ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Assessment of Challenging Laparoscopic Cholecystectomy for Gallbladder Stone Disease Both Before and During Surgery

Kondal Reddy J[1], Yella Anvesh Kumar[2], Chetana V[2], Mohammed Ashfa Neelofer[3]

[1]Associate Professor, Department of General Surgery, Dr.V.R.K. Women's Medical College, Teaching Hospital and Research Centre, Aziz Nagar, Moinabad, Telangana, India.
[2]Assistant Professor, Department of General Surgery, Shadan Institute of Medical Sciences, Chevella Road, near PBEL city road, Peeramcheru, Telangana, India.
[3]Assistant Professor, Department of General Surgery, Dr.V.R.K. Women's Medical College, Teaching Hospital and Research Centre, Aziz Nagar, Moinabad, Telangana, India.

Abstract

Background: A typical digestive condition is gallstone disease. According to autopsy results, gallstone incidence ranges from 11% to 36%. The surgical procedure known as a cholecystectomy is common everywhere. **Material and Methods:** This prospective observational study was carried out in Department of General Surgery, Dr.V.R.K. Women's Medical College, Teaching Hospital and Research Centre, Aziz Nagar, Moinabad, R.R Dist., Telangana - 500075, India. The study period started from November 2021 to October 2022. Data form was prepared for each patient satisfying the inclusion criteria. Patients with any one of the exclusion criteria were not considered for the study. **Results:** In our study we observed that male sex was found to be a significant predictor of difficult LC in terms of increased mean duration of insertion of ports to completion of GB dissection, mean total time of LC and moderate bleeding during surgery which could be explained due to high pain tolerance, recurrent attacks, delayed presentation in males, dense adhesiolysis (in Calot's triangle as well as in between GB and other structures), thickened GB wall and difficult biliary anatomy in most cases. **Conclusion:** In our study we also observed that age > 60 years to have difficult dissection at the Calot's triangle, dissection of the GB from its bed and increased mean total time of LC possibly because of the long-standing recurrent attacks of acute cholecystitis leading to adhesions in Calot's triangle and also between GB and other structures. Obese patients in our series (BMI >27.5kg/m2) were associated with difficult port placement may be due to thick abdominal wall. Rest of the procedure was not difficult in different BMI groups.

Keywords: Intra-operative assessment, laparoscopic, cholecystectomy, gallbladder stone disease.

Corresponding Author: Dr. Kondal Reddy J, Associate Professor, Department of General Surgery, Dr.V.R.K. Women's Medical College, Teaching Hospital and Research Centre, Aziz Nagar, Moinabad, Telangana, India

Introduction

Gallstone disease is one of the most common problems affecting the digestive tract. Autopsy reports have shown a prevalence of gallstones from 11% to 36%. Cholecystectomy is one of the most common surgical procedures performed in the world.[1-3] In 1992, National Institute of Health consensus development stated that laparoscopic cholecystectomy "Provides a safe and effective treatment for most patients with symptomatic gallstones" and it is the treatment of choice for cholelithiasis. Currently it is estimated that over 80% of cholecystectomies are performed using the laparoscopic approach.[4-8] Approximately 2-15% of the attempted Laparoscopic cholecystectomy have to be converted to open procedures due to various difficulties faced while performing the procedure. The difficulties in LC may be due to

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

difficulty in port placement, dissection of the Calot's triangle or extracting excised gall bladder (GB).[9-11] Various clinical and ultrasonological parameters that may help to predict the difficulty level preoperatively were analysed in the present study. The factors considered were age, sex, number of attacks of acute cholecystitis, BMI, palpability of GB and those based on US assessment were GB size (maximum AP diameter), site of GB stone, GB wall thickness.[12,13] Such predictions done preoperatively may help the patient and surgeon in being better assessment preoperatively for intra operative risk & risk of conversion to open cholecystectomy.[14] Aim of these study was to study and assess difficulties in laparoscopic cholecystectomy in gallbladder stone disease in patients attending Dr.V.R.K. Women's Medical College, Teaching Hospital and Research Centre, Aziz Nagar, Moinabad.

Material and Methods

Study Area: Department of General Surgery, Dr.V.R.K. Women's Medical College, Teaching Hospital and Research Centre, Aziz Nagar, Moinabad, R.R Dist., Telangana - 500075, India.
Study Population: Total of 100 patients with symptomatic gallbladder stone disease admitted for Laparoscopic Cholecystectomy.

