

Parameters for safe dissection at Calot's Triangle in Laparoscopic Cholecystectomy

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Abstract

Objective: To explore the parameters critical to safe laparoscopic cholecystectomies.

Method: The prospective study was conducted at Al-Yarmook Teaching Hospital, Baghdad, from May 1, 2020, to December 31, 2021, and comprised patients with gall-stone disease who were admitted for laparoscopic cholecystectomy. Consecutive non-probability sampling technique was used for collecting the data which was analysed using SPSS (version 25).

Results: Of the 93 patients, 68(73.12%) were females, and 25(26.88) were males. The overall mean age was 40.7±8.1 years, and 52(55.91%) patients were aged >40 years. Calot triangle was seen in 72(77.4%) cases, while the sulcus of Rouviere, duodenum and right hepatic artery were spotted in 50(53.8%), 49(52.7%) and 19(20.4%) cases, respectively. There was a significant association of late presentation, lateral traction, 4-port option, good setting and difficult anatomy with anatomical landmark visualisation ($p<0.05$).

Conclusions: There is a need for a national guideline to ensure safe laparoscopic cholecystectomy.

Key Words: Cholecystectomy, Laparoscopic, Hepatic Artery, Traction, Duodenum
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Introduction

Laparoscopic cholecystectomy is the operation of choice for elective as well as for urgent gall bladder removal surgery.¹ A minimally invasive procedure used since the early 1990s, this technique has principally replaced the open technique for cholecystectomies.

It is one of the most commonly performed procedures globally, but bile duct injury is a serious and potentially life-threatening complication of cholecystectomy.

Ensuring parameters for safe dissection at Calot's triangle is essential since it is absolutely necessary to avoid any chance to increase incidents, like bile duct injury and other vasculo-biliary injuries.²

The Research Institute Against Cancer of the Digestive System (IRCAD) Recommendations Group in 2017³ agreed on the Critical View of Safety (CVS) concept, which includes complete clearance of the areolar tissue at the safe upper part of Calot's triangle, taking the lower part of the gall bladder off the cystic plate, and recognising the only 2 structures (cystic duct and artery) while entering the gall bladder.^{2, 3}

Calot's triangle is an anatomical landmark of special value

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in cholecystectomy. Boundaries of this triangle are the common hepatic duct medially, the cystic duct laterally, and the inferior edge of the liver superiorly. It is where the cystic artery branches off the right hepatic artery. This triangular space is dissected to allow the surgeon to identify, divide and ligate the cystic duct and artery.²

The Rouviere's sulcus is most commonly visible as a fine groove at the inferior surface of the liver, which is open at its medial end, and is claimed to be an indicator of the right hepatic portal pedicle as it exits the liver hilum. Recognition of variations in the right hepatic artery anatomy is of major importance in the planning and execution of surgical procedures, such as transplantation, cholecystectomy and pancreaticoduodenectomy.

The current study was planned to explore the parameters critical to safe laparoscopic cholecystectomies.

Patients and Methods

The prospective study was conducted at Al-Yarmook Teaching Hospital, Baghdad, from May 1, 2020, to December 31, 2021, and comprised patients with gall-stone disease who were admitted for laparoscopic cholecystectomy. Data was collected using consecutive non-probability sampling technique. The study was approved by the Scientific Council of General Surgery of the Iraqi Board for Medical Specialisations, and the ethics review committee of the College of Medicine, Mustansiriyah University, Baghdad. Permission was obtained from the Al-Karkh Health Directorate and Al

Yarmook Teaching Hospital and patient consent was obtained prior to data collection.

Data was collected regarding age, gender, weight and height. Body mass index (BMI) was calculated for each subject. The diagnosis was classified as 'early presentation' when surgery was done immediately after acute inflammation, or 'late presentation' when surgery was done at least 6 weeks after the resolution of the acute attack. Operative details noted were: lateral traction of the gall bladder, 4-port technique, professional operative settings, well-trained assistance, and difficult anatomy. A patient was considered having difficult anatomy if an adhesion was found at Calot triangle and / or gallbladder that obscured the anatomy, or distortions due to the severe fibrosis induced by inflammation.⁴

Recognition of anatomical landmarks Calot's triangle, sulcus of Rouviere, right hepatic artery and the duodenum was cross-linked with the other parameters.

Data were coded and analysed using SPSS (version 25). Data was presented as frequencies and percentages or as mean ± standard deviation, as appropriate. Fisher's exact test was used to assess the significance of the association between dependent and independent variables. P≤0.05 was considered significant.

Results

Of the 93 patients, 68(73.12%) were females, and 25(26.88) were males. The overall mean age was 40.7±8.1 years, and 52(55.91%) patients were aged >40 years. More than half the sample 54(58.06%) showed no obesity, and 63(67.7%) had no difficult anatomy.

