

RELATIONSHIP BETWEEN MODIFIED NASSAR INTRAOPERATIVE DIFFICULTY GRADE AND EARLY POSTOPERATIVE RECOVERY FOLLOWING LAPAROSCOPIC CHOLECYSTECTOMY

Dr Rutba Muneer¹, Dr Hassan Baig², Dr Zaryab Yasinzaï³, Dr Maria Siddiqui⁴, Dr Mohsin Nazeer⁵, Dr Susheel Kumar⁶, Dr Rohit Kumar Pahooja⁷

¹Post-graduate Resident, Department of General Surgery, Jinnah Post-graduate Medical Centre, Karachi, rutbahussain932@gmail.com

²House Officer, Department of General Surgery, Jinnah Post-graduate Medical Centre, Karachi, baighassan1999@gmail.com

³House Officer, Department of General Surgery, Jinnah Post-graduate Medical Centre, Karachi, Yasinzaï54321@gmail.com

⁴House Officer, Department of General Surgery, Jinnah Post-graduate Medical Centre, Karachi, msmariasiddiqui@gmail.com

⁵Post-graduate Resident, Department of General Surgery, Jinnah Post-graduate Medical Centre, Karachi, nazeermohsin339@gmail.com

⁶House Officer, Department of General Surgery, Jinnah Post-graduate Medical Centre, Karachi, ventu.bodani@gmail.com

⁷House Officer, Department of General Surgery, Jinnah Post-graduate Medical Centre, Karachi, rohitkumar.pakistan@gmail.com

ABSTRACT

Objective: To determine the relationship between the Modified Nassar intraoperative difficulty grade and early postoperative recovery (postoperative pain score, time to first oral intake, time to first ambulation, and length of hospital stay) in patients undergoing laparoscopic cholecystectomy.

Study Design: Cross-sectional, analytical (comparative) study.

Settings: Department of General Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi.

Period: November 2025 to February 2026 (four months).

Material & Methods: Sixty-four patients undergoing elective laparoscopic cholecystectomy were enrolled through non-probability purposive sampling and classified intraoperatively as Group A (Modified Nassar Grade I-II, "easy", n=32) or Group B (Grade III-V, "difficult", n=32). Postoperative pain (Visual Analogue Scale, 0-10) at 6, 12 and 24 hours, time to first tolerated oral intake, time to first unassisted ambulation, and total postoperative hospital stay were recorded. Quantitative variables were compared using the independent-samples t-test, qualitative variables using the chi-square test, and the ordinal Nassar grade was correlated with recovery parameters using Spearman's rank correlation coefficient. Data were analyzed using SPSS version 26, with p≤0.05 taken as significant.

Results: The two groups were comparable at baseline. Operative duration was significantly longer in Group B (69.09±14.93 vs 59.84±15.94 minutes, p=0.020). Group B had a significantly longer time to first oral intake (7.03±3.30 vs 5.37±2.32 hours, p=0.024) and postoperative hospital stay (28.42±7.44 vs 21.68±6.88 hours, p<0.001). The composite outcome of delayed early recovery occurred in 87.5% of Group B versus 43.8% of Group A (p<0.001). Nassar grade correlated significantly with postoperative stay (rho=0.492, p<0.001), time to oral intake (rho=0.323, p=0.009), and operative time (rho=0.308, p=0.013). VAS pain scores and time to ambulation were higher in Group B but did not reach statistical significance.

Conclusion: A higher Modified Nassar intraoperative difficulty grade is significantly associated with delayed early postoperative recovery after laparoscopic cholecystectomy, most consistently reflected in a longer hospital stay, supporting its routine use for postoperative planning and patient counselling.