Selection of Patients

In the study, patients of age more than 10yrs and less than 65yrs of both sex admitted in Dr.V.R.K. Women's Medical College, Teaching Hospital and Research Centre, Aziz Nagar, Moinabad were included in the study.

Inclusion criteria

- All cases of Symptomatic Gall Stone Disease

Exclusion criteria

- Patients with choledocholithiasis, gallbladder cancer.
- Patients with age less than 10yrs.
- Patients with age more than 65yrs.

Study period: A period 1 year from November 2021 to October 2022 during which patients meeting the inclusion criteria were included in the study.
Study design: It was a hospital based Prospective Study
Methodology: All patients satisfying the inclusion criteria were included in the study. Written informed consent is obtained from all patients included in the study. All patients were given scores based on various factors influencing the outcome.

Table 1: Pre-operative risk based on scoring system

Risk	Score
No Risk	0-5
Moderate Risk	6-10
High Risk	11-15

Patient Preparation

All cases were admitted one day prior to surgery. Detailed history, findings in general and systemic examination, investigation reports were obtained for each patient. Patients were counseled about the surgical procedure. They will be informed of the probable risk of being converted to open procedure based on complications encountered intra- operatively. Patient willing to undergo surgery and his or her relative were required to sign in the form for consent for the procedure as well as in the form for open conversion of LC. Pre anesthetic

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

checkup was done by the experienced anesthesia team of the hospital. Pre anesthetic medication was given as appropriate for each patient. A fasting period of 12 hours prior to surgery was made compulsory for all the patients. Proper shaving of skin from the level of nipples to mid-thigh was done. Soap water enema is given in the early morning on the day of surgery. A single dose of a broad spectrum injectable antibiotic was given routinely within 1 hour of scalpel skin contact. Just before taking the patient to the operation room, patient was asked to pass urine or catheterized.

OPERATION ROOM SET UP:

The position of the operating surgeon was on the left and the assistant on the right of the patient. The laparoscopic video camera operator stands on the left of the operating surgeon. One television monitors were placed, one facing the surgeon and the other facing the assistant .The insufflation unit was placed opposite the surgeon to observe the insufflation and gas flow rate for continuous monitoring of the intra-abdominal pressure. An instruments set for OC was kept ready inside operating room for each LC.

OPERATIVE TECHNIQUE:

In each case the initial position was supine with 20 degree reverse Trendelenburg position. Then pneumoperitoneum was created using closed technique with Verres needle which was inserted in the midline at the umbilicus. Insufflating gas used was carbon dioxide. Initially insufflation was done at the flow rate of 1L/min. As the intra-abdominal pressure increases, monitoring of pulse, respiration and blood pressure is done. The pressure reading in the insufflator should not exceed 15mm Hg.

Figure 1: Operative techniques

The standard four trocar technique was used for all cases. After achieving pneumoperitoneum, a 10 mm trocar and cannula were inserted in the umbilicus. Then a 10 mm zero degree laparoscope was introduced down the cannula into the abdominal cavity. Subsequently three other trocars were placed, one 10 mm trocar in the epigastrium, one 5 mm trocar in the mid clavicular line 3 cm below the right costal margin and another 5mm in the right anterior axillary line between lowest costal margin and the iliac crest. Needle decompression was needed if the GB was found to be tense with fluid followed by thorough saline wash.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

