

Ultrasonographic Predictors of Difficult Laparoscopic Cholecystectomy

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ABSTRACT

Aims: Ultrasonographic predictors of difficult laparoscopic cholecystectomy.

Materials And Methods: A prospective longitudinal study was conducted included 250 patients who underwent elective laparoscopic cholecystectomy for uncomplicated gallstone disease. The study was conducted at one surgical unit in Department of Surgery in collaboration with Department of Radio-diagnosis.

Results: In this study out of 250 patients, 158(63.2%) patients have only gallstones and 92(36.8%) patients have ultrasound findings of gallstones associated with other findings in gallbladder. Out of these 93 patients, 29.3% patients have gallbladder wall thickness more than 4mm; 43.5% patients have gallbladder stone impacted at the neck; 18.5% patients have contracted gallbladder; 8.7% patients have common bile duct diameter more than 6mm. Gall bladder wall thickness more than 4mm leads to difficult laparoscopic cholecystectomy in 25.4% cases. 40 patients have contracted gallbladder and 46% of them had undergone difficult laparoscopic cholecystectomy. In the present study, 8 patients had common bile duct dilated more than 6mm and all of them had to undergo difficult laparoscopic cholecystectomy. Time taken from insertion of trocar to gallbladder extraction is more than 90mins in majority of cases (52.2% vs 12.1%) with ultrasound findings of gallstones associated with other findings than the cases with ultrasound findings of gallstones only. Intra operative complications which led to difficult laparoscopic cholecystectomy; majority of cases (56%) had dense adhesions at calots triangle and surrounding structure followed by tear of cystic

artery during dissection which accounted for 24.4% of patients.

Conclusion: Ultrasonographic findings of gallbladder wall thickness more than 4mm, stone impacted at the neck of gallbladder, contracted gallbladder, common bile duct diameter more than 6mm are found to be significant predictors of difficult laparoscopic cholecystectomy in our study.

Keywords: Laparoscopic cholecystectomy, difficult cholecystectomy, Calot's triangle, uncomplicated gallstone disease

INTRODUCTION

Laparoscopic cholecystectomy has rapidly replaced open cholecystectomy as the standard treatment. The advantages of laparoscopic cholecystectomy over the classical open cholecystectomy includes a reduced hospitalization stay, decreased morbidity, short recovery time, economical and better cosmesis. [1-3]

The term 'difficult cholecystectomy' usually refers to multiple technical intra-operative difficulties that increase the risk for complications and significantly prolong the operating time subsequently the Surgical time and cost increases. There are several conditions that are to be noted that makes laparoscopic cholecystectomy a technically difficult procedure. These include acute cholecystitis, empyema of gall bladder, gangrenous cholecystitis, porcelain gall bladder and intrahepatic gall bladder, mucocele, pyocele.

Ultrasonography is the initial imaging method for diagnostic approach

and evaluation of the biliary system, it is widely available, non-invasive, safe, innocuous and non-expensive. This method allows the detailed real-time study of the gallbladder and the other hepato-biliary systems besides the evaluation of other findings that contribute to the final diagnosis. [4] Cholesterol stones cannot be distinguished from pigment stones with ultrasonography. [5] When the gallbladder is completely filled with stones, the lumen may not be visualized. Only a large acoustic shadow is evidence of stones in 20% of patients with cholelithiasis. [6]

One of the important findings gall bladder wall thicknesses of more than 4.0 mm which indicates thickened gallbladder wall and signifies acute cholecystitis, a contracted fibrotic gall bladder which makes the gallbladder difficult to grasp. [7] Apart from this, the ultrasound may demonstrate a porcelain gall bladder, calcification of gall bladder wall and a gall bladder containing large stones; all of these findings are technically difficult due to inability to grasp and retract with standard laparoscopic instruments. When the gallbladder is completely filled with stones, the lumen may not be visualized. Only a large acoustic shadow is evidence of stones in 20% of patients with cholelithiasis. [8]

It is to be noted that age above 60 years makes laparoscopic cholecystectomy difficult. [9] Significantly high mortality, morbidity and conversion rate has been reported in male sex. [10] It has also been found that acute cholecystitis in obese has been the most important factor for conversion. [11]

In our study, a checklist helped us systematically record all relevant sonographic information and to convey it to the leading surgeon. The purpose to undertake this study was to evaluate pre-operative ultra-sonographic finding in order to predict a difficult cholecystectomy. This would be beneficial in term of better management of patients. This study is useful to the laparoscopic surgeon in predicting a difficult cholecystectomy and any possible

conversion from laparoscopic cholecystectomy to open laparoscopic cholecystectomy in a Government medical college environment

MATERIAL AND METHOD

Study design:-A Cross-sectional study.

