

The aberrant anatomy was delineated well before clipping and no intraoperative complications were seen.

Pertaining to GB, 12 cases of mucocele & 3 cases of pyocele were seen leading to overdistended GB which required intraoperative suctioning to avoid bile spillage. All these cases of overdistended GB were associated with dense adhesions at the Calot' s triangle leading to increased duration of surgery.

7. Intraoperative variables affecting surgery

Various intraoperative variables/factors which made the surgical procedure prolonged & at times made the procedure difficult were

Adhesions at the Calot' s triangle Impaction of stone at GB neck Mucocele/Pyocele

Aberrant anatomy Overdistended GB Need for GB suctioning

Camera port position infraumbilical in cases with supraumbilical scar due to laparoscopic tubal ligation.

These intraoperative variables either made the surgical procedure difficult & also contributed to increase the duration of surgery.

Use of antibiotics

Routinely we didn' t use antibiotics as laparoscopic Cholecystectomy being a clean procedure. However in cases of contamination due to pus spillage a single shot of second generation cephalosporin was given.

Only 2 cases were converted to open cholecystectomy owing to frozen Calot' s triangle with concurrent comorbidities necessitating shorter duration of surgery.

Intraoperative complications

Bile and stone slippage occurred in 18 & 7 cases respectively while separating gall bladder from the liver bed which was managed by irrigation and suctioning of the bile after extraction of GB and extraction of stone with laparoscopic ovum forceps. Cystic artery bleeding was another complication which was encountered in 10 cases.

Routinely drains were not used except in 2 cases where there was extensive dissection and bleeding from liver bed. The drains were removed on post-operative day (POD) 2 and the patients were discharged the next day.

The postoperative length of hospital stay was 1 day and the patients were discharged the next day, 7 cases had length of stay more than 1 day due to severe abdominal pain and abdominal distension which were managed conservatively and were discharged on POD2. The patients were followed up after a week for removal of sutures or staples & also for complete check-up.

We analyzed the correlation of some of the preoperative & intraoperative variables & some of the intraoperative complications with the difficulty & duration of surgery and the length of post-operative stay in the hospital from the data we collected and we tried to find an association between these.

We also ascertained the time taken to perform surgery which was around 40 minutes and the patients with time taken 60 Or more than 60 minutes were considered as difficult LC as also described by Randhawa & Pujahari & Hussein Atta [4, 5]

Out of 100 patients in our study 27 of them had duration of surgery 60 Or more than 60 minutes and the variables affecting were

a. **Patient factors:** Males, age more than 40 years, BMI>25, associated comorbidities and attack of acute cholecystits within two weeks prior to surgery.
b. **Ultrasonographic findings:** Increase GB wall thickness, stone at the GB neck, single or multiple calculi
c. **Intraoperative variables:** Some intraoperative variables affected the procedure by making it more difficult and contributed to increase the duration of surgery which were as follows:- Adhesions, mucocele and pyocele, cystic artery bleeding, bile & stone spillage, intrahepatic gall bladder and aberrant anatomy. All these variables in one way or the other made the procedure difficult & increased the duration of surgery.

It was observed that BMI, impaction of stone at GB neck and cystic artery bleeding were significant factors causing a difficult LC while aberrant anatomy, increased GB wall thickness, adhesions & male gender which were said to be significant factors for a difficult LC were not found to be very significant in our study. Also none of the variables showed any significant effect on postoperative length of hospital stay.

Discussion

Laparoscopic Cholecystectomy has become the standard treatment for benign gall stone disease and results in earlier post-operative recovery & fewer GI complications [1, 2]. However there were many pre and intraoperative factors that might result in a difficult LC. Randhawa and Pujahari formulated a scoring system listing several pre and intraoperative predictors both clinical and sonological for predicticting a difficult LC. Abdulzahra Hussain also mentioned some predictors of difficult LC which are listed below [4, 5]:

- Male gender
- Age
- Recent attack of cholecystitis prior to surgery
- GB wall thickness
- Obesity
- Impaction of stone at GB neck
- Short and wide cystic duct
- Mucocele and pyocele
- Aberrant anatomy &
- Hepatomegaly

Obesity is associated with higher risk of complications during surgery leading to prolongation of duration of surgery & higher chances of conversion to open Cholecystectomy & increased morbidity & increased duration of hospital stay [4, 6-8]. In our study out of 27 patients who had difficult LC 21 of them had a BMI of >25 kg/m. sq. and in them it was difficult to create pneumoperitoneum via Veres' needle, difficulty in manipulation of laparoscopic instruments due to thickness of subcutaneous fat and difficult dissection at fatty Calot' s triangle [4, 9]. However our study saw no conversion to open in these patients. In contrast to our study, Simopaulos *et al* showed no significance between obesity and difficult LC.

