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Original Research Article

Predicting difficult laparoscopic cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) has become the gold standard treatment for gallstone disease. Though mostly safe occasionally it can be difficult due to various problems faced during surgical procedure. Anticipation of likely difficulty can help in avoiding complications.
Methods: With the aim of identifying various predictors of difficulty and their correlation with likely difficulty this prospective study on 50 adults undergoing laparoscopic cholecystectomy for symptomatic cholelithiasis was undertaken. Various clinical, radiological and biochemical predictors and frequency and type of intraoperative difficulty was recorded.
Results: In present study adverse clinical factors only showed significant predictive value (p value - 0.005). Adverse radiological predictors although showing trend towards, did not achieve statistical significance (p value 0.065). In clinical predictors duration of symptoms >1yr, History of acute cholecystitis and BMI >30 showed statistically significant association. Age >50yrs, Male gender, radiological predictors (Thickened gall bladder wall, small contracted gall bladder, Single large impacted stone) and deranged LFT did not show significant predictive value.
Conclusions: Clinical predictors are most reliable factors. Use of good clinical judgement regarding possibility of and likely difficulty along with understanding of available resources is important in making decision in each case.

Keywords: Clinical, Difficult laparoscopic cholecystectomy, Predictors, Predicting, Radiological

INTRODUCTION

Cholelithiasis is one of the most common problems affecting the digestive tract. In India its prevalence is estimated to be around 4%.[1] Westernization of diet, socioeconomic changes and widespread availability of ultrasonography have contributed in increased prevalence. Minimal postoperative morbidity resulting from minimal invasiveness along with safety and efficacy have made laparoscopic cholecystectomy gold standard treatment for symptomatic cholelithiasis. It has now become the most common operation performed by general surgeons.[2] Currently around 80% of cholecystectomies are performed using laparoscopic approach.[3] Almost every laparoscopic surgeon performs and usually starts his career with this surgery.

Laparoscopic cholecystectomy though mostly safe and uneventful can be difficult at times. Approximately 2% to 15% of patients require conversion to open surgery for various reasons.[4,5] Most of the beginner laparoscopic surgeons in the country work with very basic instrumentation and infrastructure. Expertise of senior laparoscopic surgeons also may not be readily available. With increasing experience selection criteria for laparoscopic cholecystectomy has become more liberal. It

is being used in more and more earlier contraindicated situations. In these circumstances a lot of problems can be avoided by correct preoperative prediction of difficult cholecystectomy.

It may help in making arrangements for specialized instrumentation, expertise or timely referral thus avoiding many complications. These days laparoscopic cholecystectomy is considered as a day care surgery and patient's expectations are also accordingly. These patients can also be counselled regarding postoperative morbidity by correctly predicting difficult cholecystectomy.

Aims and objectives of the study were to identify the clinical, biochemical and radiological predictors of difficulty in laparoscopic cholecystectomy. To find co-relation of different pre-operative predictors with type of intra-operative difficulty during laparoscopic cholecystectomy.

METHODS

This prospective study was conducted at Santosh medical college and Hospital, Ghaziabad. Fifty patients undergoing laparoscopic cholecystectomy for symptomatic gall stones in a single unit during June 2016 to June 2017 were included. Patients with current acute cholecystitis, CBD stone, concomitant another procedure and those not willing to be part of study were excluded. Study protocol was approved by institutional committee. Preoperative risk factors assessed were clinical (age, gender, duration of symptoms, BMI, H/O attack of acute cholecystitis, past history of abdominal surgery), radiological (on USG gall bladder wall thickness >3mm, single large stone in Hartmann's pouch, small contracted gall bladder) and biochemical (deranged LFT).

Definition of difficult cholecystectomy

Access related

More than 2 veress needle attempts or alternate methods like open technique to be used.

Identification of gallbladder

If gall bladder covered with omentum/bowel loops and adhesions have to be divided (not separable by pulling) by the use of electro-cautery.

Grasping of gallbladder

Need of special instruments (with bigger jaw) for grasping or need of evacuation of gall bladder before grasping required.

Adhesiolysis

Adhesions requiring cutting by electro-cautery.

Flimsy/ easily separable adhesions by pulling were not included.

Calot's triangle dissection

More than 20 min time needed for calot's triangle dissection.

Duct clipping

Wide/short duct requiring suture rather than clipping or inadequate length to put two proximal and one distal clip.

Dissection from liver bed

Dissection of gall bladder from liver bed requiring more than 20 min. or perforation of gall bladder.

