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Research Paper

Assessment of Preoperative Factors in Relation with Difficulty of Laparoscopic Cholecystectomy

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ABSTRACT:

BACKGROUND:

Laparoscopic cholecystectomy is relatively a simple and quick procedure, but it can be difficult, takes longer time, and needs special instruments and an experienced surgeon. However, identifying the preoperative patient-related factors, and anticipating the need to convert from laparoscopic cholecystectomy to open surgery can help identifying high-risk patients and redefine the surgical strategy needed.

OBJECTIVE:

To Assess laparoscopic cholecystectomies through identifying the preoperative factors that predict the difficulty of laparoscopic cholecystectomy.

PATIENTS AND METHOD:

A cross-sectional study conducted on patients preparing for laparoscopic cholecystectomy in during 2023.

RESULTS:

The study involved 221 patients with mean age was 41.3±12.3 years, 51(45.5%) were overweight. The average time needed for laparoscopic cholecystectomy was 58.9±10.0 minutes. The average time needed for port installation (porting time) was 8.5± 2.1 minutes. Difficult procedure was reported in 100 (89.3%), of them 99 (88.4%) patients were classified as having moderate difficulty, and only one case was considered as very difficult and was converted to open procedure. The current study showed a significant association between the difficulty level of laparoscopic cholecystectomy and older age, sex, and high BMI.

CONCLUSION:

Difficult laparoscopic cholecystectomy is common though the conversion rate is low, the current study presented a significant association between the difficulty level of laparoscopic cholecystectomy with older age, sex, and high BMI.

KEYWORDS: Difficulty, Laparoscopic cholecystectomy, Preoperative factors.

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INTRODUCTION:

Since the early era of 1990s, laparoscopic cholecystectomy has supplanted open invasive surgery. This treatment has a lower overall complication rate and a shorter postoperative hospital stay than open cholecystectomy. Laparoscopic cholecystectomy was introduced to Iraqi hospitals around 1995, the conversion rate to open cholecystectomy was 5%, mainly due to the inability to define Calot's triangle due to poor experience. The conversion rate was decreased from 10% in the first 100 cases to 1% in the third 100 cases due to the improvement of the learning curve [1,2].

Several studies pointed to the severity of acute cholecystitis, severe inflammation of the gallbladder and its surrounding tissues as a factor to increase both the difficulty of intraoperative findings and the frequency of postoperative complications in laparoscopic cholecystectomy, also obesity was blamed for greater technical difficulty during surgery in comparison of non-obese patients, yet obesity was not considered a contraindication for laparoscopic cholecystectomies and can be safely performed in the emergency setting[3]. Other studies used factors such as the open conversion rate, operating time, and the incidence of complications, Gallbladder wall thickening, impacted stones as indicators of surgical difficulty [4].

Previously published systematic reviews revealed a rate of 2% up to 15% of laparoscopic

cholecystectomies are converted to open surgery for various reasons [5].

Older literature state that conversion to open cholecystectomy was the most commonly reported complication, reported in 135 (58%) studies, followed by bile leak in 89 (38%) and bile duct injury in 75 (32%). Mortality was reported in 89 studies (38%) [6].

Converted cases are associated with an increased number of infectious and other postoperative complications, an increased risk of additional procedures, and a higher rate of readmission within 30 days. Moreover, the conversion from laparoscopic to open surgery will lead to longer postoperative stays and higher morbidity and mortality rates in this group of patients [7].

As surgeons' knowledge has grown over time, conversion to an open operation is now an uncommon occurrence. Conversion to an open technique result in a scar that is unsightly, a bigger abdominal incision, and serious pain management problems after surgery [8].

Although peritoneal adhesions and inflammatory gallbladder infiltration had been shown to be the most frequent causes of conversion, additional pre- and intraoperative variables were still involved. Surgeons are subject to intense psychological strain and the possibility of patient lawsuits [9]. Thus, safe cholecystectomy is crucial for the patient as well as the operating surgeon. By determining the preoperative patient-related factors and anticipating the need to switch from laparoscopic to open surgery, one can identify high-risk patients and reevaluate the necessary surgical approach, which will increase the established cost-effectiveness of treatment while also ensuring patient safety [10].

Study objectives: to assess laparoscopic cholecystectomy through identifying the preoperative factors that may predict the difficulty of the procedure.

PATIENTS AND METHODS:

Study design and setting: A prospective cross-sectional study was conducted in Al Yarmouk Teaching Hospital during 2023. All patients whom were admitted for laparoscopic cholecystectomy were approached.

Sampling and data collection: The study included 112 patients who were admitted for laparoscopic cholecystectomy during the period of the study.

Inclusion criteria: All the patients, 18 years of age and older, fully checked to be fit for general anesthesia.