Hussain M. Atta and Lal *et al* showed that impaction of stone at the neck of GB had increased chances of undergoing a difficult LC which was reciprocated in our study [10, 11]. 50% of patients undergoing difficult LC had stone impacted at the GB neck and it was seen that it was a significant factor in causing difficult LC. This was mainly due to inflammation produced at the neck of the GB causing difficult dissection at Calot' s triangle and difficulty in grasping the Hartmann's pouch to provide adequate traction in order to visualize the duct and the artery.

Many authors have reported that increasing age and male gender are known to be significant factors responsible for a difficult LC but our study suggested otherwise [9, 12-14]. Even in the study conducted by Randhawa and Pujahari there was no significant effect of male gender on difficult LC [4]. Out of 100 patients in our study only 21 were males and out of these 21 patients only 3 had duration of surgery more than 60 minutes. All of them were discharged on POD1 without any complications.

As observed by Pavlidis in his study although LC is considered a safe procedure in the elderly, it is associated with high morbidity and conversion rate [15]. But as found in our study increasing age was not a significant factor for causing difficult LC and the results were similar to a study by Khetan [16]. In our study we had 7 patients who were above 60 years of age, the oldest being a 75 years old female and all of them had an uneventful surgery and were discharged the next day. Cystic artery bleeding occurred in 10 out of 100 cases out of which 7 had difficult LC and it occurred because of adhesions at the Calot' s triangle which obscured the anatomy of the duct and the artery. Adhesions as an independent intraoperative variable were not significant in causing the LC a difficult procedure and so were the variables increased GB wall thickness and aberrant anatomy at the Calot' s triangle. Randhawa and Pujahari, Lal *et al* and Khetan showed that increased GB wall thickness was associated with a difficult LC [3, 4, 11, 16, 17].

Our study suggested that presence of mucocele and pyocele was associated with a difficult LC mainly due to adhesions at the Calot' s triangle, over distended GB and the need for suctioning of gall bladder before dissection from liver bed. However these factors independently were not significant factors to consider a surgery a difficult LC. Acute attack of Cholecystits within the last two weeks, intrahepatic GB, dilated CBD and co-morbidities like DM also showed no significance in our study in contrast to studies by Yang and Randhawa and Pujahari [3, 4]. None of the variables evaluated showed significant effect on post-operative length of hospital stay and all except 4 were discharged on POD1. Drain was put in only 1 patient owing to bleeding at Calot' s triangle which was removed on POD2 and the patient was discharged on the same day. There was only one conversion from lap to open cholecystectomy owing to multiple co-morbidities of the patient and difficult dissection at Calot' s triangle.

It is difficult to say preoperatively whether laparoscopic cholecystectomy is going to be easy or difficult based on clinical history. Identification of preoperative sonological parameters, assessment of patient and gall bladder factors could predict the possible conversion or the difficult LC. We saw very few conversions to open surgery and no CBD injuries. Cystic artery injuries were managed promptly without any major complications.

In our study of 100 patients we found that laparoscopic cholecystectomy was a very efficient method of relieving the patients of their symptoms and also providing them smaller scars, shorter hospital stays and lesser complications. It can easily be said that laparoscopic cholecystectomy is indeed the gold standard treatment for benign gall bladder pathological conditions.

Conclusion

In our study of 100 patients we experienced that a number of preoperative factors affected the intraoperative status of surgery like difficult dissection at Calot' s triangle, bile or stone spillage or cystic artery bleeding which thereby affected the duration of surgery and the length of hospital stay. But looking to the limitations of our study like small sample size more evidence and more research in this field is required to be able to say definitely that a particular case is going to be difficult laparoscopic cholecystectomy and a particular case may need a conversion to an open cholecystectomy. Moreover there is level 2 and level 3 evidence based on retrospective studies depicting certain factors that may predict difficult laparoscopic cholecystectomy such as patients demography, history of acute cholecystits, history of previous upper abdominal surgery, obesity, abnormal anatomy & presence of concurrent co-morbidities. But higher levels of evidence and more research is required in this field.

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