



To Assess The Validity Of Parkland Grading System In Predicting Difficult Laparoscopic Cholecystectomy.

Dr. Byomkesh Patro^{1*}, Dr. Dhachinamoorthy S.², Dr. Lakshminarayanan Sadhasivan³, Dr. Bhanumathi Giridharan⁴

¹Associate Professor, Department of General Surgery, ESIC Medical College and Hospital, K. K. Nagar, Chennai, Tamil Nadu, India.

²Senior Resident, Department of General Surgery, ESIC Medical College and Hospital, K. K. Nagar, Chennai, Tamil Nadu, India.

³Assistant Professor, Department of General Surgery, ESIC Medical College and Hospital, K. K. Nagar, Chennai, Tamil Nadu, India.

⁴Professor, Department of General Surgery, ESIC Medical College and Hospital, K. K. Nagar, Chennai, Tamil Nadu, India.



Correspondence:

Dr. Byomkesh Patro,
Associate Professor,
Department of General
Surgery, ESIC Medical College
and Hospital, K.K.Nagar,
Chennai, Tamil Nadu, India.

Email:

byomkesh.patro@gmail.com

Received: 14-06-2026

Revised: 22-07-2026

Accepted: 10-08-2026

Published: 30-09-2026

Abstract

Background: The Parkland Grading System (PGS) grades gallbladder inflammation and anatomic difficulty at initial laparoscopic visualization. This study assessed its relationship with operative and postoperative outcomes. **Aim:** To assess the validity of the PGS in predicting difficult laparoscopic cholecystectomy. **Methods:** A prospective observational study included 105 consecutive patients aged 18-70 years undergoing laparoscopic cholecystectomy at ESIC Medical College and Hospital, Chennai. The surgeon recorded PGS grade before dissection. Grade-wise operative duration and hospital stay were compared using one-way ANOVA. Higher (Grades 4-5) versus lower (Grades 1-3) grades were compared for complications and conversion using two-sided Fisher exact tests. An independent binary reference standard for difficult surgery was not available. **Results:** There were 80 women (76.19%) and 25 men (23.81%). Parkland Grades 1-5 accounted for 18 (17.14%), 25 (23.81%), 35 (33.33%), 13 (12.38%), and 14 (13.33%) cases, respectively. Mean operative time was 68.12±18.40 minutes and differed across grades (F [4, 100] =51.77, p<0.001). Mean hospital stay was 4.65±1.86 days and also differed by grade (F [4, 100] =25.58, p<0.001). All six bile leaks and all six conversions occurred in Grades 4-5 (each 22.22% in Grades 4-5; p=0.0002). Two bile duct injuries occurred in Grades 4-5; the association was not significant by Fisher exact test (p=0.064). **Conclusion:** Higher PGS grades were associated with prolonged operative time, longer hospital stay, bile leak, and conversion. The dataset supports an association with difficulty-related outcomes but cannot establish diagnostic accuracy without an independent reference standard.

Keywords: Parkland Grading System; laparoscopic cholecystectomy; operative difficulty.



This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Laparoscopic cholecystectomy is the standard surgical treatment for symptomatic gallstone disease and acute calculous cholecystitis. Although most procedures are completed safely, inflammation, fibrosis, adhesions, a contracted or distended gallbladder, and distorted biliary anatomy can make dissection difficult. These features may lengthen operating time, impair achievement of the critical view of safety, necessitate a bailout procedure or conversion to open surgery, and increase the risk of bile duct injury or postoperative bile leakage. Anticipating complexity helps the surgical team plan operating time, ensure appropriate senior support, counsel patients, and adopt a safe alternative when anatomy cannot be defined.^[1,2]

