

To Evaluate the Efficacy of Intra-Operative G10 Scoring to Predict Conversion of Laparoscopic to Open Cholecystectomy

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Abstract: **Background:** Conversion from laparoscopic to open cholecystectomy remains an important indicator of operative difficulty and adverse outcomes. An objective intraoperative scoring system may assist surgeons in predicting conversion and planning timely bailout strategies. **Aim:** To evaluate the efficacy of intra-operative G10 scoring in predicting conversion of laparoscopic to open cholecystectomy. **Methods:** This prospective observational study included 50 patients undergoing elective laparoscopic cholecystectomy. Intraoperative G10 scoring was applied in real time based on gallbladder appearance, adhesions, distension, access factors, and sepsis-related findings. Patients were stratified into easy, moderate, difficult, and extremely difficult categories. Outcomes analyzed included conversion to open surgery, operative time, postoperative hospital stay, major complications, and readmission. Statistical analysis was performed using SPSS version 25. **Results:** The overall conversion rate was 18.0%. Conversion increased significantly with higher G10 categories, reaching 100% in extremely difficult cases ($p < 0.001$). Mean operative time increased from 51.5 ± 11.2 minutes in easy cases to 156.7 ± 21.1 minutes in extremely difficult cases ($p < 0.001$). Hospital stay also showed a stepwise rise from 2.1 ± 0.7 days in easy cases to 8.0 ± 1.0 days in extremely difficult cases ($p < 0.001$). ROC analysis demonstrated excellent predictive accuracy of the G10 score with an AUC of 0.92, sensitivity of 88.9%, specificity of 87.8%, and optimal cut-off ≥ 5 . **Conclusion:** The intraoperative G10 scoring system is a reliable and reproducible predictor of conversion and perioperative outcomes in laparoscopic cholecystectomy. Early identification of high-risk cases can improve surgical planning and patient safety.

Keywords: G10 score, laparoscopic cholecystectomy, conversion, operative difficulty, predictive scoring

1. Introduction

Laparoscopic cholecystectomy has become the gold standard for the management of symptomatic gallstone disease; however, conversion to open cholecystectomy continues to be required in a subset of patients due to dense adhesions, severe inflammation, distorted anatomy, impacted stones, or intraoperative complications. Although advances in imaging, instrumentation, and surgical training have reduced conversion rates, intraoperative unpredictability remains a significant concern. Conversion is not a failure but rather a strategic decision aimed at ensuring patient safety; nevertheless, it is associated with prolonged operative time, increased morbidity, extended hospital stay, and higher healthcare costs. Various preoperative scoring systems have been developed to anticipate operative difficulty, yet many fail to accurately predict real-time anatomical challenges encountered during surgery. To address this limitation, Sugrue from Ireland proposed the G10 intraoperative scoring system, which objectively grades operative findings based on gallbladder appearance, adhesions, distension, access-related factors, and septic complications. This structured scoring system allows surgeons to quantify operative difficulty during the procedure itself and make informed decisions regarding bailout strategies or early conversion. Evaluating the efficacy of the intraoperative G10 score in predicting conversion and correlating it with perioperative outcomes is essential to determine its reliability and clinical applicability across diverse surgical settings.

2. Aim

To evaluate the efficacy of intra-operative G10 scoring to predict conversion of laparoscopic to open cholecystectomy.

3. Methodology

This prospective comparative observational study was conducted in the Department of General Surgery at Saraswathi Institute of Medical Sciences, Hapur, over a period of 18 months and included 50 consecutive patients undergoing elective laparoscopic cholecystectomy for cholelithiasis. Sample size was calculated using prevalence-based formula with final inclusion of 50 patients. After institutional ethics approval and informed consent, patients underwent standard preoperative evaluation including clinical examination, laboratory investigations, ultrasonography, and anesthetic assessment. All procedures were performed using a standardized four-port laparoscopic technique under general anesthesia. Intraoperatively, the G10 scoring system was applied in real time based on predefined parameters including gallbladder appearance, adhesions, distension or contraction, impacted stones, BMI greater than 30 kg/m^2 , adhesions from previous surgery, free bile or pus, and cholecystoenteric fistula. Total scores ranged from 0 to 10 and cases were categorized as easy (< 2), moderate (2–4), difficult (5–7), and extremely difficult (8–10). Outcome variables included conversion to open cholecystectomy, operative time, postoperative hospital stay, major complications, and readmission. Data were analyzed

using SPSS version 25, with p-value <0.05 considered statistically significant. **4. Results**

Table 1: Intraoperative G10 Score Distribution and Difficulty Stratification

G10 Difficulty Category	Score Range	Frequency, n (%)	Mean G10 Score ± S.D.
Easy	0-1	10 (20.0%)	0.8 ± 0.4
Moderate	2-4	26 (52.0%)	3.1 ± 0.9
Difficult	5-7	11 (22.0%)	5.7 ± 0.8
Extremely Difficult	8-10	3 (6.0%)	8.3 ± 0.6
Total	0-10	50 (100%)	3.9 ± 2.2

Out of 50 patients, 20.0% were easy, 52.0% moderate, 22.0% difficult, and 6.0% extremely difficult cases.

