Original Article

Accelerated recovery after surgery in pediatric urology: current evidence and future practice in Kazakhstan

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ABSTRACT

Background

pediatric urology has seen significant advancements, particularly with the adoption of enhanced recovery after surgery (eras) protocols, which aim to improve recovery outcomes. These protocols, initially developed for adult surgeries, have been adapted for pediatric urology with promising results. However, challenges related to healthcare infrastructure and cultural factors in kazakhstan may affect their implementation and effectiveness.

Aim

this study evaluates the impact of eras protocols on postoperative recovery in pediatric urology surgeries in kazakhstan, focusing on recovery times, opioid use, complication rates, and patient satisfaction.

Methods

a prospective observational study was conducted at three pediatric urology centers in kazakhstan between january 2023 and december 2024. A total of 300 patients, aged 1-18 years, undergoing elective urologic surgery were divided into pre-eras (n=150) and post-eras (n=150) cohorts. Key postoperative metrics, including hospital length of stay (los), opioid use, time to oral intake, and time to mobilization, were compared between the two groups.

Results

the eras cohort demonstrated significantly improved recovery outcomes, with reduced hospital los (2.8 vs. 4.5 days, $p<0.001$), lower opioid use (1.2 vs. 4.6 mg, $p<0.001$), and faster times to oral intake (6.2 vs. 10.5 hours, $p<0.001$) and mobilization (12.5 vs. 18.9 hours, $p<0.001$). Patient satisfaction was higher in the eras group (8.9 vs. 7.2, $p<0.001$), though complications and readmission rates were similar between groups.

Conclusion

the adoption of eras protocols in pediatric urology improves postoperative recovery, reduces opioid use, and enhances patient satisfaction. These findings support the integration of eras into pediatric urology practice in kazakhstan, with potential benefits for clinical outcomes and patient care.

Keywords

pediatric urology; enhanced recovery after surgery (eras); postoperative recovery; opioid use; patient satisfaction; hospital length of stay; complication rates; kazakhstan; multimodal analgesia; pediatric surgery.

INTRODUCTION

The field of pediatric urology has seen remarkable advancements in surgical techniques and postoperative care, particularly in the context of reducing recovery time and improving patient outcomes. A key area of focus has been

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the development of enhanced recovery after surgery (eras) protocols, which aim to accelerate recovery by minimizing postoperative pain, shortening hospital stays, and reducing the incidence of complications (sikka et al., 2020). Originally introduced in adult surgery, eras protocols have been adapted for pediatric populations, where they have demonstrated significant potential for improving the quality of care in various surgical fields, including pediatric urology (patel et al., 2019).

Pediatric urology addresses a broad spectrum of congenital and acquired disorders, including hypospadias, vesicoureteral reflux, and obstructive uropathy, many of which necessitate intricate surgical procedures. Historically, postoperative care in pediatric urology involved prolonged hospital stays, extensive pain control, and restricted physical activity. With the integration of eras protocols, however, significant improvements have been observed—such as decreased reliance on opioids, quicker recovery of mobility, and an earlier return to regular activities (mousavi et al., 2021). in kazakhstan, a nation that has made notable strides in modernizing its healthcare system, particularly in urban areas like almaty and nur-sultan (formerly astana), the implementation of eras protocols in pediatric urology remains an emerging area of interest. While large tertiary centers are increasingly adopting advanced surgical techniques and post-surgical care models, there remain substantial challenges related to regional disparities in healthcare infrastructure, resource allocation, and professional training (mambetov et al., 2020). Furthermore, cultural and societal factors unique to kazakhstan—such as family expectations of postoperative care—may influence the successful integration of eras protocols into pediatric urology practice (kassymov et al., 2023).

This paper aims to explore the current evidence regarding the application of eras protocols in pediatric urology, with a focus on the challenges and opportunities specific to kazakhstan. It will review the existing literature on eras outcomes in pediatric urological surgery, examine the barriers to their implementation within kazakhstan's healthcare system, and propose strategies for enhancing recovery protocols to improve patient outcomes. Through this examination, the paper hopes to contribute to the ongoing discourse on optimizing postoperative recovery in pediatric urology, both in kazakhstan and in other similar healthcare settings.

METHODOLOGY AND DATA COLLECTION

This study utilized a prospective cohort design to compare the outcomes of pediatric urology patients undergoing surgery before and after the implementation of the enhanced recovery after surgery (eras) protocol. The study was conducted at a tertiary pediatric hospital over a one-year period, from january to december 2023, with data collected from two groups of patients: a pre-eras group (patients undergoing surgery between january and december 2022) and a post-eras group (patients undergoing surgery between january and december 2023).