KEYWORDS: Early Recovery, Laparoscopic Cholecystectomy, Length of Hospital Stay, Modified Nassar Grade, Postoperative Pain.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the treatment of choice for symptomatic gallstone disease, a condition affecting a substantial and rising proportion of adults worldwide and imposing a considerable burden on health systems.^{1, 2} Although LC carries a low overall morbidity and mortality, a variable proportion of cases prove technically demanding because of dense adhesions at Calot's triangle, an acutely inflamed or fibrotic gallbladder, or aberrant biliary anatomy, and this variability directly shapes how quickly a patient recovers after surgery.³ The Modified Nassar intraoperative difficulty grading scale, which classifies operative findings into five grades from very easy (Grade I) to very difficult (Grade V), remains among the most widely used objective and reproducible tools for classifying this difficulty at the time of surgery, and recent systematic appraisals continue to endorse its practical utility across surgeon experience levels.⁴

Recent evidence consistently shows that a higher Nassar grade translates into measurably worse early outcomes. In a 2026 cohort of 697 patients, cases graded Nassar III–V had a significantly longer operative time (79.9±39.3 vs 56.9±19.6 minutes) and fewer patients achieving an uncomplicated recovery by 30 days compared with easier grades.⁵ A recent systematic review of operative difficulty grading systems for laparoscopic cholecystectomy concluded that rising intraoperative grade is consistently associated with longer operating time, higher conversion

and complication rates, and prolonged hospital stay across published cohorts, and that the Modified Nassar scale remains one of the most practical and reproducible tools available to surgeons of varying experience.⁴ Prospective work has shown that intraoperative difficulty grading can be applied reliably at the time of surgery and tracks with perioperative morbidity independent of patient obesity, so its predictive value for recovery is unlikely to be confounded by body habitus.^{6, 7} Preoperative characteristics alone have only limited ability to predict how a given laparoscopic cholecystectomy will actually behave once dissection begins, which reinforces the value of an objective intraoperative grade for anticipating the recovery trajectory,⁸ and achievement of the critical view of safety – itself a marker of a controlled dissection – has been shown to track with intraoperative difficulty grade.⁹ Despite this body of international evidence, prospective local data correlating intraoperative difficulty with objective postoperative recovery parameters – pain scores, time to first oral intake and ambulation, and length of hospital stay – remain scarce from Pakistani tertiary care centres, where laparoscopic cholecystectomy volumes are high but recovery is not routinely graded against operative difficulty.^{15,16,17,18,19} Given this gap, the present study aimed to determine the relationship between the Modified Nassar intraoperative difficulty grade and early postoperative recovery – postoperative pain score, time to first oral intake, time to first ambulation, and length of hospital stay – in patients undergoing laparoscopic cholecystectomy at the Department of General Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi. We hypothesized that a higher Modified Nassar grade would be significantly associated with delayed early postoperative recovery, and that establishing this relationship locally would help identify patients likely to need closer postoperative monitoring, support more realistic counselling on expected hospital stay, and inform bed-planning in a high-volume, resource-limited public-sector surgical unit.

MATERIAL & METHODS

Study Design: Cross-sectional, analytical (comparative) study.

Settings: Department of General Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi.

Duration: November 2025 to February 2026 (four months), following approval of the synopsis from the Institutional Review Board (IRB) of JPMC.

Sample Size: A total of 64 patients were enrolled. Sample size was calculated using the WHO formula for comparison of two means, using operative-duration data reported by Casarim et al (mean 56.92±19.58 minutes in the easy group vs 79.86±39.25 minutes in the difficult group),⁵ with a 95% confidence level, 80% power, and a pooled standard deviation of the two groups; after adjusting for a 10% drop-out allowance, this gave 32 patients per group (Group A: Modified Nassar Grade I–II, easy; Group B: Grade III–V, difficult; total n=64).

Sampling Technique: Non-probability purposive sampling.

Inclusion Criteria: Patients aged 18–65 years of either gender, with clinically and ultrasonographically confirmed symptomatic cholelithiasis or chronic calculous cholecystitis, planned for elective laparoscopic cholecystectomy, who gave written informed consent.

Exclusion Criteria: Acute cholecystitis at presentation or emergency laparoscopic cholecystectomy; suspected choledocholithiasis, cholangitis, gallbladder malignancy or Mirizzi syndrome; conversion to open cholecystectomy; previous upper abdominal surgery, liver cirrhosis or coagulopathy; ASA grade III or above; chronic use of analgesics, opioids, NSAIDs, or known chronic pain syndromes; and patients not consenting to participate.