Place of study:-Department of Surgery, Sushila Tiwari Government Medical College, Haldwani; Uttarakhand.

Period of study:-20 months: January 2018 - September 2019.

Sample size:-All Patients that were admitted and who underwent laparoscopic cholecystectomy for cholelithiasis during the study period. We perform laparoscopic cholecystectomy in 250 patients, 92 patients had other ultrasounds findings along with cholelithiasis. In the remaining 148 patients there was only cholelithiasis with no other findings.

Study population:-Cases that were admitted as in-patient in various surgical wards in GMC, Haldwani; for cholelithiasis, who are clinically evaluated and confirmed by ultrasonography. Patients were considered from any socio-economic status, age limits are 18-60 years, both gender included and from any religion.

Inclusion criteria: -

The patients aged between 18 to 60 years having cholelithiasis with/without other findings which were diagnosed by ultrasonographic examination, admitted in various surgical wards and planned for laparoscopic cholecystectomy of Sushila Tiwari Government Medical College and Hospital, Haldwani, Uttarakhand.

Exclusion criteria: -

-Patients with common bile duct (CBD) calculus, dilated common bile duct (CBD), raised alkaline phosphatase, where common bile duct(CBD) exploration was needed or in any cases where there was a requirement of pre-operative endoscopic retrograde cholangio-pancreatography (ERCP).

-Patients who refused surgery that is laparoscopic cholecystectomy.

-Patients with any signs or symptoms of obstructive jaundice.

- Patients not willing for laparoscopic cholecystectomy or opting for open cholecystectomy.
- Patients who were not fit for laparoscopic surgery.
- Patient below than 18 years and above 60 years of age.

Study variables:

Ultra-sonographic prediction of the technical difficulties which were encountered during laparoscopic cholecystectomy and this prediction will be done using some of the ultra-sonographic findings of the patients, namely

1. Gallbladder wall thickness (more than 4-mm thick; gallbladder wall thickness >4mm will predict a difficult laparoscopic cholecystectomy)
2. Gallstone mobility (gallstone impacted at the neck of the gallbladder is taken to be a difficult laparoscopic cholecystectomy)
3. Gallbladder size or gallbladder content (contracted gallbladder will therefore predict to be a difficult laparoscopic cholecystectomy)
4. Common bile duct (CBD) diameter (Common bile duct size more than 6mm will therefore predict to be difficult laparoscopic cholecystectomy).
5. Number of calculus:- Single calculus and multiple calculi.

Operative criteria:

1. More than 90 minutes taken for laparoscopic cholecystectomy from the insertion of the trocar until the extraction of gallbladder, was considered a difficult laparoscopic cholecystectomy.
2. More than 20 minutes taken to dissect calot's triangle was considered a difficult laparoscopic cholecystectomy.
3. More than 20 minutes taken to dissect the gallbladder from the gallbladder bed was

considered a difficult laparoscopic cholecystectomy

4. Any laparoscopic cholecystectomy which was converted to open procedure was considered a difficult laparoscopic cholecystectomy

5. Tear of gallbladder during dissection, common bile duct tear or injury, spillage of bile and stones was considered a difficult laparoscopic cholecystectomy.

Statistical analysis

Patient details were entered in a proforma and then transferred on to a Microsoft Excel spreadsheet. Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Continuous variables are presented as mean±SD, and categorical variables are presented as absolute numbers and percentage. Nominal categorical data between the groups (before-after) were compared using Chi-squared test or Fischer's exact test as appropriate. For all statistical tests, a P-value less than 0.05 was taken to indicate a significant difference.

RESULTS AND OBSERVATIONS

The highest incidence of gallstone in the present study is in the age group of 31 to 40 years (40.0%), followed by 41 to 50 years (27.6%) and 51 to 60 years (17.2%). The sex ratio of female is to male is about (71.6% : 28.4%) which comes to about 2.7 : 1.