Table-1: Parameters facilitating a safe dissection.

Parameters		Frequency	Percentage
Medical status	Early	10	10.75
	Late	83	89.25
Lateral traction of gall bladder	Yes	83	89.25
	No	10	10.75
Four ports	Yes	63	67.74
	No	30	32.26
Good setting	Yes	74	79.57
	No	19	20.43
Good assistance	Yes	90	96.77
	No	3	3.23
Gender	Female	68	73.12
	Male	25	26.88
Obesity	Yes	39	41.94
	No	54	58.06
Difficult anatomy	Yes	30	32.26
	No	63	67.74
Total		93	100%

Table-2: Parameters facilitating the visualisation of Calot triangle.

Parameters		Calot triangle		P value
		Yes	No	
Medical status	Early	5(50%)	5(50%)	0.043
	Late	67(80.7%)	16(19.3%)	
Lateral traction of gall bladder	yes	71(85.5%)	12 (14.5%)	0.000
	no	1(10.0%)	9(90.0%)	
Four ports	yes	54 (85.7%)	9(14.3%)	0.008
	no	18(60%)	12(40%)	
Good setting	Yes	62(83.8%)	12(16.2%)	0.011
	No	10(52.6%)	9(47.4%)	
Good assistance	Yes	70(77.8%)	20(22.2%)	0.540
	No	2(66.7%)	1(33.3%)	
Gender	Male	18(72%)	7(28%)	0.576
	Female	54(79.4%)	14(20.6%)	
Obesity	Yes	30(76.9%)	9(23.1%)	1.000
	No	42(77.8%)	12(22.2%)	
Difficult anatomy	Yes	19(63.3%)	11(36.7%)	0.034

There were 10(10.8%) patients with acute cholecystitis, while 83(89.2%) were classified as late presentation cases. Lateral traction of the gall bladder was applied in 83(89.2%) cases, and the 4-port option was used in 63(67.7%). Good settings and good assistance were available in 74(79.57%) and 90(96.77%) surgeries, respectively (Table 1).

Calot triangle was seen in 72(77.4%) cases, while the sulcus of Rouviere, duodenum and right hepatic artery were spotted in 50(53.8%), 49(52.7%) and 19(20.4%) cases, respectively (Figure).

There was a significant association between defining Calot triangle and late presentation, lateral traction, 4-port option, good setting and clear anatomy (Table 2).



Figure: Anatomical land marks identified.

Identification of Rouviere's sulcus was significantly associated with late presentation, lateral traction of the gallbladder, 4-port option and clear anatomy ($p < 0.05$).

Visualisation of the right hepatic artery was significantly associated with 4-port option and clear anatomy ($p < 0.05$).

Identification of duodenum was significantly associated with female gender and clear anatomy ($p < 0.05$).

Discussion

A safe dissection in laparoscopic cholecystectomy implies a safe procedure not only for the patients, but also for the operating surgeon.⁵ A correct assortment and patient selection is fundamental to achieving good and safe results in laparoscopic cholecystectomies.⁶

The average age of the current sample was 40.7 ± 8.1 years, which was comparable to that reported from India (42.5 year)⁷, but lower results were reported from Turkey (46.54 years),⁸ Nepal (47 years)⁹, Indonesia (49.2 years)¹⁰, and Ireland (53.5 years).¹¹ The difference might be attributed to environmental, dietary and sociodemographic factors.

The male-to-female ratio in the current study was 1:2.7, which was comparable to results reported from Nepal⁹ and Bangladesh¹², but lower results were reported from the United Kingdom.³ The number of females undergoing cholecystectomies was higher than males in most studies.⁷⁻¹⁵ It has been reported that women have triple the risk of developing gallstones compared to men.¹⁶

The current study showed significant association between presenting late and better visualisation of Calot triangle boundaries and the sulcus of Rouviere. This might be related to the fact that having early (acute) presentation is associated with oedema and features of acute inflammation that might hinder clear visualisation of the anatomical landmarks. When presenting late, most of the acute inflammatory features have subsided, allowing better visualisation. This agrees with earlier findings from Nepal.⁹

The current study confirmed a significant association between applying lateral traction and the visualisation of Calot's triangle and the Rouviere's sulcus. Traction provides wider field and better visualisation of the anatomical details by pulling the infundibulum of gallbladder lateral to the midline. This agrees with earlier study from South Korea.¹⁴

Significant association between using the 4-port option and optimum visualisation of Calot triangle, Rouviere's sulcus and the right hepatic artery was reported by the current study. The vision achieved with the 3-port option

is quite different compared to the 4-port technique as the latter provides superior surgical convenience through the retraction of fundus of the gall bladder, and, thus better anatomic views. This agrees with the findings reported by a system review.¹⁷

There was a significant association between having a good surgical setting and viewing Calot triangle. Although other landmarks did not show a significant association with good setting and good assistance, this could be explained either with the availability of optimal setting standards, which is doubtful, or it means that the surgical team could overcome such improper settings.

