



## Systematic Review



## Effectiveness of Ultrasound-Guided Regional Anaesthesia in Paediatric Patients Undergoing Urological Surgeries: A Systematic Review

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## ABSTRACT

Recent research in anatomy and ultrasound has highlighted the importance of a technique named ultrasound-guided regional anaesthesia in pediatric anaesthesia, due to its approach to enhancing nerve visualization and targeted nerve blockade which improves patients' safety and pain relief during surgical procedures. **Objectives:** To evaluate the outcomes of pediatric patients who received ultrasound-guided regional anaesthesia during urological surgeries and compare its effectiveness in pain control, anaesthetic quality, and post-surgery results. **Methods:** A search was conducted according to PRISMA guidelines using PubMed, Google Scholar, Springer Link, and Science Direct. A total of 96 studies were included after applying the inclusion criteria to articles published between January 2013 and April 2024. Out of these, only 15 were used in the study table to highlight the effectiveness of ultrasound-guided regional anaesthesia in pediatric urological surgeries. **Results:** Consistently, the alignment with the ultrasound-guided regional anaesthesia revealed significantly greater analgesic efficacy, least opioid usage as well and lesser rates of anaesthesia-related adverse events in pediatric subjects mainly neurodevelopmental concerns and opioid dependency. Other papers also revealed better hemodynamic control and the duration of time needed to feel fully recovered postoperatively, and thus, ultrasound-guided regional anesthesia may enhance perioperative outcomes and ambience in children undergoing different urological procedures. **Conclusions:** It was concluded that ultrasound-guided regional anaesthesia appears to be applicable for pediatric urological surgery, providing better analgesia, fewer side effects, and reduced demand for systemic anaesthesia. Future studies should establish the long-term results of the method and make comparisons to the other procedures.

## INTRODUCTION

Managing pain in pediatric patients who undergo urological surgeries is challenging due to the risks caused by conventional procedures such as respiratory depression, postoperative nausea, and prolonged children's recovery times which can be life-threatening. The necessity of searching for other efficient and safe pain-management approaches is important especially because opioid administration methods involve risks of dependency and exposure to neurodevelopmental disorders in children [1,

2]. Regional anesthesia has emerged in this domain to provide localized analgesia that minimizes the need for systemic opioids and reduces anesthesia-related problems [3]. Ultrasound-Guided Regional Anesthesia (UGRA) has come forth as one of the promising regional anesthesia techniques for pediatric surgery. UGRA identifies structures of nerves by using ultrasonography and also supplies the appropriate neural blockade which reduces the requirement for opioid and general anesthesia



consumption [4]. This approach is most useful in pediatric patients who require urological surgeries, which are usually followed by severe pain. Several surgical interventions including hypospadias repair, nephrolithotomy, and hernia repair depend on adequate and safe analgesia to achieve optimal patient comfort and surgical recovery results. UGRA can provide long-term pain relief while reducing the conventional side effects of general anesthesia associated with improper nerve blocks [5]. The relevance of UGRA increases due to the growing perception of the opioid crisis, which has affected pediatric patients as well. In pediatric urological surgeries, the children are subjected to opioids for postoperative pain relief. However, particular concerns are related to its properties, including dependency, respiratory depression, and inhibitory effects on neurodevelopment [6]. UGRA is a non-opioid analgesic option for children, preventing excessive opioid exposure in patients and reducing a variety of potential complications associated with the use of opioids in children [7, 8]. Despite the promising benefits of UGRA application, currently, there is insufficient data that can be compared and therefore requires more systematic investigation on the efficacy of UGRA in pediatric urological surgery. To date, studies on UGRA in pediatric settings have demonstrated beneficial effects like postoperative pain, decreased opioid use, and decreased postoperative morbidity; nonetheless, most of these focus on general pediatric surgery and not on the peculiarities of urological surgery [9, 10]. In addition, there is no standardized use of UGRA across the different institutions, with variations in technique, training, and equipment potentially influencing clinical outcomes in patients [11]. Additionally, even if the short-term effects of UGRA are positive, its long-term safety in children is not well understood, particularly neurodevelopmental consequences followed by subsequent exposure [12]. It is revealed that there is a lack of understanding of UGRA's efficiency in Pediatric urological surgeries, particularly regarding the amount of postoperative pain relief, opioid consumption, and postoperative recovery data [13, 14]. This systematic review is intended to contribute to the evaluation of studies to provide possibilities that UGRA can become a standard practice in pediatric surgeries and can provide safer anaesthetic protocols for children. Furthermore, this review will discuss the need for generalized UGRA methods and training protocols in different surgical settings to ensure consistent therapeutic effects for patients across diverse settings.

