Original Article

To Determine Predictive Factors For Difficult Laproscopic Cholecystectomy Using Ultrasonography Criteria

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ABSTRACT

Objective: The aim of the study was to find out the predictive factors for difficult laproscopic cholecystectomy using ultrasonographic criteria.

Study Design: cross-sectional study

Place and Duration of Study: This study was conducted at the department of Bacha Khan Medical Complex/Gajju Khan Medical College-SWABI from July 2022 to December 2022.

Methods: After taking permission from the ethical committee of the institute. A total of 154 individuals were enrolled in this study. Individuals of both genders diagnosed with cholelithiasis and were admitted for laparoscopic cholecystectomy were included. Gallbladder wall thickness, impacted stone, number of gallstones, pericholecystic fluid, , and constricted gall bladder were the main features examined by ultrasonography . All the data were analyzed using SPSS version 24. A P value was regarded as statistically significant if it was less than 0.05. Ultrasonography's diagnostic effectiveness indices, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy, were tested.

Results: Out of 154 individuals, 31 (20.1%) were male and 123 (79.87%) were female. The presence of pericholecystic fluid on ultrasonography, gall bladder wall thickness greater than 4 mm and stone size were the main the predictors of a difficult laparoscopic cholecystectomy. The difficult laparoscopic cholecystectomy was predicted by sensitivity, specificity, positive predictive value, negative predictive value, and probing precision of gall bladder wall thickness greater than 4 mm and pericholecystic fluid on ultrasonography. The number of gall stones on ultrasonography demonstrated 96.5%, sensitivity, 75% specificity, 99.3%, and PPV 37.5%, NPV and 96% diagnostic accuracy.

Conclusion: Our study concluded that Ultrasonography should be used as a screening method because it is a very good indicator in difficult laparoscopic cholecystectomy in the majority of the participants. This can assist the surgeon in anticipating any possible issues that may arise during surgery.

Key Words: Predictive factors, Difficult laproscopic cholecystectomy; Ultrasonographic criteria

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INTRODUCTION

The surgical removal of the gallbladder because of inflammation or stone formation is known as a cholecystectomy. And it's the most common surgery carried out in the biliary system.[1] The recommended and acknowledged gold standard for the definitive treatment of gallstones or cholelithiasis symptoms is laparoscopic cholecystectomy.[2] Compared to a typical open cholecystectomy, this surgical approach offers several benefits, including less trauma, less pain, a shorter hospital stay, improved cosmetic results, and a quicker recovery.[3-4] Yet some research indicates that compared to open cholecystectomy, laparoscopic cholecystectomy offers a greater rate of complications. These complications include damage to the vascular and visceral structures during the application of a trocar and Verses needle, gallbladder perforation, bile leakage, injury to the common bile duct, and other issues like external biliary fistula, perihepatic collection, wound sepsis, haematoma, foreign body inclusions, adhesions, metastatic port-site deposits, and cholelithoptysis.[1-3] The conversion rate to an open surgery during the early years of laparoscopic cholecystectomy was between 2 and 15%. The conversion rate decreased to around 1% to 6% after years of learning and comprehending the laparoscopic procedure and growing surgeon expertise. This change

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was an effort to prevent problems because of a number of issues that arose throughout the process.[5] Preoperative and intraoperative risk factors that increase the complexity of laparoscopic cholecystectomy include advanced age, male gender, body mass index (BMI), history of abdominal surgery, acute cholecystitis with fever, leukocytosis, gallbladder stones, and particular ultrasonographic findings like gallbladder distention and wall thickness ≥4 mm, impacted gallstones, as well as pericholecystic fluid collection. According to a study by Kama et al., the risk of open cholecystectomy was significantly correlated with six parameters: prior diagnosis of acute cholecystitis, sonographically detected thickened gallbladder wall, upper abdominal tenderness at the time of surgery, male gender, age, and history of abdominal surgery.[6] The preferred method of investigation for gallbladder or biliary diseases is ultrasonography. The most often used technique is preoperative abdominal ultrasonography since it is an inexpensive, radiation-free, & non-invasive diagnostic method.[7] Therefor the current study was carried out to determine predictive factors for difficult laproscopic cholecystectomy using ultrasonographic criteria.