Difficulty is not a single outcome. Research has used operative duration, surgeon-rated difficulty, blood loss, failure to obtain the critical view of safety, subtotal cholecystectomy, conversion, and complications as indicators. Preoperative scores may aid scheduling and preparation, but they estimate the disease before direct visualization and can be limited by incomplete history or imaging. The Parkland Grading System (PGS) was developed as a five-grade intraoperative scale based on the initial appearance of the gallbladder, surrounding adhesions, inflammation, and anatomic distortion. Its practical advantage is that it can be applied after initial exposure and before dissection, creating a structured description of operative severity.^[3,4]

Published validation studies have reported associations between increasing PGS grade and longer operations, more difficult dissection, higher conversion or subtotal cholecystectomy rates, and postoperative morbidity. The scale may therefore support real-time communication, operative planning, training, and audit. However, a significant association does not by itself establish diagnostic accuracy. A validation study also requires a clearly specified independent reference definition of difficult surgery, adequate numbers of outcome events, and preferably assessment of interobserver agreement and

discrimination. Rare events such as bile duct injury require particular caution because estimates from small cohorts are imprecise.^[5]

This study evaluated intraoperative Parkland grades in patients undergoing laparoscopic cholecystectomy and examined their relationship with operative time, length of hospital stay, conversion to open surgery, bile duct injury, and bile leak. These outcomes provide complementary evidence about technical and postoperative complexity. The results are interpreted as associations with observable difficulty-related outcomes; the source dataset did not provide a separately adjudicated binary difficulty endpoint from which sensitivity, specificity, or an area under the receiver-operating-characteristic curve could be calculated. A transparent appraisal of this distinction is necessary when judging the validity of the system.

AIM

To assess the validity of the Parkland Grading System in predicting difficult laparoscopic cholecystectomy and its association with intraoperative and postoperative outcomes.

OBJECTIVES

- To describe the distribution of Parkland grades and the demographic profile of patients undergoing laparoscopic cholecystectomy.
- To assess the association of Parkland grades with conversion to open surgery, common bile duct injury, and postoperative bile leak.
- To compare operative duration and postoperative length of hospital stay across Parkland grades.

MATERIALS AND METHODS

Source of data

Data were obtained from consecutive eligible patients undergoing laparoscopic cholecystectomy in the Department of General Surgery at ESIC Medical College and Hospital. The manuscript was prepared from the supplied dissertation dataset and reported analyses.

Study design

The study was described in the dissertation as a prospective longitudinal observational study. Parkland grade was recorded intraoperatively, and operative and in-hospital postoperative outcomes were followed and documented without altering routine clinical care.

Study location

The study was conducted in the Department of General Surgery, ESIC Medical College and PGIMSR, K.K. Nagar, Chennai, India.

Study duration

The study was conducted over 18 months. Exact start and end dates were not specified in the dissertation text available for manuscript preparation.

Sample size

A total of 105 patients were included in the completed cohort. The dissertation did not provide the assumptions used for its sample-size calculation. For a transparent manuscript-format estimate, the single-proportion formula is shown below using an assumed prevalence of 50%, 95% confidence, and 9.6% absolute precision:

$$n = Z^2_{1-\alpha/2} \times p \times q / d^2 = (1.96)^2 \times 0.50 \times 0.50 / (0.096)^2 = 104.2 \approx 105 \text{ patients}$$

The prevalence and precision values above are reconstructed assumptions to display the calculation and were not reported in the source dissertation. They must be checked against the approved protocol before submission.

Inclusion criteria

- Patients of either sex aged 18-70 years.
- Patients diagnosed with acute cholecystitis of less than 72 hours' duration or chronic calculous cholecystitis.
- Patients scheduled for elective or emergency laparoscopic cholecystectomy.

Exclusion criteria

- Patients with ongoing cholangitis or gallstone pancreatitis.
- Patients with suspected or confirmed gallbladder malignancy.
- Cases converted to open surgery for instrumental or technical problems unrelated to operative difficulty.

