Volume 4, Issue 3, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

PERIOPERATIVE FACTORS ASSOCIATED WITH EARLY POSTOPERATIVE RECOVERY AFTER UROLOGICAL PROCEDURES: A SINGLE-CENTER PROSPECTIVE OBSERVATIONAL STUDY

[1]Muhammad Usama, [2]Umair Ali, [3]Irshad Hussain, [4]Dr. Najma Ayub, [5]Hamad Khalid, [6]Laiyya Gul, [*7]Shayan Gul, [8]Azmat Ullah

[1]Lecturer, Department of Anesthesia Technology, Seena Institute of Medical Sciences, Swabi, Pakistan.

[2]Faculty of Allied Health Sciences, Superior University, Lahore, Pakistan.

[3]Khyber Medical University, Peshawar, Pakistan.

[4]Assistant Professor, HBS Medical and Dental College, Islamabad, Pakistan.

[5]Internee, Department of Anesthesia, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan.

[6]Khyber Medical University, Peshawar, Pakistan.

[*7]Khyber Medical University, Peshawar, Pakistan.

[8]Faculty of Allied Health Sciences, Superior University, Lahore, Pakistan.

[1]musamaofficial463@gmail.com, [2]umair.ali.sgd@superior.edu.pk, [3]irshad1012@gmail.com, [4]sweethoney612@yahoo.com, [5]khalidhamadkhalid152@gmail.com, [6]laiyyagul1@gmail.com, [*7]nightingale9694@gmail.com, [8]azmat.ullah.sgd@superior.edu.pk

DOI: https://doi.org/10.5281/zenodo.21995145

Keywords:
Urological Surgery; Postoperative Recovery; Quality Of Recovery-15; Anesthesia; Postoperative Nausea And Vomiting; Mobilization; Opioid Requirement

Article History
Received on 20 Feb, 2026
Accepted on 28 March, 2026
Published on 31 March, 2026

Abstract

Background: Early postoperative recovery after urological surgery may be influenced by patient characteristics, surgical factors, anesthetic technique, and perioperative care. This study assessed the association between selected perioperative factors and recovery outcomes during the first 24 hours after elective urological procedures. Methods: A single-center prospective observational study was conducted at the Institute of Kidney Diseases, Peshawar, from September 2025 to February 2026. Fifty adults undergoing elective urological procedures were included. Data were collected during the preoperative, intraoperative, and postoperative periods. The recorded variables included age, sex, body mass index, American Society of Anesthesiologists physical status, preoperative fasting duration, carbohydrate loading, surgical approach, procedure type, anesthetic technique, and opioid-sparing practice. Recovery outcomes included the Quality of Recovery-15 score, postoperative pain, postoperative nausea and vomiting, time to first solid food intake, time to first mobilization, and postoperative opioid requirement. Data were analyzed using IBM SPSS Statistics version 27. Nonparametric tests, correlation analysis, chi-square tests, and Fisher's exact tests were applied according to the type of variable. Results: Among the 50 participants, 34 were male (68%) and 16 were female (32%). The mean age was 47.0 years, and the mean body mass index was (21.38 \pm 2.22\ \{kg/m^2}). Twenty-three participants (46%) had American Society of Anesthesiologists physical status I, and 27 (54%) had physical status II. Regional anesthesia was used in 37 participants (74%), whereas 13 (26%) received general anesthesia. Body mass index showed a statistically significant negative correlation with the total Quality of Recovery-15 score ((r=-0.381), (p=0.006)). American Society of

Volume 4, Issue 3, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Anesthesiologists physical status was significantly associated with time to first mobilization ((tau b=0.404), (p=0.001)), but not with Quality of Recovery-15 score, postoperative pain, or time to first solid food intake. Surgical approach was associated with time to first mobilization ((p<0.001), and post hoc analysis showed a significant difference between endoscopic and open approaches after Bonferroni adjustment. Procedure type was associated with time to first solid food intake ((p=0.003)) and time to first mobilization ((p<0.001)), but not with Quality of Recovery-15 score ((p=0.052)) or postoperative pain ((p=0.324)). Anesthesia type was associated with postoperative opioid requirement in the unadjusted analysis ((p<0.001)). No statistically significant association was reported between the examined variables and postoperative nausea and vomiting. Conclusion: Selected patient, surgical, and anesthetic factors were associated with specific early postoperative outcomes. Higher body mass index was associated with a lower Quality of Recovery-15 score, while surgical approach and procedure type were associated with early mobilization and oral intake. Anesthesia type was associated with postoperative opioid requirement. These findings should be interpreted as preliminary associations because the study was small, observational, and based on unadjusted analyses.

