Int. J Med. Pharm. Res.
E-ISSN: 2958-3683 | **P-ISSN**: 2958-3675
Available on: https://ijmpr.in/

International Journal of
Medical and Pharmaceutical Research

ORGINAL ARTICLE **OPEN ACCESS**

Assessment Of Accuracy of Tokyo Guidelines(TG)18 To Investigate Its Role in Predicting Difficult Laparoscopic Cholecystectomy

Dr Shivam Sethi[1] , Dr Manpreet Kaur[2], Dr Darshanjit Singh Walia[3], Dr Anand Singla[4], Dr Manmeet Singh[1], Dr Aashima Sethi[5]

[1]Junior resident, Department of General Surgery, Government medical college, Patiala
[2]Associate Professor, Department of Ophthalmology, Government medical college, Patiala
[3]Professor, Department of General Surgery, Government medical college, Patiala
[4]Assistant Professor, Department of General Surgery, Government medical college, Patiala
[5]Medical officer

OPEN ACCESS

*Corresponding Author:

Dr Manpreet Kaur
Associate Professor, Department of Ophthalmology, Government medical college, Patiala

Received: 14-07-2025
Accepted: 28-07-2025
Available Online: 10-08-2025

ABSTRACT

Background: Acute cholecystitis (AC) is a common surgical emergency, with laparoscopic cholecystectomy (LC) as the preferred treatment. However, difficult LC, characterized by prolonged operative time, bile spillage, or conversion to open surgery, poses significant challenges. The Tokyo Guidelines 2018 (TG18) provide a standardized framework for diagnosing and grading AC severity, but their role in predicting difficult LC and conversion remains under-explored. This study evaluates TG18's accuracy in diagnosing AC and identifying preoperative predictors of difficult LC and conversion.

Methods: A prospective study of 46 patients with acute calculous cholecystitis was conducted from May 2023 to May 2025 at Rajindra Hospital, Patiala. Patients meeting TG18 diagnostic criteria underwent LC, with severity graded as mild (Grade 1), moderate (Grade 2), or severe (Grade 3). Preoperative factors (e.g., symptom duration >72 hours, gallbladder wall thickness ≥4–5 mm, elevated CRP/TLC) were correlated with intraoperative difficulties (operative time >60–120 minutes, bile spillage, or conversion) and bailout strategies (e.g., subtotal cholecystectomy, fundus-first technique).

Results: Of 46 patients (71.7% female, mean age 42.0 ± 14.0 years), 58.7% were predicted to have difficult LC, with 41.3% confirmed intraoperatively. Conversion to open surgery occurred in 8.7% (4/46), with Grade 3 showing the highest rate (25%), followed by Grade 1 (13.3%) and Grade 2 (3.7%). Hypotension (p=0.001) and oliguria (p=0.034) were significant predictors of conversion, while male gender (p=0.080), GB wall thickness (p=0.101), and fibrotic GB (p=0.116) showed trends toward intraoperative difficulty. No postoperative complications were observed.

Conclusion: TG18 is effective in diagnosing AC and stratifying severity, with moderate success in predicting difficult LC. Hypotension, oliguria, and higher TG grades are key predictors of conversion, while early LC reduces complications and hospital stay. Integrating TG18 with preoperative markers enhances surgical planning, minimizing intraoperative challenges and optimizing outcomes in AC management.

Keywords: Acute cholecystitis, difficult laparoscopic cholecystectomy, Tokyo Guidelines 2018, conversion to open surgery, bailout strategies, intraoperative complications.

INTRODUCTION

Acute cholecystitis (AC), predominantly caused by gallstone obstruction of the cystic duct, is a frequent surgical emergency requiring cholecystectomy. Laparoscopic cholecystectomy (LC) is the preferred treatment due to its minimally invasive approach, faster recovery, and lower complication rates compared to open surgery.[1,2] However, certain cases, termed "difficult LC," present significant intraoperative challenges due to severe inflammation, adhesions,

anatomical variations, or complications like gangrenous cholecystitis or pericholecystic abscess. Difficult LC is characterized by operative times exceeding 60–120 minutes, bile spillage, potential bile duct injury, or conversion to open surgery, with conversion rates ranging from 2–15%. [3,4]

Various risk factors of difficult LC are as follows:

History: In Males with age >65 years if the time interval between the onset of symptoms and presentation in acute cholecystitis greater than 72–96 hours, previous multiple attacks of AC, previous upper abdominal surgery and prior attempt at cholecystectomy (cholecystostomy).

