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OPERATIVE DIFFICULTIES IN LAPAROSCOPIC CHOLECYSTECTOMY–SCORING SYSTEM

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ABSTRACT

Background: The laparoscopic cholecystectomy is the golden standard for many surgeons nowadays. Many intra-operative difficulties occurred during laparoscopic cholecystectomy that urging surgeons to develop scoring system predicting these difficulties. **Aim of study**: To establish the best scoring system based on intra operative parameters to predict the difficulty of laparoscopic cholecystectomy. **Patients and methods**: This study is a prospective follow up study carried out in Surgical Ward of Baghdad Teaching Hospital during the period from 1st of October, 2016 to 31st of September, 2017 on convenient sample of 80 patients with chronic symptomatic cholelithiasis. The intra-operative characteristics were recorded by the researcher during the procedure of laparoscopic cholecystectomy. **Results:** The difficulty criteria of laparoscopic cholecystectomy in studied patients were based on operation time, bile or stone spillage and conversion to open surgery. Significant risk factors for difficulty were obesity, pre-operate surgery, complete gall bladder adhesions, distended gall bladder, inability to grasp, impacted stones, peri-colic collections and prolonged time of Calots' triangle dissection. **Conclusions**: The intra-operative difficulty scoring of Laparoscopic cholecystectomy is cornerstone in laparoscopy technique.

KEYWORDS: Laparoscopic Cholecystectomy, cholelithiasis.

INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the procedure of choice for management of symptomatic gall stone disease.[1] It has been observed that surgeons encountered difficulty while LC when there were dense adhesions at calot's triangle, fibrotic and contracted gallbladder, acutely inflamed or gangrenous gall bladder and cholcystoenteric fistula etc.[2] There are many risk factors which make laparoscopic surgery difficult like old age, male sex, attacks of acute cholecystitis with fever and leukocytosis, obesity, previous abdominal surgery, clinical signs of acute cholecystitis, and certain ultrasonographic findings i.e. thickened gall bladder wall, distended gall bladder, pericholecystic fluid collection, impacted stone etc.[3]

Preoperative assessment of complexity factors is needed for frequent procedures such as (LC) in order to avoid complications and delays and to guarantee an efficient course of surgery.[4] In case of laparoscopic cholecystectomy, preoperative complexity estimation helps surgeons deciding whether to proceed with a minimally invasive approach, perform an open procedure or make a referral to a more experienced surgeon. It may also be useful for explaining the various risks of laparoscopic and open procedures.[4] Although laparoscopic cholecystectomy has generally a low incidence of morbidity and mortality and of conversion rate to open surgery, its outcome is particularly affected by the presence and severity of inflammation, advancing patient's age, male sex and greater body mass index.[5] Previous upper abdominal surgery is associated with a higher rate of adhesions, an increased risk of operative complications, a greater conversion rate, a prolonged operating time and longer stay.[5]

Laparoscopic cholecystectomy after endoscopic retrograde cholangiopancreatography (ERCP) with

endoscopic sphincterotomy (ES) for combined choledochocystolithiasis is more difficult with prolonged procedure than in uncomplicated gallstone disease with a longer post-operative hospital stay.[6]

It was shown that six parameters namely male sex, upper abdominal tenderness at the time of surgery, previous upper abdominal surgery, sonographically ascertained thick gallbladder wall, age >60 years and preoperative diagnosis of acute cholecystitis were found to have significant effect on risk of conversion on multivariate analysis.[7] The risk factors for conversion included age >65 years, male sex, patients with previous upper abdominal surgery and a documented history of acute cholecystitis.[8] Preoperative prediction of the risk of conversion or difficulty of operation is an important aspect of planning laparoscopic surgery with the help of accurate prediction, high risk patients may be informed beforehand and they may have a chance to make arrangements. Surgeons too may get an indication so that they may schedule the time and team for the operation appropriately.