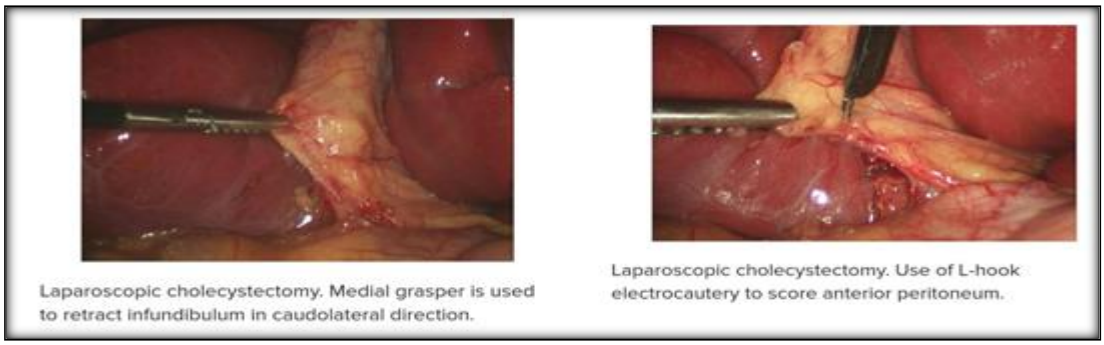


Figure 2: During Operation

An atraumatic grasping forceps was introduced into the axillary lateral port to grasp the fundus of the GB and push it towards the right shoulder over the edge of the liver to expose the Calot's triangle. The other atraumatic grasping forceps was inserted into the mid clavicular port to grasp the infundibulum of GB pulling it away from the liver thereby attaining optimum exposure of Calot's triangle. The dissection started at the Calot's triangle beginning with freeing the cystic duct and artery from the surrounding adhesions and after skeletonization of the structures, clips were applied first on the cystic duct which was cut first and then on the cystic artery which was cut subsequently. Then the GB was dissected off the GB fossa using electro-cautery hook. After the separation of the GB it was taken out through the epigastric point port site.

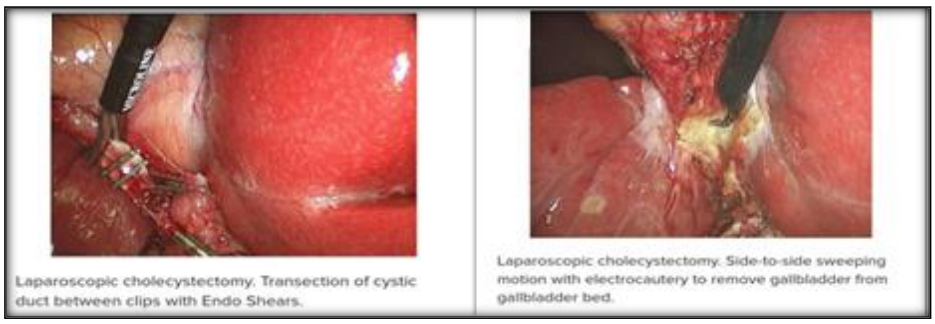


Figure 3: Operation

Statistical Analysis

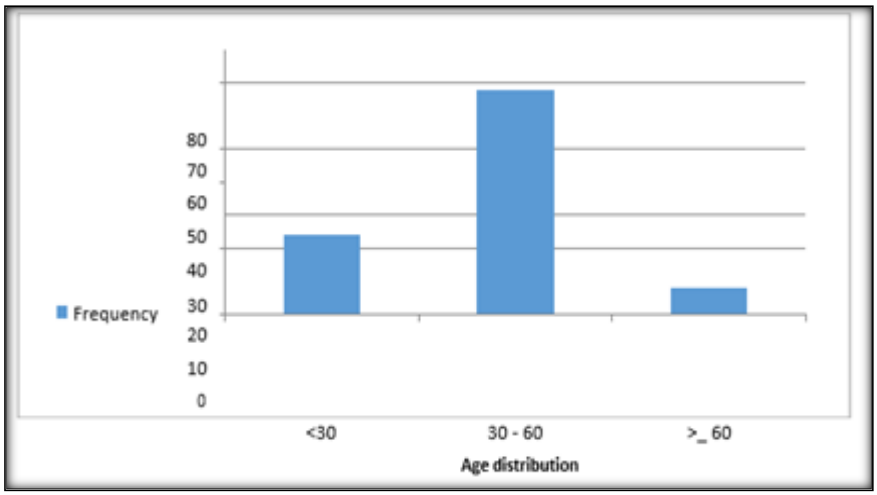
Statistical testing was conducted with the statistical package for the social science system version SPSS 15.0. Continuous variables are presented as mean ± SD and Categorical variables are presented as frequency distributions and percentages. Suitable graphs have been made to enhance visual appeal. The association of qualitative variables with various parameters has been determined using Chi- square/Fisher's exact test.

