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An Observational Study to Assess the Effect of Multiple Risk factors in Predicting a Difficult Laparoscopic Cholecystectomy Preoperatively

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ABSTRACT

The current study is an attempt to know access the preoperative predictability of difficult laparoscopic cholecystectomy based on the following predictors age more than or equal to 60 years, BMI more than or equal to 30 kg/sq.m, Past history of acute cholecystitis, Gallbladder wall thickness more than or equal to 3mm, Presence of pericholecystic fluid, Total WBC count more than or equal to 10,000, Serum Fibrinogen >4gm/L ,Serum Alkaline phosphatase > 100IU/L.

Key words: Gallbladder, BMI, Cholangitis, WBC count, Laparoscopic Cholecystectomy, Pericholecystic fluid

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INTRODUCTION

Gallstone disease affects 3 to 20 % of the people living worldwide. Most of the gallstones remain asymptomatic throughout. Only some patients with gall stones show symptoms like biliary colic, jaundice, fever, etc. Pain is usually caused if there is an obstruction in the cystic duct by a calculus [1]. Complications due to symptomatic gall stone disease include cholecystitis, gallstone pancreatitis, choledocholithiasis with or without cholangitis, cholecystocholedochal fistula, cholecystoenteric or cholecystoduodenal fistula leading to gallstone ileus and carcinoma gallbladder[1,2].

Gallstones are generally diagnosed incidentally by ultrasonography, CT scans, HIDA scans, abdominal radiography or during laparotomy. Lab tests like liver function tests and total leucocyte counts also help in diagnosing gallbladder diseases. Only around 3% of asymptomatic gallstone patients become symptomatic every year [1]. Several trials for medical treatment of gallstones remained unsuccessful. Some of the medical treatments include contact dissolution in which gallbladder is cannulated and an organic solvent is infused, oral bile salt therapy and extracorporeal shock wave lithotripsy.

As the recurrence rates are pretty much high, in 50 % patients who underwent dissolution therapies, they are no longer used for the treatment of gallstone disease. But extracorporeal shock wave lithotripsy proved beneficial in some patient's having single gallstone of size between 0.5 – 2 cm. The recurrence rates are also quite low, around 20 % in these patients [1,2]. Gallbladder removal (Cholecystectomy) is the choice of treatment for all gallbladder diseases which are symptomatic and asymptomatic, unless the patient have increased risk to undergo surgery under general anesthesia. Among cholecystectomies, laparoscopic procedure is accepted widely as the standard procedure of choice. Laparoscopic cholecystectomy since its introduction has revolutionized minimally invasive surgery within a short period of twenty years [1].

First cholecystectomy was performed in 1882. A century later in 1985 the first laparoscopic cholecystectomy was performed. Since then,

cholecystectomy has undergone many changes like invention of laparoscopic procedure, single port laparoscopic cholecystectomy to performing robot assisted cholecystectomy [3]. With increasing experience gained by the surgeons in this procedure, they started accepting cases which are more challenging and patients who are at high risk, leading to increased complication rates and so the rate of conversion to open cholecystectomy. Among all the laparoscopic cholecystectomies performed worldwide 3 to 10 % need conversion to open cholecystectomy [4,5].

Conventionally laparoscopic procedure is done in all cases if it's not contra-indicated. Laparoscopic cholecystectomy have various advantages like decreased morbidity, decreased stay in hospital, better cosmesis and short time for recovery. However not all laparoscopic cholecystectomies can be finished the same way, conversion to open cholecystectomy is required in some patient's [1,2,6].

Various factors are responsible for the conversion of laparoscopic to open cholecystectomy like in cases of acute cholecystitis, anatomic anomalies, massive fibrosis, old age, male gender, history of upper abdominal surgeries and pancreatitis, lack of appropriate laparoscopic instruments, gallbladder wall thickness of more than 3mm, presence of pericholecystic fluid, intraoperative complications like uncontrolled bleeding, injury to the internal organs [4,5,7]. But conversion from laparoscopic to open cholecystectomy involves its own complications like increased chances of surgical site and respiratory infections, prolonged hospital stays. So, certain studies were performed to predict the preoperative prediction of difficult laparoscopic cholecystectomy and to predict the conversion from laparoscopic to open cholecystectomy [4,8,9].