Patients predicted to have a high risk should be scheduled for longer hospitalization and more intensive post-operative care. This may also help the hospital administration to plan and predict admissions and bed vacancy more efficiently.[9]

Laparoscopic cholecystectomy can be performed using four ports, three port and single incision laparoscopic surgery (SILS). In four ports LC there will be two 10 mm ports and two 5mm ports. In three ports LC there will be two 10 mm ports and one 5 mm port. SILS contains only one port of 20 mm size.[10]

Pregnancy is a controversial relative contraindication to LC because of the unknown effects of prolonged CO2 pneumoperitoneum on the fetus. LC can be performed safely during pregnancy but only with great care.[11] Most agree cholecystectomy should be performed if conservative management fails, either during the same admission or in patients whose symptoms recur after resumption of oral intake, in the same trimester. Although pregnancy was once considered an absolute contraindication to the performance of laparoscopic procedures, many recent case reports have shown favorable outcomes.[12] No structure should be divided until the cystic duct and cystic artery are unequivocally identified. This is the "critical view" of safety essential to prevent bile duct injury during LC.[17] SILC is associated with longer operating time, but equals LC with respect to safety, postoperative pain, use of analgesics, length of stay, return to work, rate of incisional hernia, and cosmetic outcome.[13]

PATIENTS AND METHODS

This study is a prospective follow up study carried out in Surgical Ward of Baghdad Teaching Hospital during the period from 1st of October, 2016 to 31st of September, 2017.

Our study provides a preliminary scoring system to enable key aspects of the surgical findings to be documented. The current scoring system proposed is based on the severity of cholecystitis and degree of potential difficulty with a score from 1 to 10. The key aspects of the score include access to the gallbladder including patient body mass index (BMI), the degree of pericholic and right upper quadrant adhesions particularly in patients who have had previous abdominal surgery, the presence of complicated cholecystitis and the time taken by the surgeon to achieve the triangle of safety with identification of the cystic artery and duct. With this scoring system a score of <2 would be considered easy, 2 to 4 moderate, 5–7 very difficult, and 8 to 10, extreme. Fistulation of the gallbladder which would be associated with extreme difficulty and a high rate of conversion were not included in the score, given its rarity and potential to skew a simple scoring system. The five key aspects include: 1) gallbladder appearance and amount of adhesions, 2) degree of distension/contracture of the gallbladder, 3) ease of access, 4) local/septic complications, and, 5) time taken to identify the cystic artery and duct. Where there are no adhesions, a score of zero is given. The maximum achievable score for adhesions is 2, which would occur if the gallbladder were completely buried in adhesions. A distended gallbladder receives a score of 1. Failure to grasp the gallbladder with a standard, traumatic laparoscopic forceps scores a further point. This applies either with or without adhesions present. If decompression is performed to allow grasping, then a point is still awarded. Further points are awarded for access difficulties (i.e. port placement difficulties using Hasson's technique) and complicated cholecystitis with perforation.

Table 1: Operative grading system of severity of cholecystitis.

Variable		Score
Appearance	Adhesions <50% of gall bladder	1
	Adhesions >50% of gall bladder	2
	Completely Buried	3(Max)
Distension/contraction	Distended gall bladder	1
	Inability to grasp without decompression	1
	Stone >1cm impacted in Hartman's Pouch	1

Access	BMI >30 kg/m^2	1
	Previous surgery adhesions	1
Sepsis and complications	Bile or pus outside gall bladder	1
	Fistula	1

Inclusion criteria

- Adults (age ≥18 years).
- Confirmed diagnosis of chronic cholecystitis by USS.
- Underwent elective Laparoscopic cholecystectomy.

Exclusion criteria

- Acute cholecystitis.
- Perforation contraindications of Laparoscopic cholecystectomy.
- Co-morbidity with malignancy (Ca. gallbladder).

A convenient sample of 80 patients with chronic cholelithiasis admitted to Surgical Ward of Baghdad Teaching Hospital was selected after eligibility to inclusion and exclusion criteria.

The data was collected by researcher from the patients and filled in a prepared questionnaire. The questionnaire included the followings.

- Demographic characteristics of patients: Age and gender.
- Body mass index.
- Past surgical history: Previous abdominal surgery (either upper abdominal surgery or lower abdominal surgery).
- Intra-operative characteristics: Gall bladder adhesions, distended gall bladder, impacted stone, inability to grasp, peri-colic collection and time to identification of Calots' triangle.
- Intra-operative assessment criteria of difficulty of Laparoscopic cholecystectomy: Surgical operation time, bile or stone spillage and conversion to open surgery.
- Difficulty score.