Physical examination: Patients with Morbid obesity and high ASA score.
Laboratory tests: Patients with Abnormal liver function tests.
Imaging (USG/CT/MRI–MRCP): Patients with thick-walled gallbladder (>4–5 mm), contracted gallbladder, distended gallbladder with impacted stone in the neck, gangrenous gallbladder/gallbladder perforation, Mirizzi's syndrome/ cholecystoenteric fistula and cirrhosis/extrahepatic portal vein obstruction (portal cavernoma) with portal hypertension.
Intraoperative: Patients with Shrunken gallbladder, liver edge retracted with fissure/depression/ puckering near the fundus and fatty/firm cirrhotic liver (diffculty in retraction). [5]

The Tokyo Guidelines 2018 (TG18) provide a standardized framework for diagnosing AC and stratifying its severity into mild (Grade 1), moderate (Grade 2), and severe (Grade 3) based on clinical, laboratory, and imaging findings, with a diagnostic sensitivity of 91.8% and specificity of 94.1%. While TG18 guides treatment decisions, such as early LC for Grade 1 and 2 or gallbladder drainage for Grade 3, its utility in predicting intraoperative difficulties during LC is less established. Preoperative markers like thickened gallbladder wall, fibrotic changes, or systemic inflammation could help anticipate surgical complexity, reducing risks such as bile duct injury (up to 0.5% of LC cases). When LC is challenging, surgeons may employ bailout strategies, including subtotal cholecystectomy to avoid damage to critical structures, the fundus-first technique for obscured anatomy, percutaneous cholecystostomy for high-risk patients, delayed surgery after 6 weeks, or conversion to open cholecystectomy. Conversion, though not a complication, is often necessary in severe cases to ensure safety. Techniques like achieving the critical view of safety (CVS), intraoperative cholangiography, and the B-SAFE method (using anatomical landmarks like Rouvière's sulcus) are vital for minimizing complications, as emphasized by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) six-step safe cholecystectomy plan.[6,7,8,9]

This study, conducted at the Department of General Surgery, Government Medical College, Patiala, aims to assess the accuracy of TG18 to specifically investigate its role in predicting difficult LC. By analyzing preoperative clinical parameters (e.g., Murphy's sign, symptom duration), laboratory findings (e.g., CRP, TLC), and imaging features (e.g., gallbladder wall thickness, fibrosis), we aim to identify reliable predictors of intraoperative challenges, such as prolonged operative time, bile spillage, or the need for bailout strategies like subtotal cholecystectomy or conversion to open surgery. This study seeks to enhance preoperative risk assessment, optimize surgical planning, and reduce complications in patients undergoing LC for AC.

AIMS AND OBJECTIVES

To predict the possibility of difficult laparoscopic cholecystectomy and to assess the need of bailout procedures.

MATERIALS AND METHODS

A prospective study of 46 patients with acute calculous cholecystitis (AC), was conducted from May 2023 to May 2025 at the Department of General Surgery, Rajindra Hospital, Patiala, in collaboration with the Departments of Radiology and Pathology. Patients presenting with right upper quadrant pain or tenderness meeting TG18 criteria were included, while those with acute acalculous cholecystitis, pregnancy, bile duct/gallbladder/liver/pancreas malignancy, or unwilling to consent were excluded. Data were collected via a structured proforma after consent, including detailed history, physical examination, hematological tests (e.g., WBC, CRP), and imaging (USG, CECT, or MRCP). AC was diagnosed and graded as mild (Grade 1), moderate (Grade 2), or severe (Grade 3) per TG18, with LC performed for Grades 1 and 2, and gallbladder drainage prior to LC for Grade 3. Difficult LC, defined as operative time >60–120 minutes, bile spillage, or conversion to open surgery, was assessed by correlating preoperative factors like gallbladder wall thickness (>4–5 mm), symptom duration >72 hours, and elevated inflammatory markers with intraoperative challenges. LC was performed under general anesthesia using a four-port technique, with bailout strategies (e.g., subtotal cholecystectomy, fundus-first technique, or open conversion) employed for complex cases involving severe inflammation or unclear anatomy. Patients were followed up at 15 days for histopathology and 30 days postoperatively for complications.

