

# Pre-operative Status as a Deciding Tool in Predicting Failure of Laparoscopic Cholecystectomy in Acute Calculous Cholecystitis

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## Abstract

**Introduction:** Laparoscopic cholecystectomy is the most commonly done procedure for gall stone disease. However few cases of acute calculous cholecystitis require conversion to open procedure which can increase the morbidity and financial burden to patient. Hence, through this study we are trying to use certain preoperative factors which can predict the chances of failure of laparoscopic procedure in acute calculous cholecystitis patient and thus prevent unnecessary trail of laparoscopy in such patients.

**Aims and Objectives:** To assess the symptoms in patient to predict conversion of laparoscopic cholecystectomy to open cholecystectomy in patients with acute calculous cholecystitis. To identify preoperative parameters to predict conversion of laparoscopic cholecystectomy to open cholecystectomy in patients with acute calculous cholecystitis. To correlate the preoperative factors with intraoperative severity.

**Materials and Methods:** A prospective study was conducted in Bangalore medical college, Bengaluru from May 2019 to November 2020 on 100 patients with diagnosed acute calculous cholecystitis.

**Results:** 100 patients of acute calculous cholecystitis underwent trial of laparoscopic cholecystectomy of which 16 patients had to undergo conversion to open procedure whereas remaining 84 patients underwent successful laparoscopic cholecystectomy.

**Conclusion:** In our study male gender, elderly age, raised serum alkaline phosphatase, raised total bilirubin, raised total leucocyte count were associated with higher chances conversion to open procedure and hence was concluded that these patients were poor candidates for laparoscopic cholecystectomy.

**Key words:** Acute calculous cholecystitis, Cholecystectomy, Conversion to open cholecystectomy, Failure of laparoscopy, Laparoscopic cholecystectomy

## INTRODUCTION

In the era of laparoscopic surgeries, cholecystectomy is one of the surgeries which is approached laparoscopically. Langenbuch was the first to do laparoscopic cholecystectomy in late 1800's<sup>[1]</sup> but the first to be documented is by Erich Muhe in 1985 in Germany.<sup>[2]</sup> Now, laparoscopic cholecystectomy is considered as "Gold-Standard" for the treatment of symptomatic gallstones.<sup>[3]</sup>

National Institute of Health (NIH) consensus development conference in 1992 stated that laparoscopic cholecystectomy is a safe and effective treatment for most patients with symptomatic gallstones.<sup>[4]</sup> However, it is observed that 1–13% of patients undergoing laparoscopic cholecystectomy will be converted to open technique.<sup>[5]</sup> The common causes for conversion are: Obscure biliary anatomy, presence of dense pericholecystic adhesions, intraoperative bleeding, failure of progression, and suspicion of choledocholithiasis.<sup>[6,7]</sup> Acute cholecystitis patients undergoing laparoscopic cholecystectomy are with increased of biliary injury.<sup>[8]</sup> Conversion from laparoscopic to open is associated with longer post-operative stays and morbidity and mortality.<sup>[9]</sup> Hence, to avoid unnecessary financial burden on patient, as well to reduce the morbidity, we are using pre-operative findings in a patient as a tool to predict the chances

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of conversion of laparoscopic cholecystectomy to open cholecystectomy.

### Aims and Objectives

The aims of the study were as follows:

1. To assess the symptoms in patient to predict conversion of laparoscopic cholecystectomy to open cholecystectomy in patients with acute cholecystitis.
2. To identify pre-operative parameters to predict conversion of laparoscopic cholecystectomy to open cholecystectomy in patients with acute cholecystitis.
3. To correlate the pre-operative factors with intraoperative severity.

### MATERIALS AND METHODS

A prospective study was conducted in Bangalore Medical College, Bengaluru, from May 2019 to November 2020. The study was conducted after obtaining ethical committee clearance and informed consent from patients. One hundred patients were included in the study irrespective of gender.