Results

Table 2: Age Distribution of the study population

Age (in years)	**n**	**%**
< 30	24	24%
30 – 60	68	68%
≥ 60	8	8%
Total	100	100%

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022



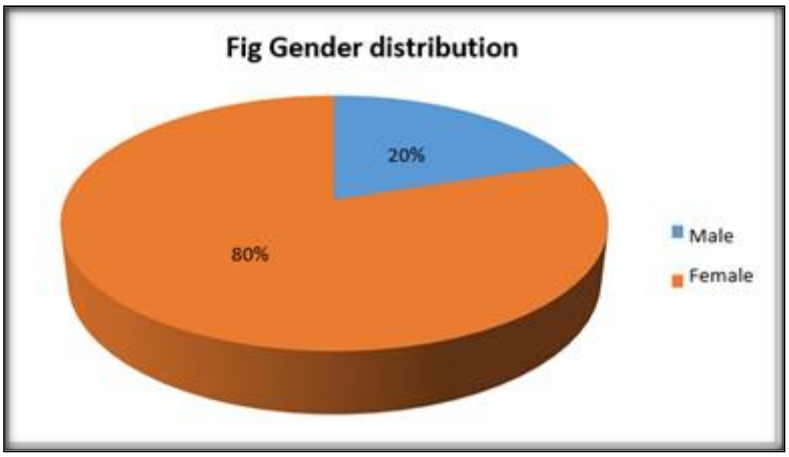
The present study was conducted in the Department of General Surgery in DR.V.R.K. Women's Hospital, Aziz Nagar, Moinabad, R.R. Dist, Telangana. In this study 100 patients undergoing Laproscopic Cholecystectomy were evaluated and the following observations were made.

Age Distribution: The mean age of the study group was 37.43 ± 10.55 (SD) years with minimum age being 22 years.

Sex Distribution: Of the 100 patients included in the study 20 patients were male (20%) and 80 were females (80%).

Table 3: Sex Distribution of Study population

Gender	n	%
Male	20	20.00%
Female	80	80.00%
Total	100	100%



Total number attacks of RUQ pain

Data regarding the total number of attacks of RUQ (Right Upper Quadrant) pain is depicted in [Table 4].

Table 4: Distribution of study population based on total no. of attacks of RUQ pain

Tot. No. of attacks of RUQ pain	n	%
< 5	68	68%
5 - 10	15	15%

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

> 10	17	17%
Total	100	100%

Mean number of attacks is 5.23 ± 6.26 (SD) with minimum being 1, maximum being 30

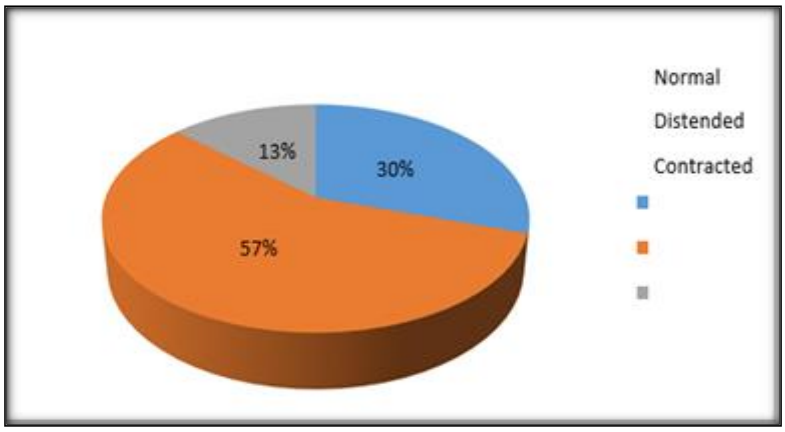
Body Mass Index (BMI): Mean BMI of the patients included in the study group was 25.67 ± 3.59 (SD) kg/m^2 while the mean in females was 26.13kg/m^2 compared to 23.79 kg/m^2 among males. Patients were divided into the categories based on their BMI <18.5 kg/m^2, 18.5-27.5 kg/m^2 and >27.5 kg/m^2.

Table 5: Distribution of patients based on BMI

BMI (Kg/m^2)	**N**	**%**
< 18.5	0	0.00%
18.5 - 27.5	77	77%
> 27.5	23	23%
Total	100	100%

Table 6: Distribution of patients based on GB size on USG

GB Size on USG	**n**	**%**
Normal	30	30%
Distended	57	57%
Contracted	13	13%
Total	100	100%



Out of these 100 cases, in 57 cases USG was suggestive of a distended GB, 6% patients (6 cases) had clinically palpable GB.