RESULTS AND OBSERVATIONS:

The study population of 46 patients with acute cholecystitis showed a majority in the 21–30 years age group (30.4%, n=14), followed by the 31–40 years group (26.1%, n=12). Frequency declined in older groups: 41–50 years (17.4%, n=8), 51–60 years (19.6%, n=9), 61–70 years (2.2%, n=1), and 71–80 years (4.3%, n=2). The mean age was 42.0 years (SD ±14.0), indicating acute cholecystitis primarily affects younger to middle-aged adults, with lower incidence in older groups. Out of 46 participants, 33 (71.7%) were female, while 13 (28.3%) were male. This notable gender disparity suggests that acute cholecystitis is more commonly observed in females.

Among the participants, 58.7% (n=27) were predicted to have a difficult laparoscopic cholecystectomy based on preoperative assessments, while 41.3% (n=19) were anticipated to have no significant challenges. Intraoperatively, 41.3% (n=19) of cases were found to be difficult, closely aligning with the preoperative predictions, whereas 58.7% (n=27) were managed without significant difficulty. Importantly, there were no postoperative complications observed in any of the cases (100%, n=46), reflecting favorable surgical outcomes. This data highlights the accuracy of predictive assessments in identifying potentially challenging laparoscopic cholecystectomies, as indicated by the congruence between predicted and intraoperative difficulties.Table 1

Among the participants, 8.7% (n=4) required conversion to open surgery, while the majority, 91.3% (n=42), successfully underwent laparoscopic cholecystectomy without conversion. This low conversion rate underscores the effectiveness of laparoscopic techniques in managing acute cholecystitis, aligning with contemporary surgical trends favoring minimally invasive approaches.Table 2

Among age groups, intraoperative difficulty was most commonly observed in the 51-60 years group (66.7%) and exclusively in the 61-70 years group (100%), whereas the 21-30 years and 71-80 years groups experienced fewer difficulties (21.4% and 0%, respectively; $p = 0.161$). GB wall thickness ≥4-5 mm showed a higher proportion of difficult cases (50.0%) compared to cases with normal thickness (25.0%), but this was not statistically significant ($p = 0.101$). Similarly, fibrotic GB was associated with a higher incidence of difficulty (55.6%) compared to non-fibrotic GB (32.1%), with a p-value of 0.116. Adhesions in the triangle of Calot were also more frequent in difficult cases (46.7%) than in non-difficult cases (31.2%), but the association did not reach statistical significance ($p = 0.312$). These findings suggest that age (particularly 51-60 years), increased GB wall thickness, fibrotic GB, and adhesions in the triangle of Calot may contribute to intraoperative difficulties during cholecystectomy.Table 3

Among age groups, the highest conversion rates were observed in patients aged 51-60 years (22.2%), while no conversions were noted in the 21-30 years, 61-70 years, and 71-80 years groups ($p = 0.573$). The duration of complaints >72 hours was associated with a lower conversion rate (3.6%) compared to patients with complaints ≤72 hours (16.7%; $p = 0.124$). Fever was present in 4.2% of cases requiring conversion, compared to 13.6% in patients without fever ($p = 0.255$). Laboratory parameters such as abnormal total leukocyte count (TLC) and C-reactive protein (CRP) were observed in 15.4% of cases requiring conversion, compared to 6.1% in non-converted cases ($p = 0.312$ for both). Elevated serum creatinine (>2 mg/dL) showed no conversions, while patients with normal creatinine levels had a conversion rate of 9.1% ($p = 0.655$). Hypotension demonstrated a strong association with conversion, as all cases with hypotension (100%) required conversion ($p = 0.001$). Oliguria also showed a significant association, with 50.0% of cases requiring conversion ($p = 0.034$). Severity grading revealed the highest conversion rate in Grade 3 cases (25.0%), followed by Grade 1 (13.3%) and Grade 2 (3.7%; $p = 0.273$). Marked local inflammation was not associated with conversion, as none of the cases with significant inflammation required conversion ($p = 0.465$). In conclusion, factors such as hypotension, oliguria, and higher severity grading demonstrated significant associations with conversion to open cholecystectomy.Table 4

Table 1: Distribution of study subjects according to Predicted Difficulty, Intraoperative Difficulty, and Postoperative Complications in Laparoscopic Cholecystectomy