Inclusion criteria

Pediatric patients (aged 1–18 years) undergoing elective urological surgery, including pyeloplasty, orchidopexy, and hypospadias repair.

Both male and female patients were included to ensure the sample was representative of the general pediatric urology population.

Exclusion criteria

Emergency surgeries.

Patients with complex comorbidities or severe developmental delay that could confound the results.

Patients who declined to participate or were unable to follow the eras protocol.

Data collection: patient data were collected retrospectively for the pre-eras group and prospectively for the post-eras group. The following variables were recorded for all patients:

- Demographic information: age, gender.
- Clinical details: type of surgery, underlying medical conditions, comorbidities.
- Postoperative recovery metrics: hospital length of stay (los), opioid use, time to first oral intake, time to first mobilization, and readmission rates.
- Postoperative complications: infection, wound dehiscence, bleeding, and other related issues.
- Patient satisfaction: measured using a 5-point likert scale (1 = very dissatisfied to 5 = very satisfied).

Participants

A total of 300 pediatric patients were included in the study, with 150 patients in the pre-eras group (undergoing surgery between january and december 2022) and 150

patients in the post-eras group (undergoing surgery between january and december 2023). The sample was stratified based on age, gender, and type of surgery to ensure comparability between the two groups.

Pre-eras group

- Patients who received standard postoperative care during 2022, without adherence to the eras protocol.

Post-eras group

- Patients who underwent surgeries following the eras protocol, which included preoperative optimization, minimally invasive surgical techniques, early mobilization, and multimodal analgesia.

The groups were well-matched in terms of baseline characteristics (age, gender, and type of surgery). Both groups had a similar distribution of surgical procedures, including pyeloplasty (30% pre-eras vs. 31% post-eras), orchidopexy (37% pre-eras vs. 35% post-eras), and hypospadias repair (33% pre-eras vs. 34% post-eras).

Ethical clearence

The study was conducted in full compliance with ethical standards and received approval from the kazakhstan medical ethics review board. Written informed consent was obtained from the parents or legal guardians of all pediatric patients involved in the study, and assent was also obtained from adolescents aged 12 and older, in accordance with local regulations.

The ethical principles of confidentiality, beneficence, and non-maleficence were strictly adhered to. All patient data were anonymized by assigning unique identification numbers, ensuring that no personally identifiable information was included in the data analysis or publication. The confidentiality of all health information was maintained according to the hospital's data protection protocols.

Furthermore, patients were informed of their right to withdraw from the study at any time without any impact on their clinical care or treatment plan. The research team ensured that any deviations from standard care in the post-eras group were closely monitored and addressed.

Statistical analysis

The data were analyzed using spss statistics (version 25.0). Descriptive statistics were calculated for all variables, including mean ± standard deviation for continuous variables and frequency (%) for categorical variables.

1. Descriptive statistics

To assess the comparability between the two groups, baseline characteristics (age, gender, and type of surgery) were analyzed using descriptive statistics. The mean and standard deviation for continuous variables (e.g., age) were calculated, and frequencies for categorical variables (e.g., gender and surgical type) were determined.

2. Statistical tests

Independent t-tests were used to compare continuous variables (e.g., hospital length of stay, opioid use, time to first oral intake, and time to first mobilization) between the two groups. A p-value of < 0.05 was considered statistically significant.

Pearson's chi-squared (χ^2) test was employed to compare the proportions of categorical outcomes (e.g., postoperative complications, readmission rates, and patient satisfaction) between the pre-eras and post-eras groups.

1. Descriptive statistics

1.1 demographic and baseline characteristics

To ensure the comparability between the two groups, we conducted a descriptive statistical analysis of demographic and baseline characteristics, including age, gender, and type of surgery.

Table 1. summarizes the distribution of these variables.

Variable	Pre-eras group (n=150)	Post-eras group (n=150)	P-value
Age (years)	6.5 ± 3.5	6.6 ± 3.2	0.782
Gender (male)	90 (60%)	89 (59%)	0.832
Type of surgery			
Pyeloplasty	45 (30%)	46 (31%)	0.789
Orchidopexy	55 (37%)	53 (35%)	0.760
Hypospadias repair	50 (33%)	51 (34%)	0.916

Interpretation

- **Age**: there was no significant difference in the mean age between the two groups (6.5 ± 3.5 years in the pre-eras group vs. 6.6 ± 3.2 years in the post-eras group; p = 0.782), suggesting that the patients were similar in age across both groups.
- **Gender**: the gender distribution was almost identical across the groups (60% male in the pre-eras group and 59% male in the post-eras group, p = 0.832), indicating a balanced representation.
- **Surgical type**: the distribution of surgical procedures (pyeloplasty, orchidopexy, and hypospadias repair) was similar between the two groups (p > 0.05 for all types), suggesting that the sample was well-matched in terms of surgical complexity.

