Research Article

History of Recurrent Acute Cholecystitis Admissions as a Predictor of Operative Time and Bile Spillage: A Retrospective Cohort Study

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ABSTRACT

Background: Repeat acute cholecystitis hospitalization could be cumulative inflammatory exposure and scarring in Calot triple, which might complicate surgery. We tested the hypothesis that prior acute cholecystitis admission predicted the duration of the operation and bile spillage during the operation in patients undergoing index laparoscopic cholecystectomy.

Methods: Our study was in the form of a retrospective cohort study conducted at Sardar Vallabhbhai Patel (SVP) Hospital, Ahmedabad, a teaching hospital of NHL Municipal Medical College, Ahmedabad. Included were adult patients who experienced laparoscopic cholecystectomy due to acute calculous cholecystitis between December, 2022, and December, 2025 (N= 200). The exposure variable was the count of recorded preceding hospital admissions of acute cholecystitis in the past, 0, 1, or 2 admissions. Operative time (incision to close time, minutes) and bile spillage (recorded gallbladder perforation with visible bile leak +/- stone leakage) were primary outcomes. Predictors of operative time were estimated using multivariate linear regression, and predictors of bile spillage were estimated using multivariate logistic regression, controlling age, sex, BMI, ASA class, symptom duration, Tokyo severity grade of the Tokyo Guidelines, ultrasound/CT exposure (wall thickness, pericholecystic fluid) and surgeon experience level..

Results: Of 200 patients, 92 (46.0%) had 0 prior admissions, 62 (31.0%) had 1, and 46 (23.0%) had ≥2. Mean operative time rose stepwise with prior admissions (0: 62.1±18.4; 1: 74.3±22.1; ≥2: 92.4±27.6 minutes; p<0.001). Bile spillage occurred in 13/92 (14.1%), 14/62 (22.6%), and 19/46 (41.3%), respectively (p<0.001). After adjustment, each additional prior admission independently predicted longer operative time (ß=+9.6 minutes/admission, SE 1.8, p<0.001) and higher odds of bile spillage (adjusted OR 1.75, 95% CI 1.28-2.42, p=0.001). Conversion to open surgery and bailout subtotal cholecystectomy were more frequent in the ≥2 group.

Conclusion: The presence of a history of recurrent admissions of acute cholecystitis was a powerful, independent indicator of increased operative time, and the spillage of bile in laparoscopic cholecystectomy. Admission history is a modest preoperative indicator that can enhance planning of the operation, risk advisory, and assignment of seasoned surgical units.

Keywords: Acute Cholecystitis, Laparoscopic Cholecystectomy, Recurrent Admissions, Operative Time; Bile Spillage, Difficult Gallbladder.

INTRODUCTION

The acute calculous cholecystitis continues to be one of the most prevalent emergency general surgery, with and without its inflammatory complications, worldwide, which is caused by gallstone disease. The modern global practice prioritizes timely laparoscopic cholecystectomy where possible, as evidenced by showing that conclusive surgery at the time of the initial episode can minimize recurrent biliary complications and subsequent healthcare expenditure [1], [2]. In most real-world environments, however, patients suffer delayed or progressive care due to referral effects, ineffective use of the operating room, optimization of comorbidity, or linguistic isolation to more progressive laparoscopic services. Such delays can expose patients to higher repeat hospitalisation due to recurring acute cholecystitis, each hospitalisation with which may worsen the inflammation and fibrosis of the hepatocystic triangle.

Laparoscopic cholecystectomy is not a technologically uniform procedure. The severity of acute inflammation, symptoms length, distension of the gallbladder, empyema/gangrene, adhesion, and anatomic distortion influence the operative complexity

and can increase the risk of conversion, injury to the bile duct, bleeding, or leakage of bile [3], [4]. Tokyo guidelines 2018 (TG18) codified the constructs of diagnostic and the grade of severity and offered operative safety measures of acute cholecystitis and highlighted standardized decision-making and bailout methods in which dissection is unsafe [3,5]. Simultaneously, the World Society of Emergency Surgery (WSES) update supported the concept of early cholecystectomy becoming the new standard of care in eligible candidates and updated subtotal cholecystectomy as a helpful option when faced with challenging situations [2].