Procedure and methodology

Eligible patients were enrolled consecutively after informed consent. Standard laparoscopic cholecystectomy was performed by the surgical team according to institutional practice. Following port placement and initial exposure, the gallbladder was assessed before dissection. The operating surgeon assigned a Parkland grade from 1 to 5 on the basis of the visible gallbladder appearance, inflammation, adhesions, and distortion of anatomy, and recorded the grade on the study proforma. Operative difficulty-related events were then recorded, including operative duration, conversion to open surgery, and intraoperative bile duct injury. Postoperative bile leak and length of hospital stay were abstracted from clinical records and monitored during admission. The dissertation did not document a separate blinded or independently adjudicated binary definition of difficult surgery.

Sample processing

No biological specimens were collected or processed for this study. The study material consisted of operative observations, surgical records, and postoperative clinical data. Patient identifiers were removed from the analytic dataset; data were checked for completeness and consistency before analysis.

Statistical methods

Categorical variables were summarized as frequency and percentage, with 95% confidence intervals for proportions where relevant. Continuous variables were summarized as mean and standard deviation. Grade-wise operative time and length of stay were compared using one-way analysis of variance (ANOVA); the F statistics were recalculated from the grade-specific sample sizes, means, and standard deviations reported in the dissertation. For rare binary outcomes, comparisons between lower grades (Parkland 1-3) and higher grades (Parkland 4-5) used two-sided Fisher exact tests rather than relying on asymptotic chi-square tests. The association between sex and Parkland grade was assessed by the Pearson chi-square test. A two-sided p value <0.05 was considered statistically significant. Because the source data lacked an independent binary reference standard for difficulty, sensitivity, specificity, predictive values, and ROC/AUC were not calculated. Statistical software version was not specified in the source.

Data collection

Data were collected prospectively on a standardized proforma and included age and sex, clinical diagnosis, Parkland grade, operative details, conversion, complications, operative time, and postoperative hospital stay. Operative and discharge records were used to verify duration and length of stay. Data were entered into a spreadsheet, anonymized, and analyzed as described above.

RESULTS

The cohort included 105 patients. Results below reproduce the reported cohort counts and grade-specific summary statistics, with confidence intervals and sparse-outcome tests recalculated from the available data. Values are descriptive of this cohort and should be checked against the original master chart before journal submission.

Table 1: Demographic profile and Parkland grade distribution (N=105)

Characteristic	n (%)	95% CI (%)	Test statistic	p value
Female sex	80 (76.19)	67.21-83.32		
Male sex	25 (23.81)	16.68-32.79		
Parkland grade 1	18 (17.14)	11.13-25.48	$\chi^2(4)=8.74^*$	0.068
Parkland grade 2	25 (23.81)	16.68-32.79		
Parkland grade 3	35 (33.33)	25.05-42.80		
Parkland grade 4	13 (12.38)	7.38-20.04		
Parkland grade 5	14 (13.33)	8.11-21.14		
Sex by Parkland grade			$\chi^2(4)=8.74$	0.068

Women accounted for 80 of 105 participants (76.19%; 95% CI 67.21-83.32). Grade 3 was the most common Parkland category (35/105, 33.33%; 95% CI 25.05-42.80), while Grade 4 was least common (13/105, 12.38%). The distribution of grades did not differ significantly by sex (Pearson $\chi^2=8.74$, df=4, p=0.068). The age summary was not available in the dissertation results table and is therefore not supplied here.

Table 2: Bile duct injury, bile leak, and conversion by lower versus higher Parkland grade

Outcome	Grades 1-3 n/N (%) (95% CI)	Grades 4-5 n/N (%) (95% CI)	Overall n/N (%) (95% CI)	Test	p value
Common bile duct injury	0/78 (0.0; 0.0-4.7)	2/27 (7.4; 2.1-23.4)	2/105 (1.9; 0.5-6.7)	Fisher exact	0.064

Postoperative bile leak	0/78 (0.0; 0.0-4.7)	6/27 (22.2; 10.6-40.8)	6/105 (5.7; 2.6-11.9)	Fisher exact	0.0002
Conversion to open surgery	0/78 (0.0; 0.0-4.7)	6/27 (22.2; 10.6-40.8)	6/105 (5.7; 2.6-11.9)	Fisher exact	0.0002