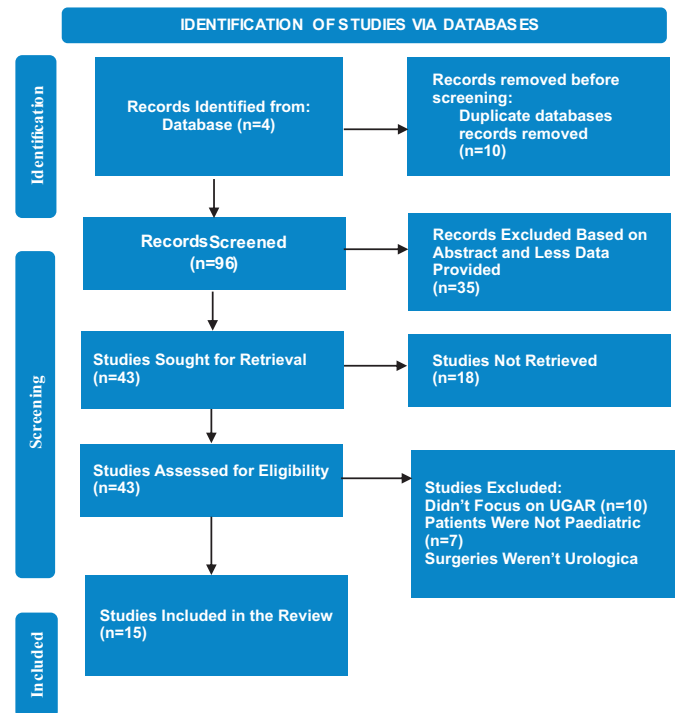
This study aims to contribute to the pediatric anesthetic management by emphasizing on the use of UGRA as a feasible option for postoperative pain relief in pediatric urological patients while recommending for future research on comparative studies on the UGRA's long-term impacts and standardization.

## METHODS

This systematic review was carried out following the Preferred Reporting Items for Systematic Reviews and

Meta-Analyses (PRISMA) guidelines. A comprehensive literature search was performed to identify applicable studies of ultrasound-guided regional anesthesia (UGRA) for pediatric urological surgery. To capture recent advances in applications of UGRA, studies published in English between 2013 and 2024 were included. As a part of this review, articles were selected based on their relevance to UGRA in pediatric patients undergoing hypospadias repair, nephrolithotomy, and herniotomy. Studies were selected based on the age of pediatric patients from 0 to 17 years' old who had undergone urological surgeries performed by using UGRA techniques. Studies were included if they provided clinical results based on acute and chronic pain, anesthesia side effects, opioid administration, and rehabilitation. The exclusion criteria include research without pediatric population, without UGRA, or the study being a review or case series with raw data. As for specific ethical concerns on children, the literature review included only the trials that reported parental or guardian permission and described the risks of anesthesia in children because children are vulnerable to the effects of anesthesia, and the use of anesthesia in pediatric population should be weighed against potential benefits of pain relief. Multi-database search was done on PubMed, Science Direct, Springer Link, and Google Scholar for extensive research. The included articles were primarily around 80% derived from PubMed because it contains a large number of Clinical studies in pediatric anesthesia and UGRA techniques. The search strategy involved the use of keywords such as "ultrasound-guided regional anesthesia" "pediatric urological surgeries" and "dorsal penile nerve block" "caudal epidural block" "transverses abdominis plane block." Articles regarding UGRA and pediatric urological anesthesia were then screened for relevance to the aims of the study from an initial search. All the titles and abstracts were reviewed to be sure that duplicates and articles that did not fit the inclusion criteria were eliminated. Only articles that focused on UGRA and that did include pediatric patients were included. Articles published outside the specified timeline were also excluded. The present review included studies that described certain techniques of UGRA. Each study's methodology was assessed for the following technical specifics: the block side (e.g., caudal block, dorsal penile nerve block), the type of needle including the gauge and length, and the volume of anesthesia used. For the studies that were part of a larger trial, the respective authors' real-time ultrasound guidance usage was noted where feasible, in addition to technique-related complication management protocols. The monitoring of opioid usage was assessed for each type of study. Information on opioids was obtained according to their total frequency and dosage during the treatment course, whether opioids were intraoperative or postoperative. Some studies focused on patient