Variables		Frequency	Percentage
Predicted difficult laparoscopic cholecystectomy	Yes	27	58.7 %
	No	19	41.3 %
Intra Op difficult cholecystectomy	Yes	19	41.3 %
	No	27	58.7 %
Post Op complications	Yes	0	0.00%
	No	46	100.0 %

Table 2: Distribution of study subjects according to conversion to open cholecystectomy

Conversion to open cholecystectomy	Frequency	Percentage
Yes	4	8.7 %
No	42	91.3 %

Table 3 Association of Intra Op difficult cholecystectomy with age, GB wall thickness, Fibrotic GB and Adhesion in triangle of Calot

		Intra Op difficult cholecystectomy		
Variables		**Yes**	**No**	**p-value**
Age (years)	≤60	18 (41.8%)	25 (58.14%)	0.772
	>60	1 (33.3%)	2 (66.6%)	
Gender	Female	11 (33.3%)	22 (66.6%)	0.080
	Male	8 (61.5%)	5 (38.5%)	
GB wall thickness	Yes	15 (50.0%)	15 (50.0%)	0.101
	No	4 (25.0%)	12 (75.0%)	
Fibrotic GB	Yes	10 (55.6%)	8 (44.4%)	0.116
	No	9 (32.1%)	19 (67.9%)	
Adhesion in triangle of Calot	Yes	14 (46.7%)	16 (53.3%)	0.312
	No	5 (31.2%)	11 (68.8%)	

Table 4: Association of Conversion to open cholecystectomy with age, Clinical, and Laboratory Variables

		Conversion to open cholecystectomy		
Variables		**Yes**	**No**	**p-value**
Age	21-30	0 (0.0%)	14 (100.0%)	0.573
	31-40	1 (8.3%)	11 (91.7%)	
	41-50	1 (12.5%)	7 (87.5%)	
	51-60	2 (22.2%)	7 (77.8%)	
	61-70	0 (0.0%)	1 (100.0%)	
	71-80	0 (0.0%)	2 (100.0%)	
Duration of complaints (>72 hrs)	Yes	1 (3.6%)	27 (96.4%)	0.124
	No	3 (16.7%)	15 (83.3%)	
Fever	Yes	1 (4.2%)	23 (95.8%)	0.255
	No	3 (13.6%)	19 (86.4%)	
Abnormal TLC	Yes	2 (15.4%)	11 (84.6%)	0.312
	No	2 (6.1%)	31 (93.9%)	
Abnormal CRP	Yes	2 (15.4%)	11 (84.6%)	0.312
	No	2 (6.1%)	31 (93.9%)	
S. Creatinine (>2mg/dl)	Yes	0 (0.0%)	2 (100.0%)	0.655
	No	4 (9.1%)	40 (90.9%)	
Hypotension	Yes	1 (100.0%)	0 (0.0%)	0.001
	No	3 (6.7%)	42 (93.3%)	
Oliguria	Yes	1 (50.0%)	1 (50.0%)	0.034
	No	3 (6.8%)	41 (93.2%)	
Severity	Grade 1	2 (13.3%)	13 (86.7%)	0.273
	Grade 2	1 (3.7%)	26 (96.3%)	
	Grade 3	1 (25.0%)	3 (75.0%)	
Marked Local Inflammation	Yes	0 (0.0%)	5 (100.0%)	0.465
	No	4 (9.8%)	37 (90.2%)	

DISCUSSION

In our study, 58.7% of patients were predicted to have a difficult LC based on preoperative clinical, laboratory, and imaging parameters, with intraoperative difficulty encountered in 41.3% of cases. These findings align with the literature, where difficult LC is often associated with factors such as prolonged symptom duration (>72 hours), elevated

inflammatory markers (CRP, TLC), gallbladder (GB) wall thickness (≥4–5 mm), fibrotic GB, and adhesions in Calot's triangle. For instance, Asai K et al. (2014) reported that symptom duration exceeding 72 hours significantly correlated with intraoperative difficulty and a higher conversion rate (18.5% in moderate AC cases, $p<0.05$) [34]. Similarly, Bhandari et al. (2021) identified GB wall thickness and Calot's triangle adhesions as key predictors of difficult LC, with an odds ratio of 166.6 for fibrotic GB [55]. In our study, the predominance of Grade 2 AC (58.7%) likely contributed to the high rate of predicted difficulty, as these patients often presented with multiple attacks of AC, abnormal TLC, delayed presentation (>72–96 hours), and marked local inflammation (e.g., gangrenous GB or biliary peritonitis).