Extraction of gallbladder

Skin incision needs to be increased, piecemeal removal of gall bladder, spillage of stones/ bile during extraction.

Time was calculated from veress needle insertion till port closure. Overall time >60 min was also considered as difficult laparoscopic cholecystectomy. All surgeries were done under GA by standard four port technique. CO_2 pneumoperitoneum at 12mm Hg was used.

Statistics analysis

Data recording was done in predesigned proforma. All the data was entered in Microsoft Excel. For analysis purpose all predictors were stratified into two groups i.e. age <50yrs and >50yrs, Symptoms duration <1yr and >1 year, BMI <30 and 30 or above. Chi square test was used to derive p value of difference between two strata of predictors. P value of <0.05 was taken as significant. Correlation coefficient along with p value was calculated to find relationship between risk factor and type of intraoperative difficulty.

RESULTS

In present study patients above 18 years only were included. Majority of patients in the study were in the age group of 31-40 years (18 out of 50). There were 45 females and 5 males. In 24 out of 50 patients (48%), intraoperatively one or more type of difficulty was encountered. Only symptom duration of >1yr, history of hospitalization for acute cholecystitis and BMI >30 were statistically significant predictor of difficult laparoscopic cholecystectomy (Table 1). Analysis of risk factors as a group showed that only clinical risk factors achieved significant predictive value (p value 0.005). Radiological risk factors i.e. small contracted gall bladder, gall bladder wall thickness >3mm and single large stone did not show significant effect either individually (p values - 0.954, 0.131, 0.087 respectively) or as a group (p value - 0.065). The only biochemical adverse factor taken into

consideration, deranged LFT also did not show significant association with difficult laparoscopic cholecystectomy (p value - 0.181).

Table 1: Predative association between risk factors and intraoperative outcome.

Risk Factor		Level	Intraoperative outcome		P value
			Easy (%)	Difficult (%)	
Clinical	Age	>50yrs	3 (33.3)	6 (66.7)	0.216
		<50yrs	23 (56.1)	18 (43.9)	
	Gender	M	2 (40.0)	3 (60.0)	0.571
		F	24 (53.3)	21 (46.7)	
	Symptoms duration	>1yr	0 (0)	5 (100)	0.012*
		<1yr	26 (57.8)	19 (42.2)	
	Past abdominal surgery	Yes	1 (50.0)	1 (50.0)	0.954
		No	26 (61.9)	16 (38.1)	
	H/O Acute cholecystitis	Yes	0 (0)	8 (100)	0.003*
		No	26 (61.9)	16 (38.1)	
	BMI	>30	2 (22.2)	7 (77.8)	0.048*
		<30	24 (58.5)	17 (41.5)	
Radiological	GB wall thickness	>3mm	1 (20)	4 (80)	0.131
		<3mm	25 (55.6)	20 (44.4)	
	Small contr. GB	Yes	1 (50)	1 (50)	0.954
		No	25(52.1)	23 (47.9)	
	Single large stone	Yes	4(80)	1(20)	0.087
		No	22(48.9)	23(51.1)	
Biochemical	Deranged LFT	Yes	2 (28.6)	5 (71.4)	0.181
		No	24 (55.8)	19 (44.2)	
	Clinical adverse factor (combined)	Yes	7 (30.4)	16 (69.6)	0.005*
		No	19 (70.4)	8 (29.6)	
	Radiological adverse factor	Yes	1 (16.7)	5 (83.3)	0.065
		No	25 (56.8)	19 (43.2)	

*statistically significant (p value<.05)

Table 2: Correlation between risk factor and type of intraoperative difficulty.

		Diff access	Idenof GB	Grasping of GB	Adhesiolysis	Calot disectn	Duct clipn	Diff. in GB dissectn	Difficulty in extractn GB	Bile spill
H/O Past surgery	Correlation coefficient	-0.05	-.05	0.04	0.09	-.15	-0.06	0.15	-0.06	-0.08
	p value	0.72	0.72	0.77	0.53	0.28	0.63	0.29	0.68	0.57
H/O Ac. chole.	Corelatn coeffi.	-0.11	0.12	.423	0.548	0.355	0.22	0.327	0.07	0.14
	p value	0.45	0.41	0.002	<0.001	0.012	0.128	0.020	0.62	0.34
LFT	Corelatn coeffi.	0.14	-.10	0.02	-0.01	-.06	0.06	-0.06	.306	0.17
	p value	0.33	0.48	0.87	0.93	0.67	0.69	0.69	0.031	0.24
GB Wall thickness	Corelatn coeffi.	0.20	-.08	0.27	-0.07	-.11	-0.11	0	.393	0.06
	p value	0.17	0.56	0.05	0.61	0.44	0.44	1	0.005	0.69
Small/contracted GB	Corelatn coeffi.	-0.05	-.05	0.04	0.09	0.06	0.27	-0.10	-0.06	0.21
	p value	0.72	0.72	0.77	0.54	0.68	0.06	0.48	0.68	0.14
Large/single stone in GB neck	Corelatn coeffi.	0.12	0.12	0.17	0.08	0.03	0.16	-0.03	0.14	0.04
	p value	0.41	0.41	0.24	0.s58	0.86	0.28	0.86	0.34	0.79
BMI	Corelatn coeffi.	.377	-.11	0.09	0.06	0.06	0.08	0.19	.358	0.342
	p value	0.007	0.47	0.53	0.69	0.68	0.60	0.18	0.011	0.015

