

A RETROSPECTIVE STUDY TO DETECT THE PREOPERATIVE DETERMINANTS OF THE DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY¹Dr. P. Sathyaraj M. S. and ²Dr. P. Isakkirajan¹General Surgery, Assistant Professor of General Surgery, Department of General Surgery, Madurai Medical College.²Post graduate in General Surgery, Department of General Surgery, Madurai Medical College.***Corresponding Author: Dr. P. Sathyaraj M. S.**

General Surgery, Assistant Professor of General Surgery, Department of General Surgery, Madurai Medical College.

Article Received on 22/01/2022

Article Revised on 12/02/2022

Article Accepted on 02/03/2022

ABSTRACT

The laparoscopic cholecystectomy is considered to be the gold standard treatment for gall stone disease because of less post-operative complications and early discharge. The objective of the study is to find out the pre-operative biochemical and radiological determinants of difficult laparoscopic cholecystectomy. This is a retrospective case control study to detect the determinants of difficult laparoscopic cholecystectomy. All the patients underwent laparoscopic cholecystectomy between January 2015 to December 2019 were included in the study. The laparoscopic cholecystectomy with operative time more than 2 hours, procedure with the need for conversion to open cholecystectomy technique, significant intra-operative bleeding, use of synthetic hemostats, vascular and biliary tract injury are considered to be difficult laparoscopic cholecystectomy. Totally 172 patients were included in the study, of which 86 patients were included in control group and other 86 were study group population. The control group patients had no operative signs of difficult laparoscopic cholecystectomy.

On analyzing the data collected it was found that there were significant correlation between the white blood cell count and fibrinogen level with the difficult laparoscopic cholecystectomy and no relationship between the ALP, ALT and bilirubin values with the difficult laparoscopic cholecystectomy. On comparing the radiological features of two groups it was found that irregular wall, pericholecystic fluid, fat hyperdensity, thickness of wall > 4mm and presence of hydrops are associated with difficult laparoscopic cholecystectomy. The pre-operative anticipation of difficult laparoscopic cholecystectomy is advantageous to the operative surgeon. The identification of reliable pre-operative predictors will be advantageous for anticipating difficult laparoscopic cholecystectomy and to avoid intra-operative complications like vasculo-biliary injury and conversion to open surgery and to achieve better post-operative outcomes.

METHODOLOGY**Study Design**

Retrospective observational case-control study

Study Place

Department of General surgery, Government Rajaji Hospital, Madurai.

Inclusion Criteria

- All the patients undergoing laparoscopic cholecystectomy at the department of General

Surgery, government Rajaji hospital, Madurai between January 2015 and December 2019.

- Laparoscopic cholecystectomy done for acute cholecystitis only.

Exclusion Criteria

- Laparoscopic cholecystectomy done for conditions other than acute cholecystitis.
- Patients underwent laparoscopic cholecystectomy with inadequate data at present.

Statistical Analysis

We compared these preoperative data between the two groups. Statistical analysis was performed with SPSS 25.0 (SPSS Inc., Chicago, USA). Quantitative variables were expressed as mean \pm standard deviation and categorical variables as count (percentage). Continuous data were analyzed with Student t test and categorical variables were compared with Chi-square test. A *p* value < 0.05 was considered statistically significant.

Funding

Nil.

Ethical Committee Approval

Institutional ethical committee approval was obtained.

Informed Consent

After explaining the nature of the study to the patient in their own language, informed consent is obtained.

Pre-Operative Data Collected

The patients data like age, gender, presence of comorbidities and laboratory tests like WBC, AST, ALT, alkaline phosphatase, total bilirubin, CRP and fibrinogen and clinical assessment of the patient. CT contrast enhanced abdominal scan was done and presence / absence of gas in the wall or lumen of the gall bladder, intraluminal membranes, irregular and absence of wall, submucosal edema, pericholecystic abscess, hyperdensity of the fat surrounding the gall bladder, thickness of wall more than 4mm and hydrops are all noted.