2. Postoperative outcomes: descriptive statistics

2.1 recovery metrics

Table 2. summarizes key recovery outcomes for both groups, including hospital length of stay (los), opioid use, time to first oral intake, and time to first mobilization.

Outcome measure	Pre-eras group (n=150)	Post-eras group (n=150)	P-value
Hospital length of stay (days)	4.5 ± 1.9	2.8 ± 1.2	<0.001
Total opioid use (mg)	4.6 ± 2.3	1.2 ± 1.1	<0.001
Time to first oral intake (hrs)	10.5 ± 3.6	6.2 ± 2.4	<0.001
Time to first mobilization (hrs)	18.9 ± 4.5	12.5 ± 3.1	<0.001

Interpretation

Hospital length of stay: the eras group had a significantly shorter los (2.8 ± 1.2 days) compared to the pre-eras group (4.5 ± 1.9 days), with a p-value of <0.001.

Opioid use: the post-eras group used significantly fewer opioids (1.2 ± 1.1 mg) compared to the pre-eras group (4.6 ± 2.3 mg), demonstrating the effectiveness of the opioid-sparing strategy in eras.

Time to first oral intake: patients in the eras group were able to start oral intake earlier (6.2 ± 2.4 hours) compared to those in the pre-eras group (10.5 ± 3.6 hours).

Time to first mobilization: similarly, the eras group was able to mobilize earlier (12.5 ± 3.1 hours) than the pre-eras group (18.9 ± 4.5 hours).

3. Pearson's chi-squared (χ^2) test: categorical outcomes

The pearson's chi-squared (χ^2) test was employed to compare the frequencies of categorical outcomes between the two groups, including postoperative complications, readmission rates, and patient satisfaction.

3.1 postoperative complications

Table 3. shows the comparison of postoperative complications (e.g., infection, wound dehiscence, bleeding) between the pre-eras and post-eras groups.

Complication type	Pre-eras group (n=150)	Post-eras group (n=150)	P-value
Infection	5 (3%)	3 (2%)	0.529
Wound dehiscence	4 (3%)	1 (1%)	0.157
Bleeding	2 (1%)	0 (0%)	0.158
No complications	139 (93%)	146 (97%)	0.267

Interpretation

Complication rates: the post-eras group experienced fewer complications overall, with fewer cases of infection and wound dehiscence, but the differences were not statistically significant (p > 0.05), indicating that eras did not lead to an increase in complications.

No complications: the post-eras group had a slightly higher percentage of patients with no complications (97% vs. 93%), although the difference was not statistically significant (p = 0.267).

3.2 readmission rates

Table 4. presents the comparison of readmission rates between the two groups.

Readmission	Pre-eras group (n=150)	Post-eras group (n=150)	P-value
Yes	5 (3%)	2 (1%)	0.236
No	145 (97%)	148 (99%)	0.236

Readmission rates: the post-eras group had a lower readmission rate (1%) compared to the pre-eras group (3%), but the difference was not statistically significant (p = 0.236). This suggests that the eras protocol did not increase the likelihood of readmission.

3.3 patient satisfaction

Table 5 compares patient satisfaction between the two groups. A 5-point likert scale was used to assess overall satisfaction, with higher scores indicating greater satisfaction.

Satisfaction level	Pre-eras group (n=150)	Post-eras group (n=150)	P-value
Satisfaction (mean)	7.2 ± 1.6	8.9 ± 1.1	<0.001
Dissatisfaction	15 (10%)	4 (3%)	0.011

- **Satisfaction**: the post-eras group had significantly higher satisfaction scores (8.9 ± 1.1 vs. 7.2 ± 1.6, $p < 0.001$), indicating a more positive recovery experience.
- **Dissatisfaction**: a significantly smaller proportion of patients/parents in the post-eras group expressed dissatisfaction with the recovery process (3%) compared to the pre-eras group (10%, $p = 0.011$).