Exclusion criteria: Patients unfit for pneumoperitoneum due to cardiac or pulmonary causes, Patients diagnosed as Chronic liver disease, common Bile Duct stone and clinical features of obstructive jaundice, or Combined gall bladder and common bile duct stones (unless they were managed by ERCP to clear CBD or the pancreatic duct prior to readmission), Suspicion of gall bladder tumor, Patients having coagulation disorders and Pregnant patients.

Patient preparation: Full medical history had been taken from all the patients with thorough clinical examination. Abdominal ultrasound was done also and the reports were reviewed and documented.

Preoperative data: a data sheet included eleven parameters were Age, gender, history of endoscopic retrograde cholangiopancreatography (ERCP), acute cholecystitis or biliary colic, and clinical examination results including body mass index (BMI), abdominal scar, palpable gallbladder, tenderness, and ultrasound findings "Wall thickness, Pericholecystic collection, impacted stone" were recorded.

Post-operative data: laparoscopic cholecystectomy was graded as the following [11]:

Easy: Time needed is less than 45 minutes, No Injury occur to cystic duct and/ or artery, and No conversion to open

Difficult: which is subdivided into

Moderately difficult: Time needed is 45-74 min, there is an injury to the cystic duct, or artery, no conversion of the laparoscopic surgery to open surgery

Very difficult: Time needed is ≥75 min, Injury to artery or duct, and/or conversion of laparoscopic to an open procedure.

Ethical consideration: The Department of Surgery's ethical committee granted formal acceptance. Before involving the patient, the author verbally consented to the study's purpose and the specifics of the surgery.

Statistical analysis: Data were coded and collected using Microsoft Excel 2019, then transferred to Statistical Package for the Social Sciences (SPSS) sheet where the data were analyzed with the help of statistician. Frequency and percentage were used to represent categorical variables, and mean± Standard Deviation (SD) was used to represent continuous variables. To demonstrate the relevance of the relationship between preoperative characteristics and the degree of difficulty involved in a laparoscopic cholecystectomy, chi-square and Fischer exact tests were utilized. A P value of less than 0.05 was deemed significant.

RESULTS:

Half of the studied sample 57(50.9%) were 40 years old or older (mean age was 41.3±12.3 years), 51(45.5%) found to be overweight and 28(25%) were obese. Table (1) shows the

distribution of the sample by demographic characteristics. Table (2) display the causes of previous admissions. Six patients (66.7%) had a previous admission due to gall stones

Table 1: Distribution of sample by sex according to demographic characteristic .

Variable		Male	Female	Total
Age	<40	13(11.6%)	42(37.5%)	55(49.1%)
	≥40	15(13.4%)	42(37.5%)	57(50.9%)
BMI	Normal	7(6.25%)	26(23.2%)	33(29.5%)
	Overweight	14(12.5%)	37(33%)	51(45.5%)
	Obese	7(6.25%)	21(18.8%)	28(25%)
Abdominal surgery	No	19(17%)	63(56.2%)	82(73.2%)
	Yes	9(8%)	21(18.8%)	30(26.8%
Previous admission for cholecystitis	No*	25(22.3%)	78(69.6%)	103(92%)
	Yes	3(2.7%)	6(5.4%)	9(8%)
ERCP	No	28(25%)	81(72.3%)	109(97.3%)
	Yes	0	3(2.7%)	3(2.7%)
Total		28(25%)	84(75%)	112(100%)

***Scheduled operation within 4-6 weeks**

According to clinical examination, Gall bladder was palpable in one patient (0.9%), while tenderness was found among 103(92%) of patients. (Table 2).

Table 2: Distribution of sample by gender according to Clinical examination.

Variable		Male	Female	Total
Palpable gall bladder	No	28(25%)	83(74.1%)	111(99.1%)
	Yes	0	1(0.9%)	1(0.9%)
Tenderness	No	6(5.4%)	3(2.7%)	9(8%)
	Yes	22(19.6%)	81(72.3%)	103(92%)
Total		28(100%)	84(100%)	112(100%)

According to ultrasound findings, pericholecystic collection was seen in only three female patients (2.7%)**, impacted stone in** 1(1.2%) **female patients, the presence of more than one stone in** 106(94.6%) **of the total patients, other sonographic feature illustrated in table 3**

Table 3: Distribution of sample by gender according to ultrasound examination.