The ability to correctly find out the individual patient's risk responsible for conversion to open cholecystectomy based on the preoperative details can help in more appropriate preparation of the patient, improved efficiency and timing of operating room, prior preparation due to anticipation of difficulty, proper instructions to the assistant, betterment of patient safety by decreasing the time for conversion[4,5].Previous conducted studies predicted the conversion of laparoscopic to open cholecystectomy using various scoring systems, but the scoring systems were not been extensively incorporated into surgical practice due to various reasons.

MATERIALS AND METHODS

The study was conducted in the department of General Surgery, Sree Balaji Medical College between March 2018 to September 2019.

Inclusion criteria

Patients above 18 years with symptomatic gallbladder disease Laproscopic Cholecystectomy performed for biliary colic or acute cholecystitis.

Exclusion criteria

All patients less than 18years old. Patients with gallbladder carcinoma operated by open cholecystectomy. When patients where gallbladder disease Laproscopic Cholecystectomy performed for biliary colic or acute cholecystitis.If they presented as choledocholithiasis or intensive unit associated acalculous cholecystitis.

Methods

It is a retrospective observational study. Patients were admitted prior to the surgery, complete history was taken and systemic examination done. Ultrasound abdomen and routine blood investigations were done in all the patients.

Definition of variables

Independent variables

All the independent variables were categorized, referring to the standard cut off value.

Characteristics of the patients - Gender, Age, BMI were used. BMI of more than or equal to 30 were considered as obese individuals.

History–Past history of cholecystitis.

Lab data–Complete blood counts (Total WBC count), Serum Fibrinogen, Serum Alkaline Phosphatase

Ultrasound abdomen Findings–Presence of gallbladder wall thickness (thick more than or equal to 3 mm vs less than 3 mm) and pericholecystic fluid collection.

Outcome variables

All the Outcome variables were evaluated as categorical variable. Difficult laparoscopic

cholecystectomy was assessed in terms of duration of surgery in minutes. Difficult laparoscopic cholecystectomy was >120 mins and Easy laparoscopic cholecystectomy was <120 mins. It was defined as the time taken from starting incision to closure of port sites. It was evaluated as continuous variable.

Statistical analysis

Logistic Regression was applied to assess factors affecting the preoperative risk of laparoscopic cholecystectomy and their relation to the outcome variable. Odds ratio of >1 is considered as significant risk factor with p value taken to be <0.05. Logistic Regression was performed to ascertain the effect of Age, Bmi, Gender, Wbc count, Serum. fibrinogen, Serum. Alkaline Phosphatase, H/o cholecystitis, Gall bladder wall thickness, Pericholecystic fluid collection on predicting a difficult laparoscopic cholecystectomy preoperatively. Logistic regression model was with p value-0.699 and chi square-4.676. The model explains 59% variation in time, and correctly classifies 84% of the cases.

RESULTS

Study population includes 50 patients who underwent cholecystectomy by either laparoscopic or open method who are admitted in the department of General Surgery, Sree Balaji Medical College, Chennai. Study population was divided into two groups, one group consisted of patients in whom the surgery duration was less than 2 hours and were called “Easy” group. Second group consisted of patients in whom the surgery took more than or equal to two hours’ time and were called “Difficult” group. Study statics are mentioned in Table 1. In the study population females are the predominant gender who underwent laparoscopic cholecystectomy (62%). Males account for 38% of the cases (Table 2 and Figure 1).

Odds of patients who are > 60 years of age had 3.2 times more risk for prolongation of surgery for more than or equal to two hours when compared with <60 years aged patients. The difference between the two groups was not statistically significant (p-value 0.392). Odds of patients having a difficult laparoscopic cholecystectomy was 4 times more in males when compared to females. The difference between the two groups was not statistically significant (p value – 0.404)

Odds of patients whose BMI > than or equal to 30 had 2.1 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients whose BMI is <30. The difference between the two groups was not statistically significant (p value–0.404) Odds of patients who had previous history of cholecystitis had 8.7 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients who had no history of cholecystitis. The difference between the two groups was statistically significant (p value–0.041).

