ORIGINAL ARTICLE

Comparison of Intraoperative Findings with Ultrasonographic Scoring for Predicting Difficult Laparoscopic Cholecystectomy

Satendra Kumar[1], Sanjay K Saroj[2], Raghunath S More[3], Soham Roy[4], Amit ND Dwivedi[5], Satyendra K Tiwary[6]

Abstract

Introduction: Nowadays laparoscopic cholecystectomy is the gold standard treatment for symptomatic gallstone disease (GSD). Prediction of "difficult laparoscopic cholecystectomy" (DLC) may decrease morbidity and mortality as well as reduce the average cost of therapy. At present, very few scoring systems are available to predict the degree of difficulty during surgery.

Aim and objective: To compare the outcome of intraoperative findings with preoperating scoring to predict DLC.

Materials and methods: Two-hundred and nine patients were having GSD, operated by a single experienced surgeon in 2-year duration. Various preoperative predictors and intraoperative parameters of DLC were used for scoring and categorizing the difficulties, into (0–5), (6–10), and (10–15) as early, difficult, and very difficult surgical procedures, respectively.

Result: History of hospitalization for acute cholecystitis, overweight with BMI ≥27.5 kg/m^2, palpable gallbladder, wall thickness >4 mm, and impacted stone were the most accurate preoperative predictors of DLC in the age-group of above 50 years. Statistically, a significant association was determined by comparing preoperative evaluation with the intraoperative outcome.

Conclusion: The preoperative and intraoperative scoring system can be helpful for assessment, experience, and decision-making. These scoring systems deserve a large-scale prospective study for validation.

Keywords: Acute cholecystitis, Gallstone disease, Intraoperative scoring.

World Journal of Laparoscopic Surgery (2021): 10.5005/jp-journals-10033-1477

Introduction

In India, the prevalence of gallstone disease is estimated at around 4%.[1] About 1–2% of asymptomatic patients may develop symptoms that require cholecystectomy per year.[2] Laparoscopic cholecystectomy (LC) is a procedure with about 0.5% mortality and 10% morbidity.[3]

Abdominal ultrasonography (USG) is sensitive and specific between 84 and 99% to diagnose extrahepatic biliary diseases and detect gallstones size between 1.5 and 2 mm in diameter. Preoperative USG is functional in accessing surgical difficulties or even the possibility of laparotomic conversion.[4,5] Existing scores use as subjective scales to identify high-risk patients, derive risk-assessment models, and evaluate the risk of conversion from laparoscopic to open procedure. However, conversion is not a good reflection of operative difficulty. In contrast, operative time is considered as reproducible criteria of the encountered difficulty for a surgeon.[6]

The study aimed to compare the preoperative predictive factors that determine difficult LC (preoperative scoring) with intraoperative parameters (intraoperative scoring).

Materials and Methods

A prospective observational study was done in Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University (UP) with a sample size of 209 patients of both sexes (age 14–74 years) having symptomatic gallstone disease (GSD). All patients were admitted to the SS Hospital, Banaras Hindu University, Varanasi, from September 2016 to July 2018. Exclusion criteria were LC performed with other combined laparoscopic procedures in the same setting, LC with common bile duct exploration, contraindications to LC, like cardiopulmonary disease, coagulopathies, and end-stage liver disease, and gallbladder anomaly. After written informed consent, all patients underwent elective LC by an experienced laparoscopic surgeon.

History of the patients, clinical examination, and laboratory and radiological investigations were the factor to diagnose the GSD. The preoperative anticipating factors for LC were as similar as defined in the preoperative scoring system.[7] In addition, while doing LC, various intraoperative parameters were calculated which were used for categorizing and grading LC as easy, difficult, and very difficult as shown in Table 1. In each patient, the scores (both preoperative and intraoperative) were compared for predicting difficult laparoscopic cholecystectomy (DLC). LC was carried out using CO_2 pneumoperitoneum with 12–13 mm Hg pressure and standard four-port manner (two 10 mm and two 5 mm). Total

[1,2,4,6]Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

[3]Department of Anatomy, Banaras Hindu University, Varanasi, Uttar Pradesh, India

[5]Department of Radiodiagnosis and Imaging, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Corresponding Author: Satendra Kumar, Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India, Phone: +91 9838673200, e-mail: skumar79bhu@gmail.com

How to cite this article: Kumar S, Saroj SK, More RS, *et al*. Comparison of Intraoperative Findings with Ultrasonographic Scoring for Predicting Difficult Laparoscopic Cholecystectomy. World J Lap Surg 2021;14(3):166–170.