Although the extent of severity grading frameworks is aimed at the episode at hand, these indicators might not fully reflect the inflammatory background that is manifested by frequent hospitalization. Recurrent episodes of acute cholecystitis likely produce adhesions between the gallbladder, omentum, duodenum and colon of a dense nature; the adhesions may also induce contraction of the gallbladder and scarring of the cystic plate, obscuring essential anatomy. These modifications can prolong the surgical duration and raise the chances of gallbladder perforation. Laparoscopic cholecystectomy is known to involve gallbladder perforation (in connection with the bile and/or stone spillage) and, though frequently asymptomatic, may result in abscess, fistula, and/or diagnostic misinterpretation on subsequent imaging in a minor percentage of patients [6], [7]. The existence of risk factors and outcomes of spilled gallstones has been previously explained in the literature, and it has been emphasized that acute cholecystitis is a condition predisposing to spillage itself [6], [7]. Perhaps there is more that is not known in regard to whether the number of previous admissions, which is a readily available, low-cost preoperative variable, is predictive of operative time and bile spillage in the current acute-care practice.

Operative time is not just a logistical outcome, it can be used to proxy technical hardiness, and might be associated with complications, anesthesia exposure and resource use. By determining preoperative predictors that can consistently predict prolonged operations, there can be better scheduling, staffing, and choice of experienced surgeons. Equally, the assumption of bile spillage can justify the specific intraoperative mitigation (atraumatic handling, decompression, retrieval, practices of irrigation, and documentation).

Consequently, the aim of present research was to determine whether the history of repeated admissions due to acute cholecystitis is linked to the predictability of the operative time and bile spillage during index laparoscopic cholecystectomy. We would have imagined that, with a growing number of previous admissions, we would find a graded relationship between spillage rates and length of operative time, regardless of the severity of the disease and appearance under imaging.

MATERIALS AND METHODS

Study Design, Setting, and Duration
A retrospective cohort study was conducted at Sardar Vallabhbhai Patel (SVP) Hospital, Ahmedabad, a tertiary-care municipal teaching hospital affiliated with NHL Municipal Medical College, Ahmedabad. The study period extended from December 1, 2022 to December 31, 2025. Eligible cases were identified from institutional operative registers and electronic/physical medical records.

Study Population
All adult patients (≥18 years) who underwent laparoscopic cholecystectomy for acute calculous cholecystitis during the index admission within the study period were assessed for eligibility.

Inclusion Criteria
1. Diagnosis of acute calculous cholecystitis based on clinical features and supportive imaging (ultrasonography and/or CT) with laboratory correlation, consistent with Tokyo Guidelines diagnostic constructs.
2. Laparoscopic approach intended at the start of surgery.
3. Complete documentation of operative time and intraoperative events.

Exclusion Criteria
1. Planned open cholecystectomy at the outset.
2. Concomitant major abdominal procedures performed during the same operation (e.g., bowel resection).
3. Pregnancy.
4. Suspected or confirmed gallbladder malignancy.
5. Incomplete records for the exposure (prior admissions) or primary outcomes (operative time, bile spillage).

Exposure Variable: History of Recurrent Admissions

The exposure was the number of prior hospital admissions for acute cholecystitis documented before the index surgery, ascertained from SVP Hospital records and available referral/discharge documents. Patients were grouped as:

- 0 prior admissions
- 1 prior admission
- ≥2 prior admissions

Outcomes

Primary Outcomes

1. **Operative Time (Minutes):** recorded as incision-to-closure time in the anesthesia chart and operative record.
2. **Bile Spillage:** recorded when the operative note described gallbladder perforation with visible bile leakage, with or without stone spillage, during dissection, extraction, or decompression.