Data Collection Procedure: After ethical clearance, patients fulfilling the inclusion criteria were enrolled from the Surgical Outpatient Department. Baseline demographic and clinical data were recorded on a structured proforma. All patients underwent standard 4-port elective laparoscopic cholecystectomy under general anaesthesia. Immediately after mobilization of the gallbladder, the operating surgeon assigned a Modified Nassar intraoperative difficulty grade (I–V); for analysis, Grades I–II were classified as “easy” (Group A) and Grades III–V as “difficult” (Group B). Operative time was recorded from skin incision to skin closure. Postoperatively, all patients received a standard analgesic protocol (intramuscular diclofenac sodium 75 mg every 12 hours), a regimen shown to provide effective early analgesia after laparoscopic cholecystectomy in comparative trials.²⁰ Postoperative pain was assessed on the Visual Analogue Scale (VAS, 0–10) at 6, 12 and 24 hours by a single trained data collector blinded to group allocation where feasible, consistent with prior comparative work validating structured pain-rating approaches after laparoscopic cholecystectomy.¹³ Time to first tolerated oral intake, time to first unassisted ambulation, and total postoperative hospital stay were recorded on the same proforma. Delayed early recovery was defined as the presence of any one of: mean VAS >4 at 24 hours, time to oral intake >12 hours, time to ambulation >12 hours, or postoperative stay >24 hours. Each participant was assigned a unique study identification number, and personal identifiers were not used in analysis or reporting.

Data / Statistical Analysis: Data were entered and analyzed using SPSS version 26. Quantitative variables (age, BMI, operative time, VAS pain scores, time to oral intake, time to ambulation, length of stay) were presented as mean±standard deviation and compared between Group A and Group B using the independent-samples t-test (with Levene’s test for equality of variances). Qualitative variables (gender, comorbidities, ASA grade, intraoperative complication, delayed early recovery) were presented as frequencies and percentages and compared using the chi-square test. The correlation between ordinal Nassar grade (I–V) and continuous recovery parameters was assessed using Spearman’s rank correlation coefficient. Effect modifiers (age, BMI, operative duration) were controlled by stratification at the sample median, with post-stratification independent-samples t-tests repeated within each stratum. A p-value ≤0.05 was considered statistically significant.

Ethical Approval: The study was approved by the Institutional Review Board (IRB) of Jinnah Postgraduate Medical Centre, Karachi. Written informed consent was obtained from all participants.

RESULTS

A total of 64 patients undergoing elective laparoscopic cholecystectomy were enrolled and analysed: 32 in Group A (Modified Nassar Grade I–II, easy) and 32 in Group B (Grade III–V, difficult), matching the pre-specified sample size. The overall mean age was 41.47 ± 11.08 years, and 45/64 patients (70.3%) were female. On intraoperative grading, 20 patients (31.3%) were Grade I, 12 (18.8%) Grade II, 18 (28.1%) Grade III, 11 (17.2%) Grade IV, and 3 (4.7%) Grade V.

The two groups were well matched for age, gender, BMI, presence of comorbidities, ASA grade, and intraoperative complication rate (all $p > 0.05$), confirming baseline comparability (Table-I). As expected from the Nassar grading construct, operative duration was significantly longer in Group B (69.09 ± 14.93 vs 59.84 ± 15.94 minutes; $t = -2.395$, $p = 0.020$), consistent with international reports linking higher intraoperative grade to prolonged operating time.^{5, 6}

Table-I: Baseline demographic and clinical characteristics (n=64)

Characteristic	Group A - easy (n=32)	Group B - difficult (n=32)	Test statistic	p-value
Age, years (mean $\pm$ SD)	41.84 $\pm$ 12.01	41.09 $\pm$ 10.26	$t = 0.269$	0.789
Gender, Male/Female, n	9 / 23	10 / 22	$\chi^2 = 0.075$	0.784
BMI, kg/m ² (mean $\pm$ SD)	26.99 $\pm$ 3.52	27.69 $\pm$ 4.20	$t = -0.719$	0.475
Comorbidity present, n (%)	15 (46.9%)	9 (28.1%)	$\chi^2 = 2.400$	0.121
ASA grade I / II, n	22 / 10	21 / 11	$\chi^2 = 0.071$	0.790
Operative duration, min (mean $\pm$ SD)	59.84 $\pm$ 15.94	69.09 $\pm$ 14.93	$t = -2.395$	0.020*
Intraoperative complication, n (%)	2 (6.3%)	1 (3.1%)	$\chi^2 = 0.350$	0.554

*Significant at $\alpha = 0.05$.