Many studies have found that the male gender is usually the one associated with a higher conversion rate to open cholecystectomies.^{8,18-21} The current study showed that the female gender was significantly associated with viewing the duodenum, yet the study failed to show a significant association between female gender and viewing Calot triangle, Rouviere's sulcus and the right hepatic artery, which might be because of sample size limitations. Although obesity is considered a risk factor for operative treatment and increased conversion rate²², the current study did not find a significant association between obesity and the recognition of anatomical landmarks. The results aligned with those reported from Ireland²³, the United States²⁴, Italy²⁵ and Japan.²⁶

The current study showed significant association between having no adhesions, fibrosis or congenital anomalies, and viewing of all the important anatomical landmarks, which agreed with results from Turkey.⁸ A significant correlation between the degree of gallbladder adhesion and conversion to open surgery or even re-operation has also been reported in literature.^{10,27}

Limitations: The current study has limitations as the sample size was not calculated which could have affected the power of the study.

Despite the limitations, the current study showed that it is advisable to have a list of the anatomical landmarks that need to be recognised during the surgery. Emphasis on evaluating patient condition prior to surgery is vital, as the categorisation of presentation plays a vital role in ensuring safe procedures.

Conclusion

Late presentation, clear anatomy, providing lateral traction, using 4-port technique and providing good surgical settings made it easier to visualise the anatomical landmarks, thereby ensuring safe laparoscopic cholecystectomies.

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Conflict of Interest: None.