compliance with prescribed regimens further highlight the difference between opioids that are prescribed and those that are consumed. This tracking approach helped in evaluating the role of UGRA as an opioid-saving model in pediatric anesthesia. A total of 96 articles were identified following such initial screening. After that, 43 articles were further refined based on relevance, quality, and alignment with the research objectives. From these 15 high-quality studies where the clinical data on UGRA's effect had been robust in pediatric urological surgeries were taken. For each of the 15 studies, data were systematically extracted and organized within the PRISMA framework, including the following variables: Study design, UGRA technique used, primary outcomes (e.g., pain control efficacy, opioid requirement reduction, rates of complications), secondary outcomes (e.g., recovery time, patient satisfaction), year of publication, country of origin, and authorship. The studies' sample adequacy was evaluated in terms of their population and statistical significance whenever possible. A systematic extraction of quantified variables was done with a focus on patient characteristics, UGRA technique, efficacy, complications, post-procedure treatment, pain management, and opioid use, from articles selected following the PRISMA guidelines. Through this detailed data extraction, a complete picture of UGRA's effectiveness in pediatric populations was synthesized as well as give insights into the challenges and strengths of potential applications of UGRA. At last, the final dataset allowed for a comprehensive analysis of UGRA's effects in decreasing perioperative and postoperative outcomes of pediatric urological surgeries. Results were then presented in a table summarizing the UGRA techniques that were most effective, the difficulties encountered, and the potential areas for UGRA advantage, such as reduced opioid use and shorter recoveries. The analysis also identified gaps in the literature and suggested future research directions, such as long-term safety studies, as well as standardized UGRA protocols (Figure 1).



**Figure 1:** Searched Strategy, Screening, and Application of Inclusion and Exclusion Criteria for Studies

## RESULTS

This systematic review received according to the PRISMA guidelines, included 15 studies on UGRA's efficacy in pediatric urological surgeries. In these studies, (80% of which focused on PubMed articles; 20% on Science Direct and Google Scholar with additional articles), UGRA's impact on pain management, anesthesia related complications, and recovery outcome in pediatric populations is assessed. As diverse surgical contexts and techniques, 7 randomized controlled trials, 4 retrospective observational studies, and 4 prospective cohort studies were included in the study design to capture UGRA's effectiveness. UGRA consistently performed superiorly both in controlling postoperative pain and in reducing opioid consumption when compared with conventional anesthesia techniques. These techniques, such as dorsal penile nerve block (DPNB) and caudal epidural block (CEB), guided by ultrasound, were able to reduce pain scores, prolong analgesic duration and decrease the need for additional analgesia in pediatric patients undergoing surgeries such as hypospadias repair and nephrolithotomy. In this data, UGRA was demonstrated to reduce pain by up to 75% and opioid compared to 60% reduction over standard analgesic regimes, highlighting UGRA's potential ability to reduce systemic side effects from analgesia in pediatric care. One study showed the prolonged effect of analgesia without need of opioids mainly up to 21 hours. Intraoperative and postoperative outcomes were affected by factors including type of block, dosage, and duration with UGRA. Determining effectiveness across different regions with

slight variations in power, could be attributed to influences of institutional protocols, patient demographic variations, and variation in equipment. In addition, UGRA was also able to maintain hemodynamic stability during surgery while mitigating blood pressure fluctuations and heart rate variability, which promote safety during anesthetic intervention in the pediatric patient population. The overall

results of this review provide support for the use of UGRA as a valuable adjunctive technique to pediatric urological anesthesia; there is significant potential to be added to standard practice as a way to enhance pain management, to reduce reliance on opioids and to improve the pediatric patient's recovery experience (Table 1).