Odds of patient having high WBC count > or equal to 10,000 had 2.5 times more risk for prolongation of surgery when compared with patients who have WBC count less than 10,000. The difference between the two groups was not statistically significant (p value–0.502). Odds of patients having gall bladder wall thickness had 2.1 times more risk of prolongation of surgery for more than or equal to two hours when compared with patients with no gall bladder wall thickness. The difference between the two groups was not statistically significant (p value–0.612).

Odds of patients having peri cholecystic fluid collection had 10.1 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients with no peri cholecystic fluid collection in ultrasound abdomen. The difference between the two groups was statistically significant (p value–0.036) Odds of patients having S. fibrinogen >4 had 7.9 times more risk for prolongation of surgery when compared with patients who have S. Fibrinogen <4. The difference between the two groups was statistically significant (p value–0.048).

Odds of patients having S. Alkaline Phosphatase >100 had 5.5 times more risk for prolongation of surgery when compared with patients who have S. Alkaline Phosphatase <100. The difference between the two groups was not statistically significant (p value–0.110) (Tables 3 to Table 9) and (Figures 2 to Figure 7).

Table 1: Statistics.

		Age	BMI	Serum Fibrogen	Neutrophil	Alkaline Phosphatase
N	Valid	50	50	50	50	50
	Missing	0	0	0	0	0
Percentile	Median	48	23.35	5.1	10050	83
	Minimum	18	20	3.2	5900	58
	Maximum	80	50	7.8	315000	218
	25	37.5	21.99	4.1	7500	73
	50	48	23.35	5.1	10050	83
	75	63	26.71	5.725	12225	107

Table 2: Gender distribution of cases.

Gender distribution of cases	
Men	19 (38%)
Women	31 (61%)
Total	50

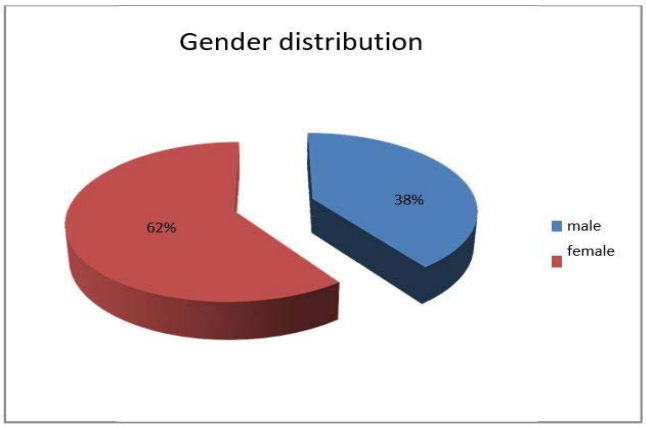

Figure 1: Gender distribution of cases.

Table 3: Relation between age & difficulty of surgery.

Age			Frequency	Percent	Valid Percent	Cumulative Percent
<60	Valid	Difficult	25	69.4	69.4	69.4
		Easy	11	30.6	30.6	100
		Total	36	100	100	
>60	Valid	Difficult	9	64.3	64.3	64.3
		Easy	5	35.7	35.7	100
		Total	14	100	100	

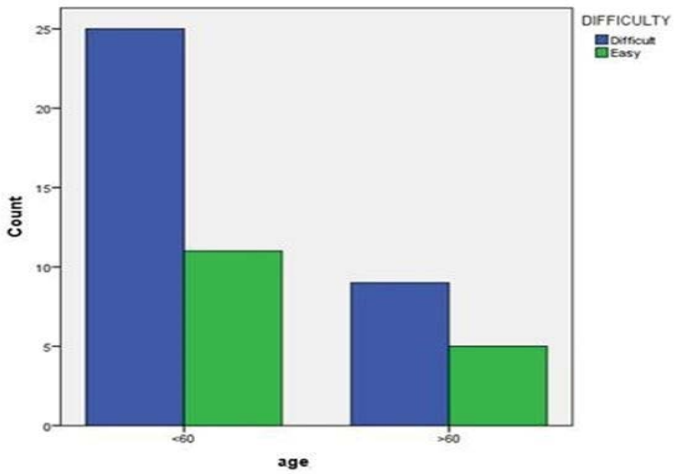

Figure 2: Relation between age & difficulty of surgery.

Table 4: Relation between gender and difficulty of surgery.