Introduction

Enhanced Recovery After Surgery is a multidisciplinary approach that combines evidence-based interventions during the preoperative, intraoperative, and postoperative periods. Its objectives include reducing physiological stress, preventing complications, supporting early functional recovery, and improving patient experience [1,3]. Common components include patient counseling, appropriate fasting management, prevention of hypothermia, minimally invasive surgery, multimodal analgesia, prevention of postoperative nausea and vomiting, early oral intake, and early mobilization.

Anesthetic care is an important part of perioperative recovery. Postoperative pain, nausea and vomiting, dizziness, hypothermia, airway-related discomfort, and delayed cognitive recovery may prolong recovery and delay discharge. Appropriate anesthetic selection, multimodal analgesia, prevention of postoperative nausea and vomiting, maintenance of normothermia, and reduction of unnecessary opioid exposure may support earlier functional recovery [2,3].

The quality of postoperative recovery can be assessed using patient-reported instruments. The 15-item Quality of Recovery questionnaire, known as QoR-15, evaluates several domains, including physical comfort, emotional state, psychological support, physical independence, and pain. Other clinically relevant outcomes include postoperative pain, postoperative nausea and vomiting, opioid requirement, time to oral intake, and time to mobilization.

Recovery after urological surgery may be affected by patient-related factors such as age, body mass index, comorbidity, and American Society of Anesthesiologists physical status. Surgical factors, including procedure type, surgical approach, duration, and tissue trauma, may also influence recovery. Endoscopic and minimally invasive procedures may permit earlier mobilization than open surgery; however, comparisons may be affected by differences in procedure complexity and patient selection. Similarly, an observed association between anesthetic technique and opioid requirement may be influenced by the type and extent of surgery.

Previous studies have reported associations between increased body mass index, advanced age, comorbidities, smoking, surgical complexity, and delayed recovery [18–21]. Other studies have emphasized the potential benefits of minimally invasive procedures, multimodal analgesia, and opioid-sparing strategies [9,10,22]. However, evidence from routine urological practice in Pakistan remains limited.

Therefore, this study assessed the association between selected patient, surgical, anesthetic, and perioperative factors and recovery outcomes during

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

the first 24 hours after elective urological procedures.

Objective

The objective of this study was to assess the association between selected perioperative factors and early postoperative recovery among adults undergoing elective urological procedures.

Materials and Methods

Study design and setting

This was a single-center prospective observational study conducted at the Institute of Kidney Diseases, Peshawar, Pakistan. Data were collected over six months, from September 2025 to February 2026.

Participants

Patients aged 18 years or older who were scheduled for elective urological procedures were eligible for inclusion. Both male and female patients were included.

Patients undergoing emergency procedures, those unable to complete the study assessment because of severe psychological or psychiatric illness, those with a documented contraindication to the planned anesthetic technique, and those unable to provide informed consent were excluded**.**

Sample Size and Sampling

Fifty patients were included in the final analysis. Participants were recruited during the six-month study period using convenience sampling.

Because this was a small, single-center exploratory observational study, the sample size was based on the number of eligible and consenting participants available during the study period. The study was not designed to provide definitive statistical power for all tested associations.

Data Collection Tools

Data were collected using a structured questionnaire. The questionnaire included two sections.