METHODS

The current cross-sectional study was conducted in the surgery department of Bacha Khan Medical Complex/Gajju Khan Medical College-SWABI from July 2022 to December 2022 after taking permission from the ethical committee of the institute. A total of 154 individuals were enrolled in this study. WHO sample size calculator was used for sampling procedure. Individuals of both sexes diagnosed with cholelithiasis and were hospitalized for laparoscopic cholecystectomy were included. Non-probable consecutive sampling technique were used .Individuals with abnormal liver function tests (LFTs), or jaundice , acute cholecystitis, abnormal coagulation, or CBD stones as well as any other CBD disease profile, and those who had previously had surgeries in the upper abdominal region were not were excluded. Patients from the general surgery department's outpatient department (OPD) who met the inclusion criteria were admitted to the ward for a laparoscopic cholecystectomy. A comprehensive examination and a detailed history were obtained from the participants. The identical probe (Aplio 500, Toshiba, Japan) was used by the radiologist to perform preoperative ultrasonography on each individuals. The features examined by ultrasonography were wall thickness of gallbladder, gallstones frequency, pericholecystic fluid, impacted stone, and contraction in gall bladder. This study does not employ learning curve statistics because the surgeon has laparoscopic surgical expertise. The results of the procedure were documented on a specially created proforma. The following standards were established in order to objectively classify the surgical results as challenging laparoscopic cholecystectomy.

i. Technique duration of more than sixty minutes (the amount of time from the start of the trocar or Verses needle to the gallbladder's removal)
ii. During dissection, the gallbladder tore, causing bile and stone to leak.
iii. The gall bladder was dissected from the bed for more than 30 minutes.
iv. Calot's triangle took more than thirty minutes during dissection.
v. Any process that requires being converted to the open

Data analysis: The data were analyzed using 24 version of SPSS and frequencies and percentages were calculated for the categorical variables, such as gender, the number of gallstones, the thickness of the bladder wall, and the presence of pericholecystic fluid. Continuous numerical data, such as age, were used to compute the mean and standard deviations. The chi-squared post-stratification test was used. A P value was regarded as statistically significant if it was less than 0.05. Ultrasonography's diagnostic effectiveness indices, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy, were tested and computed using the standard formulae shown below:

TP/TP+FN x 100 is the sensitivity. Sensitivity = TN/TN+FP x 100 Value of Positive Prediction = TP/TP+FP × 100 Negative prediction value = TN/TN+FN x 100.

RESULTS

Overall 154 participants, who had laparoscopic cholecystectomy were included in this study.

Table No. 1. Parameters and demographic features of the study participants N=150

Features	Statistics/N(%)
Age in years	
Range (median)	44(21-66)
Mean ± SD	42.4±9.8
Genders	
Female	123 (79.87%)
Male	31 (20.1%)
Body mass index (kg/m2)	
Less than 25	104 (67.5)
25 to 27.5	15 (9.74)
Greater than 27.5	35 (23.7)
Gallbladder palpable	
No	118(76.62)
Yes	36(23.37)
Duration of surgery in minutes	
Mean	20.36 ± 17.63
Range	8.30 – 90.6
Rate of conversion	08(5.1)

Table No. 2: Findings of Preoperative Ultrasonography of the study participants (n=154)

Ultrasonography results	N /%
Peri-cholecystic fluid	9(5.8)
No of stones	
One	10(6.4)
More than one	144(93.5)
Thickness of the wall of gall bladder	
Less than 4 millimeter	134(87)
Equal or greater than 4 millimeter	20(12.9)
Stone that were impacted	22(14.28)
Gallbladder impacted	20(12.9)
Stone size	
Less than one centimeter	124(80.5)
Equal are greater than 1 centimeter	30(19.4)