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Female	Valid	Difficult	20	64.5	64.5	64.5
		Easy	11	35.5	35.5	100
		Total	31	100	100	
Male	Valid	Difficult	14	73.7	73.7	73.7
		Easy	5	26.3	26.3	100
		Total	19	100	100	

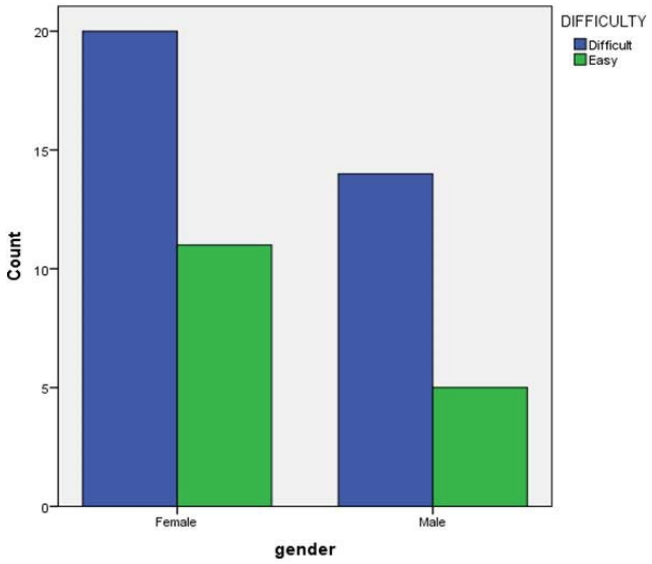

Figure 3: Relation between gender and difficulty of surgery.

Table 5: Relation between BMI & difficulty of surgery.

BMI			Frequency	Percent	Valid Percent	Cumulative Percent
<30	Valid	Difficult	28	65.1	65.1	65.1
		Easy	15	34.9	34.9	100
		Total	43	100	100	
>30	Valid	Difficult	6	85.7	85.7	85.7
		Easy	1	14.3	14.3	100
		Total	7	100	100	

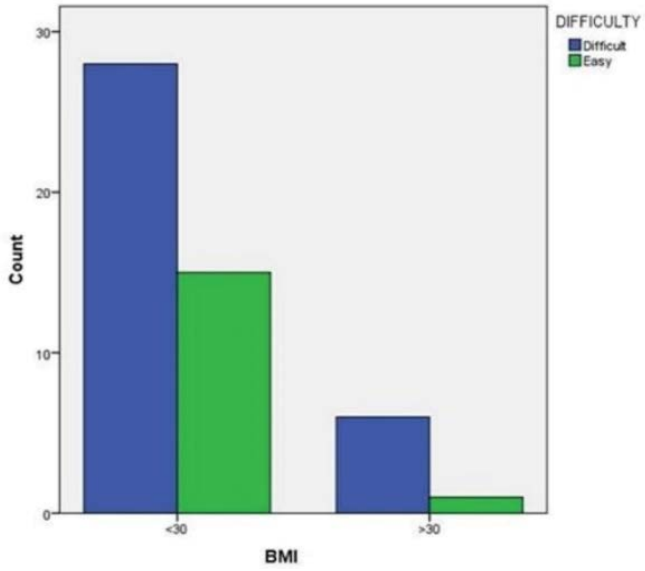

Figure 4: Relation between BMI & difficulty of surgery.

Table 6: Relation between previous history of cholecystitis & difficulty of surgery.

H/o cholecystitis			Frequency	Percent	Valid Percent	Cumulative Percent
No	Valid	Difficult	12	57.1	57.1	57.1
		Easy	9	42.9	42.9	100
		Total	21	100	100	
Yes	Valid	Difficult	22	75.9	75.9	75.9
		Easy	7	24.1	24.1	100
		Total	29	100	100	