After taking preoperative history and information from selected chronic symptomatic cholelithiasis patients, the examination of patient done. A sample of 5 ml of blood was drawn from patients for LFT, PT, PTT and INR and sent for Laboratory of Baghdad Teaching Hospital. The diagnosis was confirmed by the history and examination. After checking of patients by an Anesthetist, the selected patients were surgically operated with Laparoscopic cholecystectomy by the supervisor or other senior in our surgical team. The intra-operative characteristics were recorded by the researcher. The intra-operative assessment was done for patients by the researcher according to difficulty scores applied in previous literatures using surgical operation time, bile or stone spillage and conversion to open surgery.

Patients were followed for 1 month after discharge by the researcher by either direct interview or phone calling to assess any complications.

All patients' data entered using computerized statistical software; Statistical Package for Social Sciences (SPSS) version 20 was used. Descriptive statistics presented as (mean ± standard deviation) and frequencies as percentages. Multiple contingency tables conducted and appropriate statistical tests performed, Chi-square used for categorical variables (Fishers exact test was used when expected variables were less than 5). In all statistical analysis, level of significance (p value) set at ≤ 0.05 and the result presented as tables and/or graphs. Statistical analysis of the study was done by the community medicine specialist.

RESULTS

This study included 80 patients surgically operated with Laparoscopic Cholecystectomy. Mean age of studied patients was 29.8±5.4 years; 6 (7.5%) of them were in age group 18-24 years, 26 (32.5%) of them were in age group 25-34 years, 20 (25%) of them were in age group 35-44 years, 16 (20%) of them were in age group 45-54 years, 6 (7.5%) of them were in age group 55-64 years and 6 (7.5%) of them were 65 years and more. All these findings were shown in table 2.

Table 2: Age distribution of patients.

Variable	No.	%
Age **Mean ± SD (29.8±5.4 years)**		
11-19 years	6	7.5
20-29 years	26	32.5
30-39 years	20	25.0
40-49 years	16	20.0
50-59 years	6	7.5
≥ 60 years	6	7.5
Total	80	100.0

Male patients surgically operated with Laparoscopic Cholecystectomy were 20 (25%) and female patients were 60 (75%) with female to male ratio, as shown in figure 1.

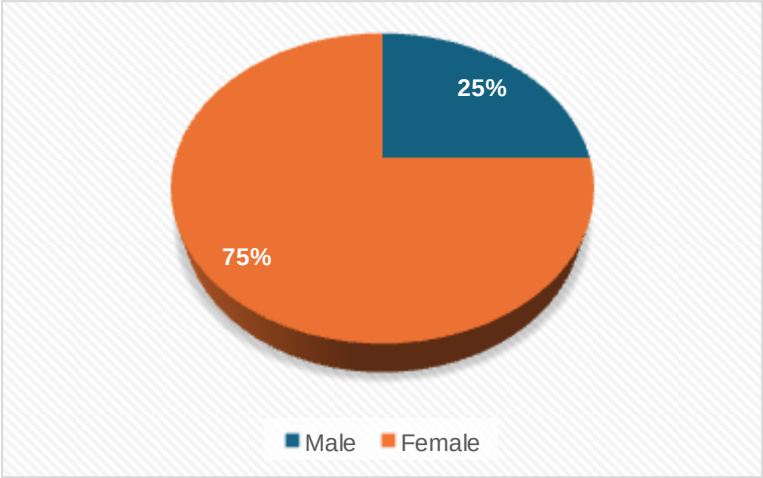

Figure 1: Sex of patients.

The difficulty criteria of Laparoscopic Cholecystectomy in studied patients were based on operation time, bile or stone spillage and conversion to open surgery. Regarding surgical operation time, 87.5% of patients had operation time of less than 60 minutes while 12.5% of them had operation time of 60 minutes and more. The bile or stone spillage was observed among 12.5% of surgically operated patients while conversion to open surgery was conducted for 5% of them. All these findings were shown in table 3.

