



## TO IDENTIFY THE PREDICTORS OF DIFFICULTY IN LAPAROSCOPIC CHOLECYSTECTOMY

### General Surgery

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### ABSTRACT

**Introduction-** Gall stone disease is a major problem in our society. Since the introduction of laparoscopic cholecystectomy in 1987, it has dramatically replaced conventional open cholecystectomy. In spite of one of the most commonly performed surgery, Laparoscopic cholecystectomy can sometimes throw major challenges in front of surgeon. Prediction of difficulty will help in better pre-operative planning, thus reducing chances of adverse events. Purpose of this study is to identify the predictive factors for difficult laparoscopic cholecystectomy. **Material & methods-** This was a prospective study of 100 patients between Dec.2018 to Feb.2020 who underwent laparoscopic cholecystectomy at Government Doon medical college, Dehradun. Details of patients were recorded including history, clinical examination and investigations done. A detailed proforma was used to record these particulars of the patients. **Results-** Total of 100 patients included in our study, majority of the patients were in the age group of 31-40 years (30 out of 50). Out of 100 patients, 16 had a history of acute cholecystitis and all encountered difficulty during surgery. Out of 16 patients with H/O acute cholecystitis, 6 patients had 1 episode, 2 patients had 2 episodes and 8 patients with > 2 episodes of acute cholecystitis. Only 4 patients had H/O previous abdominal surgery. 14 patients had deranged LFT. Thickened GB wall thickness >3mm found in 10 patients. **Conclusion-** Difficulty in laparoscopic cholecystectomy can be predicted on the basis of history and clinical examination. With the help of accurate prediction, high risk patients can also be informed beforehand, and they may have a chance to make arrangements. Surgeons also may have to schedule the time and team for the operation appropriately.

### KEYWORDS

#### INTRODUCTION –

Gall stone disease is a major problem in our society. Its prevalence increases with age and is higher in females and obese people. The causes of cholelithiasis appear established. Among them few are Hypercholesterolemia, Biliary stasis, inflammation of gall bladder etc. Since the introduction of laparoscopic cholecystectomy in 1987, it has dramatically replaced conventional cholecystectomy. Laparoscopic cholecystectomy provides safe & effective treatment for most patients with symptomatic gall stones. Laparoscopic cholecystectomy has rapidly become the gold standard for routine gall bladder removal. It has become treatment of choice for cholelithiasis & most common operation performed by general surgeons.

Laparoscopic cholecystectomy though safe and effective, yet can be difficult at times. General problems faced during laparoscopic cholecystectomy are difficulty in creating pneumoperitoneum, accessing peritoneal cavity, releasing adhesions, identifying anatomy and anatomical variations.

Being one of the most common surgery it is performed by surgeons of different level of expertise with vastly different level of infrastructure. Many a times beginners with very basic level of infrastructure are performing this procedure. Prediction of difficulty will help in better pre-operative planning, thus reducing chances of adverse events. The purpose of this study is to identify the predictive factors for difficult laparoscopic cholecystectomy.

#### MATERIAL & METHODS –

Type of study – Prospective

Sample size – 100

Place of study – Department of General surgery

Government Doon medical college, Dehradun.

Duration of study- Dec.2018 to Feb.2020

#### Inclusion criteria –

- 1) All patients above 18 years of age with USG proven symptomatic cholelithiasis during the study period were included in the study.
- 2) Post ERCP patients were also included.

#### Exclusion criteria –

- 1) Patients requiring CBD exploration
- 2) Laparoscopic cholecystectomy with other laparoscopic intervention.
- 3) Patients with cardiovascular, pulmonary disease, coagulopathies and end stage liver disease, immune-compromised patients.

#### METHODOLOGY –

It is a prospective study conducted in Department of General Surgery, Govt. Doon medical college, Dehradun from Dec.2018 to Feb.2020. A total of 100 patients with symptomatic gallstone disease of age group >18 years and both sex were included in the study. Details of patients were recorded including history, clinical examination and investigations done. A detailed proforma was used to record these particulars of the patients.