Variable		Male	Female	Total
Pericholecystic collection	No	28(100%)	81(96.4%)	109(97.3%)
	Yes	0	3(3.6%)	3(2.7%)
Impacted stone	No	28(100%)	83(98.8%)	111(99.1%)
	Yes	0	1(1.2%)	1(0.9%)
GB stone number	one stone	0	6(7.1%)	6(5.4%)
	More	28(100%)	78(92.9%)	106(94.6%)
Gall bladder wall thickness	≤ 3 mm	19(67.9%)	60(71.4%)	79(70.5%)
	> 3 mm	9(32.1%)	24(28.6%)	33(29.5%)
Total		28(100%)	84(100%)	112(100%)

The average time needed for laparoscopic cholecystectomy was 58.9±10.0 minutes. Around 12 (10.7%) of patients had their laparoscopic cholecystectomy completed within less than 45 mins. Majority 99 (88.4%) patients needed 45-74 minutes and only one patient (0.9%) required more than 75 minutes for the procedure to be completed.

As for the average time needed for port installation (porting time), it was 8.5± 2.1 minutes. Fourteen patients (12.5%) needed 5 minutes or less for ports to be installed, while the majority 96 (85.7%) required 6-10 minutes. Only 2 patients (1.8%) needed more than 10 minutes for the installation of ports. (Table 4)

Table 4: Time projection for laparoscopic cholecystectomy among the sample (n=112).

Time	Frequency	Percent
Total time needed for laparoscopic cholecystectomy		
<45 min	12	10.7
45-74	99	88.4
≥75	1	0.9
Ports insertion time		
≤5	14	12.5
6-10	96	85.7
>10	2	1.8
Total	112	100.0

Regarding intraoperative complications, Port bleeding was only witnessed among 3 (2.7%) patients, spillage occurred in 16 (14.3%) of patients, adhesions were noted in 18 (16.1%) of patients, while excessive fat was observed in 25 (22.3%) of patients. Table (5) shows the details of intra-operative complications among the studied sample.

Table 5: The intra-operative characteristics among the studied sample.

Variables		Frequency	Percentage
Port bleeding	No	109	97.3
	Yes	**3**	**2.7**
Spillage	No	96	85.7
	Yes	**16**	**14.3**
Adhesions	No	94	83.9
	Yes	**18**	**16.1**
Excessive fat	No	87	77.7
	Yes	**25**	**22.3**
Abnormal anatomy	No	109	97.3
	Yes	**3**	**2.7**
Failure of Critical view of safety	No	109	97.3
	Yes	**3**	**2.7**
Failure of Rouviere's sulcus	No	109	97.3
	Yes	**3**	**2.7**
Injury of cystic duct or artery	No	106	94.6
	Yes	**6**	**5.4**
Conversion to open cholecystectomy	**No**	**111**	**99,1**
	Yes	**1**	**0.9**
Total		112	100%

According to the previous complications, difficult procedure was reported in 100 (89.3%), of them only one case was considered as very difficult and was converted to open procedure, and 99(88.4%) were classified as moderate difficulty. While only 12 (10.7%) had easy laparoscopic procedure. (Table 6)

Table 6: Distribution of the studied sample by the difficulty level of the laparoscopic operation.

Difficulty level			Number	Percentage
Easy Procedure		Time < 45 min No injury No conversion	12	10.7
Difficult	Moderate	Time 45-74 mins Injury of duct or artery No conversion	99	88.4
	Severe	Time≥75 min Injury to artery or duct and/or Conversion to an open procedure	1	0.9
Total			112	100.0

This study showed a significant association between difficulty level of laparoscopic cholecystectomy and age more than 40 years, female sex and overweight. while no significant association was found in other preoperative factors with intraoperative difficulty. (Table 7)

Table 7: Distribution of patients by pre-operative parameters according to the operative difficulty.

Variables		Difficulty level		Total	P value
		Easy	Difficult		
Age	≤40	10(18.2%)	45(81.8%)	55(100%)	0.015
	>40	2(3.5%)	55(96.5%)	57(100%)	
Gender	**Male**	**0**	28(100%)	28(100%)	0.035
	Female	12(14.3%)	72(85.7%)	84(100%)	
BMI	Normal	12(36.4%)	21(63.6%)	33(100%)	0.000
	Overweight or obese	0	79(100%)	79(100%)	
Previous admission	No	12(11.7%)	91(88.3%)	103(100%)	0.594
	Yes	0	9(100%)	9(100%)	
ERCP	No	12(11%)	97(89%)	109(100%)	1.000
	Yes	0	3(100%)	3(100%)	
Surgery	No	9(11%)	73(89%)	82(100%	1.000
	Yes	3(10%)	27(90%)	30(100%)	
Palpable Gallbladder	No	12(10.8%)	99(89.2%)	111(100%)	1.000
	Yes	0	1(100%)	1(100%)	
Tenderness	No	0	9(100%)	9(100%)	0.594
	Yes	12(11.7%)	91(88.3%)	103(100%)	
Collection	No	12(11%)	97(89%)	109(100%)	1.000
	Yes	0	3(100%)	3(100%)	
Impacted stone	No	12(10.8%)	99(89.2%)	111(100%)	1.000
	Yes	0	1(100%)	1(100%)	
Wall thickness	≤3 mm	9(11.4%)	70(88.6%)	79(100%)	1.000
	>3 mm	3(9.1%)	30(90.95)	33(100%)	

DISCUSSION:

By properly organizing the operating room and providing technical resources, the preoperative diagnosis of the laparoscopic cholecystectomy's complexity benefits the patient as well as the surgeons who must conduct the surgery [12]. Thus, it would be prudent to keep those preoperative considerations in mind in individuals exhibiting the clinical and laboratory signs and symptoms of acute cholecystitis.