Site of GB stone: Ultrasound was done to detect whether the gall stones were freely mobile in the GB lumen or impacted at the neck of the GB. The findings were as follows.

Table 7: Distribution of patients based on site of the gall stone in the GB

GB Stone	**n**	**%**
Free in lumen	55	55.00%
Impacted at neck	45	45.00%
Total	100	100%

GB Wall thickness: GB wall thickness was assessed in all cases undergoing pre-operative ultrasound. The findings were grouped into three categories: GB wall thickness of <4 mm, 4-8 mm and >8 mm.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Table 8: Distribution of patients based on GB wall thickness

GB Wall thickness (mm)	n	%
< 4	90	90.00%
4 - 8	10	10.00%
> 8	0	0.00%
Total	100	100%

Table 9: Outcome of 68 cases predicted to be easy.

Actual Outcome of cases predicted to be easy	Number of patients
Easy	52 (77.77%)
Difficult	16 (22.33%)
Total	68

We observed a positive predictive value (PPV) of 82.93% for scoring system for cases predicted to be easy or Negative Predictive Value (NPV) of scoring system is 82.93%.

Table 10: Outcome of 32 patients predicted to be difficult

Outcome of patients predicted to be difficult	Number of patients
Difficult	26 (80%)
Easy	6 (20%)
Total	32

For cases predicted to be difficult we registered a positive predictive value (PPV) of 84.21% for the scoring system. Out of the above 16 patients, 2 were found to be very difficult as the total time for Laparoscopic Cholecystectomy was more than >90 min, these were included under difficult cases in view of ease of calculations and graphical representation.

Table 11: Shows the correlation of gender with the outcome in terms of mean time of various steps taken to perform Laparoscopic Cholecystectomy.

	Gender	n	Min	Max	Mean	±SD	p-value
Time taken 1st incision to insertion of all ports(mins)	Female Male	80 20	4 5	16 10	7.21 7.42	2.48 1.56	0.783
Insertion of all ports to completion of GB Dissection (mins)	Female Male	80 20	18 23	43 89	25.94 48.83	6.33 24.49	<0.001
Completion of GB dissection to Completion of GB extraction (mins)	Female Male	80 20	3 2	8 8	5.06 4.92	1.44 1.51	0.756
Completion of GB extraction to suturing of all ports (mins)	Female Male	80 20	4 5	15 8	6.17 6.08	1.97 0.90	0.888
Total time (min)	Female Male	80 20	35 39	62 109	44.38 67.25	7.50 25.18	<0.001

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

As is evident in [Table 11] the mean time taken from all ports insertion to completion of GB dissection was 25.94 ± 6.33 mins in females, 48.83 ± 24.49 in males which was statistically significant (P < 0.001) so also the mean total times of Laproscopic Cholecystectomy in females, males were 44.38 ± 7.5 min, 67.25 ± 25.18 min respectively which was also found to be statistically significant (P < 0.001). Also it is evident that the other timings, like insertion of ports, completion of GB dissection to GB out of peritoneal cavity and timing from GB out to suturing of all ports, varied little with the sex of the patient. Application of statistical tests shows that gender is a significant factor in terms of mean time taken for the dissection at Calot's triangle and GB bed (P value < 0.001), and mean total time of Laproscopic Cholecystectomy (p< 0.001).

Table 12: Shows the correlation of age with the outcome in terms of mean time of various steps taken to perform Laparoscopic Cholecystectomy.

	Age (years)	**n**	**Min**	**Max**	**Mean**	**± SD**	**p-value**
Time taken 1st incision to insertion of all ports(mins)	< 30 30 - 60 > 60	23 69 8	5 4 6	9 16 10	6.07 7.56 8.00	1.38 2.50 1.87	0.084
Insertion ofall ports to completion of GB dissection(mins)	< 30 30 - 60 > 60	23 69 8	18 18 23	65 89 68	29.00 29.02 47.00	12.30 14.95 16.76	0.036
Completion of GB dissection to completion of GB extraction (mins)	< 30 30 - 60 > 60	23 69 8	3 2 4	8 8 6	5.00 5.02 5.20	1.62 1.46 0.84	0.964
Completion of GB extraction to suturing of all ports (mins)	< 30 30 - 60 > 60	23 69 8	4 4 5	9 15 7	5.93 6.27 5.80	1.49 1.99 0.84	0.756
	< 30	23	36	88	46.00	14.10	
Total time (mins)	30 - 60	69	35	109	47.88	15.13	0.035
	> 60	8	40	89	66.00	17.90	

The above [Table 12] shows that there is a nonlinear rise in the meantime taken for the insertion of ports and the GB dissection with age which was more for the mean time taken to perform GB dissection. It also shows the rise in the mean duration of GB extraction total mean time taken for the procedure with age. From this table there appears no significant relation between age and suturing of the ports. Application of statistical tests shows significant correlation between age and mean duration of GB dissection (p=0.036), age and mean total time of LC (p=0.035).