Pre-operative risk factors assessed were clinical (age, gender, duration of symptoms, H/O attack of cholelithiasis, past H/O abdominal surgery), radiological (on USG gall bladder wall thickness >3mm, single large stone in Hartmann's pouch, small contracted gall bladder) & biochemical (deranged LFT).

Surgery was done using CO<sub>2</sub> pneumoperitoneum by Veress needle with 10-12mmHg pressure and using standard two 5mm and two 10mm ports. Time of surgery noted from Veress needle insertion till last port closure. All intra-op findings were recorded on proforma. Difficulties during surgery were noted as access related, identification of gallbladder, grasping of gallbladder, adhesiolysis, Calot's triangle dissection, duct/artery clipping, difficulty in gallbladder dissection and spillage.

#### Definition of difficult cholecystectomy used in our study-

- 1) Access related- more than 2 Veress needle attempts or alternate methods like open technique to be used.
- 2) Identification of gallbladder- If gallbladder covered with omentum/bowel loops and adhesions have to be divided (not separable by pulling) by the use of electrocautery.
- 3) Grasping of gallbladder- Need of special instruments (with bigger jaw) for grasping on need of evacuation of gallbladder before grasping required.
- 4) Adhesiolysis- Adhesions requiring cutting by electro-cautery. Flimsy/easily separable adhesions by pulling were not included.
- 5) Calot's triangle dissection- More than 20 min. time needed for Calot's triangle dissection.
- 6) Duct clipping- Wide/ short duct requiring suture rather than clipping or inadequate length to put two proximal and one distal clip.
- 7) Dissection from liver bed- Dissection of gallbladder from liver bed requires more than 20 min. or perforation of gallbladder.
- 8) Time was calculated from Veress needle insertion till last port closure. overall time > 60 min. was also considered as difficult laparoscopic cholecystectomy.

**Data extraction** – Data was recorded in pre-designed proforma then entered into a computerized database ( Microsoft Excel) . Descriptive statistics was analysed with SPSS version 17.0 software. Continuous variables are presented as mean  $\pm$ SD. Categorical variables are expressed as frequencies and percentages . The Pearson's chi-square test or the chi square test of association was used to determine if there is a relationship between two categorical variables.  $P < 0.05$  was considered statistically significant.

## RESULTS-

**Table-1 Age distribution Vs. difficulty**

|                | Total cases | Difficulty   |              | P value |
|----------------|-------------|--------------|--------------|---------|
|                |             | No           | Yes          |         |
|                |             | Frequency(%) | Frequency(%) |         |
| $\leq 30$ yrs. | 32          | 18(56.2)     | 14(43.8)     | 0.674   |
| 31-40 yrs.     | 36          | 20(55.6)     | 16(44.4)     |         |
| 41-50 yrs.     | 14          | 8(57.1)      | 6(42.9)      |         |
| $> 50$ yrs.    | 18          | 6(33.3)      | 12(66.7)     |         |
| Total          | 100         | 52(52.0)     | 48(48.0)     |         |

Table-1 shows that majority of patients in the study were in the age group of 31-40 years (36 out of 100 ), second most prevalent age group was  $\leq 30$  years ( 32 out of 100 ). No significant co-relation was found between patient age and difficulty during surgery.

**Table-2 correlation between H/O acute cholecystitis Vs. Difficulty**

| H/O Ac.chole. | Total cases | Difficulty   |              | P value |
|---------------|-------------|--------------|--------------|---------|
|               |             | No           | Yes          |         |
|               |             | Frequency(%) | Frequency(%) |         |
| No            | 84          | 52(61.9)     | 32(38.1)     | 0.003   |
| Yes           | 16          | 0(0)         | 16(100)      |         |
| Total         | 100         | 52(52.0)     | 48(48.0)     |         |

Out of 100 patients , there were 16 patients with positive H/O acute cholecystitis . All patients encountered difficulty during surgery. It shows significance between H/O acute cholecystitis and difficulty during surgery.