Correlation coefficient significance >0.3 weak, >0.5 moderate, >0.7 strong, P value <0.05 Significant, # nonsignificant values i.e. correlation coefficient <0.3 and p value >0.05 shown only up to two places after decimal

Correlation coefficient and p value of correlation between risk factor and type of difficulty encountered intraoperatively is shown in table 2. History of acute cholecystitis was associated with difficult calot's triangle dissection, adhesiolysis, difficult gall bladder dissection from liver bed as well as difficulty in grasping of hartmann's pouch. BMI >30 was associated with difficult peritoneal access as well as extraction of gall bladder from thick abdominal wall.

DISCUSSION

Some studies have reported old age as a significant risk factor for difficult laparoscopic cholecystectomy.[6-8] Most of these studies have taken 50 yrs as cut off for this purpose. But in present study age had no significant effect on intraoperative difficulty (p value - 0.216). This finding is consistent with Gupta N and Acharya A.[9,10]

Ninety percent (45/50) of patients in present study were females. Higher incidence of gallstone in females has been suggested due to the efect of estrogen and progesterone on biliary cholesterol level and gallbladder motility.[11,12]

Relationship between male sex and difficult cholecystectomy is controversial. Some literature suggests that male gender is a risk factor for difficult cholecystectomy.[13,14] Since cholelithiasis is considered to be predominantly disease of females, males may be diagnosed late. It may result in significant adhesions due to repeated attacks of inflammation before diagnosis. Nidoni et al found conversion rate in males was significantly higher compared to females (p = 0.034, 95% confidence interval).[15] Gold-Deutch R. et al also found higher conversion rates in males over females (21% vs 4.5%).[16] But in present study, male sex was not a statistically significant predictor of difficult Laparoscopic cholecystectomy (p-0.571). It is consistent with observations of Schrenk P et al and others.[17-19]

Sixteen percent patients (8/50) in present study had past history of hospitalization due to episodes of acute cholecystitis. In all these (100%) patients intraoperatively some difficulty was encountered. This factor was the most significant predictor of difficult laparoscopic cholecystectomy (p value-0.003). This finding is supported by Thyagarajan M et al. They found a conversion rate of as high as 34% in cases with history of previous attacks of acute cholecystitis.[20] Liu et al and Khetan A also reported previous history of acte cholecystitis as a significant predictor of difficult LC.[21,22] Acute cholecystitis may lead to increased gall bladder wall thickness and cause scarring and fibrosis in and around gall bladder, making subsequent surgery difficult. This assumption is supported by the findings. In present study authors tried to correlate predictive factor with type of intraoperative difficulty. Previous history of acute cholecystitis caused significant difficulty in grasping of gall bladder, adhesiolysis as well as dissection of calots triangle and dissection of gall bladder from liver bed (Table 2). Since intraoperative difficulty was encountered in all 8 patients with history of acute cholecystitis, understandably no relationship between intraoperative difficulty and number of attacks of acute cholecystitis was found.

It is presumed that previous abdominal surgery; especially upper abdominal surgery may cause difficulty due to periumbilical and peri gallbladder adhesions. Nachnani et al reported that previous abdominal surgery poses problems during creation of pneumoperitoneum and during adhesiolysis to gain adequate exposure to the operative field.[23] But Kanaan et al and Lipman et al did not find prior abdominal surgery as a significant risk factor for conversion or prediction of difficult laparoscopic cholecystectomy.[24,25] In present study also no statistically significant correlation (p=1.000) between history of previous abdominal surgery and intraoperative difficulty was found. Two (4%) patients had history of previous abdominal surgery (both had history of LSCS). Only in 1 of these patient difficulties was encountered during surgery. Since number of patients with previous abdominal surgery in present study was very small (only 2) and none of them had upper abdominal surgery, no definitive conclusion can be derived regarding this risk factor from present study.