Source of support: Nil

Conflict of interest: None

Table 1: Intraoperative scoring and difficulty levels—our criteria

Intraoperative parameters	*Scores*	*Grading*
Time taken <60 minutes, thin GB wall having no/<50% omental adhesion, no stone in the Hartman's pouch, no bile spillage, no injury to duct or artery	0–5	Easy
Time taken 60–120 minutes, thick GB wall having >50% omental adhesion/buried GB, stone impacted in the Hartman's pouch, and/or bile or stone spillage and/or injury to duct	6–10	Difficult
Time taken >120 minutes or conversion	11–15	Very difficult

operation time was considered from the first port site incision to the last port closure. The data were statistically analyzed using SPSS 16.0. Receiver operating characteristic (ROC) curve analysis was used to estimate difficulty.

Declaration of Patients Consent

The authors certify that consent forms have been obtained from each patient. In that form, the patients have given their consent for their general and other clinical information to be reported in the journal. The patients understand that their personal information will not be published and due efforts will be made to conceal their identity.

Results

A total of 209 patients with symptomatic gallstone disease undergoing LC were included in this study. The patient characteristics are shown in Table 2. Out of 209 patients, 111 (53.1%) patients were found easy during surgery, while 86 (41.1%) patients were found difficult. Five patients had a duration of surgery >120 minutes while 7 patients were converted to open, due to dense adhesion with difficulty in delineating anatomy of Calot's triangle, so these 12 (5.8%) patients were considered as very difficult (Table 3).

Through preoperative evaluation, 98 (46.88%) patients were predicted to be difficult/very difficult while 95 (45.45%) surgery of patients was difficult/very difficult, whereas 3 (1.43%) patients turned out to be on an easy surgery. However, the cases predicted to be easy on preoperative evaluation were 111 (53.11%) patients, of which 108 (51.67%) patients were easy, whereas 3 (1.43%) patients turned out to be difficult/very difficult on surgery, and by comparing preoperative and intraoperative evaluation (p <0.001), statistically significant association was found (Table 3).

On comparing the preoperative outcome with risk factors in predicting difficult LC, acute cholecystitis, overweight with BMI >27.5 kg/m^2, palpable GB, ≥4 mm of wall thickness, and obstructed stones were found as significant in bivariate analysis, whereas other factors, such as sex, abdominal scar, and pericholecystic collection, were found insignificant in above 50 years of age-group. On comparing the intraoperative outcome with risk factors, we found almost similar observations as shown in Table 4.

The study evaluated the ROC curves for prediction of intraoperative outcome through the preoperative score at cutoff point of 5.5 and area under the curve (AUC) of 0.974 [95% CI: (0.95–0.99); p <0.001], and showed 96.9 and 97.3% of sensitivity and specificity, respectively (Table 5, Fig. 1). In addition, the ROC curve for very difficult vs difficult cases at cutoff point of 8.5 and AUC of 0.782 (95% CI: 0.60–0.96; p = 0.002) showed the sensitivity of 75% and specificity of 62.0%, as shown in Table 5 and Figures 2 and 3.

Table 2: Preoperative predictive factors of DLC (preoperative scoring system), according to Randhawa and Pujahari[7]

Parameters		*Score*	*No. (%)*
Age	≤50	0	144 (68.90)
	>50	1	65 (31.10)
Sex	Female	0	144 (68.90)
	Male	1	65 (31.10)
History of hospitalization for acute cholecystitis	No	0	136 (65.10)
	Yes	4	73 (34.90)
BMI	<25 + 25–27.5	0–1	148 (70.81)
	>27.5	2	61 (29.19)
Abdominal scar	No	0	125 (59.80)
	Infraumbilical + supraumbilical	1–2	84 (40.20)
Palpable gallbladder	No	0	130 (62.20)
	Yes	1	79 (37.80)
Wall thickness	<4 mm	0	148 (70.82)
	≥4 mm	2	61 (29.18)
Pericholecystic collection	No	0	157 (75.11)
	Yes	1	52 (24.89)
Impacted stone	No	0	142 (67.94)
	Yes	1	67 (32.06)
Easy		0–5	
Difficult		6–10	
Very difficult		11–15	