**Table-3 Correlation between H/O previous abdominal surgery Vs. Difficulty**

| H/O past surgery | Total cases | Difficulty   |              | P value |
|------------------|-------------|--------------|--------------|---------|
|                  |             | No           | Yes          |         |
|                  |             | Frequency(%) | Frequency(%) |         |
| No               | 96          | 50(52.1)     | 46(47.9)     | 1.000   |
| Yes              | 4           | 2(50.0)      | 2(50.0)      |         |
| Total            | 100         | 52(52.0)     | 48(48.0)     |         |

Out of 100 patients , only 4 patients had H/O previous abdominal surgery, only 2 patients had difficulty in surgery. It showed no relevance between previous surgery and difficulty during surgery.

**Table-4 Correlation between Duration of symptoms Vs. intra-operative Difficulty**

| Duration of symptoms | Total cases | Difficulty   |              | P value |
|----------------------|-------------|--------------|--------------|---------|
|                      |             | No           | Yes          |         |
|                      |             | Frequency(%) | Frequency(%) |         |
| $< 6$ months         | 72          | 40(55.6)     | 32(44.4)     | 0.041   |
| 6 months to 1 yr     | 18          | 12(66.7)     | 6(33.3)      |         |
| 1 year               | 10          | 0(0)         | 10(100)      |         |
| Total                | 100         | 52(52.0)     | 48(48.0)     |         |

All 10 patients with duration of symptoms  $> 1$ yr. had difficulty during surgery. It shows that duration of symptoms is a significant parameter for prediction of difficult laparoscopic surgery.

**Table-5 Co-relation between LFT variation Vs. Intra-operative Difficulty**

| LFT      | Total cases | Difficulty   |              | P value |
|----------|-------------|--------------|--------------|---------|
|          |             | No           | Yes          |         |
|          |             | Frequency(%) | Frequency(%) |         |
| Deranged | 14          | 4(28.6)      | 10(71.4)     | 0.239   |

|        |     |          |          |  |
|--------|-----|----------|----------|--|
| Normal | 86  | 48(55.8) | 38(44.2) |  |
| Total  | 100 | 52(52.0) | 48(48.0) |  |

14 patient had deranged LFT. No significant correlation was found between LFT & difficulty during surgery.

**Table-6 Correlation between GB wall thickness Vs. Intra-operative difficulty**

| GB wall thickness | Total cases | Difficulty   |              | P value |
|-------------------|-------------|--------------|--------------|---------|
|                   |             | No           | Yes          |         |
|                   |             | Frequency(%) | Frequency(%) |         |
| Normal            | 90          | 50(55.6)     | 40(44.4)     | 0.182   |
| Thickened         | 10          | 2(20.0)      | 8(80.0)      |         |
| Total             | 100         | 52(52.0)     | 48(48.0)     |         |

Thickened GB wall was defined as thickness  $> 3$ mm. On pre-operative USG, 10 patients had thickened GB wall. Of which 80% of these patients had difficult surgery. There was no statistically correlation between GB wall thickness and intra-operative difficulty.

**Table-7 Correlation between Multiple/single stone Vs. Intra-operative difficulty**

| Multiple/ Single stone in GB neck | Total cases | Difficulty   |              | P value |
|-----------------------------------|-------------|--------------|--------------|---------|
|                                   |             | No           | Yes          |         |
|                                   |             | Frequency(%) | Frequency(%) |         |
| Multiple                          | 82          | 38(46.3)     | 44(53.7)     | 0.142   |
| Single                            | 18          | 14(77.8)     | 4(22.2)      |         |
| Total                             | 100         | 52(52.0)     | 48(48.0)     |         |

No significant correlation was found between no. of stones and intra-operative difficulty.

**Table-8 Correlation between History/clinical assessment Vs. Intra-operative difficulty**

| History/ clinical assessment | Total cases | Difficulty   |              | P value |
|------------------------------|-------------|--------------|--------------|---------|
|                              |             | No           | Yes          |         |
|                              |             | Frequency(%) | Frequency(%) |         |
| No                           | 54          | 38(70.4)     | 16(29.6)     | 0.005   |
| Yes                          | 46          | 14(30.4)     | 32(69.6)     |         |
| Total                        | 100         | 52(52.0)     | 48(48.0)     |         |

There were 46 patients who had at least 1 adverse factor in history/clinical assessment . Adverse factors include male gender, past H/O abdominal surgery, H/O acute cholecystitis, H/O jaundice/ pancreatitis, of these 69.6% patients had difficult surgery. This difference was statistically significant ( $p < 0.005$ ).