In present study out of 50 patients, 36 patients had duration of symptoms ≤6 months, in which 16 (44.4%) had difficult surgery. In 3 out of 9 patients (33.3%) with duration of symptoms 6 months to 1-year surgery was difficult. In all 5 (100%) patients with duration of symptoms for more than 1 year, difficulty was encountered during surgery. It shows that duration of symptoms is an acceptable (p-0.012) factor for prediction of difficult laparoscopic cholecystectomy. 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 and difficult surgery.

In the series of 50 patients, 7 (14%) patients had adverse biochemical findings. In all 7 patients LFT was deranged. Leucocyte count and *S. amylse*/ lipase were normal in all patients. Out of these 7, five (71.4%) patients had difficult surgery. Murthy AK et al and Alphonat et al found that deranged LFT and elevated amylase is a factor for prediction of difficult laparoscopic cholecystectomy.[26,4] However present study found no significance (p-0.181) between deranged LFT and difficulty during surgery.

In the present series of 50 patients, 5 patients (10%) had thickened gall bladder wall (>3mm) on preoperative USG. Authors found no significance (p-0.131) between gallbladder wall thickness and overall difficulty during surgery, but in these patients extraction of gall bladder

was significantly difficult (p - 0.005). This contradictory observation could be due to small number of patients with thickened GB wall. Larger number of such patients could have made overall difficulty significant.

Authors did not find any significant (p-1.000) correlation between small/ contracted gall bladder on preoperative ultrasonography and difficulty during surgery. In present study 2 (4%) patients were reported to have small/ contracted gall bladder on ultrasonography. Only in 1 of these patients there was difficulty in grasping of gall bladder, adhesions, difficult calot's triangle dissection and difficulty in duct clipping. Thickened gall bladder wall and small contracted gall bladder on preoperative ultrasonography is an indirect indicator of repeated attacks of inflammation and thus higher likelihood of fibrosis and scarring in and around gall balder. Understandably it will result in difficult surgery. Agarwal PN et al found that contracted gall bladder and gall bladder wall thickness was a predictive factor for difficult LC.[27] But Carmody E et al did not find preoperative USG useful to predict difficult LC.[28] These contradictory observations regarding utility of USG are due to inherent limitations of technology besides dependence on quality of machinery and expertise of operator. In present study also actually only in one patient gall bladder was found small and contracted intraoperatively, the one with difficult surgery.

Lal et al stated that large calculus at neck region is associated with distention of gall bladder and multiple stones are associated with difficulty in gall bladder extraction through small incision of LC and hence may lead to perforation of gall bladder with spillage of bile and gall stones.[27] But in present study authors found no significance between single large/ multiple calculi and difficulty during surgery (p value - 0.087). Khandelwal et al also did not find calculus size or single calculus a significant predictor of difficult laparoscopic cholecystectomy.[29] Although 83.3% of patients with adverse radiological predictor in present study had difficult surgery compared to only 43.2% of those with no adverse radiological predictor, this difference did not achieve statistical significance (p value - 0.065).

BMI more than 30 was associated with significant intraoperative difficulty (p value 0.048). It caused significant difficulty in gaining first access and extraction of gall bladder (Table 2). Obesity and abdominal fat is obvious cause for difficulty in the placement of the port, specially umbilical port and manouevering instruments through thick abdominal wall. Increased fat in calot's triangle also makes dissection difficult. Nachnani et al, Randhawa et al and others have found high BMI as significant independent predictor of difficult laparoscopic cholecystectomy.[23,30,31] But Simopoulos C et al and others found no significant correlation between obesity and intraoperative difficulty.[32,9]

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Although conversion to open cholecystectomy was needed only in two patients (4%), overall difficulty rate in present study was high (24/50 - 48%). It is because authors deliberately kept threshold for labelling difficult cholecystectomy very low. Any deviation from a straightforward cholecystectomy, need of any extra instrument or step was labelled as difficult cholecystectomy. Authors think that in a resource starved country like their, majority of cholecystectomies especially in peripheries are done by comparatively not so experienced surgeons. They work under pressure with significant infrastructural and budgetary constraints. So, it is much more important to predict a difficult cholecystectomy for them than in an advanced laparoscopic surgery centre where resources and expertise to deal with all kind of eventualities are there.

CONCLUSION

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. 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.

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