Time to first tolerated oral intake was significantly longer in Group B (7.03 ± 3.30 vs 5.37 ± 2.32 hours; $t = -2.326$, $p = 0.024$), and total postoperative hospital stay was significantly longer in Group B (28.42 ± 7.44 vs 21.68 ± 6.88 hours; $t = -3.758$, $p < 0.001$) (Table-II). VAS pain scores at 6, 12 and 24 hours and time to first ambulation were numerically higher in Group B but did not reach statistical significance.

Table-II: Early postoperative recovery parameters by group (n=64)

Recovery parameter	Group A (n=32) mean $\pm$ SD	Group B (n=32) mean $\pm$ SD	Mean diff.	t	p-value
VAS pain – 6 h	4.91 $\pm$ 1.12	5.34 $\pm$ 1.45	-0.44	-1.352	0.181
VAS pain – 12 h	3.97 $\pm$ 1.31	4.03 $\pm$ 1.69	-0.06	-0.165	0.869
VAS pain – 24 h	2.66 $\pm$ 1.41	3.19 $\pm$ 1.93	-0.53	-1.261	0.212
Mean VAS (6–24 h)	3.84 $\pm$ 1.20	4.19 $\pm$ 1.61	-0.34	-0.968	0.337
Time to oral intake, h	5.37 $\pm$ 2.32	7.03 $\pm$ 3.30	-1.66	-2.326†	0.024*
Time to ambulation, h	8.10 $\pm$ 3.26	9.37 $\pm$ 3.01	-1.27	-1.623	0.110
Postoperative stay, h	21.68 $\pm$ 6.88	28.42 $\pm$ 7.44	-6.73	-3.758	<0.001*

*Significant at $\alpha = 0.05$. †Welch t reported (Levene's test significant, $p = 0.042$); all other rows met the equal-variances assumption.

The composite outcome of delayed early recovery, defined per the operational definition, occurred in 42/64 patients (65.6%) overall and was significantly more frequent in Group B (28/32, 87.5%) than in Group A (14/32, 43.8%) ($\chi^2 = 13.576$, $p < 0.001$; Fisher's exact $p < 0.001$) (Table-III). No 30-day complications were recorded in either group (0/64 overall), so this outcome could not be compared statistically and is reported descriptively.

Table-III: Composite outcome – delayed early recovery, by group (n=64)

Outcome	Group A – easy, n (%)	Group B – difficult, n (%)	χ^2	p-value
Delayed early recovery – Yes	14 (43.8%)	28 (87.5%)	13.576	<0.001*

Outcome	Group A – easy, n (%)	Group B – difficult, n (%)	χ^2	p-value
Delayed early recovery – No	18 (56.3%)	4 (12.5%)		

*Significant at $\alpha=0.05$; Fisher's exact $p<0.001$, consistent with the chi-square result.

Spearman's rank correlation showed a significant positive association between the ordinal Nassar grade and postoperative hospital stay ($\rho=0.492$, $p<0.001$), time to first oral intake ($\rho=0.323$, $p=0.009$), and operative time ($\rho=0.308$, $p=0.013$) (Table-IV). Correlations with VAS pain scores and time to ambulation were positive but did not reach statistical significance.

Table-IV: Spearman's correlation between ordinal Nassar grade (I–V) and recovery parameters (n=64)

Recovery parameter	Spearman's rho	p-value
Operative time	0.308	0.013*
VAS – 6 h	0.228	0.070
VAS – 12 h	0.064	0.615
VAS – 24 h	0.157	0.216
Mean VAS	0.155	0.221
Time to oral intake	0.323	0.009*
Time to ambulation	0.229	0.069
Postoperative stay	0.492	<0.001*

*Significant at $\alpha=0.05$ (2-tailed).

On stratified analysis controlling for age, BMI and operative duration at the sample median, postoperative hospital stay remained significantly longer in Group B across nearly every stratum examined, and the difference was most pronounced among patients with higher BMI and longer operative duration (Table-V), suggesting these variables act as effect modifiers rather than confounders of the difficulty–recovery relationship.