Discussion

Difficult laparoscopic cholecystectomies have an inbuilt risk of conversion, due to dense adhesions of the gallbladder or inability to delineate the anatomy.[8] Conversion to open cholecystectomy is considered a wise decision of the operating surgeon. Age is a risk factor for difficult GB surgery.[9] Lee et al. found that for difficult LC, late-adulthood (>50 years) age-group considered as significant risk factor.[10] The study established a significant association between the difficulty level of surgery in bivariate analysis and the late-adulthood age-group in both preoperative (p <0.001) and intraoperative (p <0.001) outcomes. An independent risk for conversion is controversial in male. However, the study did not find any significant association between different sex and difficulty level of surgery through bivariate analysis in preoperative and intraoperative outcomes, likewise Liu et al.[11] findings.

Bhondave et al. and Nidoni et al. reveal that prior attacks of acute cholecystitis were a significant predictor of difficult LC (p = 0.0002).[12,13]

BMI >27.5 was found to be a significant risk factor in preoperative and intraoperative outcomes, in concordance with the study by Randhawa and Pujahari and Naik and Kailas.[7,14] Hence, the study concludes that obesity is considered a risk factor for difficult LC.

Previous abdominal surgery may have caused adhesions between the viscera and omentum or abdominal wall.[15] Bhondave et al. and Gupta et al. scars over the abdomen were statistically not significant and did not contribute to difficult LC (p = 0.149).[12] The abdominal scar was found as statistically insignificant while palpable GB was found to be predictor of difficult LC, clinically

Table 3: Table showing preoperative evaluation, intraoperative finding, and outcome

1. Correlation between the preoperative score and the outcome				
Preoperative scores	*Easy*	*Difficult*	*Very difficult*	*Total*
0–5	108 (51.67)	2 (0.96)	1 (0.48)	111 (53.11)
6–10	3 (1.44)	84 (40.19)	11 (5.26)	98 (46.89)
11–15	—	—	—	—
Total	111 (53.11)	86 (41.15)	12 (5.74)	209 (100)

2. Comparison of preoperative evaluation with difficulty in performing laparoscopic cholecystectomy			
	Intraoperative difficult/ very difficult cases [n (%)]	*Intraoperative easy cases [n (%)]*	*Total*
Preoperatively difficult/very difficult cases	95 (45.45)	3 (1.44)	98 (46.89)
Preoperatively easy cases	3 (1.44)	108 (51.67)	111 (53.11)
Total	98 (46.89)	111 (53.11)	209 (100)

3. Comparison between preoperative evaluation and intraoperative findings			
	Number of cases easy on surgery [n (%)]	*Number of cases difficult/very difficult on surgery [n (%)]*	*p value*
Number of cases easy on preoperative evaluation	108 (51.67)	3 (1.44)	<0.001
Number of cases difficult/very difficult on preoperative evaluation	3 (1.44)	95 (45.45)	

