

Parkland Grading Scale: Predictive Accuracy for Outcome Prediction in Gallbladder Surgery

Jaimini Jayswal¹, Rahul Khokhar², Manish Bhatiya³, Mithilesh Vrujlal Rathod⁴

¹M.S (General Surgery), Department of Surgery, Vadodara, Gujarat, India.

²Assistant Professor, Department of General Surgery, Dr N D Desai Faculty of Medical Science and Research, Nadiad, Gujarat, India

³Assistant Professor, Department of General Surgery, GMERS Medical College, Morbi, Gujarat, India

⁴Assistant Professor, Department of General Surgery, Shantaba Medical College and General Hospital, Amreli, Gujarat, India

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Corresponding Author: Dr. Mithilesh Vrujlal Rathod

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Abstract:

Background: Laparoscopic Cholecystectomy (LC) has become the preferred approach for treating symptomatic gallstone disease. Numerous preoperative cholecystitis grading systems have been created to predict both intraoperative and postoperative outcomes; however, only a few of these systems address anatomical variations encountered during surgery. Furthermore, aside from identifying challenging cases, few of these grading scales have been utilized for comparing postoperative complications. To address these limitations, the Parkland Grading Scale for Cholecystitis (PGS) was developed to assess the severity of gallbladder (GB) disease. This study aims to prospectively validate the PGS as a tool for predicting LC outcomes.

Materials and Methods: The study involved 156 patients undergoing laparoscopic cholecystectomy. The initial grade was determined solely based on the objective criteria outlined in the PGS and was assigned immediately after the initial view was observed. 5 independent surgeon raters, who were not involved in the original study, retrospectively reviewed the stored images from the study period. The cases were randomly assigned in equal numbers to each rater, who then evaluated the images using the PGS.

Results: The average age of the patients in this study was 47.56 ± 17.54 years. The association between complications and PGS grades was not statistically significant. The majority of patients (67.31%) were classified under Grade 1, indicating relatively easier procedures. Grade 2 followed at 17.31%, reflecting moderate complexity. Grades 3, 4, and 5, indicating increasing levels of surgical difficulty, had lower frequencies, with Grade 3 at 7.69%, and Grades 4 and 5 at 3.85% each. The mean surgical difficulty scores were 1.25 ± 0.34 for PGS Grade 1, 1.80 ± 0.77 for PGS Grade 2, 3.38 ± 0.69 for PGS Grade 3, 4.75 ± 0.74 for PGS Grade 4, and 5 ± 0.00 for PGS Grade 5.

Conclusion: The Parkland Grading Scale is a reliable tool for assessing the difficulty of laparoscopic cholecystectomy and predicting both intraoperative and postoperative complications. This scale provides a practical method for evaluating gallbladder diseases, which can assist in predicting LC outcomes, guiding case allocation based on surgical difficulty, and determining the need for conversion to open surgery.

Keywords: Parkland Grading Scale, Laparoscopic Cholecystectomy, Gall bladder.

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Introduction

Laparoscopic Cholecystectomy (LC) has emerged as the preferred approach for treating symptomatic gallstone disease since its introduction by P. Mouret in 1987. Today, LC is one of the most frequently performed procedures by general surgeons globally. Its benefits include reduced postoperative pain, shorter ileus, quicker resumption of oral intake, faster recovery to normal activities, and improved cosmetic outcomes. However, due to the technical complexity of LC, complications can arise, particularly in challenging cases. As such, the development of a preoperative

predictive scale to assess gallbladder disease and inform management strategies is of significant importance [1, 2]. Several preoperative grading systems for cholecystitis have been proposed over the years to predict both intraoperative and postoperative outcomes. However, few of these systems consider intraoperative anatomical variations. Moreover, aside from identifying challenging cases, only a limited number of these grading systems are designed to compare postoperative complications. Ultimately, the complexity and difficulty in remembering these

scales, coupled with their inability to effectively compare outcomes, have hindered their widespread use in clinical practice. To date, no validated grading systems are commonly employed to assess the intraoperative severity of gallbladder inflammation [1,2]. In response to these limitations, the Parkland Grading Scale for Cholecystitis (PGS) was developed to classify the severity of gallbladder disease. This simple, five-level system incorporates anatomical and inflammatory changes and has demonstrated high reproducibility, with an Intra-class Correlation Coefficient (ICC) of 0.804, indicating its reliability [3-6]. This study aims to prospectively validate the PGS as an effective tool for predicting outcomes of LC.