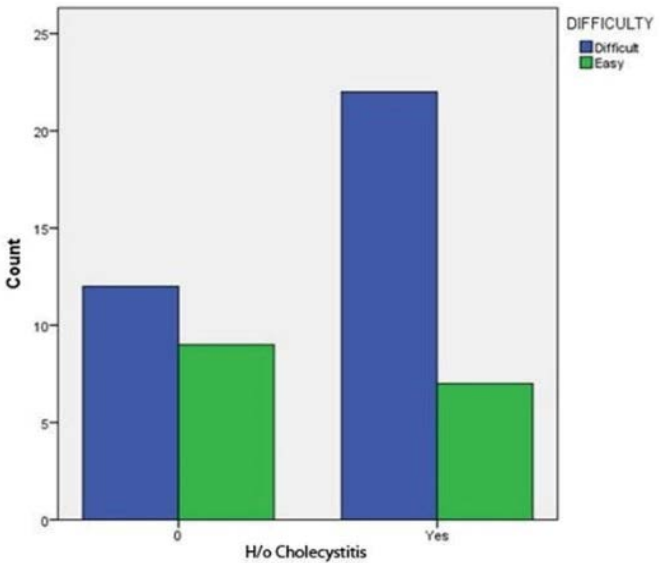

Figure 5: Relation between previous history of cholecystitis & difficulty of surgery.

Table 7: Relation between pericholecystic fluid collection & surgery duration.

Pericholecystic Fluid collection			Frequency	Percent	Valid Percent	Cumulative Percent
No	Valid	Difficult	15	51.7	51.7	51.7
		Easy	14	48.3	48.3	100
		Total	29	100	100	
Yes	Valid	Difficult	19	90.5	90.5	90.5
		Easy	2	9.5	9.5	100
		Total	21	100	100	

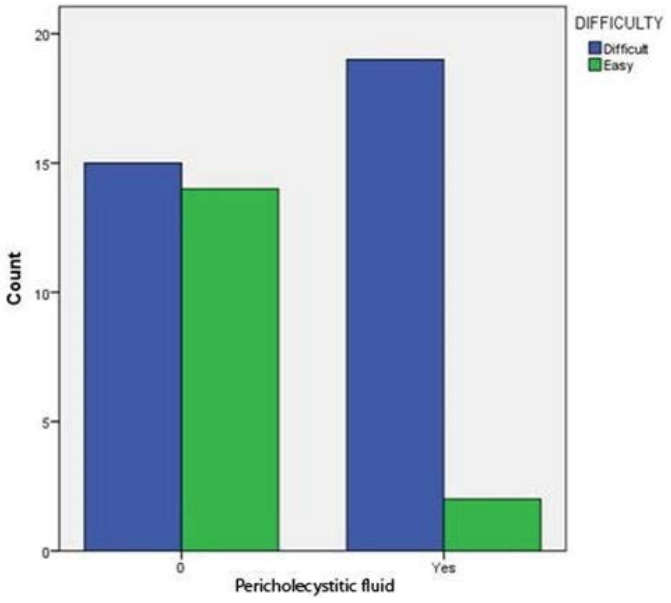

Figure 6: Relation between pericholecystic fluid collection & surgery duration.

Table 8: Relation between previous gall bladder wall thickness & surgery duration.

GB wall thickness (3mm)			Frequency	Percent	Valid Percent	Cumulative Percent
No	Valid	Difficult	12	57.1	57.1	57.1
		Easy	9	42.9	42.9	100
		Total	21	100	100	
Yes	Valid	Difficult	22	75.9	75.9	75.9
		Easy	7	24.1	24.1	100
		Total	29	100	100	

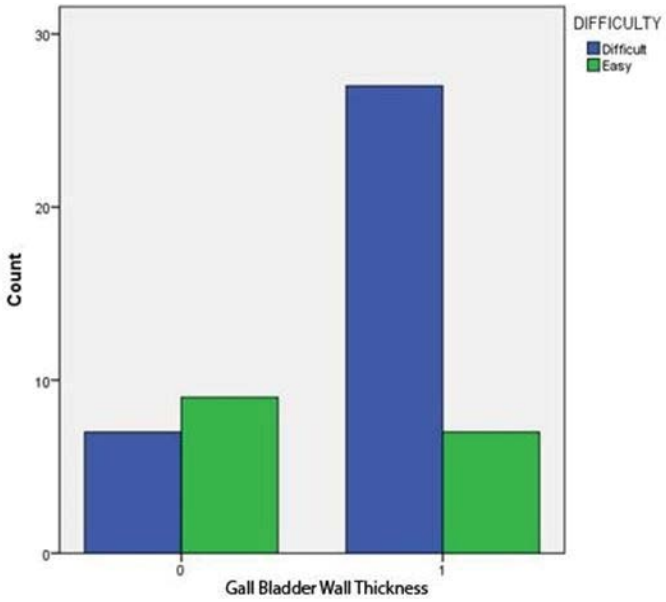

Figure 7: Relation between previous gall bladder wall thickness & surgery duration.