The mean age of the study participants were (range 21-66 years) 42.4±9.8 years. Out of which 31 (20.1%) were male and 123 (79.87%) were female. The mean duration of the surgical procedure was 21.35 ± 17.63 minutes, and the average duration of the hospital stay after surgery was 1.5 ± 0.6 days. The participants demographic features presented in table 1 while table 2 represent the Ultrasonography results. The presence of pericholecystic fluid on ultrasonography, gall bladder wall thickness greater than 4 mm and stone size were the main the predictors of a difficult laparoscopic cholecystectomy as described in table 3. Sensitivity, specificity, positive predictive accuracy, negative predictive value, as well as evaluation accuracy of gall bladder wall thickness exceeding 4 mm or pericholecystic fluid on ultrasonography were used to predict the difficult laparoscopic cholecystectomy. The results revealed 90.4%, 98.4%, 95.5%, 99.0%, and 98%, and 75%, 99.3%, 85.7%, 98.6%, and 98%, correspondingly. The number of gallstones on ultrasonography revealed 96% diagnostic accuracy, 96.5% sensitivity, 75% specificity, 99.3% PPV, and 37.5% NPV.(Table 4)

Table No. 3: Relationship between Difficult Laparoscopic Cholecystectomy and preoperative Ultrasonography Outcomes (n=154)

Ultrasonography features	Results	Laparoscopic Cholecystectomy			
Wall thickness of gallbladder	----------	Difficult (n) ----------	Not difficult (n) ----------	Total (n) ----------	Value of P
	≤ 4mm	19(12.3)	98(63.6)	117	
	> 4mm	32(20.7)	05(3.2)	37	
Stone size	<1cm	31(20.1)	93(60.3)	124	.001*
	≥1cm	21(13.6)	9(5.8)	30	
Mobility of gall stone	Mobile	100(64.9)	32(20.7)	132	.004*
	Impacted	21(13.6)	1(0.6)	22	
Contracted gall bladder	No	3(1.9)	131(85.0)	134	.001*
	Yes	18(11.6)	02(1.2)	20	
Pericholecystic fluid	No	26(16.8)	99(64.2)	125	.001*
	Yes	27(17.5)	2(1.2)	29	
A p-value of less than 0.05 is taken to be statistically significant.					

Table No. 4: The diagnostic accuracy of ultrasound results in predicting difficult laparoscopic cholecystectomy

Ultrasound results	Diagnostic accuracy				
	Sensitiviy (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
Wall thickness of gallbladder	90.4	98.4	95.5	99.0	97.9
Size of the stone (≥1cm)	96.5	75	99.3	37.5	96
Gall stone mobility (Impacted	40	100	100	76.9	80
Contracted gall bladder	65	97.5	92.9	84.5	86.7
pericholecystic fluid	75	99.3	89.7	98.6	98

DISCUSSION

One of the most common problems with digestion is cholelithiasis. The incidence of gallstones varies almost globally. And they are usually asymptomatic (>80% of the time).[8] The gold standard for treating symptomatic gallstones is laparoscopic cholecystectomy because of its benefit of decreased postoperative morbidity, safety, and success.[9] It is currently the procedure that general surgeons do the most frequently. Approximately 80% of cholecystectomies performed now are laparoscopic procedures.[10] The aim of the study was to determine the

predictive factors for difficult laproscopic cholecystectomy using ultrasonographic criteria. The surgeons had trouble performing a laparoscopic cholecystectomy when the gallbladder was fibrotic and contracted, had thick adhesions near Calot's triangle, or was highly inflamed or gangrenous. Male sex, elderly status, being overweight, acute cholecystitis attacks, prior surgery to the abdomen, and certain ultrasonographic abnormalities such as thickening gall bladder wall, enlarged gall bladder, pericholecystic fluid storage, and impacted stone are danger variables which make laparoscopic surgery difficult. Laparoscopic cholecystectomy is usually safe and uncomplicated, however it can occasionally be difficult. Most of the untrained laparoscopic surgeons make use of quite simple equipment and facilities. Additionally, senior laparoscopic surgeons might not be accessible to them. The choice c for laparoscopic cholecystectomy have been more relaxed as competence has grown. According to several studies, advanced age is a significant risk factor for a complex laparoscopic cholecystectomy.[11] and set the cutoff age for this purpose at 50 years old. Age had no effect on intraoperative complications in this research because the majority of the patients were under 50. Gupta et al.[12] found a similar result, however Saleem AA et al.[13] found a significant correlation between surgical difficulties and age greater than 50. In this study, female participants were in the majority (79.87%). Due to the effect of estrogen and progesterone women are more likely to develop gallstones on biliary cholesterol levels and gallbladder motility.[14]