The first section recorded demographic and perioperative information, including:

a) Age
b) Sex
c) Body mass index
d) American Society of Anesthesiologists physical status
e) Preoperative counseling
f) Duration of preoperative fasting
g) Preoperative carbohydrate loading
h) Type of urological procedure
i) Surgical approach
j) Type of anesthesia
k) Maintenance of normothermia
l) Opioid-sparing technique

The second section recorded postoperative recovery outcomes during the first 24 hours after surgery. These included:

a) Quality of Recovery-15 score
b) Postoperative pain
c) Postoperative nausea and vomiting
d) Postoperative opioid requirement
e) Time to first mobilization
f) Time to first solid food intake
g) Sleep quality
h) Ability to communicate
i) Ability to use the toilet
j) Physical mobility
k) Respiratory comfort
l) General well-being

The exact language, validation status, administration method, scoring procedure, and total score range of the QoR-15 questionnaire should be added from the original study records before submission.

Data Collection Procedure

Data were collected at three stages.

Preoperative Stage

The preoperative assessment included demographic characteristics, body mass index, American Society of Anesthesiologists physical status, preoperative counseling, fasting duration, and preoperative carbohydrate loading.

Intraoperative Stage

The intraoperative assessment included the type of urological procedure, surgical approach, type of anesthesia, maintenance of normothermia, and use of an opioid-sparing technique.

Postoperative Stage

A postoperative assessment was conducted approximately 24 hours after surgery. Recovery was assessed using the QoR-15 score and the other predefined postoperative outcomes, including pain, nausea and vomiting, opioid requirement, time to

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

first mobilization, and time to first solid food intake.

Ethical Considerations

The study was conducted after approval from the relevant institutional research authorities and the Institute of Kidney Diseases, Peshawar. Written informed consent was obtained from all participants before data collection. Participation was voluntary, and participants were informed that they could withdraw from the study without affecting their medical care. Participant information was kept confidential and used only for research purposes.

The final manuscript should include the exact name of the ethics committee, approval number, and approval date.

Statistical Analysis

Data were entered, coded, and analyzed using IBM SPSS Statistics version 27. Categorical variables were summarized using frequencies and percentages. Continuous variables were summarized using means, standard deviations, minimum values, and maximum values.

The distribution of continuous variables was assessed using histograms. Because the data were not normally distributed, nonparametric tests were used for most comparisons.

The Mann Whitney (U) test was used to compare continuous outcomes between two independent groups. The Kruskal Wallis test was used to compare continuous outcomes among three or more independent groups. When the Kruskal Wallis test showed a statistically significant difference, Bonferroni-adjusted pairwise comparisons were performed.

Pearson correlation was used for the reported correlation analyses because the supplied statistical tables displayed Pearson correlation coefficients. Kendall's tau-b correlation was used to examine the relationship between American Society of Anesthesiologists physical status and postoperative recovery outcomes.

Associations between categorical variables were assessed using the Pearson chi-square test. Fisher's exact test was used when expected cell counts were small.

All tests were two-sided. A p-value below 0.05 was considered statistically significant. The analyses were unadjusted and did not control for differences in procedure type, surgical complexity, operative duration, postoperative pain, or other possible confounding factors.

Statistical tests used

Type of analysis	Statistical test
Categorical variables	Frequencies and percentages
Continuous variables	Mean, standard deviation, minimum, and maximum
Two independent groups	Mann–Whitney (U) test
Three or more independent groups	Kruskal–Wallis test
Post hoc comparison	Bonferroni-adjusted pairwise comparison
Continuous variables	Pearson correlation
Ordinal and continuous variables	Kendall's tau-b correlation
Categorical variables	Pearson chi-square test
Small expected cell counts	Fisher's exact test

Results

Patient Characteristics

A total of 50 patients were included in the analysis. Of these, 34 (68%) were male and 16 (32%) were female. The mean age was 47.0 years, with a range of 19–77 years. The mean body mass index (BMI) was 21.38 ± 2.22 kg/m², ranging from 18 to 29 kg/m².

Regarding preoperative risk stratification, 23 patients (46%) were classified as American Society of Anesthesiologists (ASA) physical status I, whereas 27 (54%) were classified as ASA physical status II. All patients received preoperative counseling. The mean duration of preoperative fasting was 7.34 ± 0.85 hours, with a range of 6–8 hours. Preoperative carbohydrate loading was administered to 4 patients (8%).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Surgical and Anesthetic Characteristics

The surgical procedures performed included ureteroscopy in 14 patients (28%), nephrectomy in 9 (18%), transurethral resection of bladder tumor (TURBT) in 9 (18%), cystoscopy in 9 (18%), prostatectomy in 8 (16%), and bladder-stone treatment in 1 patient (2%).