Table 9: Logistic regression for odds ratio variables in the equation.

Risk factors	B	S.E.	Wald	Difference	P VALUE (<0.05)	Odds Ratio	95% C.I.for EXP(B)	
							Lower	Upper
H/o cholecystitis	1.564	1.254	1.557	1	0.041	8.779	0.41	55.762
GB wall Thickness	0.54	1.177	0.211	1	0.612	2.125	0.171	17.238
Pericholecystic fluid	2.952	1.324	4.969	1	0.036	10.144	1.428	256.608
Age	1.167	1.363	0.733	1	0.392	3.212	0.222	46.464
BMI	0.744	1.464	0.259	1	0.611	2.105	0.119	37.103
Fibrinogen	2.197	1.125	3.81	1	0.048	7.996	0.991	81.665
WBC	-0.567	1.086	0.272	1	0.502	2.567	0.068	4.766
Gender	2.137	1.315	2.641	1	0.404	4.471	0.644	111.468
Alkaline phosphatase	2.071	1.295	2.557	1	0.11	5.534	0.627	100.478

DISCUSSION

Laparoscopic cholecystectomy is the gold standard procedure used worldwide for treating symptomatic gallbladder disease. It replaced open cholecystectomy as the treatment of choice for gallbladder disease. Advantages of laparoscopic cholecystectomy weigh over the open procedure in many ways like significant reduction in postop pain, early oral intake and getting back to normal routine, decreased rate of postop ileus and surgical site wound complications, reduced stay in hospital, better cosmesis [10-18].

But sometimes laparoscopic cholecystectomy poses difficulties during the procedure leading to prolongation of the surgery time due to problems in creating the pneumoperitoneum, in accessing the peritoneal cavity, releasing the adhesions around the gallbladder, retrieving the gallbladder, delay if there is spillage of stone or bile and sometimes it even requires conversion to open procedure. So, it would be helpful to the operating surgeon if there are certain factors to help in predicting the difficulty of the surgery preoperatively [19].

Various studies were conducted and being

conducted in which they identified certain factors predicting the difficulty of laparoscopic cholecystectomy preoperatively like gender, BMI, previous history of pancreatitis, cholecystitis, upper abdominal surgeries, ultrasound findings like gallbladder wall thickness, peri cholecystic fluid collection, old age and so on.

Age of the patient

In study conducted by Baki et al. showed mean age of 42.5 ± 11.7 years. In previous studies it is showed mean age of 44.2 ± 16.8 years [5]. In another study it is found that 26.8 % patients with age > 65 had difficult lap cholecystectomy. According to this study this variable was found to be statistically significant [20]. Wiebke et al. conducted a study in USA in 1996. They found that as the age increases, the chances of conversion from laparoscopy to open cholecystectomy increases [21].

In this present study, patients who are > 60 years of age had 3.2 times more risk for prolongation of surgery for more than or equal to two hours when compared with <60 yrs aged patients.

Gender

In the study population females are the predominant gender who underwent laparoscopic cholecystectomy (62%). Males accounts for 38% of the cases. Study conducted by Baki et al. found that females are the predominant gender who underwent laparoscopic cholecystectomy (90 %). In study conducted by Lipman et al showed 80.7 % of the cases were females [20]. In study conducted by Jagdish Nachnani et al. showed that male gender is one of the risk factors to predict difficult laparoscopic cholecystectomy [22].

According to previous studies it showed 50.9 % of male patients required conversion from lap to open cholecystectomy. This was found to be significant according to the study [20]. A study conducted by Wiebke et al. showed that male gender is not a risk factor for conversion of lap to open cholecystectomy [21]. Study conducted by Baki et al found that percentage of conversion from lap to open cholecystectomy is higher in male gender than in females. This difference was not found to be statistically significant [5].