Table 13: Shows the correlation of BMI with the outcome in terms of mean time of various steps taken to perform LC

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

	BMI	n	Min	Max	Mean	± SD	p-value
Time taken 1st incision to insertion of all ports (mins)	18.5 - 27.5 > 27.5	46 14	4 6	16 14	6.72 9.00	2.03 2.39	0.001
Insertion ofall ports to completion of GB dissection (min)	18.5 - 27.5 > 27.5	46 14	18 20	89 40	31.26 28.07	16.88 6.70	0.495
Completion of GB dissection to Completion of GB extraction (mins)	18.5 - 27.5 > 27.5	46 14	2 4	8 8	4.87 5.57	1.42 1.40	0.110
Completion of GB extraction to suturing of all ports (mins)	18.5 - 27.5 > 27.5	46 14	4 5	15 10	6.00 6.64	1.80 1.78	0.246
Total time (min)	18.5 - 27.5	46	35	109	48.85	17.55	0.928
	> 27.5	14	38	60	49.29	7.76	

[Table 13] shows that all the patients undergoing the procedure were divided into 3 categories based on their BMI: <18.5kg/m^2, 18.5-27.5kg/m^2 and >27.5kgm^2. There were no cases with a BMI of <18.5kg/m^2. There is a positive correlation between the BMI and the mean time taken to insert ports, mean time taken for the extraction of GB, the mean time taken in closure of ports and mean total time of LC as evident by the above table. Also there appears to be a negative correlation between the BMI and the mean time required for GB dissection. Application of statistical tests proved that only the correlation with increase in time to put ports was statistically significant (p value = 0.001).

DISCUSSION

Laparoscopic Cholecystectomy (LC) is one of the most commonly performed surgeries world over and is undergoing regular improvements with growing technology in order to make it safer, cosmetically acceptable and cost effective. Many prospective as well as retrospective studies have illustrated certain factors that play a role directly or indirectly in making this procedure difficult.

Getting access to the peritoneal cavity, creating pneumoperitoneum, dissecting the GB and extracting the excised GB may pose problems while performing Laproscopic Cholecystectomy. Various clinical and ultrasonological parameters that may help predict the difficulty level preoperatively were analysed in the present study. The clinical factors that were considered included age, sex, number of attacks of acute cholecystitis, BMI and palpability of GB and those based on ultrasonological assessment were GB size (maximum anteroposterior diameter), site of GB stone (impacted at neck or free in the lumen) and GB wall thickness.[15] Each of the above risk factors was graded on a scale of 0 to 2. Based on the sum total of this score an attempt was made to predict the difficulty level of the surgery preoperatively. The scores were categorised into 3 categories; no risk, moderate risk, and high risk with scores of 0-5,6-10,11-15 respectively.

The difficulty level so assessed was correlated with the surgical outcome as easy, difficult and very difficult in terms of time taken to perform the procedure, blood loss and bile spillage and conversion to open cholecystectomy.[16] Such predictions done preoperatively may help the patient as well as the surgeon in being better prepared for the intra-operative risk and the risk of conversion to open cholecystectomy.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

In studies done world-wide, male sex has been described to be associated with difficult Laproscopic Cholecystectomy.[17] In a study of population of 564 patients, Kanaan et al, reported a conversion rate of 4% among patients undergoing elective Laproscopic Cholecystectomy, the rate being higher in males. In a series of 1804 patients found male sex to be one of the factors attributing to a difficult surgery in terms of time taken for the procedure (p value < 0.01) and the conversion to open cholecystectomy. On the contrary series published by Wicker et al and Ronan et al did not find male sex to be a risk factor for difficult surgery. In the present study there were 20 males and 80 females patients. Out of 20 males, 14 were predicted to have a difficult surgery. Post op 75% males (14 out of 20) turned out to have a difficult procedure, while the incidence of difficult cases in females was 31.25% (25 out of 80 cases) though the prediction was for 18 cases.[18] We observed significant difference in mean time for GB dissection ($p < 0.001$) and in the mean total time for Laproscopic Cholecystectomy ($p < 0.001$) between males and females.