Table 3: Distribution of operation time, bile or stone spillage and conversion to open surgery.

Criteria of difficulty	No.	%
Surgical operation time (minutes)		
<60	70	87.5
≥60	10	12.5
Total	80	100.0
Bile or stone spillage		
Yes	22	27.5
No	58	72.5
Total	80	100.0
Conversion to open surgery		
Yes	4	5.0
No	76	95.0
Total	80	100.0

There was a highly significant association between patients with BMI of 30 and more (obese) and difficult Laparoscopic Cholecystectomy (p<0.001; OR=36.5); 87.5% of obese patients had difficulty while 83.9% of patients with BMI of <30 had easy operation. All these findings were shown in table 4.

Table 4: Distribution of BMI according to difficulty.

BMI (Kg/m^2)	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
<30	47	83.9	9	16.1	56	**<0.001*** OR=36.5 CI={8.9-148}
≥30	3	12.5	21	87.5	24	
Total	50	62.5	30	37.5	80	

*Fishers exact test, S=Significant.

A significant association was observed between previous surgery and difficult surgical operation (p=0.02); 83.3% of patients with no previous surgery had easy operation while the previous upper abdominal surgery was significantly associated with difficult operation (66.7%). All these findings were shown in table 5.

Table 5: Distribution of previous surgery according to difficulty.

Previous surgery	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
No	20	83.3	4	16.7	24	**0.02** S
Upper abdominal	2	33.3	4	66.7	6	
Lower abdominal	28	56.0	22	44.0	50	
Total	50	62.5	30	37.5	80	

*Fishers exact test, S=Significant.

There was a highly significant association between complete gall bladder adhesions and difficult surgical operation (p<0.001); 77.8% of patients with gall bladder adhesions had difficult operation while 100% of patients with no adhesions had significantly easy operation. All these findings were shown in table 6.

Table 6: Distribution of gall bladder adhesions according to difficulty.

Gall bladder adhesions	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
No adhesions	12	100.0	0	-	12	**<0.001**S
<1/3	24	85.7	4	14.3	28	
Up to 2/3	10	45.4	12	54.6	22	
Complete	4	22.2	14	77.8	18	
Total	50	62.5	30	37.5	80	

*Chi-square test, S=Significant.

The absence of distended gall bladder among studied patients was significantly associated with easy Laparoscopic Cholecystectomy (p=0.003; OR=0.13); 90% of patients with no distention had easy operation while 46.7% of patients with distention of gall bladder had significantly difficult operation. All these findings were shown in table 7 and figure 2.

Table 7: Distribution distended gall bladder according to difficulty.

Distended gall bladder	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
Yes	32	53.3	28	46.7	60	**0.003**S OR=0.13 CI={0.03-0.6}
No	18	90.0	2	10.0	20	
Total	50	62.5	30	37.5	80	

*Fishers exact test, S=Significant.

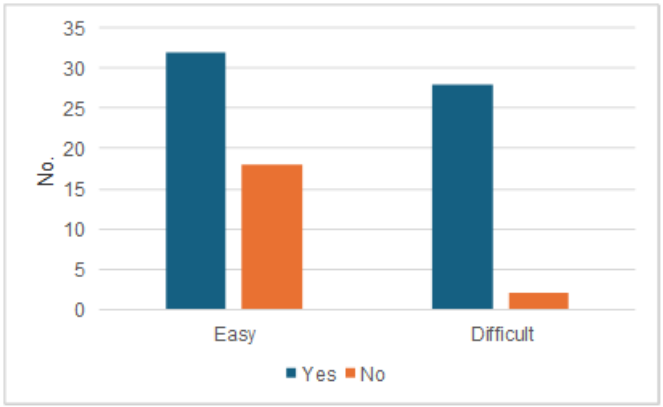

Figure 2: Distribution of bladder distention according to difficulty.

There was a highly significant association between inability of surgeon to grasp and difficult Laparoscopic Cholecystectomy (p<0.001; OR=0.01); 92.3% of patients with inability of grasp had difficult surgical operation while 88% of patients with ability to grasp had easy operation. All these findings were shown in table 8 and figure 3.