Material and Methods

The primary objective of this study was to prospectively validate the use of the grading scale in predicting outcomes of LC. A total of 156 LC cases were included in the study, with prior informed consent obtained from all participants. Preoperative assessments were performed, including routine blood tests such as complete blood count, differential leukocyte count, PT/INR, blood chemistry (glucose, urea, creatinine, electrolytes, bilirubin), as well as liver function tests (SGOT, SGPT, alkaline phosphatase, amylase, lipase). All patients received standardized general anesthesia. A standardized four-port laparoscopic

cholecystectomy was performed by experienced surgeons. Following the insertion of the first 10-mm trocar, a general abdominal exploration was conducted using a laparoscope. The initial view of the gallbladder was captured once visualized. The operating surgeon then self-assigned a grade to the initial view based on the objective criteria of the grading scale. Subsequently, 5 independent surgeons, who were not involved in the original study, retrospectively reviewed the stored images of the initial view. The cases were randomly assigned in equal numbers to each rater, and each independent rater applied the Parkland Grading Scale to evaluate the images.

Results

Table 1 presents the distribution of intra-operative grades according to the PGS for LC patients. The majority of patients (67.31%) were classified under Grade 1, indicating relatively easier procedures. Grade 2 followed at 17.31%, reflecting moderate complexity. Grades 3, 4, and 5, indicating increasing levels of surgical difficulty, had lower frequencies, with Grade 3 at 7.69%, and Grades 4 and 5 at 3.85% each. This suggests that the cohort predominantly consisted of patients undergoing procedures with lower surgical complexity. The average age of the patients in this study was 47.56 ± 17.54 years.

Table 1: Intra-Operative Grades as per PGS in LC patients

Grade	n	%
1	105	67.31
2	27	17.31
3	12	7.69
4	6	3.85
5	6	3.85
Total	156	100.00

Table 2 compares intra- and post-operative findings across different PSG grades. The majority of patients in Grade 1 (53.85%) had symptomatic cholelithiasis.

A sharp decrease in the proportion of patients with symptomatic cholelithiasis was seen in Grades 2–5, with only 1.28% of Grade 5 patients exhibiting this condition. The P value (<0.05) indicates a statistically significant association between the severity of symptoms and the grade. The frequency of acute cholecystitis decreased with higher grades. This finding may suggest a lower incidence of acute cases in more difficult surgeries. Chronic

cholecystitis was fairly evenly distributed across all grades. This indicates that chronic cholecystitis does not correlate strongly with surgical difficulty. Only Grade 5 patients had a post-operative bile duct leak or wound infection (1.28%), with no such occurrences in the lower grades.

This suggests a possible correlation between higher surgical grades and post-operative complications, though the P value indicates no statistical significance. No cases of post-operative stone retention were reported, regardless of surgical grade.

Table 2: Intra and post-operative findings across PSG grades

Diagnosis	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	P Value
Symptomatic cholelithiasis	84 (53.85)	14 (8.97)	5 (3.21)	3 (1.92)	2 (1.28)	<0.05
Acute cholecystitis	11 (7.05)	5 (3.21)	3 (1.92)	2 (1.28)	0 (0.00)	
Chronic cholecystitis	9 (5.77)	8 (5.13)	5 (3.21)	2 (1.28)	5 (3.21)	

Post-op bile duct leakaged	0	0	0	0	2 (1.28)	0.87
Post-op wound infection	0	0	0	0	2 (1.28)	
Post-op stone retention	0	0	0	0	0	

Table 3 evaluates the difficulty level of surgeries across the various PSG grades. The distribution across difficulty levels is more spread out, with 12 patients in Difficulty 1 and 12 in Difficulty 2. The

significant P value (<0.01) indicates a strong correlation between PSG grade and the surgical difficulty, with higher grades being associated with more complex procedures.