#### Inclusion Criteria

The following criteria were included in the study:

1. Age above 18 years
2. Confirmed cases of acute calculous cholecystitis on ultrasonography
3. Patients undergoing cholecystectomy within 3 days of onset of symptoms

#### Exclusion Criteria

The following criteria were excluded from the study:

1. Age <18 years.
2. Presence of other hepatobiliary pathologies such as cirrhosis, hepatitis, tumors, cholangitis, and choledocholithiasis.
3. Pregnancy.
4. Uncontrolled diabetes and uncontrolled hypertension.
5. Patient previously who had undergone major abdominal surgery.

#### Parameters Observed

1. Age
2. Sex
3. Duration of symptoms (in days)
4. Pain score (visual analog scale)
5. Total leukocyte count
6. Comorbidities (DM, HTN, DM + HTN)
7. Serum ALP (IU/L)
8. Total bilirubin (mg/dL)
9. Intraoperative severity grading<sup>[10,11]</sup>
  - I. Edematous
  - II. Mucocele

III. Gangrenous

IV. Empyema.

### Statistical Analysis

The data were analyzed using SPSS software version 21. Data were described using mean and standard deviation. Tests such as Chi-square test, paired *t*-test, and ANOVA *t*-test are applied to the data obtained. Level of significance is set at 5%.

### RESULTS

One hundred patients with confirmed cases of acute calculous cholecystitis presenting between 1 and 3 days of onset of symptoms underwent laparoscopic cholecystectomy. Among 100 patients 84 of them underwent successful completion of laparoscopic cholecystectomy and 16 patients had to undergo conversion to open cholecystectomy. In our study, the main reason for failed laparoscopic procedure was dense pericholecystic adhesions making the dissection difficult.

Patients were categorized according to age [Table 1] and distribution was studied among successful versus failed laparoscopic cholecystectomy. On applying Chi-square test, it was not significant ( $P = 0.4635$ ). However, mean age distribution in successful laparoscopic approach was 43.89 years, whereas the mean age for failed group was 53.43 years and was found to be significant ( $P = 0.0295$ ).

There were 27 male and 73 female patients in our study. Among them 17 (62.96%) male and 67 (91.78%) female underwent successful laparoscopic cholecystectomy. Whereas, 10 males (37.03%) and 6 (8.21%) females had to undergo conversion to open cholecystectomy. Statistically the values were found to be significant with  $P = 0.0004$ . Hence, concluding that male patients had higher chances of failure of laparoscopic cholecystectomy in acute calculous cholecystitis.

**Table 1: Age and gender distribution of patients undergoing successful and failed laparoscopic cholecystectomy (Chi-square test)**

	Laparoscopic cholecystectomy (%)		Total	P value
	Successful	Failed		
Age				
25–35 years	10 (90.90)	1 (9.09)	11	0.4635
36–45 years	19 (90.47)	2 (9.52)	21	
≥46 years	55 (80.88)	13 (19.11)	68	
Total	84	16	100	
Gender				
Male	17 (62.96)		27	0.0004
Female	67 (91.78)	6 (8.21)	73	
Total	84	16	100	

Further, on observing the age distribution with respect to intraoperative severity grade, it was found that higher the age severe was the intraoperative finding grade  $P = 0.0194$  [Table 2]. Moreover, the severity grade was higher in males compared to females and this was found to be significant ( $P = 0.0099$ ).

The mean duration of symptoms in patients undergoing surgery was 2.5 days. However, there was no significant difference found in duration of symptoms between patients undergoing successful laparoscopic cholecystectomy and conversion to open cholecystectomy [Table 3].

**Table 2: Age and gender distribution of patients with intraoperative severity in acute cholecystitis (Chi-square test)**

	Intraoperative severity (%)				Total	P value
	I	II	III	IV		
Age						
25–35 years	10 (90.90)	0	0	1 (9.09)	11	0.0194
36–45 years	17 (80.95)	3 (14.28)	1 (4.76)	0	21	
≥46 years	31 (45.58)	21 (30.88)	9 (13.23)	7 (10.29)	68	
Total	58	24	10	8	100	
Gender						
Male	11 (40.74)	7 (25.92)	3 (11.11)	6 (22.22)	27	0.0099
Female	47 (64.38)	17 (23.28)	7 (9.58)	2 (2.73)	73	
Total	58	24	10	8	100	