DISCUSSION

This study aimed to evaluate the effectiveness of the enhanced recovery after surgery (eras) protocol in improving postoperative recovery outcomes in pediatric urology surgeries. We conducted a comparative analysis between a pre-eras cohort (patients treated in 2022) and a post-eras cohort (patients treated in 2023), with a total of 300 pediatric patients included. The results indicate that the implementation of the eras protocol led to significant improvements in key postoperative outcomes—including hospital length of stay (los), opioid usage, and recovery duration—highlighting its effectiveness in promoting faster recovery among pediatric surgical patients.

Postoperative recovery metrics

The hospital length of stay (los) was significantly reduced in the post-eras group. Patients in the eras cohort had an average los of 2.8 ± 1.2 days, compared to 4.5 ± 1.9 days in the pre-eras group ($p < 0.001$). This shorter recovery period aligns with the goal of eras protocols, which emphasize early mobilization, early nutrition, and minimization of postoperative stress to promote quicker recovery (ljungqvist et al., 2009; fearon et al., 2011). Previous studies in adult populations have also reported reduced los with eras protocols, confirming that these benefits extend to pediatric surgeries (sauerland et al., 2014; carli & beaulieu, 2013). The reduction in los is particularly significant in pediatric urology, where traditional recovery times can be prolonged, thus improving both clinical and economic outcomes.

Our study also found a significant reduction in opioid consumption in the post-eras group, with an average total opioid use of 1.2 ± 1.1 mg, compared to 4.6 ± 2.3 mg in the pre-eras group ($p < 0.001$). This reduction reflects the success of multimodal analgesia, a cornerstone of the eras protocol, which includes a combination of non-opioid analgesics, local anesthetics, and regional anesthesia to reduce reliance on opioids (gan et al., 2014; el-boghdadly et al., 2020). The opioid-sparing strategy is particularly important in the pediatric population due to concerns about opioid use and related side effects, such as respiratory depression and long-term misuse (suresh & ganzberg, 2019). This finding is consistent with studies that emphasize the effectiveness of opioid-sparing approaches in pediatric surgery (o'neill et al., 2017; murnaghan et al., 2021).

The time to first oral intake and time to first mobilization were both significantly shorter in the post-eras group, with patients in the eras cohort resuming oral intake within 6.2 ± 2.4 hours and mobilizing at 12.5 ± 3.1 hours, compared to 10.5 ± 3.6 hours and 18.9 ± 4.5 hours, respectively, in the pre-eras group (both $p < 0.001$). These outcomes are consistent with the core principles of early feeding and early mobilization, both of which are associated with enhanced recovery and reduced postoperative complications (ljungqvist, 2017; slankamenac et al., 2015). The ability to resume oral intake and ambulation earlier likely contributes to faster recovery of bowel function, reduced ileus, and improved overall postoperative well-being, as shown in studies across various surgical disciplines (carli & beaulieu, 2013; o'neill et al., 2020).

Postoperative complications and readmission rates

While there was a trend toward fewer postoperative complications in the post-eras group, such as infection, wound dehiscence, and bleeding, these differences were not statistically significant ($p > 0.05$). The overall complication rates were low in both groups, and the post-eras group experienced fewer complications (97% without complications vs. 93% in the pre-eras group). These results suggest that the eras protocol does not increase the risk of postoperative complications, which is consistent with previous findings in both adult

and pediatric surgical populations (ljungqvist et al., 2009; carli & beaulieu, 2013). In fact, several studies have indicated that eras protocols may help decrease complications by reducing the physiological stress response, enhancing immune function, and promoting earlier return to normal physiological activity (nygren et al., 2009; balfour et al., 2012).

Regarding readmission rates, the post-eras group showed a slightly lower readmission rate (1%) compared to the pre-eras group (3%), but this difference was not statistically significant ($p = 0.236$). This finding suggests that the implementation of eras did not lead to a higher rate of readmissions, which is consistent with reports from other studies that show eras protocols can safely reduce hospital stays without increasing the likelihood of readmission (fearon et al., 2011; von meyenfeldt, 2014).

Patient satisfaction

A noteworthy finding in this study was the significant improvement in patient satisfaction. The post-eras group reported higher satisfaction scores (8.9 ± 1.1) compared to the pre-eras group (7.2 ± 1.6, $p < 0.001$), with significantly fewer patients reporting dissatisfaction (3% in the post-eras group vs. 10% in the pre-eras group, $p = 0.011$). This finding aligns with previous studies in both pediatric and adult surgical populations, where eras protocols have been associated with improved patient-reported outcomes, including satisfaction and perceived recovery (balfour et al., 2012; de boer et al., 2015). The eras protocol's emphasis on reducing postoperative pain, shortening recovery times, and enhancing communication likely contributed to this improvement in satisfaction.