Table 8: Distribution inability to grasp according to difficulty.

Inability to grasp	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
Yes	2	7.7	24	92.3	26	**<0.001**[S] OR=0.01 CI={0.001-0.6}
No	48	88.8	6	11.2	54	
Total	50	62.5	30	37.5	80	

*Fishers exact test, S=Significant.

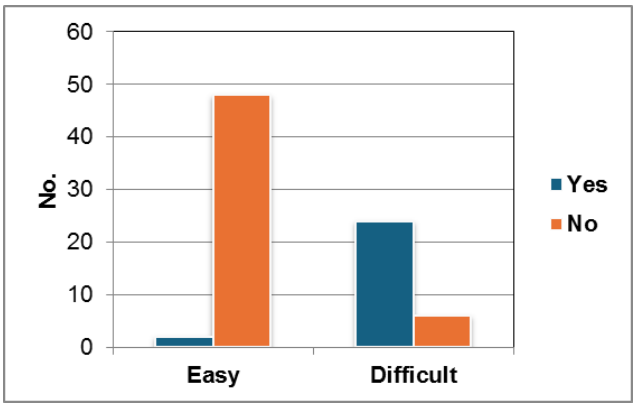

Figure 3: Distribution of inability to grasp according to difficulty.

Regarding the impacted stones, a significant association was detected between presence of impacted stones and difficult Laparoscopic Cholecystectomy (p<0.001; OR=0.36); 53.9% of patients with impacted stones had difficult surgical operation while 70.3% of patients with no impacted stones had easy operation. All these findings were shown in table 9.

Table 9: Distribution impacted stones according to difficulty.

Impacted stones	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
Yes	12	46.1	14	53.9	26	**0.03** [S] OR=0.36 CI={0.14-0.9}
No	38	70.3	16	29.7	54	
Total	50	62.5	30	37.5	80	

*Chi-square test, S=Significant.

For peri-colic collection, there was a significant association between peri-colic collection and difficulty in Laparoscopic Cholecystectomy (p=0.01); 100% of patients with peri-colic collection had difficult surgical operation while 65.8% of patients with no peri-colic collection had easy operation. All these findings were shown in table 10.

Table 10: Distribution peri-colic collection outside gall bladder according to difficulty.

Peri-colic collection	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
Yes	0	-	4	100.0	4	**0.01** [S]
No	50	65.8	26	34.2	76	
Total	50	62.5	30	37.5	80	

*Fishers exact test, S=Significant.

The patients with time of Calots' triangle dissection of 30 minutes and more was significantly associated with difficult Laparoscopic Cholecystectomy (p<0.001); 100% of patients with ≥30 minutes time of dissection had difficult operation while 83.3% of patients with <30 minutes time of dissection had significantly easy operation. All these findings were shown in table 11.

Table 11: Distribution time to dissection according to difficulty.

Time to dissection	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
<30 minutes	50	83.3	10	16.7	60	**<0.001**[S]
≥30 minutes	0	-	20	100.0	20	
Total	50	62.5	30	37.5	80	

*Fishers exact test, S=Significant.

Finally, there was a highly significant association between higher scores and difficult Laparoscopic Cholecystectomy (p<0.001); 100% of patients with 8-10 scores had difficult surgical operation while 100% of patients with <2 score had easy operation, 91.7% of patients with 2-4 scores had easy operation while 91.7% of patients with 5-7 scores had difficult operation. All these findings were shown in table 12 and figure 4.

Table 12: Distribution of scores according to difficulty.

Scores	Difficulty				Total	P
	Easy		Difficult			
	No.	%	No.	%		
<2 (mild)	4	100.0	0	-	4	**<0.001**[S]
2-4 (moderate)	44	91.7	4	8.3	48	
5-7 (severe)	2	8.3	22	91.7	24	
8-10 (extreme severe)	0	-	4	100.0	4	
Total	50	62.5	30	37.5	80	

*Fishers exact test, S=Significant.