It is debatable if male sex and difficult cholecystectomy are related. Male gender may increase the likelihood of a troubling cholecystectomy, according a number of studies. Due to the belief that cholelithiasis mostly affects females, men may be diagnosed later. There may be significant adhesions as a result of the many inflammatory episodes prior to diagnosis. As to Nidoni et al., the conversion rate of males was significantly greater than that of females ($p = 0.034$, 95% CI).[15] Worldwide, the percentage of patients who switch from laparoscopic to open cholecystectomy ranges from 7% to 35%.[16] The overall conversion rate in the present research was 5.1% and was not influenced by age or gender, although all individuals shared predictive characteristics such as palpable GB, pericholecystic storage, thickening GB walls, and a BMI over 25.. This result differs from that of Bourgouin et al. (4.3%).[17]The operating surgeon's skill may be the reason for this low conversion rate. A number of prediction models for the difficult LC have been proposed however, these are predicated on the surgeon's subjective evaluation of the difficulties he experiences during surgery. These assessments are challenging to transfer between institutions, though, because they are predicated on a surgeon's skill and standard procedure.[18]Thus, ultrasonography results have been utilized to predict the outcome of difficult laparoscopic cholecystectomy procedures. Studies have shown that gallbladder is a predictor of complicated surgery.[19]Increased gall bladder wall thickness makes it harder for the gall bladder to separate from its bed; thicker walls also make it harder to grasp and manipulate the gall bladder and make dissection at Calot's triangle and the gall bladder bed harder to accomplish.[13] Similar to previous research, we found a substantial (p 0.001) correlation between the complexity of the operation and the thickness of the gall bladder wall. According to the research, the existence of pericholecystic fluid on the use of ultrasound was a predictor of a difficult laparoscopic cholecystectomy; it was observed in 29 people, and in 27 of those cases, the surgical procedure was determined to be difficult.. In their searches, Nidoni et al.[15] and Chindarkar H et al. [20]reported similar findings. A stone impacted at the neck is another significant signal with a high predictive value. A stone impacted at the neck is another significant signal with a high predictive value.

An impacted stone near the gall bladder's neck poses some technical difficulties during the laparoscopic cholecystectomy because of the gall bladder's distension and thick wall. We discovered that 22 patients (14.28%) had impacted stones, and all of them had challenging surgical outcomes. Mucocele from the impacted stone made it difficult to grab the gallbladder's muscles for retraction during dissection, making the procedure puzzling. This outcome is in line with previous research.[21] Numerous investigations have found a statistical correlation between the size of the stones and the decision to switch from laparoscopic to open cholecystectomy.[20] The current study finds the same thing, however another study demonstrated that stones bigger than 20 mm were linked to a greater conversion rate.

Limitation: Ultrasound's main drawbacks are operator dependence, sinologist experience, challenges with obese patients, and issues with a contracted gallbladder.

CONCLUSION

Our study concluded that Ultrasonography should be used as a screening method because it is a very good indicator in difficult laparoscopic cholecystectomy in the majority of the participants. This can assist the surgeon in anticipating any possible issues that may arise during surgery. A difficult laparoscopic cholecystectomy was substantially ($p < 0.001$) linked with preoperative ultrasonography results.

Author's Contribution:

Concept & Design of Study:	Muhammad Kashif
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