Despite the high predicted difficulty, intraoperative challenges were encountered in a lower proportion (41.3%), suggesting that preoperative assessment using TG18 criteria effectively identifies at-risk cases, allowing for tailored surgical strategies. The absence of statistical significance for factors such as age ($p=0.772$), gender ($p=0.080$), GB wall thickness ($p=0.101$), fibrotic GB ($p=0.116$), and Calot's triangle adhesions ($p=0.312$) in our study may be attributed to the small sample size ($n=46$), which likely limited statistical power. However, trends observed in our data align with the literature. For example, male gender showed a trend toward higher surgical difficulty (61.5% in males vs. 33.3% in females), consistent with Bouassida et al. (2017) and Inoue K et al. (2017), who identified male sex as a predictor of operative challenges due to increased visceral fat and denser adhesions [39, 47]. The lack of significance in our study may also reflect intraoperative adaptations, such as fundus-first dissection which may have mitigated surgical challenges [70].

GB wall thickness, a well-established marker of inflammation and fibrosis, was observed in 65.2% of our patients but did not reach statistical significance for predicting difficult LC ($p=0.101$). This contrasts with Morales-Maza et al. (2021) and Bhandari et al. (2021), who reported a significant association between GB wall thickness (>4 mm) and conversion risk [53, 55]. However, Lee SW et al. (2010) noted that edema in acute cases may facilitate dissection, potentially explaining our non-significant findings [31]. Similarly, adhesions in Calot's triangle, while present in 65.2% of cases, were not significantly associated with difficulty ($p=0.312$), possibly due to the presence of flimsy adhesions, early intervention, and meticulous surgical technique. This contrasts with Bhandari et al. (2021) and Reddy et al. (2019), who emphasized adhesions as a critical determinant of intraoperative complexity and bile duct injury risk [55, 59].

The conversion rate from laparoscopic to open cholecystectomy in our study was 8.7% (4/46 cases), which is within the mid-range of reported rates in the literature (1.4%–13.8%) [34, 37, 39, 40, 47, 53, 58, 60]. Conversion was required in 13.3% of Grade 1, 3.7% of Grade 2, and 25% of Grade 3 patients, highlighting the influence of disease severity on surgical outcomes. Notably, hypotension ($p=0.001$) and oliguria ($p=0.034$) were statistically significant predictors of conversion, underscoring the role of systemic complications in complicating laparoscopic procedures. These findings align with Asai K et al. (2014) and Paul Wright G et al. (2015), who reported higher conversion rates in patients with higher TG severity grades and prolonged symptom duration (>72 hours) [34, 35]. Bouassida et al. (2017) further identified TG severity grading as the strongest predictor of conversion ($p<0.001$), with male sex and diabetes as additional risk factors [39].

Interestingly, our study found a higher conversion rate in Grade 1 patients (13.3%) compared to Grade 2 (3.7%), which contrasts with Amirthalingam V et al. (2017), who reported no conversions in Grade 1 cases [40]. This discrepancy may be due to patient-specific factors, such as male gender, age >50 years, or systemic complications (e.g., hypotension, oliguria), which were associated with increased conversion risk in our cohort. The low conversion rate in Grade 2 patients may reflect the benefits of early LC (82.6% of cases performed within 7 days), meticulous dissection techniques, and preoperative planning guided by TG18 criteria. Gupta et al. (2022) similarly noted that early LC reduced conversion rates (6.7% vs. 0% in delayed LC), supporting the trend toward early intervention [60].

Non-significant associations for age ($p=0.573$), duration of complaints >72 hours ($p=0.124$), fever ($p=0.255$), abnormal TLC ($p=0.312$), abnormal CRP ($p=0.312$), and severity grades ($p=0.273$) in predicting conversion may be attributed to several factors. The small sample size likely reduced statistical power, as larger studies like Bhandari et al. (2021) and Morales-Maza et al. (2021) achieved significance for similar variables with larger cohorts [53, 55]. Additionally, surgeon expertise, intraoperative adaptations (e.g., fundus-first cholecystectomy), and advanced surgical technologies may have mitigated challenges, as supported by Thapar P et al. (2021), who reported a low conversion rate (1.4%) with meticulous techniques [58]. The integration of TG18 criteria into preoperative planning likely enhanced risk stratification, allowing surgeons to anticipate and manage potential difficulties effectively.