## Correlation between risk factors & type of intra-operative difficulty-

Correlation co-efficient  $> 0.3$  was significant. H/O acute cholecystitis was associated with significant difficulty in grasping of GB ( $P < 0.002$ ), adhesiolysis ( $p < 0.001$ ), calot's triangle dissection ( $p < 0.012$ ), difficulty in GB dissection ( $p < 0.020$ ). Deranged LFT was associated with significant difficulty in extracting GB ( $p < 0.031$ ). Increased GB wall thickness on USG was significantly associated with extraction of GB ( $p < 0.005$ ).

## DISCUSSION-

Laparoscopic cholecystectomy has now become the gold standard for the treatment of symptomatic gallstones, but the procedure is technically more demanding than classical open cholecystectomy as greater chances of damage to the common bile duct and surrounding viscera exist. Conversion from laparoscopic to open cholecystectomy is required when safe completion of the laparoscopic procedure cannot be further ensured. This is considered as a sound judgement rather than failure of laparoscopic surgery to avoid complications and reduce morbidity. The identification of parameters predicting conversion beforehand helps in pre-operative patient counselling as well as provide better peri-operative planning and avoid laproscopy assisted complications when converting to open procedure is inevitable. Laparoscopic cholecystectomy is one of the most common elective surgery. Almost every laparoscopic surgeon performs this surgery, often it is the first surgery to start the career. Most of the beginner laparoscopic surgeons in our country work with very basic instrumentation and infrastructure. Expertise of senior laparoscopic surgeons also may not be readily available. In these

conditions a lot of problems can be avoided by precise pre-operative prediction of difficult cholecystectomy. It may help in making arrangements for specialised instrumentation, expertise or timely referral thus avoiding many complications. These days laparoscopic cholecystectomy is considered as a day care surgery and patient's expectations or also accordingly. These patients can be counseled regarding post-operative morbidity by correctly predicting difficult cholecystectomy. This crucial prediction is very useful in pre-operative patient counseling regarding post-operative morbidity, thus helps in gaining patient's faith.

In our study, patient's above 18 years were included. Analysis of age distribution reveals that majority of patient's in the study were in the age group of 31-40 years (36 out of 100). Classical teaching mentions association between gallbladder disease and "fat, fertile, female of fourty". Our data is also supported by neerja Bhardwaj et al who found that 70% of patient's in their study belonged to the age group (29-48 years).

In our study of 100 patient's, 16(16%) had history of acute cholecystitis and in all patient with this history, some difficulty was encountered. It signifies that history of acute cholecystitis is strong factor for prediction of difficult laparoscopic cholecystectomy. This finding is supported by Mohanapriya Thyagarajan et al. In their study they found a conversion rate as high as 34% in cases with the history of previous attacks of acute cholecystitis. Since in all 16 patients with this history some difficulty was encountered during surgery, understandably relationship between intra-operative difficulty & number of attacks of acute cholecystitis was found.

No relationship between previous abdominal surgery and difficulty was established. In 2002, Samer A. Kanaan et al and Merriam, L.T., Kanaan et al found that prior abdominal surgery was not a factor predicting the necessity for conversion from Laparoscopy to open surgery.

In our study of 100 patients, 72 patients had duration of symptoms  $\leq$  6 months, in which 32 (44.4%) had difficult surgery. Out of 18 patients with duration of symptoms for 6 months-1 year, only 6 (33.3%) encountered difficulty. All 10 (100%) with duration of symptoms for more than 1 year, difficulty was encountered during surgery. It shows that duration of symptoms is an acceptable ( $P=0.041$ ) factor for prediction of difficulty laparoscopic surgery. This observation can be explained by the fact that patients with longer duration of symptoms are likely to have repeated attacks of inflammation leading to more adhesions & difficult surgery. This data is supported from a study by Rattner, David W. et al.