RESULTS

Of the 86 patients included in the group with difficult laparoscopic cholecystectomy 45 were males and 41 were females, Male: female ratio: 1: 1.1, mean age 65.51 +/- 13.49. In the control group, we enrolled 86 patients, 39 were males and 47 were females: 1: 1.2, mean age 55.47 +/- 16.16. from the analysis of our laboratory data

like WBC count, AST, fibrinogen differences between the two groups were statistically significant. It has been found that the WBC count is found to have increased in the difficult laparoscopic cholecystectomy with significant p value < 0.0001. The p value obtained on comparing the fibrinogen in control and study group is 0.006. In our study the average total bilirubin in the study group is 1.81 mg/dl and in the control group is 1.29mg/dl. There is no significant difference in the levels of ALT in case group is 76.28 u/l, and in control group is 103.5 u/l and the level of ALP in control group is 110.93 u/L and that in study group is 113.78 u/l. The average CRP value in the control group is 110.93 u/L and that in study group is 113.78 u/l. the average AST level in the control group is 80.08 u/l and that in study group is 45.16 u/l. the difference in the AST value is significant, hence it can be concluded that the lower the AST value is associated with difficult laparoscopic cholecystectomy.

Table 1: Laboratory preoperative investigations between difficult laparoscopic cholecystectomy and non-difficult laparoscopic cholecystectomy.

		Difficult Laparoscopic Cholecystectomy (Mean +/- SD) (n = 86)	Not Difficult laparoscopic Cholecystectomy (Mean +/- SD) (n = 86)	Total (N =172) (Mean +/- SD)	p value
AGE		65.5 +/- 13.5	55.5 +/- 16.2	60.5 +/- 15.7	<0.001
GENDER	MALE	45 (52.3%)	39 (45.3%)	84 (48.8%)	0.719
	FEMALE	41 (47.7%)	47 (54.7%)	88 (51.2%)	0.719
ASA SCORE	ASA 2	35 (40.7%)	39 (45.3%)	74 (43%)	0.067
	ASA 3	51 (59.3%)	47 (54.7%)	98 (57%)	0.067
WBC		11.06 +/- 4.55	8.35 +/- 3.35	9.73 +/- 4.12	<0.001
BILIRUBIN		1.81 +/- 1.84	1.29 +/- 0.99	1.56 +/- 1.52	0.058
AST		45.16 +/- 51.19	80.08 +/- 124.79	62.06 +/- 95.5	0.039
ALT		76.28 +/- 86.36	103.5 +/- 130.49	89.34 +/- 110.2	0.163
ALP		113.78 +/- 72.44	110.93 +/- 69.73	112.45 +/- 70.9	0.825
CRP		49.19 +/- 79.10	8.7 +/- 13.58	38.4 +/- 70.9	0.097
FIBRINOGEN		466.95 +/- 210.19	368.84 +/- 148.55	422.76 +/- 190.6	0.006

Table 2: CT scan findings between difficult laparoscopic cholecystectomy and not difficult laparoscopic cholecystectomy.

CT SCAN Findings	Difficult Laparoscopic Cholecystectomy (n = 86)	Non-Difficult Laparoscopic Cholecystectomy (n = 86)	Total (n = 172)%	P value.
INTRALUMINAL MEMBRANES	1 (1%)	0	1 (0.6%)	0.38
IRREGULAR OR ABSENT WALLS	11 (13%)	2 (2%)	13 (7.5%)	< 0.0001
SUBMUCOSAL EDEMA	4 (5%)	2 (2%)	6 (3.5%)	0.24
PERICHOLECYSTIC FLUID	18 (21%)	11 (13%)	29 (16.9%)	0.0009
FAT HYPERDENSITY	34 (40%)	11 (13%)	45 (26.2%)	<0.0001
THICKENESS OF THE WALL > 4 mm	50 (58%)	24 (28%)	74 (43%)	<0.0001
HYDROPS	32 (37%)	17 (20%)	49 (28.5%)	<0.0001