Table 1: Respondents having cholelithiasis and showing the mean and median.

Age Groups	Frequency	%
18- 20 years	4	1.6%
21 - 30 years	34	13.6%
31 - 40 years	100	40.0%
41 - 50 years	69	27.6%
51 - 60 years	43	17.2%
Total	250	100%
Mean ± SD	40.17 ± 10.11	
Median	39	
Min - Max	19 - 60	

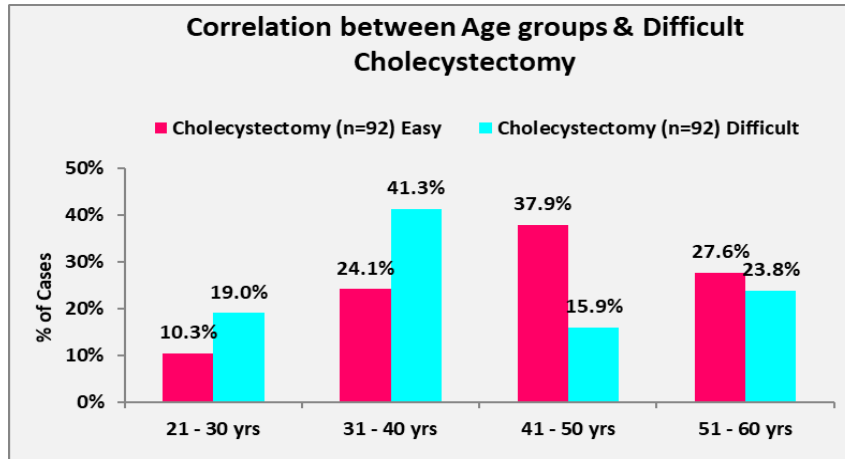


Fig 1: This chart showing the relation of age with the difficulty in our total 92 patients who had gallstone with other findings in the ultrasound.

Table 2: The respondents are group based on gender.

Sex	Frequency	%
Female	179	71.6%
Male	71	28.4%
Total	250	100%

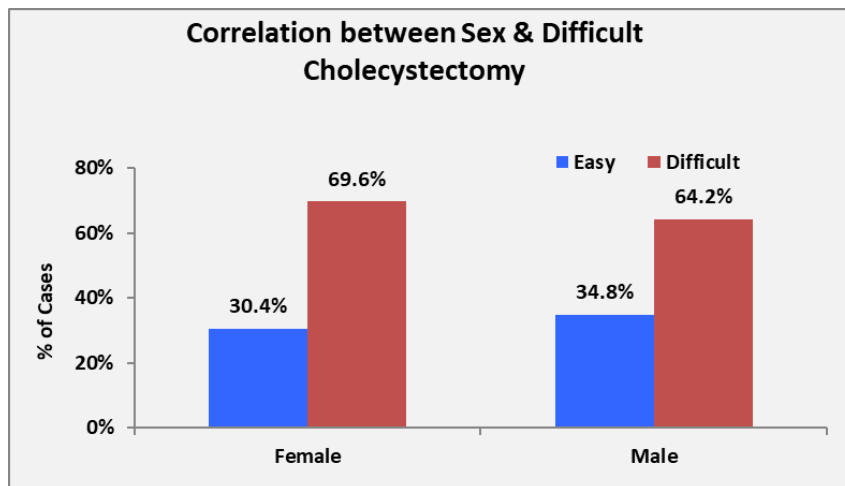


Fig 2: Showing the co-relation between gender and the difficulty in performing cholecystectomy.

Table 3: The respondents are grouped depending on their religion.

Religion	Frequency	%
Hindu	207	82.8%
Muslim	32	12.8%
Sikh	11	4.4%
Total	250	100%

Table 4: the respondents were as followed when grouped into their daily lifestyle.

Lifestyle	Frequency	%
Sedentary	126	50.4%
Moderate	80	32.0%
High	43	17.2%

In this study, almost half 126 (50.4%) patients of the respondents were having sedentary life style, and about 80 (32%) were having moderate lifestyle habits which in relation to other studies and reviews of

literatures are found to be almost same all over the world.