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References

- Hassan H, Arif S, Al-Nakshabandi MM. The role of laparoscopic cholecystectomy in acute cholecystitis. *Duhok Medical Journal* 2018;11:69-81. Doi: 10.31386/dmj.2017.11.8
- Sgaramella LI, Gurrado A, Pasculli A, de Angelis N, Memeo R, Prete FP, et al. The critical view of safety during laparoscopic cholecystectomy: Strasberg Yes or No? An Italian Multicentre study. *Surg Endosc* 2021;35:3698-708. doi: 10.1007/s00464-020-07852-6.
- Conrad C, Wakabayashi G, Asbun HJ, Dallemagne B, Demartines N, Diana M, et al. IRCAD recommendation on safe laparoscopic cholecystectomy. *J Hepatobiliary Pancreat Sci* 2017;24:603-15. doi: 10.1002/jhbp.491
- Akcakaya A, Okan I, Bas G, Sahin G, Sahin M. Does the Difficulty of Laparoscopic Cholecystectomy Differ Between Genders? *Indian J Surg* 2015;77:452-6. doi: 10.1007/s12262-013-0872-x
- Gupta V, Jain G. Safe laparoscopic cholecystectomy: Adoption of universal culture of safety in cholecystectomy. *World J Gastrointest Surg* 2019;11:62-84. doi: 10.4240/wjgs.v11.i2.62
- Cirocchi R, Panata L, Griffiths EA, Tebala GD, Lancia M, Fedeli P, et al. Injuries during Laparoscopic Cholecystectomy: A Scoping Review of the Claims and Civil Action Judgements. *J Clin Med* 2021;10:5238. doi: 10.3390/jcm10225238
- Shah MY, Somasundaram U, Wilkinson T, Wasnik N. Feasibility and Safety of Three-Port Laparoscopic Cholecystectomy Compared to Four-Port Laparoscopic Cholecystectomy. *Cureus* 2021;13:e19979. doi: 10.7759/cureus.19979
- Ekici U, Tatli F, Kanlıöz M. Preoperative and postoperative risk factors in laparoscopic cholecystectomy converted to open surgery. *Adv Clin Exp Med* 2019;28:857-60. doi: 10.17219/acem/81519
- Bhandari TR, Khan SA, Jha JL. Prediction of difficult laparoscopic cholecystectomy: An observational study. *Ann Med Surg (Lond)* 2021;72:103060. doi: 10.1016/j.amsu.2021.103060
- Yuda Handaya A, Werdana VAP, Fauzi AR, Andrew J, Hanif AS, Tjendra KR, et al. Gallbladder adhesion degree as predictor of conversion surgery, common bile duct injury and resurgery in laparoscopic cholecystectomy: A cross-sectional study. *Ann Med Surg (Lond)* 2021;68:102631. doi: 10.1016/j.amsu.2021.102631
- Sugrue M, Coccolini F, Bucholz M, Johnston A; Contributors from WSES. Intra-operative gallbladder scoring predicts conversion of laparoscopic to open cholecystectomy: a WSES prospective collaborative study. *World J Emerg Surg* 2019;14:12. doi: 10.1186/s13017-019-0230-9.
- Talukder MI, Khan MH, Chowdhury F, Ansary AA, Rahman K, Islam N. Evaluation of Preoperative Ultrasonography in Gall Stone Disease to Predict Technical Difficulties during Laparoscopic Cholecystectomy. *Mymensingh Med J* 2018;27:757-63.
- Nassar AHM, Ng HJ, Wysocki AP, Khan KS, Gil IC. Achieving the critical view of safety in the difficult laparoscopic cholecystectomy: a prospective study of predictors of failure. *Surg Endosc* 2021;35:6039-47. doi: 10.1007/s00464-020-08093-3
- Son JI, Choi IS, Moon JI, Ra YM, Lee SE, Choi WJ, et al. Single incision laparoscopic cholecystectomy using Konyang Standard Method. *Ann Surg Treat Res* 2014;86:177-83. doi: 10.4174/ast.2014.86.4.177
- Sewefy AM, Hassanen AM, Atyia AM, Gaafar AM. Retroinfundibular laparoscopic cholecystectomy versus standard laparoscopic cholecystectomy in difficult cases. *Int J Surg* 2017;43:75-80. doi: 10.1016/j.ijsu.2017.05.044
- Novacek G. Gender and gallstone disease. *Wien Med Wochenschr* 2006;156:527-33. doi: 10.1007/s10354-006-0346-x
- Gurusamy KS, Vaughan J, Rossi M, Davidson BR. Fewer-than-four ports versus four ports for laparoscopic cholecystectomy. *Cochrane Database Syst Rev* 2014;2014:CD007109. doi: 10.1002/14651858.CD007109.pub2
- Coelho JCU, Dalledone GO, Schiel W, Berardin JP, Claus CMP, Matias JEF, et al. Does male gender increase the risk of laparoscopic cholecystectomy? *Arq Bras Cir Dig* 2019;32:e1438. doi: 10.1590/0102-672020190001e1438
- Bahadur A, Bisht SD, Rathi Y, Shukla A, Aggarwal A. Is gender a determinant for the outcome of laparoscopic cholecystectomy? *Int Surg J* 2020;7:3959-64. Doi: 10.18203/2349-2902.isj20204992
- Ambe PC, Köhler L. Is the male gender an independent risk factor for complication in patients undergoing laparoscopic cholecystectomy for acute cholecystitis? *Int Surg* 2015;100:854-9. doi: 10.9738/INTSURG-D-14-00151.1
- El Nakeeb A, Mahdy Y, Salem A, El Sorogy M, El Rafea AA, El Dosoky M, et al. Open Cholecystectomy Has a Place in the Laparoscopic Era: a Retrospective Cohort Study. *Indian J Surg* 2017;79:437-43. doi: 10.1007/s12262-017-1622-2
- Paajanen H, Käkälä P, Suuronen S, Paajanen J, Juvonen P, Pihlajamäki J. Impact of obesity and associated diseases on outcome after laparoscopic cholecystectomy. *Surg Laparosc Endosc Percutan Tech* 2012;22:509-13. doi: 10.1097/SLE.0b013e318270473b
- Hussien M, Appadurai IR, Delicata RJ, Carey PD. Laparoscopic cholecystectomy in the grossly obese: 4 years experience and review of literature. *HPB (Oxford)* 2002;4:157-61. doi: 10.1080/13651820260503792
- Neylan CJ, Damrauer SM, Kelz RR, Farrar JT, Dempsey DT, Lee MK, et al. The role of body mass index class in cholecystectomy after acute cholecystitis: An American College of Surgeons National Surgical Quality Improvement Program analysis. *Surgery* 2016;160:699-707. doi: 10.1016/j.surg.2016.05.012
- Gregori M, Miccini M, Biacchi D, de Schoutheete JC, Bonomo L, Manzelli A. Day case laparoscopic cholecystectomy: Safety and feasibility in obese patients. *Int J Surg* 2018;49:22-6. doi: 10.1016/j.ijsu.2017.11.051
- Obuchi T, Kameyama N, Tomita M, Mitsuhashi H, Miyata R, Baba S. Impact of obesity on surgical outcome after single-incision laparoscopic cholecystectomy. *J Minim Access Surg* 2018;14:99-10. doi: 10.4103/jmas.JMAS_13_17
- Vardar YM, Akturk OM. Can we predict the risk of conversion in elective laparoscopic cholecystectomy? *Ann Ital Chir* 2020;91:181-6.