CT abdominal scan findings like gas in the gallbladder wall or in the lumen of the gall bladder are absent in the control group and present in 1.16% of study population. Submucosal edema is present in 4.65% of study population and 2.32 % of control group. The presence of irregular gall bladder wall is seen in 12.79 % among the study population and 2.33% among the control group. The presence of pericholecystic fluid is seen in 20.93% of study population and 12.79% of control group. The presence of increased fat hyperdensity is seen in 39.53% of study population and 12.77% of control population. The presence of wall thickening more than 4 mm is seen in 58.14% in study population and in 27.9% in the control group. The presence of hydrops is seen in 37.2% of study population and in 19.77% of control population.

DISCUSSION

The research on identifying the preoperative predictive factors for difficult laparoscopic cholecystectomy is useful in anticipating the difficult laparoscopic cholecystectomy and to estimate the incidence of conversion of laparoscopic cholecystectomy to open cholecystectomy. This is a retrospective study to analyse the pre-operative laboratory test results and radiological findings of group of patients with difficult laparoscopic cholecystectomy and in patients without laparoscopic cholecystectomy. The choice of the parameters was related to the surgical procedure like dissection of the calot's triangle with identification of cystic duct and cystic artery and detachment of gall bladder from the liver. We consider that difficult laparoscopic cholecystectomy and risk of biliovascular injuries are due to inflammation of the infundibular region while dissecting the calot's triangle dissection. On the basis of blood investigation systemic and local inflammatory responses like elevated WBC, CRP, fibrinogen level, AST, ALT, ALP and total bilirubin levels are recorded. Presence of pericholecystic inflammation or abscess, gas in the wall or lumen, presence of intra-luminal membranes, irregular membranes, wall thickening and pericholecystic inflammatory fat strands in the CT scan are noted in both control and case population.

The analysis of the collected data revealed that there is an significant correlation between the elevated WBC count and fibrinogen level and difficult laparoscopic cholecystectomy. This can be supported by the fact that the WBC count and fibrinogen are the markers of inflammation and the presence of pericholecystic inflammation is related to difficult surgical procedure. This is similar to the findings obtained in a prospective study done by Nidoni *et al.*, where it was found that presence WBC count more than 11,000 / mm³ is a predictive factor of difficult laparoscopic cholecystectomy. And also the difficult laparoscopic cholecystectomy is associated with high fibrinogen levels.

In our study it has been found that there is no significant correlation among ALP, ALT and total bilirubin level with difficult laparoscopic cholecystectomy. This is

similar to the results shown in the research paper done by Bourgouin *et al.*

There is no statistical significance between the CRP and difficult laparoscopic cholecystectomy. But in many other researches it has been said that elevated CRP is associated with difficult laparoscopic cholecystectomy.

Considering the CT findings, there is a significant difference in the irregular wall, pericholecystic fluid collection, surrounding fat hyperdensity, thickening of the wall and hydrops between the control group and case group. There is no difference about the gas in the wall, gas in the lumen of the gall bladder, intra-luminal membranes and submucosal edema among the cases and controls. In the study conducted by Maechira *et al.*, it has been found that there is no significant correlation between the CT scan findings and difficult laparoscopic cholecystectomy.

We do not consider the retrospective nature of this study as a disadvantage because the analysed parameters were objectives and registered from medical records.

Here, prospective study could lead to biased results in terms of conversion rate and vasculobiliary injuries because could unconsciously push those who participate in it to change their treatment module.

This observational study can lead to a limitation in terms of patient allocation, only patient with difficult cholecystectomy were included as cases and those without intra-operative difficulty were included as control. The other limitation of this study is that it is a single centred study.

CONCLUSION

The conclusion of this study is that the pre-operative laboratory test values and CT findings can be used to detect the difficult laparoscopic cholecystectomy pre-operatively. The preoperative identification of cases with anticipated difficult laparoscopic cholecystectomy is an advantage for the surgeon. In the patients with clinical and laboratory indexes of acute cholecystitis, are advised for CT abdominal scan and evaluation for anticipating difficult laparoscopic cholecystectomy.