General anesthesia was administered to 13 patients (26%), while 37 patients (74%) received regional anesthesia. An opioid-sparing anesthetic technique was documented in 6 patients (12%).

Association Between Age and Recovery Outcomes

Age was not significantly associated with postoperative recovery outcomes. No statistically significant correlations were observed between age and the total Quality of Recovery-15 (QoR-15) score ($r = 0.135$, $p = 0.350$), postoperative pain ($r = -0.120$, $p = 0.406$), time to first solid food intake ($r = 0.062$, $p = 0.667$), or time to first mobilization ($r = 0.126$, $p = 0.383$).

Association Between BMI and Recovery Outcomes

BMI demonstrated a statistically significant negative correlation with the total QoR-15 score ($r = -0.381$, $p = 0.006$), indicating that higher BMI was associated with lower QoR-15 scores.

However, BMI was not significantly correlated with postoperative pain ($r = 0.194$, $p = 0.177$), time to first solid food intake ($r = 0.244$, $p = 0.087$), or time to first mobilization ($r = 0.070$, $p = 0.631$).

No statistically significant association was observed between BMI and postoperative nausea and vomiting (PONV) ($p = 0.942$) or postoperative opioid requirement ($p = 0.133$).

Association Between ASA Physical Status and Recovery Outcomes

ASA physical status was not significantly associated with the total QoR-15 score (Kendall's $\tau b = 0.139$, $p = 0.246$), postoperative pain ($\tau_b = 0.042$, $p = 0.750$), or time to first solid food intake ($\tau_b = 0.189$, $p = 0.152$).

In contrast, a statistically significant positive association was observed between ASA physical status and time to first mobilization ($\tau_b = 0.404$, $p = 0.001$), indicating that patients with a higher ASA physical status tended to require a longer time to achieve first mobilization.

Association Between Surgical Approach and Recovery Outcomes

Surgical approach was not significantly associated with the total QoR-15 score ($p = 0.233$), postoperative pain ($p = 0.177$), or time to first solid food intake ($p = 0.283$).

However, a statistically significant overall difference was observed in time to first mobilization according to surgical approach ($p < 0.001$). Bonferroni-adjusted pairwise comparisons demonstrated a statistically significant difference between endoscopic and open approaches (adjusted $p < 0.001$). In contrast, no statistically significant difference was observed between endoscopic and laparoscopic approaches (adjusted $p = 0.211$) or between open and laparoscopic approaches (adjusted $p = 1.000$).

Association Between Procedure Type and Recovery Outcomes

Procedure type was not significantly associated with the total QoR-15 score ($p = 0.052$) or postoperative pain ($p = 0.324$).

However, procedure type was significantly associated with both time to first solid food intake ($p = 0.003$) and time to first mobilization ($p < 0.001$). Pairwise analyses indicated statistically significant differences involving prostatectomy, ureteroscopy, nephrectomy, and cystoscopy. However, because the available statistical output does not clearly distinguish whether these pairwise comparisons correspond to time to first solid food intake, time to first mobilization, or both outcomes, the individual pairwise findings should be interpreted cautiously and reported only after verification against the original statistical table.

Postoperative Nausea and Vomiting

No statistically significant associations were observed between PONV and BMI ($p = 0.942$), preoperative fasting duration ($p = 0.582$), ASA physical status ($p = 0.226$), anesthesia type ($p = 0.175$), or procedure type ($p = 0.055$).

Several categorical comparisons contained small expected cell counts. Therefore, exact tests or Monte Carlo-based significance estimates should be considered when confirming the final PONV analyses to ensure the validity of the reported p-values.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Postoperative Opioid Requirement

Postoperative opioid requirement was not significantly associated with BMI ($p = 0.133$), ASA physical status (Fisher's exact test, $p = 0.136$), or use of an opioid-sparing anesthetic technique ($p = 0.561$).