Secondary Outcomes

Conversion to open surgery, bailout subtotal cholecystectomy, drain placement, postoperative length of stay, and 30-day postoperative complications (bile leak requiring intervention, intra-abdominal collection, wound infection, or readmission).

Covariates and Data Collection

A standardized proforma was used to abstract the variables: age, sex, BMI, diabetes mellitus, ASA class, symptom duration before admission (hours:>72 vs 72 or less), severity grade of Tokyo Guidelines, imaging (thickness of the gallbladder wall, pericholecystic fluid, impacted stone), the pre-operative ERCP had been performed, operator status (attending/consultant as primary surgeon vs supervised trainee primary operator). Radiology reports and operative correlation were extracted as imaging variables in case they were reported.

Operative Technique

These processes were carried out with a general anesthesia and a traditional multiport laparoscopic operation. The pessimistic perspective on safety was tried where possible. Where the anatomy was obscured or the dissection was considered unsafe, bailout procedures such as fundus-first dissection (with or without fenestration or reconstitution, as recorded), or conversion to open surgery, provided on a case-by-case basis. Institutional-based administration of perioperative antibiotics was accompanied by increase in cases of complicated disease where necessary.

Ethics Approval

The study was approved by the Institutional Ethics Committee of the affiliated institution/hospital, and a waiver of informed consent was granted due to the retrospective design and use of de-identified data.

Statistical Analysis

Continuous variables were summarized as mean±SD or median (IQR) based on distribution. Between-group comparisons used one-way ANOVA (or Kruskal–Wallis test) for continuous variables and chi-square (or Fisher's exact) tests for categorical variables. Multivariable linear regression was used to model operative time, and multivariable logistic regression was used to model bile spillage, adjusting for prespecified confounders (demographics, severity, imaging markers, symptom duration, and operator level). Two-sided $p<0.05$ was considered statistically significant, and results were reported as β coefficients (minutes) and adjusted odds ratios (OR) with 95% confidence intervals.

RESULTS

Cohort Characteristics and Exposure Distribution

Two hundred and forty-seven cholecystectomies with suspected acute cholecystitis were screened; two hundred left inclusion criteria after eliminating planned open cases, combined procedures, and incomplete records (Figure 1). The last group was aged 46.826.7 years (now mean is 46.8 and standard deviation is 13.7); 124 (62.0) were female. History of previous admissions showed high recidivism: 46.0% had no history, 31.0% had 1 history and 23.0% had more than 2 history. Imaging signs of permanence and hardship (thickened wall and pericholecystic fluid) were more common in patients with 2 or more previous admissions and had a higher likelihood of having a symptom duration exceeding 72 hours at presentation.

Operative Time Increased Stepwise with Recurrent Admissions

There was an apparent dose-response correlation between operational time and admission history. There were also increases in mean operative time with no prior admission of 62.1 per cent. Standard error 18.4 to mean Operative time with 1 prior admission 74.3 per cent. Standard error 22.1 and mean Operative

time with 2 or more prior admission 92.4 per cent. Standard error 27.6 (p<0.001). The same gradient was found across TG18 severity strata indicating that frequent admissions reflected a difficulty which was out of proportion to severity at the time of index presentation. The ≥2 group had a greater incidence of prolonged adhesiolysis and increased the incidence of bailout maneuvers clinically leading to longer exposure to anesthesia and operating room use.

Bile Spillage was Substantially more Common in Patients with ≥2 Admissions
Overall, there was bile spillage in 46 patients (23.0%). The rates were 14.1% in the 0-admission group, 22.6% in the 1-admission group and 41.3% in the ≥2-admission group (p<0.001). Spillage incidents were generally reported during the dissection of a gallbladder

out of the liver bed or traction at the Hartmann pouch, which is in line with tearing, inflamed tissue planes. Most spillage was controlled intraoperative with a suction, irrigation, and wall retrieval, but the trend would indicate the increased predisposition of the gallbladder wall following repeated inflammatory postulations.