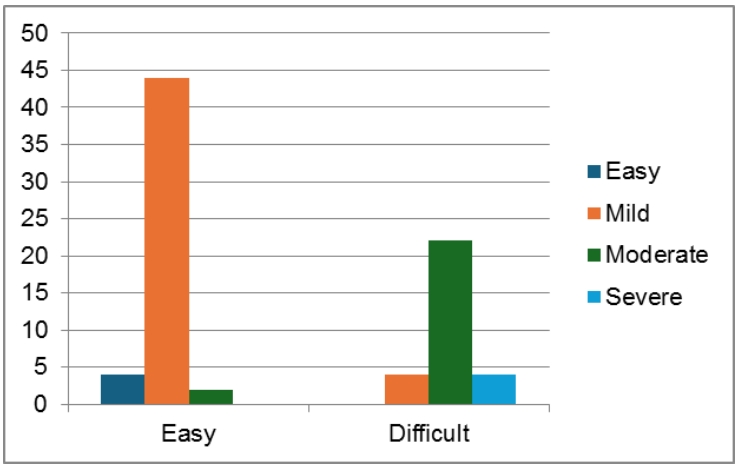

Figure 4: Distribution of scores time according to difficulty.

DISCUSSION

Although revolutionary development in surgical technology, a higher difference in curative techniques and disposition of cholecystectomy were observed.[14] Many grading or scoring classifications were designed for preoperative prediction of risks regarding surgery, however, scoring systems for laparoscopic surgery are scarce[15] which enable the researchers to provide analytic comparisons between different surgical techniques.[16]

Present study showed that 62.5% of patients were classified intraoperatively as easy and 37.5% of them were classified as difficult for Laparoscopic Cholecystectomy. These findings are similar to results of Younis study in Iraq[17] which found that 38% of patients surgically operated with Laparoscopic Cholecystectomy were graded as difficult preoperatively. Similarly, our preoperative prediction findings are close to results of Khetan et al[18] study in India which found that 36.6% of patients were scored as difficult and 63.4% were scored as easy for Laparoscopic Cholecystectomy. Many

authors defined the difficult laparoscopic cholecystectomy patients with higher surgery and post-surgery complications with elevated frequency of conversion to classical cholecystectomy.[19] Some literatures defined the difficulty in making pneumoperitoneum, exploring peritoneal cavity, removing the adhesions and dissecting gall bladder.[17] Multiple risk factors increasing conversion rate in Laparoscopic Cholecystectomy were detected like the intensity of cholecystitis, the thickness of gall bladder wall, obesity, adhesions and positive past abdominal surgical history, in addition to factors related to techniques and experience of surgeons in previous surgery.[20]

The criteria used for Laparoscopic Cholecystectomy difficulty assessment intra-operatively in our study were surgical operation time, bile or stone spillage and conversion to open surgery. These findings are consistent with results of Nile et al[21] study in Iraq which regarded conversion rate to open surgery, surgery time and stone spillage are the common scores of assessing the difficulty of Laparoscopic Cholecystectomy. The surgical operation time in current study lasts one hour and more in 12.5% of patients. This proportion is better than results of Atta et al[22] study in Egypt which reported that 53.8% of patients undergone Laparoscopic Cholecystectomy had surgical operation time of one hour and more. This difference might be attributed to discrepancy in patients' status, complications and skills of surgeons in between studies. Subhas et al[23] study in USA revealed that common risk factors lead to prolongation of Laparoscopic Cholecystectomy were emergency acute cholecystitis, obesity, adhesions, stone spillage, bile duct injury and bleeding. Bile or stone spillage was detected among 27.5% of patients in our study. This is similar to results of Helme et al[24] study in UK which stated that stone or bile duct spillage are common complications of Laparoscopic Cholecystectomy. They also revealed that bile duct spillage may be associated with higher morbidity outcomes that need urgent surgical intervention.[25] Common bile ducts spillage had a frequency rate of 0.2-3% and sometimes more than five times of incidence among open surgery.[26] In present study the conversion rate to open surgery was 5%. This conversion rate is higher than conversion rate reported by Al Saffar et al[26] study in Iraq of 1.66%. This difference might be attributed to higher sample size (300 patients) and longer duration follow up of previous Iraqi study in comparison to our study. However, our study conversion rate is close to conversion rate reported by Sakpal et al[27] study in USA of 4.9%. It was proved that 75% of gall bladder surgeries in USA were done by Laparoscopic techniques and rate of conversion to open surgery in last decade was between 5-10% in USA.[28] Keus et al documented that higher complication rate intra-operatively were related to difficulties in surgical techniques.[29] Al-Dhahiry et al[30] study in Iraq reported that elderly age, male gender, abdominal adhesions, Mirrizi syndrome, impacted stones and common bile duct stones were the main risk factors for conversion to open surgery.