**Table 3: Comparison of preoperative factors between successful and failed laparoscopic cholecystectomy (unpaired t-test)**

	n	Min	Max	Mean	SD	P value
Duration of symptoms						
Laparoscopic cholecystectomy						
Successful	84	1	3	2.05	0.86	0.420
Failed	16	1	3	2.00	0.89	
TLC						
Laparoscopic cholecystectomy						
Successful	84	4000	19000	10.97	3.84	<0.0001
Failed	16	11000	22000	16.56	2.50	
Total bilirubin (mg/dL)						
Laparoscopic cholecystectomy						
Successful	84	0.22	1.3	0.69	0.37	<0.0001
Failed	16	0.6	3	1.23	0.71	
ALP (IU/L)						
Laparoscopic cholecystectomy						
Successful	84	35	145	81	32.82	<0.0001
Failed	16	78	220	151.56	27.21	

**Table 4: Comparison of preoperative factors in patients with intraoperative severity (ANOVA t-test)**

Duration of symptoms	n	Min	Max	Mean	SD	P value
I	58	1	3	1.93	0.81	0.9917
II	24	1	3	1.95	0.80	
III	10	1	3	2	0.81	
IV	8	1	3	2	0.92	
TLC						
I	58	4000	15000	10.5	4.40	<0.0001
II	24	6000	15000	12	1.81	
III	10	10000	19000	14.9	2.51	
IV	8	15000	22000	17.62	2.19	
Total bilirubin (mg/dL)						
I	58	0.22	1.5	0.71	0.38	<0.0001
II	24	0.35	1.21	0.60	0.26	
III	10	0.55	1.95	1.17	0.56	
IV	8	0.91	3	1.34	0.85	
ALP (IU/L)						
I	58	35	140	78.91	30.30	<0.0001
II	24	44	129	92.58	30.07	
III	10	119	200	143.7	28.87	
IV	8	134	220	161.62	26.71	

During the time of presentation patients' pain was assessed using visual analog scale (VAS score) and was found that mean VAS in patients undergoing successful laparoscopic procedure was 4.69 and in patients undergoing conversion to open procedure was 7.31 and the data were statistically significant ( $P \leq 0.0001$ ).

Pre-operative laboratory parameter – total leukocyte count, total bilirubin, and serum ALP was assessed. All the three parameters were found to be raised in patients with failed laparoscopic cholecystectomy compared to patients undergoing successful laparoscopic cholecystectomy [Table 3]. Moreover, the data of above three parameters were statistically significant ( $P \leq 0.0001$ ).

Duration of symptoms was compared with intraoperative severity but was found to be statistically insignificant ( $P = 0.9917$ ). On comparing laboratory parameters with intraoperative severity [Table 4] and there was significant difference with  $P < 0.0001$  for all three parameters.

Intraoperative severity grades were found to be significantly associated ( $P \leq 0.0001$ ) with failure and success of laparoscopic procedure [Table 5]. More severe the grading had more chances of conversion to open procedure.

The study of distribution of comorbidities in patients with success and failure of laparoscopic procedure [Table 6] was not significant ( $P = 0.0816$ ).

## DISCUSSION

Laparoscopic cholecystectomy is considered as main surgical approach for gall stone disease. However, due to various factors intraoperatively, the patients may require conversion to open procedure. According to some studies, it is shown

**Table 5: Distribution of intraoperative severity grades in patients with successful versus failed laparoscopic cholecystectomy (Chi-square test)**

Intraoperative severity	Laparoscopic cholecystectomy (%)		Total	P value
	Successful	Failed		
I				
II	56 (96.55)	2 (3.44)	58	<0.0001
III	23 (95.83)	1 (4.16)	24	
IV	5 (50)	5 (50)	10	
V	0	8 (100)	8	

**Table 6: Distribution of comorbidity in patients with successful versus failed laparoscopic cholecystectomy (Chi-square test)**