Table 5: All the respondents came to us with some complaints or the other and some of them even concurrence in the patients. These complaints were as follow.

Symptoms	Frequency	%
Pain	250	100.0%
Flatulent dyspepsia	176	70.4%
Nausea and vomiting	153	61.2%
Appetite reduced	152	60.8%
Fever	71	28.4%
Mass per abdomen	52	20.8%
Altered bowel habits	34	13.6%

Pain was the predominant symptom seen in about all 250(100%) patients in this study. This complaint was further followed by flatulent dyspepsia 176 (70.4%) and nausea.

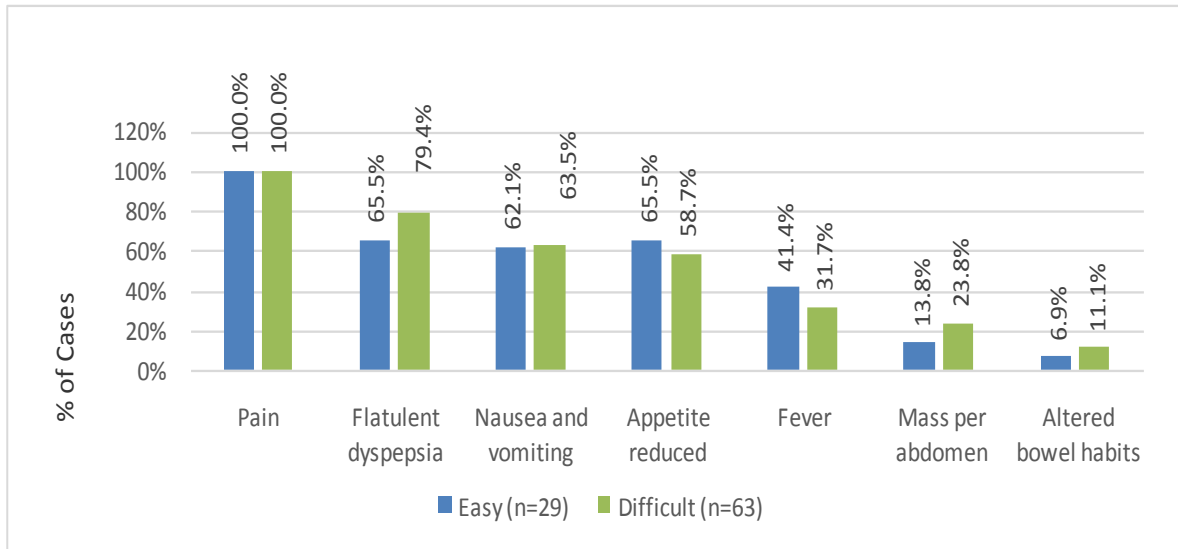


Fig 3: Showing the co-relation between the various symptoms and the difficulty met during laparoscopic cholecystectomy in the n=92 patients (patients who had cholelithiasis with other findings).

Table 6: Of the total 92 patients having cholelithiasis with other findings in the ultrasonography, in 63 patients were faced with difficult laparoscopic cholecystectomy.

Cholecystectomy in patient with other ultrasonographic findings.	Frequency	%
Easy	29	31.5%
Difficult	63	68.5%
Total	92	100.0%

Out of 250 patients, 92 patients had cholelithiasis with other associated findings. However, the remaining 158 patients had only cholelithiasis and without any other associated findings.

Table 7: The 92 patients had the above additional finding along with cholelithiasis and distributed in the frequency as above.

Gall Bladder Findings	Frequency	%
GB thickness >4mm	27	29.3%
GB stones impacted in the neck	40	43.5%
Contracted GB	17	18.5%
CBD diameter >6mm	8	8.7%
total	92	100%

Out of 92 patients, 27(29.3%) patients had gallbladder wall thickness which was more than 4mm. About 40(43.5%) patients had gallstones which were impacted at the neck of gallbladder. Around 17(18.5%) patients had contracted gallbladder, and in 8(8.7%) patients common bile duct was found to be dilated > 6mm.

Table 8: Showing the correlation between the patients (n=92) having cholelithiasis with other findings in ultrasound and above mentioned ultra-sonographic criteria.