In study conducted by Eldar et al male gender was more prone for conversion from lap to open cholecystectomy. This was found to be statistically significant (p-value 0.0017) [23]. In a previous study in which inflammatory changes, fibrosis and symptomatic gallbladder stones are seen extensively in men than in women, which lead to increased rate of conversion from lap to open in males than in females.

Body mass index

In study conducted by Jagdish Nachnani et al. found that BMI is a significant predictor for the conversion of lap to open cholecystectomy [22]. Study conducted by Baki et al showed BMI may be a risk factor in conversion of lap to open cholecystectomy [5] (p-value 0.634).In this present study, patients whose BMI >than or equal to 30 had 2.1 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients whose BMI is <30.

History of cholecystitis

According to study conducted by Nabil A. Abdel Baki et al, in was 55.46 ± 10.99. In patients with no history of cholecystitis the mean duration of surgery was 48.32 ± 8.83. The difference between the two groups is statistically significant (p- value 0.03) [5]. Wiebke et al found that past history of cholecystitis is a risk factor in the conversion of lap to open cholecystectomy [21].

In study conducted by Jagdish Nachnani et al history of cholecystitis is the most common reason for conversion from lap to open cholecystectomy due to inability to delineate the anatomy [22]. According to previous in people with past history of cholecystitis, 49.1% were converted from lap to open cholecystectomy (p-value<0.001) [20]. In this present study, patients who had previous history of cholecystitis had 8.7 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients who had no history of cholecystitis.

Serum fibrinogen

In the study conducted by S. bourgouin et al. [16] this is the first time that fibrinogen has been studied, demonstrating the best correlation to operative difficulty in univariate analysis and overwhelming the effect of CRP in the multivariate model. That's why we recommend to preoperatively dose fibrinogen rather than CRP because: CRP and fibrinogen describe the same information on systemic inflammation; fibrinogen is more useful than CRP to predict operative difficulties. In this present study,

Patients who had S .fibrinogen >4 had 7.9 times more risk for prolongation of surgery when compared with patients who have S.Fibrinogen <4 .

Serum alkaline phosphatase

In the study conducted by S.bourgouin et all- We wanted to assess the signification of abnormal liver tests in patients without choledocholithiasis and found that elevated alkaline phosphatase was predictive of difficult dissection. This result can be interpreted as the reflection of Mirrizzi syndrome, where impacted gallstones cause bile duct compression, rendering the cystic pedicle difficult to expose.

In this present study, patients who had S. Alkaline Phosphatase >100 had 5.5 times more risk For prolongation of surgery when compared with patients who have S. Alkaline Phosphatase <100.

Total WBC count

According to study conducted by Lipman et al, in people with elevated WBC counts, 36.6 % were converted from lap to open cholecystectomy (p- value < 0.001)[20]. In this present study, patients who had high WBC count > or equal to 10,000 had 2.5 times increased risk when compared with patients who have WBC count less than 10,000.

Gallbladder wall thickness

In study conducted by Jagdish Nachnani et al. increased gallbladder wall thickness is the most common reason for conversion from lap to open cholecystectomy due to inability to delineate the anatomy [22]. In this present study, patients who had gall bladder wall thickness had 2.1 times more risk of prolongation of surgery for more than or equal to two hours when compared with patients with no gall bladder wall thickness.

Presence of pericholecystic fluid

Suryawanshi Pravin et al. conducted study 6.5 % of cases who had peri gallbladder collection had difficult lap cholecystectomy [8]. According to Lipman et al 19.6 % of patients who required conversion from lap to open had fluid collection around the gallbladder, which was statistically significant [20].

In this present study, patients who had peri cholecystic fluid collection had 10.1 times more risk for prolongation of surgery for more than or equal to two hours when compared with patients with no peri cholecystic fluid collection in ultrasound abdomen.

CONCLUSION

Preoperative findings of H/o cholecystitis, presence of peri cholecystic fluid collection and an increase in S. fibrinogen can help in the prediction of difficult laparoscopic cholecystectomy. Other factors like old age (≥ 60 years), male(gender), Gall bladder wall thickness (>3mm), Serum Alkaline phosphatase >100, WBC count >10,000 and BMI ≥ 30 were all a risk factor in predicting difficult laparoscopic cholecystectomy preoperatively.

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ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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