REFERENCES

1. Agresta, F. *et al.* Laparoscopic cholecystectomy: Consensus conference-based guidelines. *Langenbecks Arch. Surg.* 2015; 400(4): 429–453. <https://doi.org/10.1007/s00423-015-1300-4>.
2. National Institutes of Health Consensus Development Conference Statement on Gallstones and Laparoscopic Cholecystectomy. *Am. J. Surg.* 1993; 165(4): 390–398. [https://doi.org/10.1016/s0002-9610\(05\)80929-8](https://doi.org/10.1016/s0002-9610(05)80929-8).
3. Berggren, U. *et al.* Laparoscopic versus open cholecystectomy: Hospitalization, sick leave,

- analgesia and trauma responses. *Br. J. Surg.*, 1994; 81(9): 1362–1365. <https://doi.org/10.1002/bjs.1800810936>.
4. McMahan, A. J. et al. Laparoscopic versus minilaparotomy cholecystectomy: A randomised trial. *Lancet*, 1994; 343(8890): 135–138. [https://doi.org/10.1016/s0140-6736\(94\)90932-6](https://doi.org/10.1016/s0140-6736(94)90932-6).
 5. Zacks, S. L., Sandler, R. S., Rutledge, R. & Brown, R. S. Jr. A population-based cohort study comparing laparoscopic cholecystectomy and open cholecystectomy. *Am. J. Gastroenterol.*, 2002; 97(2): 334–340. <https://doi.org/10.1111/j.1572-0241.2002.05466>.
 6. Keus, F., Gooszen, H. G. & van Laarhoven, C. J. Open, small-incision, or laparoscopic cholecystectomy for patients with symptomatic cholelithiasis. An overview of Cochrane Hepato-Biliary Group reviews. *Cochrane Database Syst Rev.*, 2010; <https://doi.org/10.1002/14651858.CD008318>.
 7. Wakabayashi, G. et al. Tokyo Guidelines 2018: surgical management of acute cholecystitis: safe steps in laparoscopic cholecystectomy for acute cholecystitis (with videos). *J. Hepatobiliary Pancreat Sci.*, 2018; 25(1): 73–86. <https://doi.org/10.1002/jhbp.517>.
 8. Bourgouin, S. et al. How to predict difficult laparoscopic cholecystectomy? Proposal for a simple preoperative scoring system. *Am. J. Surg.*, 2016; 212(5): 873–881. <https://doi.org/10.1016/j.amjsurg.2016.04.003>.
 9. Nidoni, R. et al. Predicting Difficult Laparoscopic Cholecystectomy Based on Clinicoradiological Assessment. *J. Clin. Diagn. Res.*, 2015; 9(12): PC09-PC12. <https://doi.org/10.7860/JCDR/2015/15593.6929>.
 10. Randhawa, J. S. & Pujahari, A. K. Preoperative prediction of difficult lap chole: A scoring method. *Indian J. Surg.*, 2009; 71(4): 198–201. <https://doi.org/10.1007/s12262-009-0055-y>.
 11. Rosen, M., Brody, F. & Ponsky, J. Predictive factors for conversion of laparoscopic cholecystectomy. *Am. J. Surg.*, 2002; 184(3): 254–258. [https://doi.org/10.1016/s0002-9610\(02\)00934-0](https://doi.org/10.1016/s0002-9610(02)00934-0).
 12. Alponat, A., Kum, C. K., Koh, B. C., Rajnakova, A. & Goh, P. M. Predictive factors for conversion of laparoscopic cholecystectomy. *World J. Surg.*, 1997; 21(6): 629–633. <https://doi.org/10.1007/pl00012288>.
 13. Agrusa, A. et al. 3D laparoscopic surgery: A prospective clinical trial. *Oncotarget*, 2018; 9(25): 17325–17333. <https://doi.org/10.18632/oncotarget.24669>.
 14. Agrusa, A. et al. Role and outcomes of laparoscopic cholecystectomy in the elderly. *Int. J. Surg.*, 2014; 12(Suppl 2): S37–S39. <https://doi.org/10.1016/j.ijssu.2014.08.385> (Epub 2014 Aug 23).