Obesity of patients in current study was significantly associated with difficult Laparoscopic Cholecystectomy ($p<0.001$). This finding coincides with results of Younis et al[31] study in Iraq which found that patients with high BMI (>35) were significantly at higher risk of difficult Laparoscopic Cholecystectomy. Similarly, Vivek et al[17] study in India showed that obesity is a risk predictor for Laparoscopic Cholecystectomy. The obesity is accompanied by high fat in abdominal walls that made the identification of umbilical fascia more difficult. Many authors showed that obesity (>30 BMI) was related to umbilical portal entry difficulties.[32]

Current study showed a significant association was observed between previous surgery and difficult surgical operation ($p=0.02$). Akyurek et al[33] study in Turkey included 600 patients undergone Laparoscopic Cholecystectomy classified into three groups; group without previous abdominal surgery, group with upper abdominal previous surgery and group with lower abdominal previous surgery. They found no contraindications for Laparoscopic Cholecystectomy among patients with previous surgery, but they detected higher rates of conversion and difficulty among those patients.[33] The explanation of difficulty of Laparoscopic Cholecystectomy in patients with previous surgery is attributed to abdominal adhesions.[34]

Present study found a highly significant association between complete gall bladder adhesions and difficult surgical operation ($p<0.001$). This finding is in agreement with Bat study in Turkey[43] which concluded that adhesions especially adhesions in calot's triangle was the common significant predictor for difficult Laparoscopic Cholecystectomy. Our study also showed that distended gall bladder among studied patients was significantly associated with difficult Laparoscopic Cholecystectomy ($p=0.003$). Gupta et al[15] study in India found that distended gall bladder was a significant predictor for difficulty among patients undergone Laparoscopic Cholecystectomy.

Inability of surgeon to grasp in our study was associated significantly with difficult Laparoscopic Cholecystectomy ($p<0.001$). This finding is consistent with results of Xu et al[36] study in China which showed that for large stone size and inability to grasp, the Laparoscopic Cholecystectomy could be performed with clear Calots' triangle, however it increased the difficulty scores. Current study found a significant association was detected between presence of impacted stones and difficult Laparoscopic Cholecystectomy ($p<0.001$). This finding is similar to results of Ahmad study[37] in Iraq which found that impacted stones were significantly related to maximum scores of Laparoscopic Cholecystectomy difficulty.

In this study, there was a significant association between peri-colic collection and difficulty in Laparoscopic Cholecystectomy (p=0.01). Atmaram et al[38] study in India stated that factors like peri-colic collection disable the surgeons to explore the anatomy of Clots' triangle are regarded as a significant predictor for difficult Laparoscopic Cholecystectomy. Longer time of Calots' triangle dissection (>30 minutes) taken by surgeon in our study was significantly associated with difficult Laparoscopic Cholecystectomy (p<0.001). This is consistent with results of Saber et al[39] study in Egypt which reported that longer time of Calots' triangle dissection increased the surgical operation time and increasing the difficulty scores of Laparoscopic Cholecystectomy. Present study showed a highly significant association between higher scores and difficult Laparoscopic Cholecystectomy (p<0.001); 100% of patients with 8-10 scores had difficult surgical operation while 100% of patients with <2 score had easy operation. Sugure et al[40] study in Ireland stated that current scoring system of Laparoscopic Cholecystectomy difficulty classification had higher validity in prediction of difficulties and complications intraoperatively.

CONCLUSIONS

- The intra-operative difficulty scoring of Laparoscopic cholecystectomy is laparoscopy technique.
- The proportion of patients with intra-operative difficult Laparoscopic cholecystectomy is within normal range.
- The conversion rate to open surgery is relatively low.

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