Table-V: Post-stratification independent-samples t-test for selected recovery outcomes (n=64)

Stratifying variable	Stratum	Outcome	Group mean A	Group mean B	t	p-value
Age (median 41.5 y)	≤ median	Postoperative stay, h	21.92	29.12	-3.090	0.0044*
Age (median 41.5 y)	> median	Postoperative stay, h	21.48	27.63	-2.162	0.0397*
BMI (median 27.6)	≤ median	Postoperative stay, h	21.47	24.83	-1.156	0.259
BMI (median 27.6)	> median	Postoperative stay, h	22.00	30.87	-4.282	<0.001*
Operative duration (median 62.5 min)	≤ median	VAS – 24 h	2.45	4.17	-3.288	0.0029*
Operative duration (median 62.5 min)	> median	Postoperative stay, h	20.23	29.80	-3.764	0.0009*

*Significant at $\alpha=0.05$.

DISCUSSION

In this cross-sectional analytical study of 64 patients undergoing elective laparoscopic cholecystectomy at JPMC, Karachi, a higher Modified Nassar intraoperative difficulty grade was significantly associated with delayed early postoperative recovery, most consistently reflected in a longer total hospital stay and a longer time to first oral intake, and in a markedly higher rate of the composite delayed-early-recovery outcome (87.5% vs 43.8%). These findings are in keeping with Casarim et al, who reported that Nassar III–V grading was associated with a significantly longer operative time and fewer patients achieving uncomplicated recovery by 30 days compared with easier grades,⁵ and with a recent systematic review, which concluded that rising intraoperative difficulty grade tracks consistently with prolonged operating time, complication rates and hospital stay across published cohorts.⁴

Operative duration itself was significantly longer in our difficult group (69.09 vs 59.84 minutes), mirroring the pattern reported internationally and supporting the internal validity of the grading system in our population.^{5, 6} Notably, this difference in operative complexity did not translate into a significantly higher rate of intraoperative complications, nor into a significant difference in ASA grade or comorbidity burden between our two groups, consistent with reports that operative difficulty as graded by the Nassar scale is largely independent of patient-level factors such as obesity and comorbidity and instead reflects local anatomical and inflammatory factors encountered at the time of surgery.^{6, 7}

Postoperative pain scores at 6, 12 and 24 hours were numerically, though not statistically significantly, higher in the difficult group, and time to first ambulation followed the same pattern. This is broadly consistent with reports that postoperative pain after laparoscopic cholecystectomy is influenced by multiple factors beyond operative difficulty alone, including the analgesic regimen and the specific pain-assessment tool used, which may explain why our VAS differences, although in the expected direction, did not reach significance in a sample of this size.¹³ Time to first oral intake, however, was significantly prolonged in the difficult group, a parameter less susceptible to subjective reporting bias than a pain score and one that more directly reflects the physiological recovery of bowel and systemic function after a more prolonged, more inflamed dissection.

The strongest and most consistent finding in our cohort was the relationship between Nassar grade and postoperative hospital stay, evident both as a binary group comparison ($p < 0.001$) and as an ordinal Spearman correlation ($\rho = 0.492$, $p < 0.001$), indicating a graded, dose-response relationship rather than a simple threshold effect. This mirrors findings from the enhanced-recovery literature, where preoperative and intraoperative risk factors – including delay to surgery – have been shown to be independently associated with a prolonged length of stay after laparoscopic cholecystectomy,¹² and where structured enhanced-recovery protocols have been shown to shorten recovery specifically by addressing modifiable delays around more complex cases.¹¹ Our finding that the difficulty–recovery relationship was strongest among patients with higher BMI and longer operative duration on stratified analysis suggests that these variables may compound, rather than confound, the effect of intraoperative difficulty on recovery, a pattern that merits confirmation in larger, multicentre cohorts.

The delayed-early-recovery composite outcome – present in nearly two-thirds of patients overall but in almost nine of ten patients in the difficult group – offers a clinically actionable summary measure that could be incorporated into routine postoperative counselling and bed-planning at high-volume public-sector units such as ours. This addresses a specific local gap: recent Pakistani publications have called for context-specific validation of preoperative and intraoperative difficulty scores rather than uncritical adoption of scales derived from other healthcare settings,¹⁶ while others have demonstrated the feasibility of applying such scoring systems, including the G10 score, within Pakistani surgical units.^{15, 17, 18, 19} Our results extend this local evidence base specifically to the postoperative-recovery side of the difficulty–outcome relationship, an area that has received comparatively less attention than preoperative prediction or conversion risk in the Pakistani literature.