Bile duct injury occurred in two patients, both in Grades 4-5; the high-grade rate was 7.41% (2/27), compared with 0% in Grades 1-3. This difference was not statistically significant by the two-sided Fisher exact test ($p=0.064$), reflecting the very small number of events. Bile leak and open conversion each occurred in six patients (5.71% overall; 95% CI 2.64-11.91), all in Grades 4-5, with significant associations with higher grades (Fisher exact $p=0.0002$ for each). The dissertation had reported much smaller p values for duct injury; those were not supported by the two-by-two counts and were not retained.

Table 3: Operative duration by Parkland grade

Parkland grade	n	Operative time, min, mean (SD)	95% CI of mean (min)
Grade 1	18	43.22 (6.60)	39.94-46.50
Grade 2	25	59.04 (4.25)	57.29-60.79
Grade 3	35	72.80 (5.14)	71.03-74.57
Grade 4	13	88.46 (5.13)	85.36-91.56
Grade 5	14	85.79 (26.42)	70.54-101.04
Overall	105	68.12 (18.40)	64.57-71.67

Mean operative duration was 68.12 ± 18.40 minutes overall. The grade-specific mean increased from 43.22 minutes in Grade 1 to 88.46 minutes in Grade 4; Grade 5 had a mean of 85.79 minutes with wider variability. ANOVA showed a difference in mean operative time across grades ($F[4,100]=51.77$, $p<0.001$). The Grade 5 confidence interval was wide because the standard deviation was high relative to its sample size.

Table 4: Postoperative length of hospital stay by Parkland grade

Parkland grade	n	Hospital stay, days, mean (SD)	95% CI of mean (days)
Grade 1	18	3.83 (0.99)	3.34-4.32
Grade 2	25	3.92 (1.12)	3.46-4.38
Grade 3	35	3.97 (0.95)	3.64-4.30
Grade 4	13	7.69 (1.25)	6.93-8.45
Grade 5	14	5.86 (2.51)	4.41-7.31
Overall	105	4.65 (1.86)	4.29-5.01

Mean hospital stay was 4.65 ± 1.86 days overall. Mean stay was approximately four days in Grades 1-3, increased to 7.69 days in Grade 4, and was 5.86 days in Grade 5. The difference across the five groups was statistically significant ($F[4,100]=25.58$, $p<0.001$). The non-monotonic Grade 4 and Grade 5 pattern indicates that the association should not be described as a strictly linear increase.

DISCUSSION

This cohort showed a clear relationship between higher Parkland grades and several indicators of operative complexity. The grade distribution covered all five categories, with Grade 3 most frequent. Higher grades (4-5) contained all recorded bile leaks and conversions, and operative duration and length of stay differed significantly across grades. The evidence supports an association between intraoperative gallbladder severity and difficult outcomes in this cohort. It does not establish diagnostic accuracy against a prespecified independent reference definition of “difficult laparoscopic cholecystectomy.”

The original Parkland scale was developed to standardize intraoperative description of gallbladder inflammation and anatomy. Madni et al. reported good agreement among raters in the scale’s development work, and their prospective validation found increasing grade associated with operative difficulty, longer operation, bile leak, and open or partial cholecystectomy^[5,7]. Lee et al. also found that higher grades were associated with more severe acute cholecystitis and greater operative difficulty^[8]. Those findings are directionally consistent with the longer operative times observed as grades increased in this series. Liu et al. later evaluated the scale against an operative difficulty score in 261 cases and reported a positive correlation between PGS and difficulty scores (Spearman $r=0.681$, $p<0.001$)^[19].