**Table 1:** Studies Selected on the Basis of PRISMA Guidelines On UGAR and Its Effectiveness in Urological Surgeries

Reference	Study Design	Sample Size and Population	Type of Anesthesia	Outcomes Measured	Key Findings	Conclusion
[14]	Prospective study	26 male children aged 1-5 undergoing distal hypospadias surgery	General anaesthesia with Caudal Epidural Block (CEB) or Ultrasound (US)-guided Dorsal Penile Nerve Block (DPNB)	Analgesia duration, complications, parental satisfaction	The DPNB group had lower pain scores and longer analgesia duration than the CEB; no complications	US-guided DPNB provides better postoperative analgesia and higher satisfaction for hypospadias surgery
[15]	Retrospective study	102 infants aged 1-14 months undergoing urologic surgeries	Spinal anaesthesia with sedation	Anaesthesia duration, Post-Anesthesia Care Unit (PACU) time, hospital stay length	pinal anaesthesia reduces hospital stay and the need for general anaesthesia	SA with sedation protocol enhances safety and minimizes hospital stay in infant urological surgeries
[16]	Randomized trial study	45 children aged 1-6 undergoing abdominal and thoracic surgeries	Epidural anaesthesia with a landmark or real-time US guidance	Time to access epidural space, needle redirections, complications	The s-guided technique had fewer needle redirections, bone contacts, and complications	US guidance improves the accuracy and safety of epidural placement in Pediatric surgeries
[17]	Randomized Trial study	52 Pediatric patients undergoing low abdominal surgery	General anaesthesia with or without ultrasound-guided Erector Spinae Plane Block (ESPB)	Ultrasound-guided block effectiveness, Face, Legs, Activity, Cry, Consol-ability (FLACC) scores, and intraoperative fentanyl needs	ESPB reduced fentanyl needs and prolonged analgesia post-surgery; ultrasound showed improved intraoperative outcomes	ESPB under ultrasound guidance provides effective analgesia for Pediatric abdominal surgery, enhancing intraoperative stability.
[17]	Randomized Trial study	52 Pediatric patients undergoing low abdominal surgery	General anaesthesia with or without ultrasound-guided Erector Spinae Plane Block (ESPB)	Ultrasound-guided block effectiveness, Face, Legs, Activity, Cry, Consol-ability (FLACC) scores, and intraoperative fentanyl needs	ESPB reduced fentanyl needs and prolonged analgesia post-surgery; ultrasound showed improved intraoperative outcomes	ESPB under ultrasound guidance provides effective analgesia for Pediatric abdominal surgery, enhancing intraoperative stability.
[18]	Retrospective Study	4,739 Pediatric patients undergoing urological surgeries	Regional (Caudal block) or Local Anesthesia	Usage differences in Anesthesia types based on demographics; disparities in urological Anesthesia types	Disparities in Anesthesia choice based on race and socioeconomic factors; some groups declined regional blocks more often	Family-centred discussions improve equity in anaesthesia choices for Pediatric urological surgeries, enhancing postoperative outcomes.