Secondary Intraoperative Outcomes
It got converted to open surgery 3.3% (0 admissions) to 6.5% (1 admission) to 13.0% (>=2 admissions) (p=0.030). The same case was observed in bailout subtotal cholecystectomy (2.2, 3.2 and 10.9 respectively: p=0.012). The length of stay in the postoperative period was slightly longer in the ≥2 group, and the readmissions within 30 days were slightly higher but the absolute rates were low.

Table 1. Baseline and Presentation Characteristics by Prior Acute Cholecystitis Admissions (N=200)

Characteristic	0 Prior Admissions (N=92)	1 Prior Admission (N=62)	≥2 Prior Admissions (N=46)	P-Value
Age, years (mean±SD)	44.9±13.1	46.5±13.6	50.7±14.2	0.041
Female sex, n (%)	62 (67.4)	38 (61.3)	24 (52.2)	0.180
BMI, kg/m² (mean±SD)	27.1±4.6	27.8±4.9	28.6±5.1	0.210
Diabetes mellitus, n (%)	18 (19.6)	14 (22.6)	13 (28.3)	0.430
ASA class III–IV, n (%)	14 (15.2)	11 (17.7)	12 (26.1)	0.190
Symptom duration >72 h, n (%)	29 (31.5)	24 (38.7)	25 (54.3)	0.031
TG18 grade II–III, n (%)	34 (37.0)	28 (45.2)	28 (60.9)	0.018
Wall thickness ≥4 mm, n (%)	36 (39.1)	32 (51.6)	31 (67.4)	0.003
Pericholecystic fluid, n (%)	22 (23.9)	20 (32.3)	22 (47.8)	0.011
Preop ERCP, n (%)	8 (8.7)	7 (11.3)	8 (17.4)	0.280

There was an increasing inflammatory-risk profile at presentation, longer symptom duration of greater than 72 hours, a larger proportion of TG18 grade II113 disease, and more ultrasound indicators of problematic dissection (wall thickening and pericholecystic fluid) in patients with increasing previous

admissions. Though there was also an age effect (shape of approximately similar magnitude across groups), comorbidity burden (e.g. diabetes, ASA III-IV) failed to account for the gradient as opposed to admission history being a unique measurement of cumulative disease effect.

Table 2. Operative and Early Postoperative Outcomes by Prior Admission Group (N=200)

Outcome	0 Prior (N=92)	1 Prior (N=62)	≥2 Prior (N=46)	P-Value
Operative time, min (mean±SD)	62.1±18.4	74.3±22.1	92.4±27.6	<0.001
Bile spillage, n (%)	13 (14.1)	14 (22.6)	19 (41.3)	<0.001
Stone spillage, n (%)	6 (6.5)	8 (12.9)	11 (23.9)	0.005
Conversion to open, n (%)	3 (3.3)	4 (6.5)	6 (13.0)	0.030
Subtotal cholecystectomy, n (%)	2 (2.2)	2 (3.2)	5 (10.9)	0.012

Drain placed, n (%)	18 (19.6)	16 (25.8)	19 (41.3)	0.014
Length of stay, days (mean±SD)	2.6±1.4	2.9±1.6	3.5±2.1	0.021
30-day complications*, n (%)	6 (6.5)	6 (9.7)	8 (17.4)	0.090
30-day readmission, n (%)	4 (4.3)	4 (6.5)	5 (10.9)	0.280

As more previous admissions were present, there was a dose-dependent worsening of operative outcomes. The ≥2 group had been allowed around 30 minutes more operating time on average than with patients having no previous admission and was almost three times that of bile spillage rate. The number of conversions and subtotal cholecystectomies bailout indicators of strenuous anatomy also increased remarkably, representing that recurrence admissions may culminate clinically material accumulation of adhesions and tissue oppressiveness converting into intraoperative conditions and resource utilization.