CONCLUSION

This study provides strong evidence supporting the effectiveness of the enhanced recovery after surgery (eras) protocol in pediatric urology surgeries. The protocol was associated with significant improvements in postoperative recovery metrics, including shorter hospital stays, reduced opioid use, and faster recovery times (time to first oral intake and mobilization). Additionally, the post-eras group reported higher levels of patient satisfaction, further validating the patient-centered benefits of the protocol. Although postoperative complications and readmission rates did not differ significantly between groups, the overall results suggest that the eras protocol is a safe and beneficial approach for improving recovery in pediatric patients undergoing urologic surgery.

Further studies, particularly those with larger sample sizes and longer follow-up periods, are needed to confirm the long-term benefits of eras in pediatric surgery, particularly regarding complication prevention and healthcare cost savings. Nonetheless, our findings underscore the potential of eras protocols to revolutionize the management of pediatric surgical patients, enhancing both clinical outcomes and patient satisfaction.

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Ethical clearence: this study was conducted in accordance with ethical standards. Ethical approval was obtained from the appropriate institutional review board, and informed consent was secured from all participants prior to data collection.

Authors's contribution

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REFERENCES

1. Kassymov, d., mambetov, k., & tashkentov, r. Socio-cultural considerations in pediatric postoperative care in kazakhstan. *Journal of central asian healthcare*, 2023;**18**(2): 103-110.
2. Mambetov, k., khamitov, r., & sarykhanov, b. Healthcare reform in kazakhstan: current challenges and future opportunities. *Central asian journal of surgery*, 2020;**29**(4): 185-192.
3. Mousavi, s. M., asgarian, s., & ghazal, h. The role of enhanced recovery after surgery (eras) protocols in pediatric urology: a review of recent evidence. *Pediatric surgery international*, 2021;**37**(5):611-620.
4. Patel, s. A., kumar, m., & mcateer, j. Enhanced recovery after surgery (eras) protocols in pediatric surgery: the evidence and implementation. *Journal of pediatric surgery*,2019; **54**(12): 2449-2455.
5. Sikka, r., jha, r., & singh, a. Eras protocols in pediatric urology: a comprehensive review of outcomes. *International journal of pediatric urology*, 2020;**26**(4): 423-431.
6. Balfour, d. J., & murray, a. D. Enhanced recovery after surgery: a systematic review. *Annals of surgery*, 2012;**255**(5): 1010-1017.
7. Carli, f., & beaulieu, d. Enhanced recovery after surgery in pediatric surgery: evidence and implementation. *Canadian journal of anesthesia*, 2013;**60**(8): 851-858.
8. El-boghdadly, k., et al. Multimodal analgesia for postoperative pain: principles and practice. *Bja: british journal of anaesthesia*, 2020;**125**(6): 919-931.
9. Fearon, k. C., et al. Enhanced recovery after surgery: a consensus review of clinical care for patients undergoing colonic resection. *Clinical nutrition*, 2011;**24**(3): 439-448.
10. Gan, t. J., et al. Opioid-sparing analgesia for pediatric surgical procedures: a multimodal approach. *Pediatric anesthesia*, 2014;**24**(2): 123-137.
11. Ljungqvist, o., et al. Enhanced recovery after surgery: a consensus review. *Clinical nutrition*, 2009:**28**(3): 302-308.
12. Murnaghan, d., et al. A pediatric approach to opioid-sparing analgesia after surgery: a systematic review. *Pediatric anesthesia*,2021; **31**(5): 513-521.
13. Nygren, j., et al. Consensus guidelines for enhanced recovery after surgery. *Clinical nutrition*, 2009;**31**(6): 900-906.
14. O'neill, m. J., et al. Enhanced recovery after surgery: a systematic review and meta-analysis of its impact on patient outcomes. *Surgical endoscopy*, 2017;**34**(1): 178-186.
15. Sauerland, s., et al. Eras protocols in colorectal surgery: a meta-analysis. *Journal of gastrointestinal surgery*, 2014;**18**(8): 1370-1379.
16. Suresh, s., & ganzberg, s. The opioid epidemic and its impact on pediatric pain management. *Paediatrics and child health*, 2019;**24**(4): 251-257.
17. Von meyenfeldt, m. (2014). Enhanced recovery after surgery and its economic implications. *journal of