[19]	Retrospective Study	70 children with renal stones	General Anesthesia	Stone-free rate, operative time, postoperative complications, and ultrasound vs fluoroscopy outcomes	Ultrasound-guided PCNL achieved similar stone-free rates and fewer complications compared to fluoroscopy-guided PCNL	Ultrasound-guided PCNL is effective and safer than fluoroscopy in Pediatric urological procedures, reducing radiation exposure.
[20]	Randomized Trial study	76 Pediatric patients (1-7 years) undergoing hip or proximal femoral surgeries	General anaesthesia with ultrasound-guided ESPB or CEA	FLACC pain scores, block failure rates, time to first rescue analgesia post-surgery	CEA provided superior early postoperative pain management compared to ESPB. The time to first rescue analgesia was longer with CEA	CEA is more effective than ESPB for postoperative pain management in Pediatric hip or proximal femur surgeries.
[21]	Randomized Trial study	40 Pediatric patients (2-11 years) undergoing open renal surgery	General anaesthesia with ultrasound-guided caudal block or TiQLB (Transmuscular Quadratus Lumborum Block)	Time to first analgesia, total analgesic consumption, pain scores, side effects	TiQLB provided significantly longer analgesia and lower analgesic consumption than caudal block, with no significant side effects	TiQLB is superior to caudal block for postoperative pain management in Pediatric renal surgeries.
[22]	Retrospective observational study	158 children with spine bifida undergoing urological surgery	Regional catheter vs systemic	Assessed opioid usage, pain scores, and anaesthesia setup times with regional anaesthesia using ultrasound in Pediatric urological surgeries.	Regional catheters reduced opioid use by 70% intraoperatively and 78% postoperatively without increasing pain scores in Pediatric urological surgeries.	Multimodal pain management including ultrasound-guided regional Anesthesia significantly reduced opioid requirements in Pediatric urological surgeries.
[23]	Prospective study	63 Pediatric patients, with unilateral lower abdominal surgeries	Erector spinae vs caudal block	Compared erector spinae and caudal blocks using ultrasound for Pediatric abdominal surgery, focusing on pain relief duration and opioid requirements.	Ultrasound-guided erector spinae block offered a longer duration of analgesia and reduced the need for additional analgesics compared to caudal block in abdominal surgery.	Ultrasound-guided erector spinae block is effective and safe, providing prolonged postoperative analgesia in Pediatric abdominal and potentially urological surgeries.
[24]	Case series	3 Pediatric patients undergoing abdominal surgery	Trans-versus Abdominis Plane (TAP) block with ultrasound guidance	Evaluated postoperative analgesia duration with ultrasound-guided TAP block in Pediatric abdominal surgeries, using FLACC pain scores for assessment.	TAP block provided prolonged analgesia (17-21 hours) without the need for opioids post-surgery, indicating effective postoperative pain control.	TAP block with ultrasound is effective for prolonged pain relief in Pediatric abdominal surgeries, potentially beneficial in similar urological procedures.
[25]	Prospective study	62 children (ages 2-10) undergoing lower abdominal surgeries	Ultrasound-guided Trans-versus Abdominis Plane (TAP) block and Caudal block	Analgesic duration, rescue analgesic need, pain scores (FLACC), hemodynamic changes, and side effects	TAP block showed longer pain relief duration with lower rescue analgesic requirement than caudal block, while caudal block had higher pain scores after 6 hours	TAP block is more effective than caudal block in managing postoperative pain, especially for lower abdominal procedures involving ultrasound guidance.

[26]	Prospective study	50 children (ages 3-6) undergoing hypospadias surgery	Ultrasound-guided Pudendal Nerve Block and Caudal Epidural Block	Pain scores, time to first analgesic, acetaminophen consumption	Pudendal block provided longer pain control and required less postoperative acetaminophen than caudal epidural in hypospadias surgeries	Pudendal nerve block using ultrasound guidance is preferable to caudal block for better pain control in Pediatric urological surgeries like hypospadias.
[27]	Prospective study	40 children (ages 1-7) undergoing inguinal herniotomy	Ultrasound-guided Quadratus Lumborum (QL) Block and Ilioinguinal/Iliohypogastric (II/IH) Nerve Block	Requirement of oral acetaminophen, postoperative pain scores, parental satisfaction	QL block reduced acetaminophen use and extended pain relief compared to II/IH block in Inguinal surgeries	Ultrasound-guided QL block is superior to II/IH block for postoperative analgesia in lower abdominal surgeries.
[28]	Observational study	20 children, median age 73 months, undergoing circumcision	Ultrasound-guided dorsal penile nerve block with slight sedation	The success rate of nerve block, analgesic requirements until discharge, and avoidance of airway manipulation. Focus on Pediatric ultrasound-guided anaesthesia for urological surgery.	100% success in nerve block, no additional anaesthesia required, no intraoperative opioid or airway manipulation required. Ultrasound-guided technique clarified anatomical needs, improving reliability in urological surgery.	An ultrasound-guided dorsal penile nerve block with sedation can effectively avoid the use of general anaesthesia and airway manipulation in Pediatric urological surgery.