Table 4: Preoperative and intraoperative outcome with risk factors

	Preoperative outcome				*Intraoperative outcome*			
Risk factors	*Easy (n = 111)*	*Difficult (n = 98)*	*Odds ratio (95% CI)*	*p value*	*Easy (n = 111)*	*Difficult (n = 86)*	*Odds ratio (95% CI)*	*p value*
Age								
≤50	92 (82.9)	52 (53.1)	4.28 (2.27–8.07)	<0.001	92 (82.9)	44 (51.2)	4.62 (2.41–8.85)	<0.001
>50	19 (17.1)	46 (46.9)			19 (17.1)	42 (48.8)		
Sex								
Female	78 (70.3)	66 (67.3)	1.146 (0.63–2.06)	0.648	78 (70.3)	58 (67.4)	1.14 (0.62–2.09)	0.670
Male	33 (29.7)	32 (32.7)			33 (29.7)	28 (32.6)		
History of hospitalization for acute cholecystitis								
No	89 (80.2)	47 (48.0)	4.39 (2.38–8.09)	<0.001	89 (80.2)	39 (45.3)	4.87 (2.59–9.16)	<0.001
Yes	22 (19.8)	51 (52.0)			22 (19.8)	47 (54.7)		
BMI								
≤27.5	93 (83.8)	55 (56.1)	4.03 (2.12–7.68)	<0.001	93 (83.8)	47 (54.7)	4.28 (2.21–8.29)	<0.001
>27.5	18 (16.2)	43 (43.9)			18 (16.2)	39 (45.3)		
Abdominal scar								
No	72 (64.9)	53 (54.1)	1.56 (0.89–2.73)	0.112	72 (64.9)	45 (52.3)	1.68 (0.94–2.99)	0.075
Infraumbilical + supraumbilical	39 (35.1)	45 (45.9)			39 (35.1)	41 (47.7)		
Palpable gallbladder								
No	82 (73.9)	48 (49.0)	2.94 (1.65–5.25)	0.0002	82 (73.9)	40 (46.5)	3.25 (1.78–5.91)	<0.001
Yes	29 (26.1)	50 (51.0)			29 (26.1)	46 (53.5)		
Wall thickness								
<4 mm	92 (82.9)	56 (57.1)	3.63 (1.92–6.85)	<0.001	92 (82.9)	48 (55.8)	3.83 (1.99–7.35)	<0.001
≥4 mm	19 (17.1)	42 (42.9)			19 (17.1)	38 (44.2)		
Pericholecystic collection								
No	86 (77.5)	71 (72.4)	1.30 (0.69–2.45)	0.401	86 (77.5)	63 (73.3)	1.25 (0.65–2.41)	0.493
Yes	25 (22.5)	27 (27.6)			25 (22.5)	23 (26.7)		
Impacted stone								
No	87 (78.4)	55 (56.1)	2.83 (1.55–5.17)	0.0005	87 (78.4)	47 (54.7)	3.00 (1.61–5.59)	0.0003
Yes	24 (21.6)	43 (43.9)			24 (21.6)	39 (45.3)		

Table 5: ROC curve and its AUC for prediction of intraoperative outcome based on preoperative score

	Cutoff point	*AUC (95% CI)*	*p value*	*Sensitivity (%)*	*Specificity (%)*
Difficult/very difficult vs easy	5.5	0.974 (0.95–0.99)	<0.001	96.9	97.3
Difficult vs easy	5.5	0.975 (0.95–0.99)	<0.001	97.7	97.3
Very difficult vs difficult	8.5	0.782 (0.60–0.96)	0.002	75.0	0.62

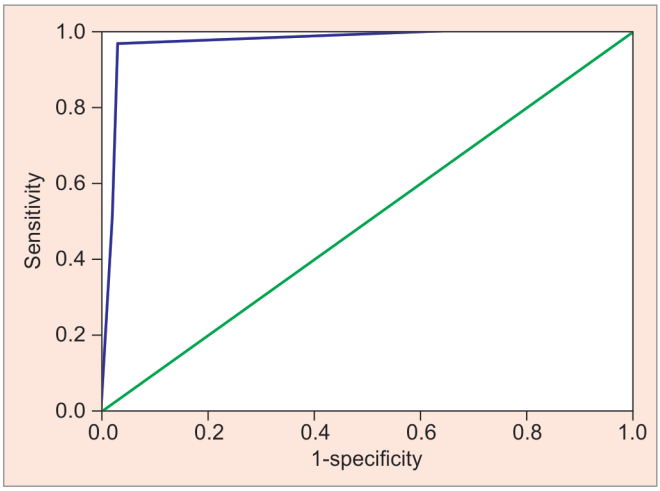

Fig. 1: ROC curve and its AUC for prediction of intraoperative outcome based on preoperative score (difficult/very difficult vs easy)