A statistically significant association was observed between anesthesia type and postoperative opioid requirement ($\chi^2 = 14.423$, $p < 0.001$). This represents an unadjusted association and should therefore not be interpreted as evidence that general anesthesia independently causes increased postoperative opioid requirements. Further adjustment for potential confounding factors would be required to determine whether this association remains significant after accounting for other patient and surgical characteristics.

Discussion

This study assessed associations between selected perioperative variables and early postoperative recovery among 50 patients undergoing elective urological procedures. The principal findings were that higher BMI was associated with a lower QoR-15 score, American Society of Anesthesiologists physical status was associated with time to first mobilization, surgical approach was associated with time to first mobilization, procedure type was associated with time to first solid food intake and time to first mobilization, and anesthesia type was associated with postoperative opioid requirement.

BMI showed a statistically significant negative correlation with the total QoR-15 score. This suggests that patients with higher BMI reported poorer overall recovery 24 hours after surgery. However, BMI was not significantly associated with postoperative pain, time to mobilization, or time to solid food intake. Therefore, the effect of BMI may not be consistent across all recovery domains. Because BMI was analyzed as a continuous variable, the result should not be presented as evidence that patients with normal BMI had better recovery.

Previous research has reported that increased BMI, advanced age, and comorbidities may be associated with delayed postoperative recovery [18–21]. The present finding is generally consistent with those reports, although direct comparison is difficult because the current study included several different urological procedures rather than a single procedure group.

Surgical approach was associated with time to first mobilization. The significant post hoc comparison was between endoscopic and open approaches. No significant differences were observed between endoscopic and laparoscopic approaches or between open and laparoscopic approaches. The earlier mobilization observed after endoscopic procedures may be related to reduced tissue trauma and postoperative discomfort. However, this association may also reflect differences in procedure complexity, operative duration, patient selection, urinary devices, analgesic treatment, and mobilization protocols.

Procedure type was associated with time to first solid food intake and time to first mobilization, but not with QoR-15 score or postoperative pain. The included procedures differed substantially in their surgical extent and expected recovery. Nephrectomy, prostatectomy, ureteroscopy, cystoscopy, and transurethral resection of bladder tumor cannot be considered equivalent procedures. Therefore, the findings may reflect differences in the complete perioperative pathway rather than an independent effect of the procedure itself.

Anesthesia type was associated with postoperative opioid requirement. Patients who received general anesthesia were reported to be more likely to require postoperative opioids. This finding may reflect the analgesic benefits of regional anesthesia. However, anesthetic technique was not randomly assigned and may have been selected according to the procedure, expected pain, patient condition, or clinician preference. The result should therefore be interpreted as an unadjusted association rather than a causal effect.

No statistically significant association was observed between anesthesia type and PONV. Similarly, the available results did not demonstrate significant associations between BMI, fasting duration, American Society of Anesthesiologists physical status, procedure type, and PONV. Several contingency tables contained small expected cell counts, limiting the reliability of standard chi-

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

square testing. Exact or Monte Carlo testing should be completed before final conclusions about PONV are made.

The study did not demonstrate a statistically significant association between opioid-sparing technique and postoperative opioid requirement. However, an opioid-sparing technique was documented in only six patients. This small number substantially limited the ability to identify a statistically significant association. The result should not be interpreted as evidence that opioid-sparing strategies are ineffective.

Preoperative counseling was provided to all participants, so its association with recovery could not be evaluated. Similarly, only four patients received carbohydrate loading, limiting comparison between patients who did and did not receive this intervention.

The main strengths of this study were its prospective assessment of patients during the preoperative, intraoperative, and postoperative periods and its inclusion of a patient-reported recovery measure. The study also evaluated practical postoperative outcomes, including pain, PONV, opioid requirement, time to mobilization, and time to oral intake.

The study has several limitations. It was conducted at a single center and included a small convenience sample. The urological procedures were heterogeneous, and the analyses were not adjusted for important confounding variables such as operative duration, surgical complexity, blood loss, comorbidity, pain score, analgesic regimen, and clinician selection of anesthesia. Several categories contained few patients, particularly the bladder-stone and opioid-sparing groups. In addition, the supplied report did not provide complete information about the QoR-15 language and validation, outcome definitions, ethics approval number, and exact method used for some statistical analyses.