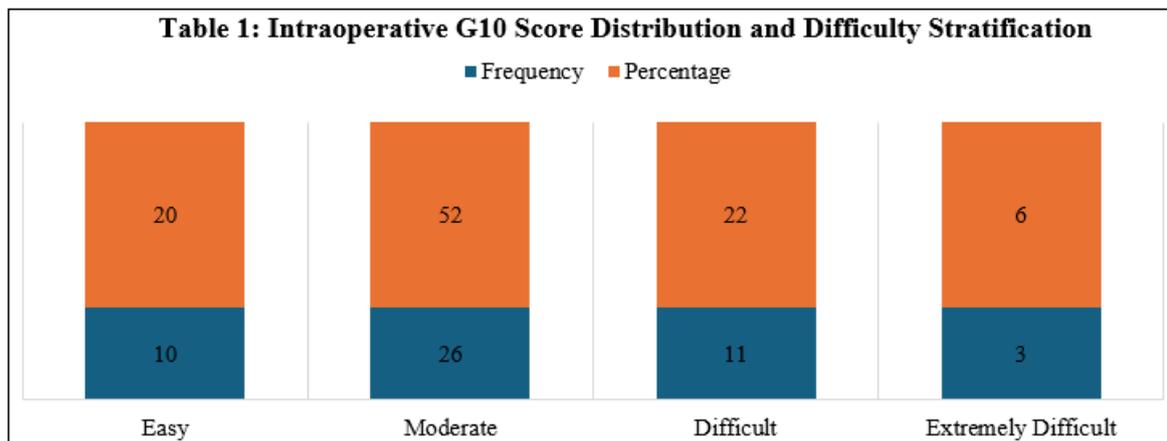


Table 2: Primary Outcome – Rate of Conversion to Open Cholecystectomy

Surgical Outcome	Overall (N=50)	G10 Easy (n=10)	G10 Moderate (n=26)	G10 Difficult (n=11)	G10 Extreme (n=3)	p-value
Completed Laparoscopically	41 (82.0%)	10 (100%)	24 (92.3%)	7 (63.6%)	0 (0%)	<0.001
Converted to Open	9 (18.0%)	0 (0%)	2 (7.7%)	4 (36.4%)	3 (100%)	

Overall conversion rate was 18.0% and increased progressively with higher G10 category (p < 0.001)

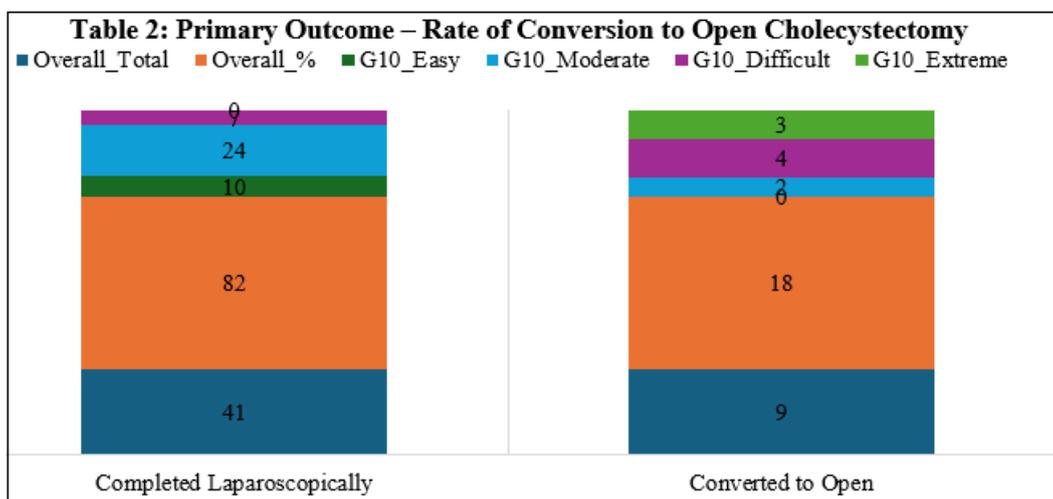


Table 3: Operative Time Stratified by G10 Difficulty Category

G10 Category	n	Mean Operative Time (minutes) ± S.D.	Range (minutes)	p-value
Easy	10	51.5 ± 11.2	35 - 70	<0.001
Moderate	26	78.6 ± 19.4	50 - 125	
Difficult	11	118.2 ± 26.3	85 - 165	
Extremely Difficult	3	156.7 ± 21.1	135 - 180	
Overall	50	86.7 ± 34.9	35 - 180	

Operative time increased significantly with rising G10 score (p < 0.001).