Gall Bladder Findings	Total	Cholecystectomy				P- Value
		Easy (n=29)		Difficult (n=63)		
		Frequency	%	Frequency	%	
GB thickness >4mm	27	11	37.9%	16	25.4%	0.220
GB stones impacted in the neck	40	11	37.9%	29	46.0%	0.466
Contracted GB	17	7	24.1%	10	15.9%	0.343
CBD diameter >6mm	8	0	0.0%	8	12.7%	0.111
Totals	92	29		63		0.220

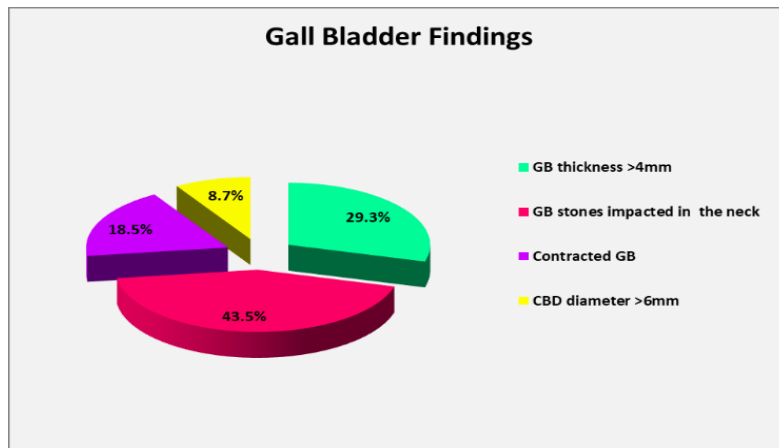


Fig 4: Distribution of the patients based on the gallbladder and ultra-sonographic findings.

Of all the patients who had cholelithiasis with other findings accounting to about 92 of the 250 patients, 2 patients converted to open cholecystectomy. Ultrasound showed contracted gallbladder and the other patient had thickened gallbladder wall with a calculus impacted in the neck of the gallbladder. In both these patients, intraoperatively there was dense calot's triangle finding leading to very difficult dissection.

Table 9: Above figure shows the distribution of all the cases into patients with other ultra-sonographic findings and the other group into cases without any other ultra-sonographic findings and the surgical time period taken. [longer time taken signifying difficult cholecystectomy]

Operative timing	Total	Gallstone with other findings (%)		Only gallstone (%)		p value
		n	%	n	%	
Time taken from insertion of trocar to GB extraction						
≤ 90 minutes	187	48	52.2%	139	88.5%	<0.001
>90 minutes	62	44	47.8%	19	12.1%	
Dissection of GB from GB bed						
≤ 20 minutes	217	71	77.2%	146	93.0%	<0.001
>20 minutes	63	21	22.8%	12	7.6%	
Dissection of Calots' triangle						
≤ 20 minutes	214	74	80.4%	140	89.2%	0.076
>20 minutes	36	18	19.6%	18	11.5%	
Total	250	92	100.0%	158	100.6%	