Strengths and limitations

Strengths

a) Prospective collection of preoperative, intraoperative, and postoperative information.

b) Inclusion of a patient-reported recovery measure.

c) Assessment of clinically relevant postoperative outcomes.

d) Evaluation of patient, surgical, and anesthetic variables.

e) Use of Bonferroni adjustment for the reported post hoc comparisons.

Limitations

a) Small sample size of 50 patients.

b) Single-center design.

c) Convenience sampling.

d) Heterogeneous urological procedures.

e) No randomization or separate control group.

f) No adjustment for confounding.

g) Small numbers in several exposure and procedure groups.

h) Incomplete definitions of PONV, mobilization, oral intake, and opioid requirement.

i) Incomplete information about QoR-15 administration and validation.

j) Preoperative counseling was provided to all participants, preventing comparison.

k) Only four patients received carbohydrate loading.

l) Only six patients received an opioid-sparing technique.

m) Postoperative opioid use was not reported as a standardized dose.

n) No long-term follow-up.

Conclusion

In this single-center prospective observational study of 50 patients undergoing elective urological procedures, higher BMI was associated with a lower QoR-15 score. American Society of Anesthesiologists physical status was associated with time to first mobilization. Surgical approach was associated with time to first mobilization, with a significant difference between endoscopic and open approaches. Procedure type was associated with time to first solid food intake and time to first mobilization. Anesthesia type was associated with postoperative opioid requirement in an unadjusted analysis.

No statistically significant association was reported between the examined variables and PONV. The findings should be interpreted as preliminary associations and not as evidence that regional

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

anesthesia, endoscopic surgery, lower BMI, or any other factor independently causes faster recovery. Larger multicenter studies with prespecified outcomes, standardized definitions, adequate sample sizes, exact statistical methods for sparse data, and adjustment for confounding are required.

Recommendations

1. Future studies should include larger samples from multiple hospitals.
2. A primary outcome, such as the QoR-15 score at 24 hours, should be selected before data collection.
3. Future sample-size calculations should be based on the expected difference in the primary outcome or the expected correlation.
4. Procedure groups should be classified according to surgical complexity or invasiveness.
5. Operative duration, blood loss, postoperative pain, analgesic regimen, and comorbidities should be recorded.
6. Future analyses should use multivariable methods when the sample size is adequate.
7. PONV should be analyzed using exact methods when expected cell counts are small.
8. Opioid use should be reported in standardized morphine milligram equivalents.
9. The QoR-15 language, validation, scoring, and administration procedure should be documented.
10. Longer follow-up should include complications, hospital stay, readmission, functional recovery, and patient satisfaction.

Declarations

Ethics approval

The study was approved by the relevant institutional research authorities and the Institute of Kidney Diseases, Peshawar.

Consent to participate

Written informed consent was obtained from all participants.

Funding

No external funding was reported. This statement should be confirmed by all authors.

Competing interests

The authors declare that they have no competing interests.

References

1. Engelman DT, Ben Ali W, Williams JB, et al. Guidelines for perioperative care in cardiac surgery: enhanced recovery after surgery society recommendations. *JAMA Surg.* 2019;154(8):755–766.
2. Riley CL. Anesthesia and enhanced recovery after surgery in bariatric surgery. *Anesthesiol Clin.* 2022;40(1):119–142.
3. Joshi GP. General anesthetic techniques for enhanced recovery after surgery: current controversies. *Best Pract Res Clin Anaesthesiol.* 2021;35(4):531–541.
4. Campoy L. Development of enhanced recovery after surgery protocols in veterinary medicine through a One Health approach: the role of anesthesia and locoregional techniques. *J Am Vet Med Assoc.* 2022;260(14):1751–1759.
5. Kehlet H. Enhanced recovery after surgery. *Dan Med J.* 2022;69(12):A09220536.
6. Ripollés-Melchor J, Ramírez-Rodríguez JM, Casans-Francés R, et al. Association between use of enhanced recovery after surgery protocols and postoperative complications in colorectal surgery in Europe: the EuroPOWER international observational study. *J Clin Anesth.* 2022;80:110752.
7. Brustia R, Slim K, Scatton O, et al. Guidelines for perioperative care for liver transplantation: enhanced recovery after surgery recommendations. *Transplantation.* 2022;106(3):552–561.
8. Lamperti M, et al. Preoperative assessment of adults undergoing elective noncardiac surgery: updated guidelines from the European Society of Anaesthesiology and Intensive Care. *Eur J Anaesthesiol.* 2025;42(1):1–35.
9. Albisinni S, et al. Current application of enhanced recovery after surgery protocols for patients undergoing radical cystectomy: lessons learned from European excellence centers. *World J Urol.* 2022;40(6):1317–1323.
10. Brooks NA, et al. Critical analysis of quality of life and cost-effectiveness of enhanced recovery after surgery for patients undergoing