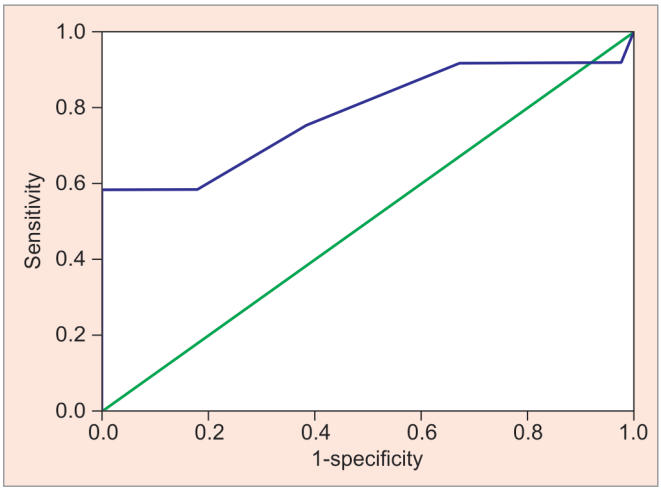

Fig. 3: ROC curve and its AUC for prediction of intraoperative outcome based on preoperative score (very difficult vs difficult)

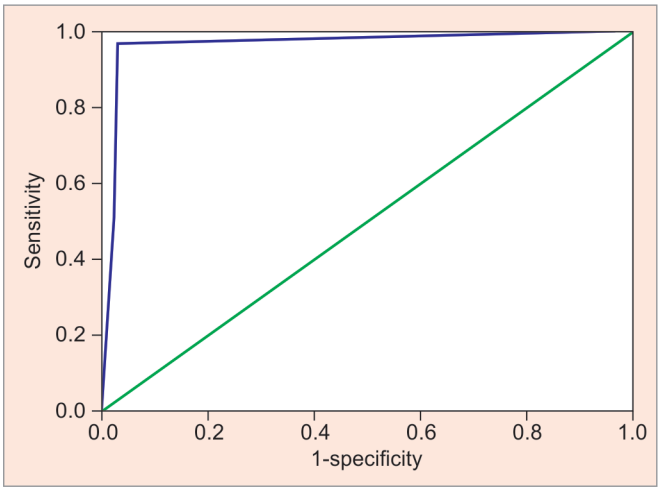

Fig. 2: ROC curve and its AUC for prediction of intraoperative outcome based on preoperative score (difficult vs easy)

palpable GB may be due to distended GB, mucocele of GB, thick-walled or owing to adhesions between the GB and the omentum.[16]

Difficult dissection of GB is associated with initial increased gallbladder wall thickening.[17] A significant correlation between the GB wall thickness and the difficulty level of surgery was observed in bivariate analyses of preoperative and intraoperative findings. Bhondave et al. and Saleem and Abdallah[18] found a similar result. Association between pericholecystic collection and difficulty level of surgery was not significant in bivariate analyses of preoperative and intraoperative findings which is similar to Naik et al.[14] But studies done by Nidoni et al. and Bhondave et al. had been found differing from our results.

Study obstructed stone at the neck of GB was found to be statistically significant in the bivariate analysis of preoperative and intraoperative findings. Kidwai et al. also found difficulty during the procedure due to impacted stone at Hartmann's pouch.[19] Conversion to open is required in 2–15% of patients undergoing elective LC.[12] In the present study, out of 209 patients, 202 cases had undergone laparoscopic cholecystectomy while 7 (3.3%) cases had converted to open.

ROC curve was to predict the intraoperative outcome based on preoperative score, and we observed that the preoperative scoring system is reliable for predicting the intraoperative outcome in LC. The present study was in concordance with the results of Saleem and Abdallah.[17] The present study also showed that a relation between preoperative score and intraoperative score of LC patients was statistically significant (p <0.001).

Conclusion

In the study, the most accurate preoperative predictors of the potential operative difficulty and conversion to open procedure in above 50 years age-groups were having the history of hospitalization for acute cholecystitis, overweight with BMI ≥27.5 kg/m^2, palpable gallbladder, ≥4 mm wall thickness, and impacted stone. The intraoperative scoring system should be standard criteria, and both scoring systems (preoperative and intraoperative) will be going to help the surgeon to take an early decision. Still, this scoring system deserves a large-scale prospective study for validation of the scoring method and establishing its efficacy.