Table 3: Difficulty of surgery across PSG grades

Difficulty	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	P Value
1	92	12	0	0	0	<0.01
2	12	12	5	0	0	
3	2	0	8	5	0	
4	0	0	0	2	2	
5	0	0	0	0	5	

Discussion

Gallstones represent the most prevalent biliary disorder and are a significant cause of Acute Cholecystitis. They affect approximately 10-15% of the population, with the majority of individuals being symptomatic (over 80%). However, only 20-30% of individuals will experience symptoms within 20 years. The occurrence of gallstones is influenced by factors such as age, gender, and ethnicity, with the prevalence varying widely across different regions. Women are three times more likely to develop gallstones, and first-degree relatives of individuals with gallstones have a two-fold higher prevalence [7-9].

While medical management is typically reserved for acute cases presenting within 48-72 hours, surgical intervention remains the primary treatment, particularly for recurrent or chronic cholecystitis. To perform a cholecystectomy, whether for symptomatic or asymptomatic patients, a thorough evaluation using clinical, biochemical, and radiological parameters is essential. LC has become one of the most common procedures conducted by general surgeons, preferred over the open technique. LC can be performed with a basic laparoscopic setup and limited resources, and its faster learning curve has contributed to a shift in the management of gallbladder disease. However, not all cholecystectomies are straightforward. Increased inflammation can result in longer operative times, higher conversion rates, and a greater risk of intra- and postoperative complications. Identifying factors that predict difficult laparoscopic cholecystectomy is crucial. An effective grading system is needed to stratify the severity of gallbladder disease, aiding in decision-making and predicting intra- and postoperative outcomes [10-13].

In a study involving 17 patients with intraoperative bile spillage, Grade 1 gallbladder disease (GB) accounted for 8 (11.94%) cases, Grade 2 GB for 3

(21.42%) cases, Grade 3 GB for 1 (12.5%) case, Grade 4 GB for 1 (25%) case, and Grade 5 GB for 4 (100%) cases. Among the Grade 5 cases, one patient experienced a postoperative bile leak and another had a postoperative wound infection. The association between complications and PGS grades was not statistically significant (p-value = 0.9). In our study, Grade 1 GB was assigned a score of 1 in 59 (88.05%) cases and a score of 2 in 8 (11.94%) cases. Grade 2 GB received a score of 1 in 8 (47.05%) cases, a score of 2 in 8 (47.05%) cases, and a score of 3 in 1 (5.9%) case [3].

Following the introduction of the Parkland Grading Scale (PGS), Madni et al. [1] validated the scale as a reliable predictor of LC outcomes, facilitating a simpler and more accurate means of comparing outcomes. This five-tiered system was found to significantly correlate with both postoperative outcomes, such as biliary leak rates, and perioperative factors like open conversion rates, operation duration, and case difficulty. The study also found an Intra-class Correlation Coefficient (ICC) of 0.82 between prospective graders and retrospective reviewers, confirming the scale's reliability when applied intraoperatively. Overall, these findings highlight the potential utility of the PGS as an easy-to-use system for comparing outcomes that can be calculated quickly and reliably during the procedure.

A prospective study by Razack GS et al. validated the PGS in assessing both operative and postoperative complications of LC. A total of 110 cases were evaluated, and the PGS was applied intraoperatively to assess gallbladder status. The study concluded that the PGS is a highly reliable and simple intraoperative scale that accurately predicts difficult LCs and their outcomes, with higher grades correlating with more severe disease, greater surgical difficulty, and worse outcomes [14].

In our study, all Grade 5 GB cases received a score of 5 for surgical difficulty. The mean surgical difficulty scores were 1.25 ± 0.34 for PGS Grade 1, 1.80 ± 0.77 for PGS Grade 2, 3.38 ± 0.69 for PGS Grade 3, 4.75 ± 0.74 for PGS Grade 4, and 5 ± 0.00 for PGS Grade 5. One-way ANOVA analysis revealed strong statistical significance in surgical difficulty scores across the PGS grades. A study by Baral et al. also utilized the Parkland Grading Scale to assess anatomy and inflammation intraoperatively, correlating the results with outcomes such as conversion to open surgery, operation duration, subtotal cholecystectomy, and bile leaks. The study concluded that higher PGS grades were associated with an increased incidence of these adverse outcomes [15].

Conclusion

The PGS is a highly dependable tool for evaluating cholecystitis, particularly in determining the complexity of surgery and anticipating both intraoperative and postoperative complications.

This reliability positions PGS as a straightforward grading system for gallbladder diseases, offering valuable insights into predicting LC outcomes. It also aids in the appropriate allocation of cases to surgeons based on surgical difficulty and the potential need for conversion.

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