The present grade-wise operative-time pattern was largely increasing through Grade 4, while Grade 5 had a similar mean and substantially greater variability. The prospective Nepal validation by Shrestha et al. likewise reported associations between increasing Parkland grade, operative difficulty, conversion, operative duration, and postoperative stay^[18]. A separate 105-patient report by Arguello et al. described conversion and subtotal procedures as grade-related indicators, while acknowledging the need for larger studies and consideration of surgeon experience^[17]. These studies support

reporting operative time and conversion alongside the grade, but differences in case mix, grade distribution, and definitions of difficulty limit direct comparison of absolute rates.

All six bile leaks and all six conversions in the current cohort occurred among Grades 4-5. This concentration is clinically plausible because severe inflammation, adhesions, and distorted anatomy can complicate safe dissection and secure closure. The prospective Parkland validation also observed higher bile-leak and open/partial cholecystectomy rates at higher grades [7]. The 2023 Nepal study documented a 5.8% conversion rate and similar grade-outcome relationships [18]. In this dataset, however, six events per outcome provide imprecise risk estimates, and an association does not show that assigning the grade itself prevents a complication. Safety decisions must continue to follow the critical-view-of-safety principles and use bailout approaches when anatomy remains unclear [4,6,22].

Bile duct injury was uncommon, with two events. Although both occurred in Grades 4-5, Fisher's exact test did not show a statistically significant association ($p=0.064$). This is a correction of the dissertation's reported $p<0.0001$, which is incompatible with the available cell counts and is likely an artifact of applying an asymptotic test to sparse data. No conclusion that the PGS predicts bile duct injury should be drawn from two cases. Larger prospective cohorts and pooled data are needed to estimate this rare outcome reliably.

The length-of-stay results differed significantly across grades, particularly because Grade 4 had a longer mean stay than Grades 1-3. This is consistent with broader work showing that operative difficulty grades correlate with postoperative outcomes. Griffiths et al. found that a validated Nassar difficulty scale was associated with conversion, length of stay, complications, and reintervention in large cohorts [10]. This is a related but distinct intraoperative grading framework, illustrating the wider value of standardized operative descriptions. At the same time, length of stay is affected by discharge practice, comorbidity, and postoperative events; it should not be treated as a pure measure of technical difficulty.

Evidence about interobserver reliability requires consideration. Madni et al. reported strong reliability in their prospective validation [7], whereas Maldonado-Calderón et al. found low concordance among observers using the Parkland scale, underscoring the potential influence of interpretation and experience [20]. The source cohort did not retain independent second ratings or report a kappa/ICC statistic, so reproducibility could not be examined. Training, calibration with reference images, and recording the grade before dissection may improve consistency in routine use.

The Parkland system is an intraoperative grading tool, whereas preoperative scores are intended to support planning before surgery. Nassar et al. developed and externally validated a preoperative risk score using a large multicenter operative difficulty dataset [11]. Di Buono et al. and Tufo et al. reviewed clinical, laboratory, and imaging predictors, noting that preoperative prediction remains challenging and that factors beyond operative appearance influence risk [12,13]. Uçaner et al. examined the relationship between preoperative ultrasonography and Parkland grade, while Liu et al. and Shrestha et al. assessed intraoperative validity using surgical difficulty outcomes [18,19,21]. Thus PGS is best viewed as a real-time adjunct that complements preoperative assessment, not as a substitute for it.

A key methodological issue is the absence of an explicit reference standard for the primary construct. Operative time, conversion, bile leak, duct injury, and length of stay are important but are not interchangeable definitions of difficulty. Reliable diagnostic validity requires an independently recorded endpoint such as a validated operative difficulty score or blinded surgeon rating, with a prespecified threshold. Because that endpoint was unavailable in the source dataset, this manuscript reports associations and cannot provide sensitivity, specificity, predictive values, or ROC area. Future multicenter studies should prospectively define the endpoint, measure interobserver agreement, adjust for acute versus chronic disease and surgeon experience, and include enough patients to evaluate uncommon complications.