It was observed that male patients had more intense inflammation and fibrosis associated with cholecystitis when compared to females most probably due to high pain tolerance in males, recurrent attacks, delayed presentation; the same is supported in the literature by Simpolous et al. It was also observed that males in our series had comparatively more number of attacks of acute cholecystitis compared to females. Number of attacks correlate well with the proportionate increase in the intra-peritoneal adhesions, increased bleeding, increased mean duration of dissection and total time that make the Laproscopic Cholecystectomy difficult.[19] The mean estimated blood loss in males was found to be 12.5 ml ± 3.97 ml while in females it was found to be 9.56 ± 3.75 ml. This was found to be statistically significant ($p= 0.024$). In our study, males were associated with moderate bleeding during surgery which could be due to break down of dense adhesions (in Calots triangle as well as in between GB and other structures), thickened GB wall and difficult anatomy of biliary tree. Meshikhes et al and Al-Saigh et al,[20] from Saudi Arabia reported a conversion rate of 11% in their cases, the most common cause of conversion in their study being a difficult anatomy. These anatomical variations are usually not diagnosed on routine USG done for cholelithiasis. Age is a risk factor for difficult GB surgery. Simpolous et al,[21] while reporting on conversion rate in LC found that patients treated successfully by LC were generally younger than 50 years of age, in comparison to those who required conversion had a mean age of more than 50 years of age. In another series of 564 patients, Kanaan et al had a difficult procedure in 33 patients who had to be converted to open surgery. In his series 60% patients were aged more than 50 years. The difficult procedure in older patients could be attributed to longer history of cholelithiasis, increased number of attacks of acute cholecystitis, increased adhesions and fibrosis around GB with time. It has been found also in other studies that elderly patients may have a higher likelihood of complicated biliary pathology further increasing the difficulty level.[22]

In our series, the majority of patients were in the age group of 30-60 years (68 patients) and only 8.33% (8 cases) were> 60 years of age. Preoperatively there were no patients in the age group of <30 years out of 23 who were predicted to have a difficult surgery. In the age group of 30-60 years and more than 60years, 36.58% (23 out of 68) and 80% (7 out of 8) respectively were predicted to have difficult Laproscopic Cholecystectomy. Post operatively 28.5% of cases (6 out of 23 cases) in the age group of less than 30 years were found to be surgically difficult, while 36.58 % (23 out of 68) and 80 % (7 out of 8) patients in the age group of 30-60 years and more than 60 years respectively had difficult outcomes postoperatively.[23] There were dense adhesions at Calot's triangle in all three patients aged > 60 years who had difficult Laproscopic Cholecystectomy. We observed a nonlinear correlation between age and the mean time taken to insert port, the dissection of GB and the mean total time taken for the procedure all increasing with age, however such correlations were found to be statistically significant only in GB dissection ($p = 0.036$) and total time of

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Laproscopic Cholecystectomy (p=0.035) [24-26]. Obese patients may have a difficult laparoscopic surgery due to various factors. Rosernet et al did a retrospective study on 1347 patients who underwent Laproscopic Cholecystectomy. He concluded that one of the significant risk factors predicting a difficult procedure and increasing the chances of open procedure is BMI > 40 kg/m^2. Jaskiran et al in a series of 228 cases divided patients into 3 groups based on BMI and found a BMI of> 27.5 kg/m^2 to be associated with difficult surgery.

CONCLUSION

In our research, we found that patients over the age of 60 were more likely to have difficulty with dissection at the Calot's triangle, as well as dissection of the GB from its bed and an increase in the mean total time of LC. This could be due to long-term recurrent attacks of acute cholecystitis, which can cause adhesions in the Calot's triangle as well as between the GB and other structures. Patients with a body mass index greater than 27.5 kg/m^2 (obese patients in our series) were related with difficult port insertion. This may be owing to the thick abdominal wall. The other parts of the operation were straightforward across all BMI categories.

