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Original Research Article

Clinicoradiological based risk assessment to predict difficult laparoscopic cholecystectomy

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ABSTRACT

Background: The aim of the present study was to predict difficult laparoscopic cholecystectomy by clinical and radiological parameters.
Methods: All consecutive patients undergoing laparoscopic cholecystectomy and conversion to open surgery. Clinico-radiological laboratory parameters and imaging features were collected from patient. The study was categorized into Group 1 in which easy laparoscopic cholecystectomy case defined by total time taken for surgery less than 60 mins and no intra operative (surgical) and post-operative complications with postoperative hospital stay <48 hours. Group 2: Difficult laparoscopic cholecystectomy case defined by total time taken for surgery more than 60 min, intra operative and post-operative complications.
Results: In group 2, total number of patients who presented with more than one attack of cholecystitis were 36 (62.1%). Dyspepsia was common symptom in both groups. More number of patients with previous history of upper abdominal surgery went for difficult lap cholecystectomy. Total number of patients in both the groups were who had hypertension were 31.2% in comparison with non-hypertensives who were 68.8%. Majority of the patients in difficult case group had gall bladder wall thickness >4 mm. Majority of patients in difficult case group had calculi size >25 µm. History of previous attacks of cholecystitis, history of previous upper abdominal surgery, gall bladder wall thickness >4 mm and pericholecystic collection can be taken as predictors for difficult laparoscopic cholecystectomy.
Conclusions: Preoperative prediction of a difficult cholecystectomy and explaining advantages and disadvantages of conversion are of great help both to the patient who can plan his work and the surgeon who can also schedule his time and team accordingly.

Keywords: Gallstone disease, Cholecystectomy, Choledocholithiasis

INTRODUCTION

Gallstone disease is one of the most common problems affecting the digestive tract. The prevalence of gallstones is related to factors like age, gender and ethnic background. In India the prevalence is estimated to be around 4%.[1] Changing incidences in India is mainly attributed to westernization of diet, change in socioeconomic structure and availability of ultrasound as investigation in both rural and urban areas.

The National Institute of Health (NIH) consensus development conference in the year 1992 concluded that

laparoscopic cholecystectomy provides a safe and effective treatment for most patients with symptomatic gallstones.[2] However, of all laparoscopic cholecystectomies, 1-13% requires conversion to open for various reasons.[3]

Thus, for surgeons it would be helpful to establish criteria that would assess the risk of conversion preoperatively.

Abdominal ultrasound accurately detects gallstones, a distended gallbladder, thickened (>4 mm) gallbladder wall, pericholecystic fluid and a sonographic Murphy's sign (intensified pain upon probe pressure directly over the gallbladder). Ultrasound has lower sensitivity for detecting stones in the setting of acute cholecystitis.[4]

Radioisotope cholescintigraphy (Tc-HIDA scan) detects cystic duct obstruction by failure of the gallbladder to fill after intravenous injection of the tracer. It has very high sensitivity for the diagnosis of acute cholecystitis, but the lack of gallstone visualization and the ionizing radiation make ultrasound the preferred imaging modality in Europe.[5-7]

Thus this study is conducted at our hospital to predict the difficult laparoscopic cholecystectomy and conversion using various clinical and radiological parameters.

METHODS

The present study will be conducted in Narayana Medical College and Hospital, Nellore from the period of October 2015 to December 2017.

Inclusion criteria

All patients who require cholecystectomy for reasons like acute cholecystitis, chronic calculous cholecystitis, and symptomatic cholelithiasis on elective basis were included in the study.

Exclusion criteria

Patients having presence of jaundice, cholangitis, altered LFT, dilated common bile duct, choledocholithiasis and acalculous cholecystitis, Mirizzi syndrome, post ERCP patients, gall bladder malignancy, patients who underwent subtotal cholecystectomy and who did not give consent for being part of the study were excluded from the study.

Study design

It was a prospective study analysis for a period of two years, all consecutive patients in inclusion criteria undergoing laparoscopic cholecystectomy and conversion to open surgery admitted in department of Surgical Gastroenterology between October 2015 to December 2017 who gave the consent to be part of the study were included in the study.

All patients were assessed through meticulous history and clinical examination. Along with routine basic hematological and biochemical investigations needed for preoperative workup, ultrasound abdomen and in few required cases CECT abdomen or MRI+MRCP was done.

All the cases included in the study were done by a single senior professor who has expertise of cases performed more than 100 laparoscopic cholecystectomy and experience in surgical gastroenterology for more than 25 years. Laparoscopic cholecystectomy was performed using standard 4 port technique and using Karl Storz Hd 3 chip camera equipment along with energy devices and supportive instruments with proper preoperative workup.