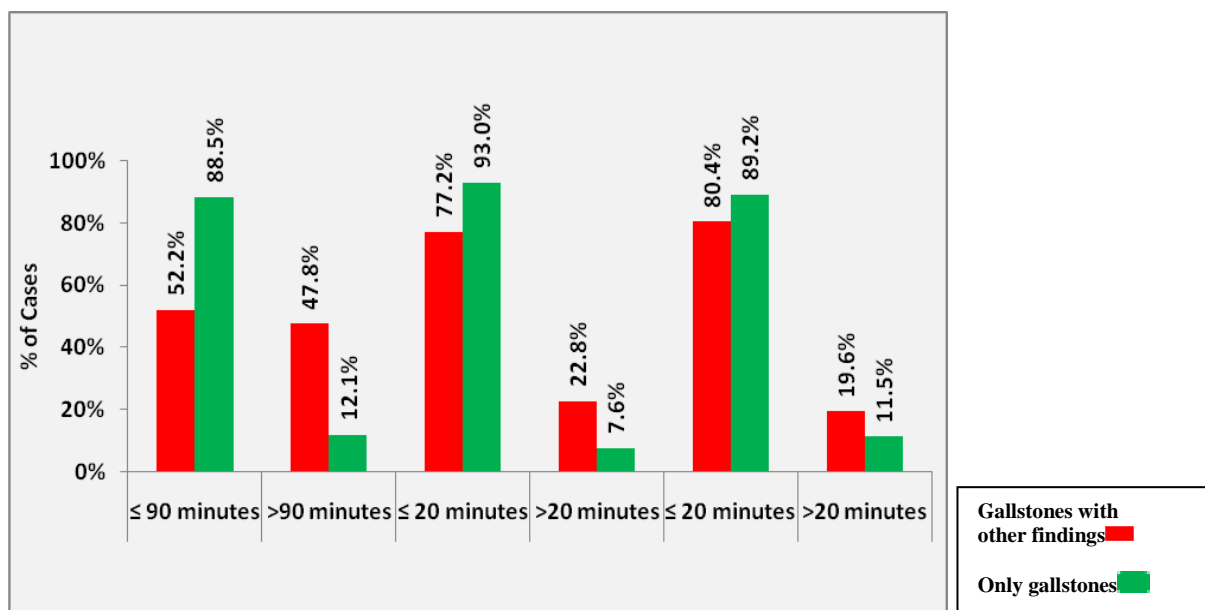


Fig 5: Above figure shows the distribution of all the cases into patients with other ultra-sonographic findings and the other group into cases without any other ultra-sonographic findings and the surgical time period taken. [longer time taken signifying difficult cholecystectomy]

According to the operative criteria of difficult laparoscopic cholecystectomy in our study, it has been found that 12.1% cases with only gallstones took more than 90mins from insertion of trocar to extraction of gallbladder as compared with cases of gallstones with other findings, where 47.8% cases took more than 90mins.

Table 10: During the operative course, some findings worth noting as this caused difficulty in performing the laparoscopic procedure. These findings were however not detected in ultrasonography.

Intra-operative findings	Frequency	%
Dense adhesions at Calot triangle or the surrounding structures	31	12.4%
Tear of cystic artery during dissection	13	5.2%
Empyema of gallbladder	4	1.6%
Sessile gallbladder	4	1.6%

Table 11: During the operative course, some findings worth noting as this caused difficulty in performing the laparoscopic procedure. These findings were however not detected in ultrasonography. Here we also see which cases were found to be difficult.

Intra-operative findings	Difficult Cholecystectomy				P Value
	Easy (n=29)		Difficult (n=63)		
	Frequency	%	Frequency	%	
Dense adhesions at Calot triangle or the surrounding structures	1	3.4%	26	41.3%	<0.001
Tear of cystic artery during dissection	1	3.4%	9	14.3%	0.162
Empyema of gallbladder	0	0.0%	3	4.8%	0.549
Sessile gallbladder	0	0.0%	4	6.3%	0.304