Table 3. Multivariable Linear Regression Predicting Operative Time (Minutes) (N=200)

Predictor	B (Minutes)	SE	95% CI	P-Value
Prior admissions (per admission)	+9.6	1.8	6.1 to 13.1	<0.001
Age (per 10 years)	+1.7	0.8	0.1 to 3.3	0.038
Male sex	+4.9	2.6	-0.2 to 10.0	0.060
BMI (per 5 kg/m²)	+2.8	1.2	0.4 to 5.2	0.024
TG18 grade II–III	+8.7	2.9	3.0 to 14.4	0.003
Symptom duration >72 h	+6.2	2.7	0.9 to 11.5	0.022
Wall thickness ≥4 mm	+7.5	2.6	2.4 to 12.6	0.004
Pericholecystic fluid	+5.8	2.5	0.9 to 10.7	0.020
Consultant/attending primary operator	-6.1	2.4	-10.8 to -1.4	0.011

Following the demographic, clinical, imaging, and operator data, the main predictive variable was the history of admission: one more previous admission would lead to the increase of the resulting operative time to about 10 additional minutes. Active disease severity was also supported in independent associations with TG18 grade II3 disease and ultrasound signs of inflammation. Remarkably, attending-level operation of primary was also linked with reduced operative time, which is in tandem with efficiency improvement in more complicated dissections and reduced threshold in timely making a bailout decision.

Table 4. Multivariable Logistic Regression Predicting Bile Spillage (N=200)

Predictor	Adjusted OR	95% CI	p-value
Prior admissions (per admission)	1.75	1.28 to 2.42	0.001
TG18 grade II–III	1.88	1.01 to 3.52	0.046
Wall thickness ≥4 mm	2.06	1.10 to 3.89	0.024
Pericholecystic fluid	1.71	0.92 to 3.17	0.090
Symptom duration >72 h	1.59	0.86 to 2.96	0.140
Male sex	1.31	0.70 to 2.47	0.390
Consultant/attending primary operator	0.73	0.39 to 1.38	0.330

Recurrent admission burden was independently related to bile spillage: with multivariate adjustment, with one extra prior admission past, the odds ratio of spillage was about 75. TG18 grade II-III and the gallbladder wall being thick also forecasted the spillage, which goes along with the idea that gallbladders of high severity and structure produce a higher risk of perforation during traction and dissection. Directionality of operator experience has implied possible protection, but crosses unity; it may happen that tissue factors may dominate the issue of spillage.

Figures

Figure 1. Distribution of prior acute cholecystitis admissions among included patients (N=200)
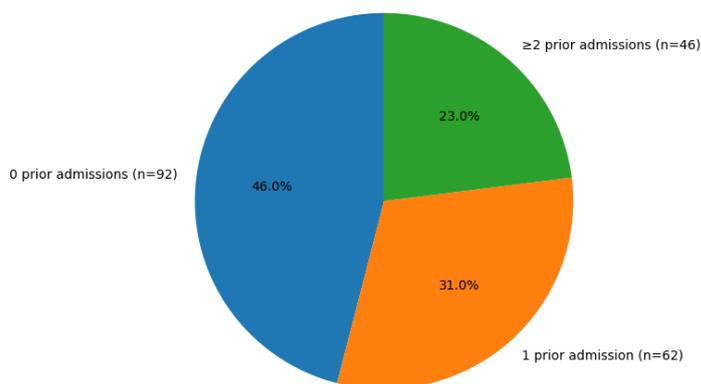

Figure 1. Distribution of Prior Acute Cholecystitis Admissions among Included Patients (N=200)

This value shows that over half of the cohort (54.0%) had a prior history of at least one prior admission with acute cholecystitis before the index laparoscopic cholecystectomy, indicating a high number of recurrence disease in the study cohort. Almost a quarter (23.0) were repeat admissions (two or more), which is a likely manifestation of cumulative inflammatory remodelling and adhesional disease. This dispensation upholds the clinical appropriateness of admission account as a utilitarian prephrasis mark of operative trouble.