Clinico-radiological laboratory parameters and imaging features were collected patient proforma was tabulated and patients included in the study were categorized into two groups:

Group 1

Easy laparoscopic cholecystectomy case defined by total time taken for surgery less than 60 mins 36 and no intra operative (surgical) and post-operative complications with postoperative hospital stay <48 hours.

Group 2

Difficult laparoscopic cholecystectomy case defined by total time taken for surgery more than 60 mins 36, intra operative and post-operative complications, intra-operative presence of dense adhesions between gall bladder and surrounding structures and frozen Calot's triangle, conversion to open surgery, contracted gall bladder, bleeding and post-operative hospital stay more than 48 hours.

Data analysis

All data collected will be entered and analyzed using SPSS software 15.0 for Windows, Med calc 9.0.1 and Systat 11.0, categorized variables are described as frequency, mean, SD have been used for continuous parameters.

For all analysis p value <0.05 is considered statistically significant.

Chi-square test, Fisher exact test and odds ratio have been used to find significant association of risk factors with preoperative outcome and predictive association of risk factors in predicting the preoperative outcome of surgery i.e., easy case or difficult case.

RESULTS

Total number of patients included in the study was 250. Number of patients in easy group was 192 (76.8%). Number of patients in difficult group was 58 (23.2%).

Table 1: Age distribution.

Age distribution		Group		Total
		Easy cases	Difficult cases	
		N (%)	N (%)	N (%)
Age (in years) (count % within group)	20-30	33 (17.2)	1 (1.7)	34 (13.6)
	31-40	50 (26.0)	9 (15.5)	59 (23.6)
	41-50	19 (9.9)	20 (34.5)	39 (15.6)
	51-60	73 (38.0)	15 (25.9)	88 (35.2)
	61-70	14 (7.3)	11 (19.0)	25 (10.0)
	71-80	3 (1.6)	2 (3.4)	5 (2.0)
Total (count % within group)		192 (100.0)	58 (100.0)	250 (100.0)

Pearson Chi-square value=35.917; p<0.001.

From Table 1, we infer that maximum percentage of patients is in age group 51-60 years with mean age- 33 years. In this study total no of patients included were 250 in which males were 99 and females were 151 which constitutes percentage of 39.6% and 60.4% respectively. In difficult cases group more population were of male with percentage of 62.1%.

Maximum number of patients in both groups were in category 25-29.9 kg/m^2 with total percentage of 64.8%. The percentage of patients belonging to 25-29.9 kg/m^2 category was 60.3% in difficult group which is significant. In this study in both groups majority of population were non-smokers. In this study majority of population were non alcoholics.

Table 2: Smoker distribution.

Smoker distribution		Group		Total
		Easy cases	Difficult cases	
		N (%)	N (%)	N (%)
Smoker (count % within group)	Yes	14 (7.3)	6 (10.3)	20 (8.0)
	No	178 (92.7)	52 (89.7)	230 (92.0)
Total (count % within group)		192 (100.0)	58 (100.0)	250 (100.0)

Pearson Chi-square value=0.564; p value=0.4.

Table 3: Alcohol distribution.

Alcohol distribution		Group		Total
		Easy cases	Difficult cases	
		N (%)	N (%)	N (%)
Alcoholic (count % within group)	Yes	19 (9.9)	2 (3.4)	21 (8.4)
	No	173 (90.1)	56 (96.6)	229 (91.6)
Total (count % within group)		192 (100.0)	58 (100.0)	250 (100.0)

Pearson Chi-square value=2.407; p value=0.1.

History of number of previous attacks of cholecystitis distribution

In the difficult case group, total number of patients who presented with more than one attack of cholecystitis was 36 (62.1%). In difficult cases group no of previous attacks more than 2 was significant. Most of patients of both groups have dyspepsia as common presenting symptom. More number of patients with previous history of upper abdominal surgery went for difficult lap cholecystectomy.

Table 4: Symptom history suggestive of acute cholecystitis.

Symptom	Easy cases		Difficult cases		P value
	Present	Absent	Present	Absent	
	N (%)	N (%)	N (%)	N (%)	
Vomiting	147 (76.6)	45(23.4)	26 (44.8)	32 (55.2)	<0.001
Pain	187 (97.4)	5 (2.6)	58 (100)	0	0.5
Murphy's sign	72 (37.5)	120 (62.5)	41 (70.7)	17 (29.3)	<0.001

Most of the population in both the groups was non diabetics. Total number of patients in both the groups were who had hypertension were 31.2% in comparison with non-hypertensives who were 68.8%.