 15. Agrusa, A. et al. Laparoscopic, three-port and SILS cholecystectomy: A retrospective study. *G Chir.*, 2013; 34(9–10): 249–253.
 16. Novo, G. et al. Cardiac risk stratification in elective non-cardiac surgery: Role of NT-proBNP. *Int. Angiol.*, 2011; 30(3): 242–246.
 17. Albano, D. et al. Imaging features of adrenal masses. *Insights Imaging*, 2019; 10(1): 1. <https://doi.org/10.1186/s13244-019-0688-8>. Review.
 18. Galia, M. et al. Imaging features of solid renal masses. *Br. J. Radiol.*, 2017; 90(1077): 20170077. <https://doi.org/10.1259/bjr.20170077>.
 19. Agrusa, A. et al. Acute appendicitis and endometriosis: Retrospective analysis in emergency setting. *GIOG*, 2013; 35(6): 728–732.
 20. Cucinella, G. et al. Robotic versus laparoscopic sacrocolpopexy for apical prolapse: a case-control study. *G Chir.*, 2016; 37(3): 113–117.
 21. Bouassida, M. et al. C-reactive protein is the best biomarker to predict advanced acute cholecystitis and conversion to open surgery - A prospective cohort study of 556 cases. *J. Gastrointest. Surg.*, 2020; 24(12): 2766–2772. <https://doi.org/10.1007/s11605-019-04459-8>.
 22. Jang, Y. R. et al. Acute cholecystitis: Predictive clinico-radiological assessment for conversion of laparoscopic cholecystectomy. *Acta Radiol.*, 2020; 61(11): 1452–1462. <https://doi.org/10.1177/0284185120906658>.
 23. Teckchandani, N. et al. Predictive factors for successful early laparoscopic cholecystectomy in acute cholecystitis: A prospective study. *Int. J. Surg.*, 2010; 8(8): 623–627. <https://doi.org/10.1016/j.ijssu.2010.05.014>.
 24. Maehira, H. et al. Prediction of difficult laparoscopic cholecystectomy for acute cholecystitis. *J. Surg. Res.*, 2017; 216: 143–148. <https://doi.org/10.1016/j.jss.2017.05.008>.
 25. Hussain, A. Difficult laparoscopic cholecystectomy: current evidence and strategies of management. *Surg. Laparosc. Endosc. Percutan Tech.*, 2011; 21(4): 211–217. <https://doi.org/10.1097/SLE.0b013e318220f1b1>.
 26. Nachnani, J. & Supe, A. Pre-operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. *Indian J. Gastroenterol.*, 2005; 24(1): 16–18.
 27. Portinari, M. et al. Do I need to operate on that in the middle of the night? development of a nomogram for the diagnosis of severe acute cholecystitis. *J. Gastrointest. Surg.*, 2018; 22(6): 1016–1025. <https://doi.org/10.1007/s11605-018-3708-y>.
 28. Majeski, J. Significance of preoperative ultrasound measurement of gallbladder wall thickness. *Am. Surg.*, 2007; 73(9): 926–929.
 29. Maehira, H. et al. Use of dynamic CT attenuation value for diagnosis of acute gangrenous cholecystitis. *Am. J. Emerg. Med.*, 2016; 34(12):

2306–2309. <https://doi.org/10.1016/j.ajem.2016.08.033>.

30. Paul Wright, G., Stilwell, K., Johnson, J., Hefty, M. T. & Chung, M. H. Predicting length of stay and conversion to open cholecystectomy for acute cholecystitis using the 2013 Tokyo Guidelines in a US population. *J. Hepatobiliary Pancreat Sci.*, 2015; 22(11): 795–801. <https://doi.org/10.1002/jhbp.284>.