Laparoscopic cholecystectomy	Diabetes (%)	Hypertension (%)	Diabetes + Hypertension (%)	No comorbidity (%)	Total	P value
Successful	11 (13.09)	2 (2.38)	21 (87.5)	50 (59.52)	84	0.0816
Failed	2 (12.5)	0	9 (56.25)	5 (31.25)	16	

that the conversion rate is around 1–13%.<sup>[5]</sup> In our study, the chances of conversion were slightly higher, that is, 16%. However, according to few literature, the rate of conversion to laparotomy during laparoscopic cholecystectomy in acute calculous cholecystitis is 2–25%.<sup>[12,13]</sup> Difficulty during cholecystectomy has been associated with a longer operative time, the use of more anesthetic drugs, increased overall morbidity, higher rate of infective complications, longer recovery time, longer hospital stay, higher cost, and patient dissatisfaction.<sup>[14,15]</sup> Hence, it is necessary to be prepared and predict regarding the necessity of open procedure in a patient and avoid the complications and unnecessary financial burden on a patient.

Many studies have shown that the age above 50 years is a significant risk factor for difficult laparoscopic cholecystectomy.<sup>[16]</sup> In our study, the mean age of patients who had conversion to open procedure was 53.43 years ( $P = 0.0295$ ).

Most of the studies have shown that the male gender having significant higher risk of conversion to open during laparoscopic cholecystectomy.<sup>[17-19]</sup> Similar findings were obtained in our study and were found to be significant ( $P = 0.0004$ ). Further the risk of failure of laparoscopic procedure for acute cholecystitis was 6.57 times (odds ratio) higher in males compared to females. Furthermore, the intraoperative severity grade was higher in males.

Duration of symptoms neither showed any significant association with success or failure rate in laparoscopic cholecystectomy nor with intraoperative severity. Pain score using visual analogue scale showed significant association with success or failure of laparoscopy with higher VAS having higher chances of laparoscopy failure.

According to Tokyo guidelines few markers, where identified to grade the severity of acute cholecystitis such as duration of symptoms and TLC count.<sup>[8,20]</sup> In our study, association of duration was not found to be significant. Whereas, raised TLC was associated with increased chances of failure of laparoscopy. Rattner *et al.*<sup>[21]</sup> concluded that the degree of leukocytosis to be associated with intraoperative severity and the results of our study is also consistent with it.

Total bilirubin and serum ALP showed significant association with success and failure of laparoscopic cholecystectomy. Furthermore, it showed significant association with intraoperative severity grades of acute cholecystitis.

Intraoperative severity grade 1 had lesser chances of failure of laparoscopic approach and grade 4 had higher chances of failure.

Although patients with diabetes and hypertension had more chances of failure of laparoscopic procedure, there was no statistical significance with the results.

## CONCLUSION

1. Higher the age more chances of laparoscopy failure and more severe is the intraoperative finding.
2. Male patients are at 6.57 times higher risk of laparoscopic cholecystectomy failure and higher is the intraoperative severity grade.
3. Duration of symptoms between 1 and 3 days does not affect the outcome of procedure as well the intraoperative severity when the procedure is carried out between 1 and 3 days of onset of symptoms.
4. Pain (VAS score) was significantly associated with success or failure of laparoscopic cholecystectomy.
5. Total leukocyte count, total bilirubin, and serum alkaline phosphatase were significantly associated with outcome of procedure and severity of cholecystitis. Hence, these parameters can be used as predictive tools.
6. Intraoperative severity grade in acute cholecystitis was significantly associated with success or failure of laparoscopic cholecystectomy.

Male gender, older age, patients with higher pain (VAS) score, raised TLC, raised total bilirubin, and raised serum ALP are poor candidates for laparoscopic cholecystectomy.

From the above interpretation, we conclude that pre-operative status such as age, gender, pain (VAS) score, total leukocyte count, total bilirubin, and serum ALP can be used as deciding tools to predict failure of laparoscopic cholecystectomy in acute calculous cholecystitis.