Table 5: History of previous upper abdominal surgery distribution

History of previous upper abdominal surgery distribution		Group		Total
		Easy cases	Difficult cases	
		N (%)	N (%)	N (%)
Previous upper abdominal surgeries (count % within group)	Present	46 (24.0)	49 (84.5)	95 (38.0)
	Absent	146 (76.0)	9 (15.5)	155 (62.0)
Total (count % within group)		192 (100.0)	58 (100.0)	250 (100.0)

Pearson Chi-square value= 69.259; p<0.001.

Table 6: Nature of gall bladder on radiology gall bladder wall on ultrasound distribution.

Gall bladder wall on ultrasound		Group		Total
		Easy cases	Difficult cases	
		N (%)	N (%)	N (%)
GB (count % within group)	Normal	174 (90.6)	1 (1.7)	175 (70.0)
	>4 mm wall	18 (9.4)	52 (89.7)	70 (28.0)
	Contracted	0 (0.0)	5 (8.6)	5 (2.0)
Total (count % within group)		192 (100.0)	58 (100.0)	250 (100.0)

Pearson Chi-square value=169.3; p<0.001.

Table 7: Pericholecystic collection on ultrasound abdomen distribution.

		Group		Total
		Easy cases	Difficult cases	
		N (%)	N (%)	N (%)
Pericholecystic collection (count % within group)	Present	65 (33.9)	39 (67.2)	104 (41.6)
	Absent	127 (66.1)	19 (32.8)	146 (58.4)
Total (count % within group)		192 (100.0)	58 (100.0)	250 (100.0)

Pearson Chi-square value= 20.43; p value= <0.001.

Table 8: Calculi size on ultrasound abdomen distribution.

Calculi size on ultrasound abdomen distribution		Group		Total
		Easy cases	Difficult cases	
		N (%)	N (%)	N (%)
Calculi size (count % within group)	<25 µm	119 (62.0)	20 (34.5)	139 (55.6)
	>25 µm	73 (38.0)	38 (65.5)	111 (44.4)
Total (count % within group)		192 (100.0)	58 (100.0)	250 (100.0)

Pearson Chi-square value= 13.64; p<0.001.

Table 9: Regression analysis for determining the predictor for difficult laparoscopic cholecystectomy.

Variables	B	S.E	Valid	Df	Sig	Exp
Age	-.328	0.559	0.344	1	0.558	0.721
Sex	2.669	1.763	2.293	1	0.130	14.430
BMI	0.108	0.916	0.014	1	0.906	1.114
History of previous attacks of cholecystitis	-1.533	0.788	3.788	1	0.052	0.216
Previous history of upper abdominal surgeries	2.798	1.142	6.002	1	0.014	16.419
Hypertension	-1.634	1.085	2.266	1	0.132	0.195
Gall bladder wall thickness >4 mm	7.696	1.758	19.162	1	0.000	2199.282
Pericholecystic collection	3.833	1.349	8.080	1	0.004	46.220
Calculi size	-1.808	1.668	1.175	1	0.278	0.164
Constant	-13.051	3.491	13.981	1	0.000	0.000

Majority of the patients in difficult case group had gall bladder wall thickness >4 mm. Majority of patients in difficult case group had pericholecystic fluid collection on USG. Majority of patients in difficult case group had calculi size >25 µm.

History of previous attacks of cholecystitis, history of previous upper abdominal surgery, gall bladder wall thickness >4 mm and pericholecystic collection can be taken as predictors for difficult laparoscopic cholecystectomy.

DISCUSSION

Since its introduction, laparoscopic cholecystectomy has aimed at improving the results of traditional surgical treatment. Obviously, if conversion is necessary for whatever reason, the benefit of the minimal access concept is lost. Therefore, every effort should be made to increase the probability of successful completion of the laparoscopic procedure to be attempted.[8]

As the experience with LC is increasing throughout the world, selection criteria have become more liberal. Most of the factors like morbid obesity and previous upper abdominal surgery which were considered as absolute contraindication for attempting lap cholecystectomy have no longer remained as absolute contraindications.

It is important to predict difficult lap cholecystectomy preoperatively so that senior surgeons can be requested to be present during surgery rather than less experienced junior surgeon prolonging the surgery which may lead to intraoperative complications. In preoperatively predicted to be conversion, early decision of conversion can be made so as to avoid unnecessarily prolonging the surgery and to prevent complications.

Any selection process is dependent on the assumption that the difficulty of the procedure can be assessed preoperatively with high accuracy. Such assessment should ideally be simple to perform, reliable, reproducible and cost-effective.

In this study dyspepsia was a common symptom present in both groups with total number of patients in difficult cases group with dyspepsia present was in 58 (100%). Most of the patients in difficult case group had presenting symptom of colicky pain in 98% of total study group.