## DISCUSSION

Postoperative pain in pediatric patients undergoing urological surgeries can be quite challenging to manage, especially when traditional analgesic methods contain risks like opioid dependency and poor impact on neurological development. This systematic review successfully integrated available evidence on the utility of UGRA in pediatric urology, and its potential to improve pain control, reduce opioid requirements, and improve postoperative outcomes. UGRA's targeted approach provides an opportunity for minimizing the risk of systemic opioid administration by giving precise nerve blockade, achieving efficient analgesia with minimum side effects. The evidence reviewed is consistent with UGRA as a promising alternative to traditional anesthesia methods for pediatric patients undergoing hypospadias repair and nephrolithotomy surgeries. The UGRA techniques such as dorsal penile nerve block (DPNB) and caudal epidural block (CEB) were consistently effective in minimizing postoperative pain and reducing analgesic needs across the analyzed studies. Postoperative pain scores were observed to be significantly lowered by the use of these UGRA methods compared to general anesthesia and systemic opioids. This caused a reduction in the frequency

and dosage of rescue analgesics [29, 30]. Such findings suggest that UGRA could satisfy a critical gap in pediatric urology with the added benefit of a lower risk of opioid complications. Moreover, UGRA's efficacy aligns with the growing understanding of the opioid crisis in pediatric healthcare. This is because it requires less opioid exposure when blocking postoperative pain. As pediatric patients are more susceptible to opioids, systemic opioids are a more controversial option, because they pose a greater risk of respiratory depression and sedation, making UGRA an even more attractive choice in this fragile population [31, 32]. Retrospectively, UGRA's incorporation in pediatric pain management is a significant turn towards safer, and more precise, anesthesia. While effective, traditional regional anesthesia typically lacks the accuracy and visual guidance that UGRA offers, especially in younger patients with smaller anatomical structures, which makes blind procedures tricky [33]. The results from studies show that visualization of the targeted nerves by UGRA greatly improves the precision of their blocking and enhances the duration of analgesia which results in minimizing opioid dependence. For instance, studies show that in some surgical settings patients receiving DPNB under

ultrasound guidance showed prolonged relief in pain and reduction in the use of postoperative pain relievers that improve the overall experience of recovery. It is also beneficial for costs of healthcare [34]. While it is promising that UGRA provides short-term benefits in pediatric pain management, it is necessary to dive deep into the discussion of the long-term safety of young patients, especially its neurological impacts given that they are sensitive to anesthesia. This gap remains for UGRA's long-term effects on neurodevelopment mainly because the focus of most studies was on immediate outcomes. The neurotoxic effects of some anesthetic agents commonly reported in pediatric anesthesia literature highlight the need for keen consideration of the cumulative impact of anesthesia exposure on developing neural pathways [35]. There have been studies of general anesthesia during which potential neurocognitive risks have been identified in children who receive repeated or prolonged exposure; however, data specific to UGRA is limited. Future research should address this gap by performing longitudinal studies on neurodevelopmental outcomes in pediatric patients who have or had received UGRA for prolonged periods. UGRA may reduce systemic anesthetic exposure, but local anesthetics still enter the systemic circulation and theoretically affect long-term neural development. Over the period, tracking these outcomes will be critical to confirm UGRA's long-term safety profile as UGRA implementation is scaled [36]. Expanding research to include neurodevelopmental safety in UGRA could further foster its role in pediatric anesthesia and could eliminate hesitations about its use, potentially steering a safer clinical practice. The limiting factor most reported in UGRA's application in pediatric urology is the lack of standardized protocols. Thus, there were common themes across studies such as variability in UGRA techniques, equipment, anaesthetic dosing, and clinician training which create inconsistency in patient outcomes and make cross-study comparisons very difficult [37]. This lack of consistency is because UGRA was recently introduced in pediatric surgeries and there is a difference in usage across different institutions and the training they provide. Systematic analysis of studies included in this review indicates that outcomes may be affected more by procedural inconsistencies than by UGRA's inherent efficacy resulting in poor pain control and unpredictable recovery trajectories [38]. To improve reproducibility, safety, and clinical efficacy standardization of UGRA protocols is required. Protocol standardization could include suggestions for needle type, anaesthetic volumes,