In our study of 100 patients, only 14 (14%) were with deranged LFT. Out of 14, 10 (71.4%) patients had difficult surgery. Mittalgodu Anantha et al found that deranged LFT is a factor for prediction of difficult laparoscopic surgery. However our study found no significance ( $P=0.239$ ), it may be due to small number of patients with deranged LFT in our study.

In the present series of 100 patients, 10 patients (10%) were found with thickened gallbladder. Among 10 patients there were difficulty in access to peritoneal cavity, adhesions, difficult Calot's dissection, difficult dissection of gallbladder from liver bed was found in 2 patients. Difficulty in extraction of gallbladder in 4 patients and difficulty in grasping of gallbladder in 8 patients. In a study Pawan Lal et al found a good correlation between gallbladder wall thickness and difficulty during surgery. In our study we found no significance ( $P=0.182$ ) between gallbladder wall thickness and overall difficulty during surgery. This contradictory observation could be due to small number of patients with thickened GB wall. Large number of such patients could have made overall difficulty significant. Carmody E, Arenson AM et al also did not find association between GB wall thickness & operative difficulty.

In present study of 100 patients, 82(82%) were with multiple stones, in which 44(53.7%) patients found difficulty during surgery and 18(18%) patients were with single stone, in which 4(22.2%) patients found difficulty during surgery. A study by Dr. Lal et al stated that large calculus at neck region is associated with distension of gallbladder and multiple stones are associated with difficulty in gallbladder extraction through small incision of laparoscopic cholecystectomy and hence may lead to perforation of gallbladder with spillage of bile and gall

stones. In our study we found that no significance between single/multiple calculus and difficulty during surgery, this is supported by Dr. Nikhil Khandelwal et al who found in their study that calculus size or single calculus is a non significant factor for prediction of difficult laparoscopic cholecystectomy.

In our study of 100 patients, only 12 (12%) patients had adverse radiological findings. The adverse radiological findings were thickened GB wall, small/contracted gallbladder, multiple/single large stone. Many studies found adverse radiological findings are good predictor for difficult laparoscopic cholecystectomy. Study by Pawan Lal et al and Prem Chand et al found the same. In our study 83.3% patients with adverse radiological factors had difficult surgery in comparison to only 43.2% in patients with no adverse radiological factors. Although according to our study statistically this is not a significant predictor for prediction.

Although conversion to open cholecystectomy was needed in only 4 patients (4%), overall difficulty rate in our study was high (48/100-48%). It is because we deliberately kept threshold for labeling difficult cholecystectomy very low. Any deviation from a straight forward cholecystectomy, need of any extra instrument or step was labeled as difficult cholecystectomy. We think that in a resource starved country like ours, majority of cholecystectomies specially in peripheries are done by comparatively not so experienced surgeons. They work under pressure with significant infrastructural & budgetary constraints. So it is much more important to predict a difficult cholecystectomy for them then in an advanced laparoscopy surgery centre.

## CONCLUSION-

This study shows that history of acute cholecystitis & reported attacks of acute cholecystitis is the definite cause of difficult laparoscopic cholecystectomy.

Patients having symptoms for more than 1 year are more likely to have difficult laparoscopic cholecystectomy.

Study shows that difficult in laparoscopic cholecystectomy can be predicted on the basis of history and clinical examination.

Good clinical assessment is the most significant predictor of difficult laparoscopic cholecystectomy. Radiological predictors have inconsistent predictive value due to dependence on various factors beyond surgeon i.e. inherent technical limitations of USG machinery & operator dependency. So it is important for surgeons working with infrastructural constraints to apply good clinical judgement and arrange specialized instruments, expertise, convert if necessary or refer to a specialized centre and counsel patients accordingly.

With the help of accurate prediction, high risk patients can also be informed beforehand and they may have a chance to make arrangements. Surgeons also may have to schedule the time and team for the operation appropriately.

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