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

urologic oncology surgery: a systematic review. *World J Urol*. 2022;40(6):1325–1342.

11. Tavoosian A, Shamshirgaran A, Hosseini SR, et al. Effect of spinal and general anesthesia on postoperative pain and satisfaction in ureteroscopic lithotripsy. *Urol J*. 2025;22(5):231–236.
12. Jain SN, Lamture Y, Krishna M. Enhanced recovery after surgery: exploring the advances and strategies. *Cureus*. 2023;15(10):e47119.
13. Sauro KM, Smith C, Bakunda L, et al. Enhanced recovery after surgery guidelines and hospital length of stay, readmission, complications, and mortality: a meta-analysis of randomized clinical trials. *JAMA Netw Open*. 2024;7(6):e2417310.
14. Long X, et al. Evidence-based practice and future development of enhanced recovery after surgery in urology: a multidimensional assessment based on the GRADE system. *J Robot Surg*. 2025;19(1):358.
15. Uleri A, et al. Personalized digital, multilevel program for preparation and early recovery after urologic surgery: a prospective, multicenter, pre- and postintervention trial. *Eur Urol Focus*. 2025.
16. Fu G, et al. State-of-the-art anesthesia practices: a comprehensive review on optimizing patient safety and recovery. *BMC Surg*. 2025;25(1):32.
17. Zain, et al. Leveraging artificial intelligence machine learning optimize enhanced recovery after surgery protocols. *Cureus*. 2024;16(3).
18. Barakat, et al. Factors contributing to early recovery of urinary continence following radical prostatectomy: a narrative review. *J Med*. 2024;13(22):6780.
19. Markos Z, et al Assessment-phase post-anesthesia quality of recovery and its affecting factors. *BMCesthesiol 2024;(1):342.
20. Karim SB. Factors related delayed after anesthesia. *Iraqi J Med Sci 2021;19().
21. Zhang Q, et al. Risk factors for delayed recovery in the post-anesthesia care unit after surgery: a large retrospective cohort study. *Int J Surg*. 2023;109(5):1281–1290.
22. Ballantyne CC, Stern KL. Postoperative pain management after ureteroscopy: focused approaches to reducing opiate dependence. *Pain Manag*. 2025;15(7):401–411.
23. Aleid A, et al. Enhanced recovery after surgery in Saudi Arabian surgical practice: a comprehensive analysis of surgical outcomes, patient satisfaction, and cost-effectiveness. *Cureus*. 2023;15(11).
24. Mao Q, et al. Preoperative risk factors for early postoperative urinary continence recovery after non-nerve-sparing radical prostatectomy in Chinese patients: a single-institute retrospective analysis. *Int J Clin Exp Med*. 2015;8(8):14105–14112.
25. McCall E, Shores R, McDonough J. The effectiveness of enhanced recovery after surgery guidelines in reducing postoperative pain. *Worldviews Evid Based Nurs*. 2022;19(4):338–340.
26. Sauro K, Smith C, Bakunda L, et al. The state of evidence for enhanced recovery after surgery effectiveness: a systematic review and meta-analysis. *Clin Nutr ESPEN*. 2023;57:785.
27. Arachchilage CE, Galketiya K. Meta-analysis of enhanced recovery after surgery protocols and their impact on postoperative outcomes. *J Surg Res*. 2025;8:172–175.
28. Tazreean R, Nelson G, Twomey R. Early mobilization in enhanced recovery after surgery pathways: current evidence and recent advancements. *J Comp Eff Res*. 2022;11(2):121–129.