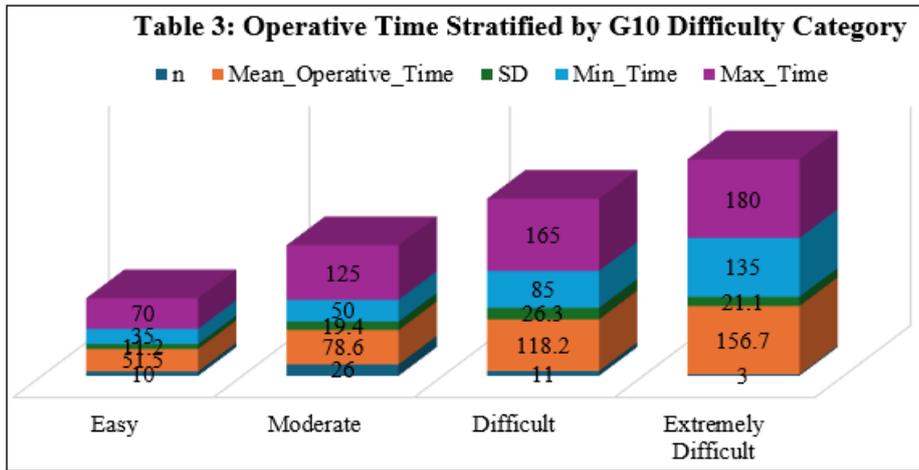
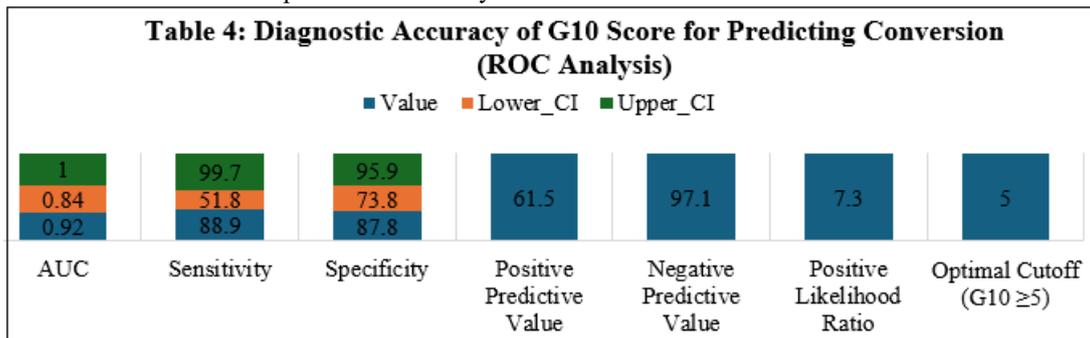


Table 4: Diagnostic Accuracy of G10 Score for Predicting Conversion (ROC Analysis)

Metric	Value	95% Confidence Interval
Area Under the Curve (AUC)	0.92	0.84 – 1.00
Optimal Cut-off	$G10 \geq 5$	
Sensitivity	88.9%	51.8% – 99.7%
Specificity	87.8%	73.8% – 95.9%
Positive Predictive Value	61.5%	
Negative Predictive Value	97.1%	
Positive Likelihood Ratio	7.3	
p-value (AUC > 0.5)	<0.001	

ROC analysis demonstrated excellent predictive accuracy of G10 score.



5. Discussion

The present study demonstrates a statistically significant association between increasing intraoperative G10 score and conversion from laparoscopic to open cholecystectomy. The overall conversion rate of 18.0% is comparable to the findings reported by Sugrue et al.¹² and Baral et al.⁸, who documented conversion rates ranging between 16% and 21% in higher operative grades. Dinçer et al.⁷ similarly reported that severe inflammatory intraoperative findings strongly predict conversion.

The graded increase in conversion across G10 categories observed in this study supports the predictive validity of structured intraoperative scoring. Gupta et al.¹ and Randhawa and Pujahari² demonstrated that dense adhesions and distorted Calot’s anatomy significantly increase operative difficulty. A systematic review by Chin et al.⁹ confirmed that intraoperative inflammatory severity is among the most reliable predictors of conversion.

Operative time in this study increased significantly with higher G10 score. Griffiths et al.³ reported a similar

correlation between operative grading and surgical duration. Wiebke et al.¹⁴ further observed prolonged operative times among converted cases, supporting the findings of the present study.

Hospital stay also demonstrated a proportional increase with higher G10 category. Ghnnam et al.⁴ reported longer hospitalization in converted patients. Magnano San Lio et al.¹⁰, through meta-analysis, identified inflammatory burden and conversion as independent determinants of prolonged recovery. These findings reinforce the prognostic relevance of intraoperative scoring.

The ROC analysis in this study revealed excellent predictive performance with an AUC of 0.92. Sugrue et al.¹² reported comparable diagnostic accuracy for intraoperative grading systems. Baral et al.⁸ demonstrated similar sensitivity and specificity using a G10 cut-off ≥ 5 . The high negative predictive value observed indicates that low G10 scores reliably exclude the need for conversion, supporting structured intraoperative assessment.

Overall, the findings validate the intraoperative G10 scoring system as a practical, objective, and reproducible tool for predicting conversion and operative difficulty.

6. Conclusion

The intraoperative G10 scoring system is an effective predictor of conversion from laparoscopic to open cholecystectomy. Its routine use can enhance intraoperative decision-making and improve surgical safety.

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