Figure 2. Operative time by number of prior acute cholecystitis admissions (mean ± SD)

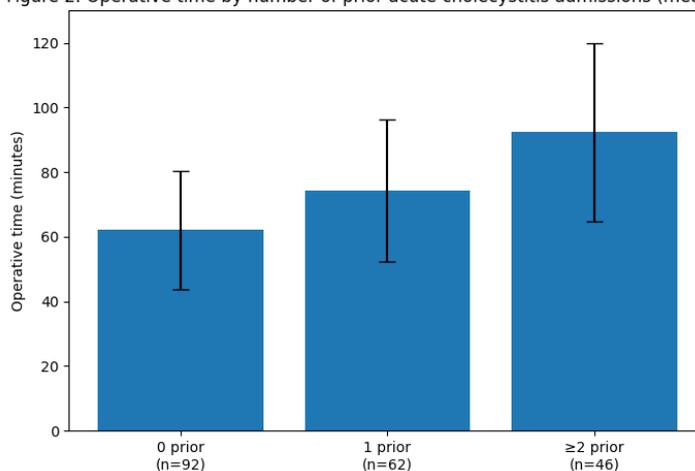
Figure 2. Operative Time by Number of Prior Acute Cholecystitis Admissions (Mean ± Sd)

The operational time rose in a gradual manner as strata based on admission history and indicates a dose response profile which is clinically compelling and statistically significant. The increased SD of the ≥2 group indicates disparity in operative complexity between recurrent presenters, which was rather expected given the presence of changeable adhesions or distorted anatomy and the necessity to use bail out measures in some cases. Operationally, these findings favour the application of admission history in predicting long-term cases, allocation of theaters, as well as the matching of complicated cases to elderly supervision.

DISCUSSION

We identified in this group of 200 patients in a retrospective cohort of laparoscopic cholecystectomy patients that the number of cholecystitis acute episodes were strong and independent predictors of both bile spillage and operative time. Although severity grade of TG18, duration of symptoms, and ultrasound indicators of inflammation were adjusted, with every further admission of the patients, an average of 10 minutes further operation time, and a significantly increased rate of bile spillage, were correlated. These data indicate that the cumulative cumulative inflammatory remodeling evident in these repeated

admissions might not be wholly recapitulated by severity grading during the initial presentation.

We have obtained findings that are consistent with guideline level appreciation that there is a continuum of inflammatory distortion of acute cholecystitis that straightforwardly affects the genre of operative safety measures and bailout values. TG18 underlines the severity assessment carried out by standardized means and safe laparoscopy procedures, suggesting that bailing out should be performed promptly when anatomy is not safe [3],[5]. Likewise, the 2020 update of WSES supports early cholecystectomy as the standard of care in case it is possible and subtotal cholecystectomy to be considered as an efficient alternative to standard care in challenging circumstances [2]. The graded changes in conversion and subtotal cholecystectomy reported in our ≥2-admission group are in line with such frameworks, which are indicative of the practical implementation of safety-first approaches.

The following relationship witnessed between repeated admissions and increased operative time is backed by the more comprehensive literature of timing-of-surgery. Randomized, meta-analytic studies have shown that early cholecystectomy is safe in a large patient population and prevents additional biliary occurrences more than their delayed counterparts [8], [9]. Though much of that literature concentrates on clinical outcomes, like length of stay and readmissions, it indirectly validates the idea that recurrent spurts in inflammatory processes may lead to operation fields that are more challenging. Moreover, the idea of operative difficulty scoring, some of them being intraoperative grading systems, highlights that adhesions, distension, and time to delimit ductal structures are major determinants of case complexity [10].