The current study showed that almost half of the studied sample were 40 years old or older (mean age 41.3 years) and the majority of the sample were females which is in agreement with Jameel SM et al 2020 Duhok, who agreed with the facts that the risk of gallbladder diseases tends to increase in female patients and in those patients more than 40 years of age [13].

The current study showed that overweight and obese patients were the commonest among the candidates for laparoscopic cholecystectomies. Which is comparable with findings by Ghadhban BR 2019 in Baghdad in which 69% of patients were overweight and 13% were obese. It had been reported that Iraq's obesity prevalence is higher than the regional average of 10.3% for women and 7.5% for men [14]. while a study by Wibowo A et al displayed that only 3 (2%) had BMI >27.5 kg/m^2 [15], this difference is attributable to country nutritional culture and food availability.

The current study showed a shorter average port-installation time (8.5±2.1 minutes). On the other hand, average time needed for laparoscopic cholecystectomy was 58.9±10.0 minutes. This can be related to many covariates starting from surgical theater preparedness, to surgical team readiness and skills, the above-mentioned results of operation time and port installation time were comparable to Omar et al, and Sutcliffe RP et al results [16,17].

This study showed that about (10%) of patients had an easy procedure, while majority of patients had a range of difficult laparoscopic cholecystectomy procedure and only one case was considered as very difficult and was converted to an open procedure, these findings were lower than that reported by Al-Dhahiry J in Wasit-Iraq [18]. where the conversion from a laparoscopic cholecystectomy to an open cholecystectomy was performed for 7 patients. Likewise, the current results were higher than findings stated by Bhandari T et al in 2021, where the total difficult laparoscopic cholecystectomies were found in (15%) of

patients [19]. These differences might be related to the variation in defining and categorizing difficult procedures, surgeon experience, in addition to the overall center success rate.

The current study revealed a significant correlation between older age and the difficulty level of laparoscopic cholecystectomy. These findings are consistent with a systemic review conducted in 2020 by Kamarajah SK et al and Di Buono G et al, which reviewed 48 articles and clearly demonstrated the impact of aging on overall complications. The results also confirmed that aging was a predictor of difficulty for laparoscopic cholecystectomies. This also confirmed the significant effect of age with the critical view of safety identification, higher rates of mortality, post-procedural infection, bleeding, and length of stay as compared to open cholecystectomy. One explanation for this is the presence of multiple comorbidities and reduced functional reserve that come with age. Consequently, assessing the complexity of a laparoscopic cholecystectomy [22].

The current study showed a significant association between the female sex and difficult laparoscopic cholecystectomy which can be compared with results reported by Nassar A et al 2020, who showed a significant effect of sex with the critical view of safety identification and determining the difficulty of laparoscopic cholecystectomy [23] .It disagrees with the results reported by Wibowo A et al 2022 , and Di Buono G et al 2021, in which no significant difference in regard to sex, and sex was not a significant risk factor in predicting difficult laparoscopic cholecystectomy [15,20].

The present study showed a significant association between BMI and difficult laparoscopic cholecystectomies. In line with Stanisic V et al 2020, patients with higher body weight have been reported to be especially prone to more severe gallbladder inflammation or fibrosis, making the dissection more difficult. Therefore, the higher the BMI, the more challenging the laparoscopic cholecystectomy would be [24]. Obese patients are more likely to undergo conversion because of potential technical issues with trocar placement, ambiguous anatomy caused by the presence of significant intraperitoneal fat, and insufficient liver retractability [25].

Other demographic and operative variables failed to show non-significant association with laparoscopic cholecystectomy difficulties which might be related to sample size and the fact that the current study reviewed a single center experience. Other literature by Ramirez-Giraldo C et al 2022 showed thick-walled gallbladders, prior abdominal surgeries and pre-operative ERCP were important independent predictors of challenging patients [26].

CONCLUSION:

Difficult laparoscopic cholecystectomy is common though the conversion rate is low, the current study presented a significant association between the difficulty level of laparoscopic cholecystectomy with older age, sex, and high BMI, and other insignificant factors which might be due to limited sample size and difference in surgeons' experience.

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