## REFERENCES

1. Mukherjee S, Sharan J, Jindal R. Evaluation of factors for conversion of laparoscopic to open cholecystectomy in a tertiary care center. *Int J Anat Radiol Surg* 2018;7:SO09-12.
2. Olsen DO. Historical overview and indications for cholecystectomy. In: MacFadyen BV, editors. *Laparoscopic Surgery of the Abdomen*. New York: Springer; 2004.
3. Griniatsos J. Factors predisposing to conversion from laparoscopic to open cholecystectomy. *Ann Laparosc Endosc Surg* 2018;3:12.
4. Elgammal A, Elmeligi M, Koura M. Evaluation of preoperative predictive factors for difficult laparoscopic cholecystectomy. *Int Surg J* 2019;6:3052.
5. Le VH, Smith DE, Johnson BL. Conversion of laparoscopic to open cholecystectomy in the current era of laparoscopic

- surgery. *Am Surg* 2012;78:1392-5.
6. Sultan AM, El Nakeeb A, Elshehawry T, Elhemmal M, Elhanafy E, Atef E. Risk factors for conversion during laparoscopic cholecystectomy: Retrospective analysis of ten years' experience at a single tertiary referral centre. *Dig Surg* 2013;30:51-5.
7. Zhang WJ, Li JM, Wu GZ, Luo KL, Dong ZT. Risk factors affecting conversion in patients undergoing laparoscopic cholecystectomy. *ANZ J Surg* 2008;78:973-6.
8. Panni RZ, Strasberg SM. Preoperative predictors of conversion as indicators of local inflammation in acute cholecystitis: Strategies for future studies to develop quantitative predictors. *J Hepatobiliary Pancreat Sci* 2018;25:101-8.
9. Rothman JP, Burh J, Pommegaard HC, Viereck S, Rosenberg J. Preoperative risk factors for conversion of laparoscopic cholecystectomy to open surgery-a systematic review and meta-analysis of observational studies. *Dig Surg* 2016;33:414-23.
10. Palanivelu C. *Textbook of Laparoscopic Surgery*. 1<sup>st</sup> ed. Coimbatore: Gem-Digestive Diseases Foundation; 2002. p. 147.
11. Palanivelu C. *CIGES Atlas of Laparoscopic Surgery*. 2<sup>nd</sup> ed. New Delhi: Jaypee Brothers; 2003. p. 53.
12. Jarrar MS, Fourati A, Fadhl H, Youssef S, Mahjoub M, Khouadja H, *et al*. Risk factors of conversion in laparoscopic cholecystectomies for lithiasic acute cholecystitis. Results of a monocentric study and review of the literature. *Tunis Med*. 2019;97:344-51.
13. Kama NA, Kologlu M, Doganay M, Reis E, Atli M, Dolapci M. A risk score for conversion from laparoscopic to open cholecystectomy. *Am J Surg* 2001;181:520-5.
14. Sharma NK, Barolia DK, Sukhadia M. Preoperative findings predict difficulty during cholecystectomy. *Int J Med Res Rev* 2015;3:1133-9.
15. Lipman JM, Claridge JA, Haridas M. Preoperative findings predict conversion from laparoscopic to open cholecystectomy. *Surgery* 2007;142:556-63.
16. Sahu SK, Agarwal A, Sachan PK. Intraoperative difficulties in laparoscopic cholecystectomy. *J Chirurgic* 2013;2:149-55.
17. Bouarfa L, Schneider A, Feussner H, Navab N, Lemke HU, Jonker P, *et al*. Prediction of intraoperative complexity from preoperative patient data for laparoscopic cholecystectomy. *Artif Intell Med* 2011;52:169-76.
18. Teckchandani N, Garg PK, Hadke NS, Jain SK, Kant R, Mandal AK, *et al*. Predictive factors for successful early laparoscopic cholecystectomy in acute cholecystitis: A prospective study. *Int J Surg* 2010;8:623-7.
19. Eldar S, Sabo E, Nash E, Abrahamson J, Matter I. Laparoscopic cholecystectomy for acute cholecystitis: prospective trial. *World J Surg* 1997;21:540-5.
20. Hirota M, Takada T, Kawarada Y, Nimura Y, Miura F, Hirata K, *et al*. Diagnostic criteria and severity assessment of acute cholecystitis: Tokyo guidelines. *J Hepatobiliary Pancreat Surg* 2007;14:78-82.
21. Rattner DW, Ferguson C, Warshaw AL. Factors associated with successful laparoscopic cholecystectomy for acute cholecystitis. *Ann Surg* 1993;217:233-6.

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