In this study age group between 41-50 years of difficult cases group was 34.5% which was significant statistically and mean age was 33 years.

Fried et al published a study suggesting some significant predictors of conversion in 1994.[9] Increasing age was one of them.

In study done by Bouarfa et al, the sex of the patient was also identified as a relevant factor for complex laparoscopic cholecystectomy surgeries, results confirm that the complexity of laparoscopic cholecystectomy surgery is increased significantly for male patients.[10]

Thyagarajan et al noted in their study, among 103 patients with body mass index was more than 25, 40 patients were converted to open, with p value of 0.008, this factor (presence of BMI>25) was statistically strongly significant.[11]

Sippey et al noted in their study, conversion rate in patients with BMI>30 kg/m^2 was significant.[12]

In this study the percentage of patients belonging to 25-29.9 kg/m^2 category was 60.3% in difficult cases group which is significant.

Arun et al noted in their study that patients who had multiple attacks of acute cholecystitis (more than one) had higher chances of difficult laparoscopic cholecystectomy and conversion.[13]

In this study total number of patients in difficult case group who had more than one previous attacks of cholecystitis were 36 (62.1%) which was significant statistically (p value <0.001).

In this study, total number of patients who had previous history of upper abdominal surgery in difficult case group were 49 (84.5%). P value <0.001 which was significant.

Randhawa et al in their study noted that upper abdominal surgery is reported to have high rate of conversion 37.5% and also found it to be not significant (p=0.88).[14]

In this study, total number of patients in difficult case group who had hypertension and cardiovascular disease were 12 (20.7%) in comparison to patients who does not have any hypertension and cardiovascular disease 46 (79.3%) and p value=0.04.

In a study, done by Kanaan et al patients who had cardiovascular disease and who underwent open conversion were 9 (52.9%) and p value 0.05 was significant.[15]

In this study total number of patients in difficult cases group with GB wall thickness>4 mm was 52 (89.7%), p value <0.001 which was significant.

In study done by Arun et al showed that thick GB wall (more than 3 mm) as determined by USG is a potential risk factor for difficult laparoscopic cholecystectomy.

Bouarfa et al in their study showed that, regardless the type of complication (technical or anatomical), wall thickening is the second most prominent factor (after inflammation) for complexity during laparoscopic cholecystectomy procedures.[10]

Kama et al noted in their study that 16.7% had thickened gallbladder wall ultra sonographically and conversion rates were 30.8% (p value univariate <0.001) in patients with thickened gall bladder wall.[16]

Gall bladder wall thickness was found as predictive risk factor for difficult laparoscopic cholecystectomy in other studies also.

In this study number of patients in difficult case group who have GB calculi size >25 µm was 38 (65.5%) in comparison with patients having GB calculi size <25 µm were 20 (34.5%) p value <0.05.

In this study conversion rate was 15.2% (38 patients) probable cause for conversion were high BMI, previous history of cholecystitis and previous history of upper abdominal surgeries which pointed out to a common factor of difficulty in delineating anatomy .

In this study, clinical and radiological parameters like history of previous attacks of cholecystitis, history of previous upper abdominal surgery, gall bladder wall thickness >4 mm and pericholecystic collection can be taken as predictors for difficult laparoscopic cholecystectomy (regression analysis) with high probability.

Supe et al in their study showed that three factors namely past history of upper abdominal surgery, past history of acute cholecystitis and greater thickness of gall bladder wall were associated with difficulty in defining anatomy apart from male gender and BMI >30 kg/m^2 .[17]

In study done by Arun et al elderly age ,multiple attacks of pain abdomen (>2), palpable GB, impacted gall stones, thickness of GB wall >3 mm, peri GB fluid collection, adhesions due to previous abdominal surgery and obesity were all found to be independent risk factors leading to difficult laparoscopic cholecystectomy.

Nidoni et al in their study noted that difficult laparoscopic cholecystectomy and conversion to open surgery can be predicted preoperatively based on number of previous attacks of cholecystitis, WBC count, gall bladder wall thickness and presence or absence of pericholecystic collection.[18]

CONCLUSION

Total number of patients with difficult cholecystectomy which included both time criteria more than 60 mins and conversion to open cholecystectomy were 38 (15.2% of total population). Dense adhesion with obscured anatomy was the commonest cause.

Significant factors which can preoperatively predict difficult laparoscopic cholecystectomy were previous cholecystitis attacks and previous history of upper abdominal surgeries, ultrasound abdomen findings of gall bladder wall thickness > 4mm and presence of pericholecystic fluid collection.

Preoperative prediction of a difficult cholecystectomy and explaining advantages and disadvantages of conversion are of great help both to the patient who can plan his work and the surgeon who can also schedule his time and team accordingly.

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