CONCLUSION

In this 105-patient cohort, higher Parkland grades were associated with longer operative duration and longer postoperative hospital stay. Bile leaks and conversions occurred only in Grades 4-5. The two bile duct injuries were also confined to higher grades, but the difference was not statistically significant with an exact test. These findings support the use of Parkland grading to describe intraoperative severity and identify cases that may require additional planning. Because an independent reference standard for difficult surgery was not recorded, diagnostic accuracy of the system could not be established from this dataset.

LIMITATIONS

- The study was conducted at a single center and included 105 patients, limiting generalizability and precision, especially for rare outcomes such as bile duct injury.
- The source dissertation did not report the assumptions for sample-size calculation; the calculation shown in this manuscript is a reconstructed illustrative estimate and must be checked against the approved protocol.

- Difficult laparoscopic cholecystectomy was not defined using a separate, prespecified, independently adjudicated reference standard. Sensitivity, specificity, predictive values, and ROC/AUC therefore could not be estimated.
- Parkland grading was assigned by the operating surgeon, and the study did not report blinded duplicate grading, interobserver agreement, or formal calibration.
- Potential confounding by surgeon experience, acute versus chronic disease, comorbidities, and other patient factors was not adjusted for in the reported analyses.
- The thesis contains inconsistencies in some percentages and sparse-event p values. Counts were prioritized, percentages were recalculated, and exact tests were used for rare binary outcomes; the original master chart should be checked before submission.
- Postoperative outcomes were captured during the hospital stay; a defined 30-day follow-up and late complication ascertainment were not documented.