References

1. Alponat A, Kum CK, Koch BC, Predictive factors for conversion of Laparoscopic cholecystectomy World J Surg. 1997,21,629-33
2. Daradkeh S, Tarawneh E, Al-Hadidy. Factors affecting common bile duct diameter. Hepatogastroenterology. 2005,52,1659-61
3. Bowie JD. What is the upper limit of normal for the common bile duct on ultrasound : how much do you want it to be ? Am J Gastroenterology 2000,95,897-900
4. Gadzijev EM. Surgical anatomy of Hepato-duodenal ligament and hepatic hilus J Hepato-biliary Pancreatic Surgery. 2002;9;531-33
5. Hirao K, Miyazaki A, Fujimoto T, Isomoto I, Hayashi K..Evaluation of aberrant bile ducts before Laparoscopic Cholecystectomy, helical CT cholangiography versus MR Cholangiography. Am J Roentgenology. 2000;175;713-20.
6. Adkins RB, Chapman WC, Reddy VS, Embryology, Anatomy, Surgical applications of Extra-hepatic biliary system. Surgical Clinics of North America; 2000;80;363-79
7. Aerts R, Penninckx F. The burden of Gall stone disease in Europe. Ailment Pharmacol Ther. 2003;18:49-53
8. Tandon RK. Pathogenesis of Gall stone in India. Trop Gastroentrol. 1998;9;89-91
9. Malhotra SL. Epidemiological study of cholelithiasis among rail road workers in India Gut. 1998;9;290-5.
10. Tazuma S. Galla Stone disease; Epidemiology, pathogenesis and classification of biliary stones (common bile duct and intra-hepatic). Best Pract Res Cilnic gastroenterol. 2006;20;1075-83
11. Shehadi WH. The biliary system through the ages. Int Surg .1979;64(6):63-78
12. Beal JM. Historical perspective of gall stone disease. Surg Gynecol Obstetr. 1984;314(13):818-22
13. Sauerbach T, Delius M, Paumgartner G, Holl J, Wess O, Weber W et al.
14. Fragmentation of gall stones by extracorporel shock waves. N Engl J Med 1986;314(13):818-22
15. Rege RV, Nemcek AA, Nahrwold DL. Selection of patients for gallstone lithotripsy. Am J Surg. 1989;158(3):184-7
16. Steven M, Strasberg SM, Clavien PA. Cholecystolithiasis: lithotripsy for the 1990s. Hepatol. 1992;16(3):820-39

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

17. Ghnnam W, Malek J, Shebl E, Elbeshry T, Ibrahim A. Rate of conversion and complications of laparoscopic cholecystectomy in a tertiary care center in Saudi Arabia. Ann Saudi Med. 2010;30:145-8.
18. Cushieri A, Dubois F, Mouiel J, Mouret P, Becker H, Troidl. The European experience with laparoscopic cholecystectomy. Am J Surgery. 1991;161:385-7.
19. Kanaan SA, Murayama KM, Merriam LT, Dawes LG , Prystowsky JB, Rege RV, Jochi RJ. Risk factors for conversion of laparoscopic to open cholecystectomy. J Surg Res 2002,106;20-4
20. Lo CM, Lai ESC, Fan St et al. Laparoscopic cholecystectomy in elderly World J Surg 1996;20-983-7.
21. Weikbe EA, Pruiit AL, Howard TJ. Conversion of laparoscopic to open cholecystectomy. An analysis of risk factors Surg Endosc 1996,10-742-5.
22. Rattner DW, Ferguson C, Warshaw AL. Factors associated with successful laparoscopic cholecystectomy for acute cholecystitis. Ann Surg 1993,217-233.
23. Fried GM, Barkun JS, Sigman HH. Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy. Am J Surg 1994,167,35-41
24. Singh K, Ohri A laparoscopic cholecystectomy is there a need to convert ? J Min Access Surg 2005,1,59-62
25. Meshikhes AW, al Dhurais S, Bhatia D, al Khatir N. Laparoscopic cholecystectomy: The Dammam Central Hospital experience Int Surg. 1995,80:102-4.
26. Fukegami K, Kawaguchi Y, Nakayama H, Youshirokubola and Nagawa H Preoperative Grading System for predicting operative conditions in Laparoscopic Cholecystectomy Surg Today, 2004 34;331-6.