Bile spillage is a definite technical complication that brokered the difficulty experienced in the course of operation and the outcome. Previous analyses involving large series have reported Gallstone spillage rates at several percent and have pointed out that acute inflammation and the male sex are some of the risk factors of complications due to lost stones [6], [7]. Though the majority of spillage incidences are clinically silent, they may result in the development of an abscess or fistulas in a small proportion of patients, and may produce diagnostic pitfalls on subsequent imaging [6], [7], [11]. Our data go further and show that the spillage rate is significant with repeat

admissions, which most probably indicate repeated inflammatory injury and decreased strength of the gallbladder wall. Mechanically, the development of recurring inflammation can facilitate deposition of collagen and scarring of the cystic plate and triangle of Calot, whilst making the gallbladder wall fragile and thin thus becoming exposed to perforation during the process of traction, decompression, or splitting of the liver- bed.

Admission history is a good predictor due to its clinical appeal, which is readily available at the triage process, is not subject to special imaging interpretation and can influence scheduling and human resource allocation decisions. A patient who has had several previous admissions can perhaps get preferential theatric listing, early involvement of the consultant, and specific bailout planning (fundus-first, subtotal cholecystectomy, or conversion). These choices conform to the set safety standards that aim at minimizing significant biliary injury [4], [12]. In addition, counseling may be even more specific: recently-admitted patients can be advised about predisposition to longer surgery period, spillage, drain positioning, or conversion to be better prepared to set expectations.

Limitations
This is a retrospective study which was based on one center and this limits the ability to cause and generalize. The documentation bias might have influenced recording of bile spillage and it might have undervalued the record of our health system recording past admissions. Remaining confounding may exist especially on surgeon-wise threshold of decision-making and immeasurable technical factors (e.g., precise adhesion density). Lastly, events at the end of the operation were rather rare, so there was little power to find variation in uncommon events.

Research Implications
Multicenter studies in the future should justify the admission-history thresholds and they also should test whether adding recurrent admissions to the preoperative risk scores predicts the challenging cholecystectomy outcomes even better and they also should test whether addition of recurrent admissions leads to the optimization of the resource allocation without raising unnecessary cholecystectomies.

CONCLUSION
A history of recurrent acute cholecystitis admissions became a simple, strong predictor

of difficult operation in this retrospective cohort study that was done between December2022 to December 2025. Even after adjusting the severity of TG18 and ultrasound inflammatory responses, the results were increasing numbers of prior admissions associated with longer time of operation and significantly higher bile spillages in laparoscopic cholecystectomy. Admission history is easily available when presenting so it can be exploited with practical preoperative risk stratification, operative scheduling, patient counseling, and early engagement of more experienced surgical teams to make acute cholecystitis safer and more effectively handled.

REFERENCES

1. Okamoto, K., Suzuki, K., Takada, T., Strasberg, S. M., Asbun, H. J., Endo, I., *et al*. (2018). Tokyo Guidelines 2018: Flowchart for the management of acute cholecystitis. *Journal of Hepato-Biliary-Pancreatic Sciences, 25*(1), 55–72. https://doi.org/10.1002/jhbp.516

2. Pisano, M., Allievi, N., Gurusamy, K., Borzellino, G., Cimbanassi, S., Boerna, D., *et al*. (2020). 2020 World Society of Emergency Surgery updated guidelines for the diagnosis and treatment of acute calculus cholecystitis. *World Journal of Emergency Surgery, 15*, 61. https://doi.org/10.1186/s13017-020-00336-x

3. Wakabayashi, G., Iwashita, Y., Hibi, T., Takada, T., Strasberg, S. M., Asbun, H. J., *et al*. (2018). Tokyo Guidelines 2018: Surgical management of acute cholecystitis: Safe steps in laparoscopic cholecystectomy for acute cholecystitis. *Journal of Hepato-Biliary-Pancreatic Sciences, 25*, 73–86. https://doi.org/10.1002/jhbp.517

4. Strasberg, S. M., Hertl, M., & Soper, N. J. (1995). An analysis of the problem of biliary injury during laparoscopic cholecystectomy. *Journal of the American College of Surgeons, 180*(1), 101–125. (PubMed ID: 8000648).