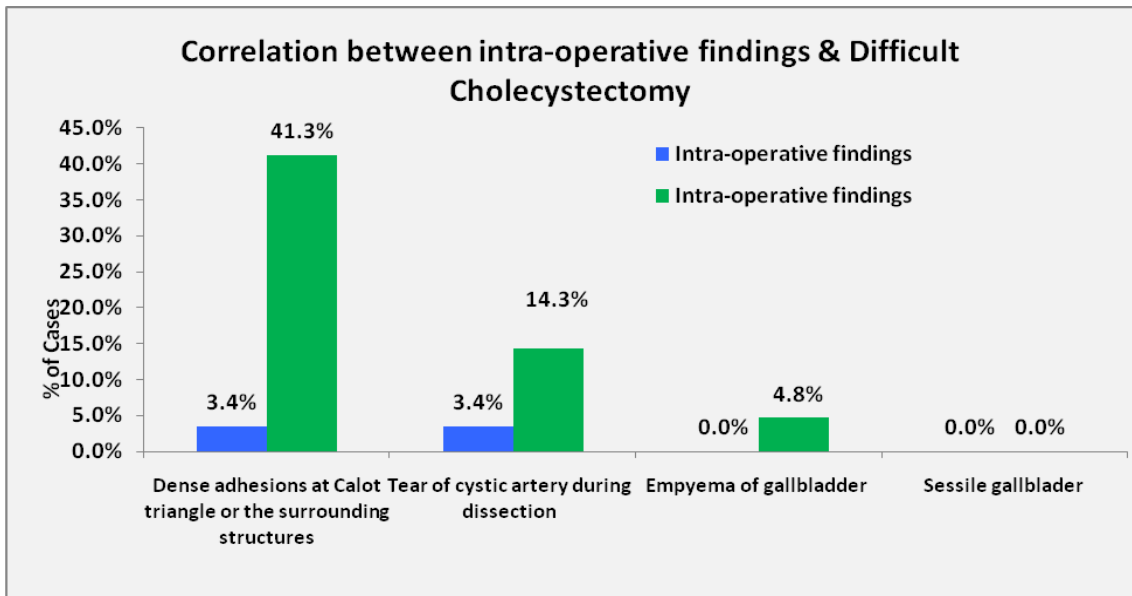


Fig 6: Showing the relations between the intra-operative findings and difficulty in performing the laparoscopic cholecystectomy in the 92 patients who had cholelithiasis with other ultra-sonographic findings.

In our study, the complications which led to difficult laparoscopic cholecystectomy are found to be dense adhesions at calots triangle or surrounding structures (12.4%), anomaly of gallbladder (1.2%), tear of cystic artery during dissection (5.2%), empyema of gallbladder (1.6%) and sessile gallbladder (1.6%).

DISCUSSION

Age distribution

Majority of the patients in our study are in the age group of 31-40 years (40.0%).

In the study conducted by Muhammad Rafique Memon et al, the majority of them were in the mean age group of 45 years. In another study that was conducted by Jaskiran Randhawa JS et al, majority of the patients were in the age group of (30-50) years with the mean age of 44.37 years.

Sex Distribution

In the present study, we included a total of 250 patients, 179(71.6%) are females and 71(28.4%) are males. In the study which was conducted by Thornton

DJA et al, 72.10% patients were females and 27.89% patients were male.

Presenting symptom

Pain: Pain is the predominant symptom of all the 250 patients in this current study. In a study that was conducted by Kumar S et al, It was found that 35.5% patients had acute attacks and rest had history of dyspeptic symptoms. It was also found that patients who were having such history of acute attacks had a significant higher rate of difficult laparoscopic cholecystectomy (15.6% vs 3.6%) than those with dyspeptic symptoms.

Flatulent Dyspepsia: In the present study, out of 250 patients, 174(70.5%) patients presented with flatulent dyspepsia. This finding is found to be in accordance with the study conducted by Kumar S et al, where 64.5% patients presented with the same complaint.

Nausea & Vomiting: In the present study, 153(61.2%) patients presented with complaints of nausea & vomiting off and on in the past. Vomiting was spontaneous and occurred mostly during the attacks of pain.

Loss of appetite: In our study, 152(60.8%) patients have history of loss of appetite. This was however not associated with any significant loss of weight.

Fever: Fever is present in 71(28.4%) patients, which is of moderate degree and is not associated with chills and rigor. However, we only admitted patients who are currently not having any fever.

Mass per abdomen: In this study, 52 (20.8%) patients presented with palpable lump in the right hypochondrium which was or was not associated with pain/tenderness. It was not associated with jaundice.

Altered bowel habits: In the present study, 34(13.6%) patients presented with altered bowel habits. It was not associated with any blood in stool.

CONCLUSION

As previously discussed, ultrasonographic study is the most accurate and a very sensitive investigation for the diagnosis

of cholelithiasis and any other findings if associated other as cholelithiasis.

The positive predictive value of difficult laparoscopic cholecystectomy is 68.5 No complications like common bile duct injury, or injury to adjacent viscera occurred in our study.

According to the operative criteria of difficult laparoscopic cholecystectomy in our study, it has been found that 12.1% cases with only gallstones took more than 90mins from insertion of trocar to extraction of gallbladder as compared with cases of gallstones with other findings, where 47.8% cases took more than 90mins.

In our study, 7.6% cases with only gallstones took more than 20mins for dissection of gallbladder from bed, whereas 22.8% cases of gallstones with other findings took more than 20mins.

Of all the patients who had cholelithiasis with other findings accounting to about 92 of the 250 patients, 2 patients converted to open cholecystectomy. Ultrasound showed contracted gallbladder and the other patient had thickened gallbladder wall with a calculus impacted in the neck of the gallbladder. In both these patients, intraoperatively there was dense calot's triangle finding leading to very difficult dissection.

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