The TG18 criteria demonstrated high clinical utility in our study for diagnosing AC (84.8% imaging-confirmed cases) and stratifying severity (Grade 1: 32.6%, Grade 2: 58.7%, Grade 3: 8.7%). The predominance of Grade 2 cases in our cohort, driven by factors such as multiple AC attacks, abnormal TLC, delayed presentation, and marked local

inflammation, underscores the ability of TG18 to identify patients at risk for difficult LC. Significant associations between severity grades and markers like Murphy's sign ($p<0.001$), abnormal CRP ($p=0.003$), abnormal TLC ($p=0.003$), GB wall thickness ($p<0.001$), and fibrotic gB ($p=0.027$) reinforce the prognostic value of these parameters, as supported by Lee SW et al. (2010) and Mishima K et al. (2024) [31, 65]. Mishima K et al. (2024) proposed a CRP- and imaging-based scoring system to enhance prediction of difficult LC (AUC 0.721), highlighting the potential for integrating biomarkers into TG18 for improved accuracy [65].

The absence of postoperative complications in our study further supports the efficacy of TG18-guided early LC, which aligns with Pisano et al. (2020) and Gupta et al. (2022), who advocate for early intervention to minimize complications and hospital stay [52, 60]. The mean hospital stay of 3.93 ± 3.17 days, with 60.8% of patients discharged within 1–3 days, reflects the benefits of early LC, particularly in Grade 1 and 2 cases (median stays of 2 and 4 days, respectively). Grade 3 patients and those requiring conversion had longer stays (10–15 days), consistent with Cheng WC et al. (2014) and Lin YN et al. (2020), who reported extended hospitalizations for severe cases [33, 56].

CONCLUSION

Our study confirms the clinical utility of the Tokyo Guidelines (TG18) in accurately diagnosing acute cholecystitis, stratifying its severity, and predicting difficult laparoscopic cholecystectomy and conversion to open surgery. Key predictors of intraoperative difficulty and conversion include hypotension, oliguria, male gender, and higher TG severity grades, although small sample size limited statistical significance for some variables. The adoption of early LC, guided by TG18, was associated with a low conversion rate (8.7%) and no postoperative complications, emphasizing its role in optimizing surgical outcomes. These findings support the integration of TG18 into routine clinical practice to enhance preoperative planning, reduce intraoperative challenges, and improve patient prognosis in the management of acute cholecystitis.

Funding: None

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Reynolds Jr W. The first laparoscopic cholecystectomy. JSLS 2001; 5(1): 89- 94.
2. Pal I, Bhatti U, Bari J. Changing trends in surgical management for acute cholecystitis, in light of Tokyo guidelines - 14 year experience. J Pak Med Assoc. 2019 Oct;69(10):1505-1508.
3. Santos BF, Brunt LM, Pucci MJ. The Difficult Gallbladder: A Safe Approach to a Dangerous Problem. J Laparoendosc Adv Surg Tech A. 2017 Jun;27(6):571-578.
4. Sutcliffe RP, Hollyman M, Hodson J, Bonney G, Vohra RS, Griffiths EA et al. Preoperative risk factors for conversion from laparoscopic to open cholecystectomy: a validated risk score derived from a prospective U.K. database of 8820 patients. HPB (Oxford). 2016 Nov;18(11):922-928.
5. Santharaj S, Marahanumaiah S. Pre-operative predictors of difficult laparoscopic cholecystectomy: a comparative study between two scoring systems. Int Surg J 2022;9:960-6.
6. Bogacki P, Krzak J, Gotfryd-Bugajska K, Szura M. Evaluation of the usefulness of the SAGES Safe Cholecystectomy Program from the viewpoint of the European surgeon. Wideochir Inne Tech Maloinwazyjne. Mar;15(1):80-86.
7. Lunevicius R. Laparoscopic subtotal cholecystectomy: a classification, which encompasses the variants, technical modalities, and extent of resection of the gallbladder. Ann R Coll Surg Engl. 2020 Apr;102(4):315317.
8. Kelly MD. Laparoscopic retrograde (fundus first) cholecystectomy. BMC Surg. 2009 Dec 11;9:19. doi: 10.1186/1471-2482-9-19.
9. Gulaya K, Desai SS, Sato K. Percutaneous Cholecystostomy: Evidence- Based Current Clinical Practice. Semin Intervent Radiol. 2016 Dec;33(4):291-296.