Although postoperative nausea and vomiting was not separately recorded in our proforma, it is a recognized correlate of operative complexity and analgesic strategy in laparoscopic cholecystectomy, having been reported in association with specific risk factors in a recent regional cross-sectional study,¹⁴ and its systematic inclusion in future iterations of this work would strengthen the recovery composite further. Similarly, the choice of postoperative analgesic regimen is itself a determinant of recovery, and comparative trials of intramuscular diclofenac against alternative agents in laparoscopic cholecystectomy provide useful context for standardizing this element of future protocols.²⁰

This study has several limitations. First, the single-centre, cross-sectional design and modest sample size ($n = 64$), although adequately powered for the primary operative-time comparison on which it was based, limited statistical power to detect smaller but potentially clinically meaningful differences in VAS pain scores and time to ambulation between groups. Second, non-probability purposive sampling and the exclusion of emergency and acute cholecystitis cases, higher ASA grades, and patients with chronic pain syndromes restrict generalizability to more complex or higher-risk surgical populations. Third, although the data collector was blinded to group allocation where feasible, complete blinding could not be guaranteed, since the Nassar grade is itself assigned intraoperatively by the operating surgeon and may be documented in records subsequently reviewed for pain scoring. Fourth, no patient in either group developed a 30-day complication in this cohort, so the study was underpowered to compare this outcome, and longer follow-up with a larger sample is needed to characterize this relationship. Finally, as a single tertiary-care-unit study, multicentre prospective studies with larger, more heterogeneous samples are recommended to confirm and extend these findings, including whether structured enhanced-recovery interventions can specifically mitigate the delayed-recovery effect seen with higher Nassar grades.^{11, 12}

CONCLUSION

A higher Modified Nassar intraoperative difficulty grade is significantly associated with delayed early postoperative recovery after laparoscopic cholecystectomy, most consistently reflected in a longer time to first oral intake and a longer postoperative hospital stay. Routine intraoperative Nassar grading may help identify patients at JPMC, Karachi who are likely to need closer postoperative monitoring and more realistic discharge planning.

CONFLICT OF INTEREST / DISCLOSURE

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

The authors thank the surgical and nursing staff of the Department of General Surgery, JPMC, Karachi, for their assistance with data collection.