REFERENCES

1. Sugrue M, Sahebally SM, Ansaloni L, Zielinski MD. Grading operative findings at laparoscopic cholecystectomy - a new scoring system. *World J Emerg Surg.* 2015;10:14. doi:10.1186/s13017-015-0005-x.
2. Ambe PC, Papadakis M, Zirngibl H. A proposal for a preoperative clinical scoring system for acute cholecystitis. *J Surg Res.* 2016;200(2):473-479. doi:10.1016/j.jss.2015.09.010.
3. Ansaloni L, Pisano M, Coccolini F, Peitzmann AB, Fingerhut A, Catena F, et al. 2016 WSES guidelines on acute calculous cholecystitis. *World J Emerg Surg.* 2016;11:25. doi:10.1186/s13017-016-0082-5.
4. Strasberg SM, Pucci MJ, Brunt LM, Deziel DJ. Subtotal cholecystectomy-“fenestrating” vs “reconstituting” subtypes and the prevention of bile duct injury: definition of the optimal procedure in difficult operative conditions. *J Am Coll Surg.* 2016;222(1):89-96.
5. Madni TD, Leshikar DE, Minshall CT, et al. The Parkland grading scale for cholecystitis. *Am J Surg.* 2018;215(4):625-630. doi:10.1016/j.amjsurg.2017.05.017.
6. Wakabayashi G, Iwashita Y, Hibi T, et al. Tokyo Guidelines 2018: surgical management of acute cholecystitis: safe steps in laparoscopic cholecystectomy for acute cholecystitis (with videos). *J Hepatobiliary Pancreat Sci.* 2018;25(1):73-86.
7. Madni TD, Nakonezny PA, Barrios E, Imran JB, Clark AT, Taveras L, et al. Prospective validation of the Parkland Grading Scale for Cholecystitis. *Am J Surg.* 2019;217(1):90-97. doi:10.1016/j.amjsurg.2018.08.005.
8. Lee W, Jang JY, Cho JK, Hong SC, Jeong CY. Does surgical difficulty relate to severity of acute cholecystitis? Validation of the Parkland grading scale based on intraoperative findings. *Am J Surg.* 2020;219(4):637-641. doi:10.1016/j.amjsurg.2018.12.005.
9. Baral S, Chhetri RK, Thapa N. Utilization of an intraoperative grading scale in laparoscopic cholecystectomy: a Nepalese perspective. *Gastroenterol Res Pract.* 2020;2020:8954572.
10. Griffiths EA, Hodson J, Vohra RS, Marriott P, Katbeh T, Zino S, et al. Utilisation of an operative difficulty grading scale for laparoscopic cholecystectomy. *Surg Endosc.* 2019;33:110-121. doi:10.1007/s00464-018-6281-2.
11. Nassar AHM, Hodson J, Ng HJ, Vohra RS, Katbeh T, Zino S, et al. Predicting the difficult laparoscopic cholecystectomy: development and validation of a pre-operative risk score using an objective operative difficulty grading system. *Surg Endosc.* 2020;34(10):4549-4561. doi:10.1007/s00464-019-07244-5.
12. Di Buono G, Romano G, Galia M, Amato G, Maienza E, Vernuccio F, et al. Difficult laparoscopic cholecystectomy and preoperative predictive factors. *Sci Rep.* 2021;11:2559. doi:10.1038/s41598-021-81938-6.
13. Tufo A, Pisano M, Ansaloni L, de Reuver P, van Laarhoven K, Davidson B, et al. Risk prediction in acute calculous cholecystitis: a systematic review and meta-analysis of prognostic factors and predictive models. *J Laparoendosc Adv Surg Tech A.* 2021;31(1):41-53. doi:10.1089/lap.2020.0151.
14. Khan SM, Emile SH, Barsom SH, Naqvi SAA, Khan MS. Accuracy of pre-operative parameters in predicting severe cholecystitis: a systematic review. *Surgeon.* 2021;19(4):219-225.
15. Lucocq J, Scollay J, Patil P. Elective laparoscopic cholecystectomy: recurrent biliary admissions predispose to difficult cholecystectomy. *Surg Endosc.* 2022;36:6403-6409. doi:10.1007/s00464-021-08986-x.
16. Arguello GG, Beltran JB, Cruz IH, Flores JS, Romero A, García B, et al. Is the Parkland grading scale related to surgical difficulty in laparoscopic cholecystectomy? *Int J Res Med Sci.* 2022;10(11):2371-2375. doi:10.18203/2320-6012.ijrms2022831.
17. Shrestha A, Bhattarai A, Tamrakar KK, Neupane HC, et al. Utility of the Parkland Grading Scale to determine intraoperative challenges during laparoscopic cholecystectomy: a validation study on 206 patients at an academic medical center in Nepal. *Patient Saf Surg.* 2023;17:15. doi:10.1186/s13037-023-00364-x.
18. Liu Y, Wang C, Cai X, Bi J. Can the Parkland Grading Scale predict the difficulty of laparoscopic cholecystectomy? A new approach to validation. *BMC Surg.* 2023;23:142. doi:10.1186/s12893-023-02036-0.

19. Uçaner B, Durmuş D, Buldanlı MZ, Hançerlioğulları O. Correlation between preoperative ultrasonography and Parkland Grading Scale in patients undergoing laparoscopic cholecystectomy. *Indian J Surg.* 2024;86(1):160-166. doi:10.1007/s12262-023-03823-y.
20. Maldonado-Calderón JL, Nava-Rivera LE, Urbina-Zeglen A, Herrera-Santos MV, Carranza-Rosales P, Morán-Martínez J, et al. Interobserver variation in the Parkland scale. Are we seeing the same thing? *Cir Cir.* 2024;92(6):709-714. doi:10.24875/CIRUE.M23000794.
21. Taveras L, Scrushy M, Cripps M, Kuhlenschmidt K, Crandall M, Puri R, et al. From mild to gangrenous cholecystitis, laparoscopic cholecystectomy is safe 24 hours a day. *Am J Surg.* 2023;226(1):83-86. doi:10.1016/j.amjsurg.2023.01.029.
22. Brunt LM, Deziel DJ, Telem DA, Strasberg SM, Aggarwal R, Asbun H, et al. Safe cholecystectomy multi-society practice guideline and state of the art consensus conference on prevention of bile duct injury during cholecystectomy. *Ann Surg.* 2020;272(1):3-23.