5. Yokoe, M., Hata, J., Takada, T., Strasberg, S. M., Asbun, H. J., Wakabayashi, G., *et al*. (2018). Tokyo Guidelines 2018: Diagnostic criteria and severity grading of acute cholecystitis (with videos). *Journal of Hepato-Biliary-Pancreatic Sciences, 25*(1), 41–54. https://doi.org/10.1002/jhbp.515

6. Schäfer, M., Suter, C., Klaiber, C., Wehrli, H., Frei, E., & Krähenbühl, L. (1998). Spilled gallstones after laparoscopic cholecystectomy: A relevant problem? A retrospective analysis of 10,174 laparoscopic cholecystectomies. *Surgical Endoscopy, 12,* 305–309. https://doi.org/10.1007/s004649900659

7. Brockmann, J. G., Kocher, T., Senninger, N. J., & Schürmann, G. M. (2002). Complications due to gallstones lost during laparoscopic cholecystectomy. *Surgical Endoscopy, 16*, 1226–1232. https://doi.org/10.1007/s00464-001-9173-8

8. Gutt, C. N., Encke, J., Köninger, J., Harnoss, J.-C., Weigand, K., Kipfmüller, K., *et al*. (2013). Acute cholecystitis: Early versus delayed cholecystectomy, a multicenter randomized trial (ACDC Study, NCT00447304). *Annals of Surgery, 258*(3), 385-391. (PubMed ID: 24022431).

9. Cao, A. M., Eslick, G. D., Cox, M. R. (2015). Early cholecystectomy is superior to delayed cholecystectomy for acute cholecystitis: A meta-analysis. *British Journal of Surgery, 102*(11), 1302–1313. https://doi.org/10.1002/bjs.9874

10. Sugrue, M., Sahebally, S. M., Ansaloni, L., & Zielinski, M. D. (2015). Grading operative findings at laparoscopic cholecystectomy—A new scoring system. *World Journal of Emergency Surgery, 10*, 14. https://doi.org/10.1186/s13017-015-0005-x

11. Nayak, L., Menias, C. O., & Gayer, G. (2013). Dropped gallstones: Spectrum of imaging findings, complications and diagnostic pitfalls. *British Journal of Radiology, 86*(1028), 20120588.

12. Strasberg, S. M., Pucci, M. J., Brunt, L. M., & Deziel, D. J. (2016). Subtotal cholecystectomy—"Fenestrating" vs "reconstituting" subtypes and the prevention of bile duct injury: Definition of the optimal procedure in difficult operative conditions. *Journal of the American College of Surgeons, 222*(1), 89–96. (PubMed ID: 26521077).

13. Törnqvist, B., Waage, A., Zheng, Z., Ye, W., & Nilsson, M. (2016). Severity of acute cholecystitis and risk of iatrogenic bile duct injury during cholecystectomy: A population-based case-control study. *World Journal of Surgery, 40*(5), 1060–1067. https://doi.org/10.1007/s00268-015-3365-1

14. Gurusamy, K. S., Davidson, B. R., & Gluud, C. (2013). Early versus delayed laparoscopic cholecystectomy for people with acute cholecystitis. *Cochrane Database of Systematic Reviews*, CD005440. https://doi.org/10.1002/14651858.CD005440.pub3

15. Pisano, M., Allievi, N., Gurusamy, K., *et al*. (2020). (Guideline statement supporting early LC and bailout subtotal cholecystectomy). *World Journal of Emergency Surgery, 15*, 61. https://doi.org/10.1186/s13017-020-00336-x