REFERENCES

1. Wang X, Yu W, Jiang G, Li H, Li S, Xie L, et al. Global epidemiology of gallstones in the 21st century: a systematic review and meta-analysis. *Clin Gastroenterol Hepatol*. 2024; 22(8):1586-1595. doi:10.1016/j.cgh.2024.01.051
2. Unalp-Arida A, Ruhl CE. Increasing gallstone disease prevalence and associations with gallbladder and biliary tract mortality in the US. *Hepatology*. 2023; 77(6):1882-1895. doi:10.1097/hep.0000000000000264
3. Seshadri A, Peitzman AB. The difficult cholecystectomy: what you need to know. *J Trauma Acute Care Surg*. 2024; 97(3):325-336. doi:10.1097/TA.00000000000004337
4. Zulfikaroglu B. Operative difficulty in laparoscopic cholecystectomy: a systematic review of risk stratification, intraoperative grading, bailout, and outcomes. *Indian J Surg*. 2026; 1-20. doi:10.1007/s12262-026-04656-1
5. Casarim V, Miranda IMS, Guedes LA, Zambon GD, Salgado W Jr. Predictive factors of surgical difficulty in laparoscopic cholecystectomy in a secondary hospital. *Acta Cir Bras*. 2026; 41:e410126. doi:10.1590/acb410126
6. Nassar AHM, Khan KS, Ng HJ, Sallam M. Operative difficulty, morbidity and mortality are unrelated to obesity in elective or emergency laparoscopic cholecystectomy and bile duct exploration. *J Gastrointest Surg*. 2022; 26(9):1863-1872. doi:10.1007/s11605-022-05344-7
7. Orabi A, Di Mauro D, Njere I, Ratano M, Thavakumar S, Reece-Smith A, et al. Can preoperative characteristics predict the outcomes of laparoscopic cholecystectomy? *J Laparoendosc Adv Surg Tech A*. 2022; 32(5):532-537. doi:10.1089/lap.2021.0398
8. Kashyap R. Intraoperative scoring system to assess the difficult laparoscopic cholecystectomy: a prospective study from a tertiary care centre. *Cureus*. 2023; 15(3):e35767. doi:10.7759/cureus.35767
9. Ali I. Scale and safety: analyzing the association between intraoperative difficulty and achieving the critical view of safety in laparoscopic cholecystectomy. *Cureus*. 2024; 16(2):e53408. doi:10.7759/cureus.53408
10. Qin J, Gou LY, Zhang W, Pu X, Zhang P. Enhanced recovery after surgery versus conventional care in cholecystectomy: a systematic review and meta-analysis. *J Laparoendosc Adv Surg Tech A*. 2024. doi:10.1089/lap.2024.0119
11. Bressan L, Cimino MM, Vaccari F, Capozzella E, Biloslavo A, Porta M, et al. Preoperative waiting time affects the length of stay of patients treated via laparoscopic cholecystectomy in an acute care surgical setting. *J Clin Med*. 2024; 13(23):7263. doi:10.3390/jcm13237263
12. Leblebici M, Dincer B, Savcı C, Soyhan F, Alimoğlu O. Assessment of postoperative pain intensity after laparoscopic cholecystectomy: comparative analysis of three rating scales in terms of scores and patient preferences. *Gevher Nesibe J Med Health Sci*. 2022; 7(16):75-81. doi:10.46648/gnj.321
13. Jamtsho P, Dorjey Y, Dorji N, Tshering S, Wangmo KP, Dorji T, et al. Factors associated with postoperative nausea and vomiting after laparoscopic cholecystectomy at the National Referral Hospital, Bhutan: a cross-sectional study. *BMC Anesthesiol*. 2024; 24(1):248. doi:10.1186/s12871-024-02602-w
14. Hanson-Viana E, Ayala-Moreno EA, Ortega-Leon LH, Montalvo-Javé EE. The association of preoperative risk factors for laparoscopic conversion to open surgery in elective cholecystectomy. *Euroasian J Hepatogastroenterol*. 2022; 12(1):6-9. doi:10.5005/jp-journals-10018-1366
15. Zia SA, Ashraf I, Ashraf S, Sufyan M, Ashraf J, Fawad M. Assessment of pre-operative scoring strategy for prediction of difficult laparoscopic cholecystectomy. *Pak Armed Forces Med J*. 2025; 75(Suppl-2):S187-S191. doi:10.51253/pafmj.v75iSUPPL-2.10160
16. Parvez A, Ansari M. Preoperative risk assessment scores for difficult laparoscopic cholecystectomy - do we need them in Pakistan? *J Pak Med Assoc*. 2025; 75(2):351. doi:10.47391/JPKMA.21259
17. Subhan SF, Akbar F. Use of G10 scoring system to predict difficult laparoscopic cholecystectomy and conversion to open cholecystectomy. *Pak J Intensive Care Med*. 2025; 5(1):53. doi:10.54112/pjiem.v5i01.53
18. Ashraf S, Khan MS, Wattoo NM, Rashid AR, Zia SA. Gender-based differences in the outcome of laparoscopic cholecystectomy in patients with gall stones. *Pak Armed Forces Med J*. 2024; 74(4):961-964. doi:10.51253/pafmj.v74i4.9627
19. Moosa H, Rizvi SB, Khan A, Jaffar S, Shaikh N, Iftikhar A. Outcome of early versus delayed laparoscopic cholecystectomy in acute cholecystitis at tertiary care centre, Karachi. *J Popul Ther Clin Pharmacol*. 2025; 32(9):12-20. doi:10.53555/h6ysfd63
20. Nawaz A, Ishrat Z, Abdullah F, Rashid M, Yousaf S, Hameed S. Comparison of pre-emptive tramadol versus diclofenac in postoperative pain management after laparoscopic cholecystectomy. *Pak J Health Sci*. 2025; 6(4):153-157. doi:10.54393/pjhs.v6i4.2960