Orcid

Raghunath S More https://orcid.org/0000-0003-0505-0034

References

1. Rao KS, Meghavathu GN, Rao GS, et al. Clinical study of gallstone disease and treatment options. J Evol Med Dent Sci 2015;4(79):13841–13848. DOI: 10.14260/jemds/2015/1972.
2. Thamil RS, Sinha P, Subramaniam PM, et al. A clinicopathological study of cholecystitis with special reference to the analysis of cholelithiasis. Int J Basic Med Sci 2011;2:68–72.
3. Kama NA, Doganay M, Dolapci M, et al. Risk factors resulting in conversion of laparoscopic cholecystectomy to open surgery. Surg Endosc 2001;15(9):965–968. DOI: 10.1007/s00464-001-0008-4.
4. Stanisic V, Milicevic M, Kocev N, et al. Prediction of difficulties in laparoscopic cholecystectomy on the base of routinely available parameters in a smaller regional hospital. Eur Rev Med Pharmacol Sci 2014;18(8):1204–1211. PMID: 24817296.
5. Tosun A, Hancerliogullari KO, Serifoglu I, et al. Role of preoperative sonography in predicting conversion from laparoscopic cholecystectomy to open surgery. Eur J Radiol 2015;84(3):346–349. DOI: 10.1016/j.ejrad.2014.12.006.
6. Sakuramoto S, Sato S, Okuri T, et al. Preoperative evaluation to predict technical difficulties of laparoscopic cholecystectomy on the basis of histological inflammation findings on resected gallbladder. Am J Surg 2000;179(2):114–121. DOI: 10.1016/s0002-9610(00)00248-8.
7. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. Indian J Surg 2009;71(4):198–201. DOI: 10.1007/s12262-009-0055-y.
8. Gupta G, Sharma PK, Gupta S, et al. Pre and per operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. Int J Res Med Sci 2015;3(11):3342–3346. DOI: 10.18203/2320-6012.ijrms20151188.
9. Sahu SK, Agrawal A, Sachan PK. Intra-operative difficulties in laparoscopic cholecystectomy. Jurnalul de Chirurgic (Iasi) 2013;9(2):149–155. DOI: 10.7438/1584-9341-9-2-5.
10. Lee NW, Collins J, Britt R, et al. Evaluation of preoperative risk factors for converting laparoscopic to open cholecystectomy. Am Surg 2012;78(8):831–833. PMID: 22856487.
11. Liu CL, Fan ST, Lai EC, et al. Factors affecting conversion of laparoscopic cholecystectomy to open surgery. Arch Surg 1996;131(1):98–101. DOI: 10.1001/archsurg.1996.01430130100022.
12. Bhondave ST, Dash N, Thipse VJ, et al. Proposed diagnostic scoring system to predict difficult laparoscopic cholecystectomy. Journal of Medical Science And Clinical Research 2017;5(12):31682–31688. DOI: 10.18535/jmscr/v5i12.67.
13. Nidoni R, Udachan TV, Sasnur P, et al. Predicting difficult laparoscopic cholecystectomy based on clinicoradiological assessment. J Clin Diagn Res 2015;9(12):PC09–PC12. DOI: 10.7860/JCDR/2015/15593.6929.
14. Naik CG, Kailas C. Predicting difficulty in laparoscopic cholecystectomy by clinical, hematological and radiological evaluation. Int Surg J 2017;4(1):189–193. DOI: 10.18203/2349-2902.isj20164080.
15. Hussain A. Difficult laparoscopic cholecystectomy: current evidence and strategies of management. Surg Laparosc Endosc Percutan Tech 2011;21(4):211–217. DOI: 10.1097/SLE.0b013e318220f1b1.
16. Chen RC, Liu MH, Tu HY, et al. The value of ultrasound measurement of gallbladder wall thickness in predicting laparoscopic operability prior to cholecystectomy. Clin Radiol 1995;50(8):570–572. DOI: 10.1016/s0009-9260(05)83195-2.
17. Tayeb M, Raza SA, Khan MR, et al. Conversion from laparoscopic to open cholecystectomy multivariate analysis of preoperative risk factors. J Postgrad Med 2005;51(1):17–20. PMID: 15793333.
18. Saleem AEA, Abdallah HA. Evaluation of preoperative predictive factors for difficult laparoscopic cholecystectomy in comparison with intraoperative parameters. Egypt J Surg 2018;37(4):504–511. DOI: 10.4103/ejs.ejs_66_18.
19. Kidwai R, Pandit R, Issrani R, et al. Assessment of risk factors for conversion from difficult laparoscopic to open cholecystectomy–a hospital based prospective study. J Krishna Inst Med Sci Univ 2016;5(3):84–97.