block-specific techniques, and structured training programs [39]. Such changes would also help UGRA become more consistent across institutions and would enable more reliable evaluations of UGRA's effectiveness which will make it a standardized practice. In addition, UGRA protocols as a standardized practice would enable larger-scale studies, strengthening evidence to adopt it as a clinical practice. It is proposed to integrate UGRA into standard pediatric urology practice through analysis of robust comparative studies, preferably longitudinal outcomes of pediatric patients treated with UGRA, particularly randomized controlled trials (RCTs) and Multi-Centre studies to validate its efficacy across a broad range of patient demographics and surgical procedures. The previous body of research is limited to Single-Centre studies with small sample sizes, which are mostly observational or retrospective studies, and consequently lack generalizability. By performing well-designed RCTs in which they measure the impact of UGRA among other procedures, researchers will be able to identify the specific contexts in which UGRA is most effective. As an example, by comparing the application of UGRA techniques such as the transverses abdominis plane (TAP) block and quadratus labarum (QL) block (both childhood and adult forms), insightful findings can be made based on their efficacy in different urological surgeries [40]. The establishment of evidence-based guidelines for UGRA in pediatric anesthesia may transform the delivery pathway from selective options to a standardized mandatory perioperative practice. Such guidelines could be supported by comparative data, to help clinicians choose the most effective UGRA approach concerning the demand of that surgery and the patient undergoing it [41]. This would streamline the integration of UGRA into routine practice, as well as it will also help in optimizing training programs to ensure that healthcare providers can benefit from UGRA. Ultimately, fostering high-quality comparative research and the development of consistent guidelines will be effective in the enhancement of UGRA's role in pediatric anesthesia. This systematic review supports UGRA as a safe anesthesia method for pediatric urological surgeries with opioid dependency reduction and postoperative pain management. UGRA's contributions align with current clinical priorities to reduce exposure to opioids in pediatric care, which could facilitate health sustenance by reducing the likelihood of using opioids and preventing side effects related to them. Particularly in pediatric anesthesia, UGRA can reshape this practice by prioritizing the type of technique that delivers effective pain relief while

minimizing side effects, thus making patients safe in all ambulatory settings.

## CONCLUSIONS

It was concluded that this systematic review suggests that UGRA significantly improves the modes of pain management, decreases opioid use and decreases complications related to anesthesia in pediatric urological surgeries. UGRA provides a promising alternative to the traditional approaches, by practicing targeted analgesia which can help reduce reliance on systemic opioids and improve postoperative recovery in children. Studies on UGRA showed that UGRA is associated with lower postoperative pain scores, decreased requirement for further analgesics, and reduced opioid exposure, which is important in pediatric opioid practice.

## Authors Contribution

Conceptualization: SA<sup>1</sup>, HWUH, SA<sup>2</sup>

Methodology: SA<sup>1</sup>, HWUH, SA<sup>2</sup>, SIAZ, AA, PS, MAS

Formal analysis: SA<sup>1</sup>, HWUH, SA<sup>2</sup>

Writing review and editing: SIAZ, AA, PS, MAS

All authors have read and agreed to the published version of the manuscript

## Conflicts of Interest

All the authors declare no conflict of interest.

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