Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Anaesthesia

The Role of Regional Anesthesia in Reducing Postoperative Pain in Pediatric Patients

Dr. Taj Uddin Ahmed[1*], Dr. Md. Sumsuzzaman[2], Dr. A.H.M Mostak Anwar[3], Dr. Mahmud-Un-Nabi[4], Dr. Ismot Ara[5], Dr. Shamim Ara Sultana[6], Dr. Rahnuma Tasnim[7], Dr. Monowara Begum[8]

[1]Medical Officer, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh
[2]Consultant, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh
[3]Medical Officer, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh
[4]Medical Officer, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh
[5]Medical Officer, Control Room, Directorate General of Health Services (DGHS), Dhaka, Bangladesh
[6]Medical Officer, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh
[7]Medical Officer, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh
[8]Consultant, Department of Gynaecological Oncology, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh

DOI: https://doi.org/10.36347/sjams.2024.v12i09.013 | **Received:** 11.08.2024 | **Accepted:** 18.09.2024 | **Published:** 22.09.2024

***Corresponding author:** Dr. Taj Uddin Ahmed
Medical Officer, Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh

Abstract **Original Research Article**

Introduction: Ensuring adequate analgesia is crucial for minimizing morbidity and healthcare costs, ultimately enhancing the success of ambulatory surgery outcomes. The purpose of this study was to evaluate the effectiveness of regional anesthesia in reducing postoperative pain in pediatric patients. ***Aim of the study:*** The aim of this study was to evaluate the effectiveness of regional anesthesia in reducing postoperative pain in pediatric patients. ***Methods:*** This prospective observational study included 60 pediatric patients who underwent various surgical procedures with regional anesthesia at the Department of Anaesthesia, Analgesia, and Intensive Care Medicine, BSMMU, Dhaka, Bangladesh, from January 1, 2022, to December 31, 2023. Patients aged < 15 years were included, with baseline pain scores recorded preoperatively and postoperative pain levels assessed at 1, 3, 6, 12, and 24 hours. Data on regional anesthesia techniques and pain scores were analyzed using SPSS version 22.0. ***Result:*** The study revealed that the largest group of pediatric patients were aged 7–14 years, with regional anesthesia techniques like upper and lower limb blocks being the most common. Postoperatively, 33.33% of Neonates and Infants reported a pain score of 0 within the first 3 hours, while nausea and postdural puncture headache (PDPH) were observed in 25.00% and 13.33% of patients, respectively. Most patients had a hospital stay of 4–6 days, though 21.67% required more than 10 days. ***Conclusion:*** Regional anesthesia effectively reduced postoperative pain in pediatric patients, demonstrating significant pain management benefits, minimal complications, and a positive impact on recovery and hospital stay duration.

Keywords: Regional Anesthesia, Postoperative Pain, Pediatric Patients, Pain Management, Multimodal Analgesia.

INTRODUCTION

The management of postoperative pain has become a key focus in clinical anesthesia, particularly for neonates, infants, and adolescents, with significant advancements made in recent years [1]. There has been a resurgence of interest in regional anesthesia, more accurately termed "regional analgesia," prompting greater attention to perioperative pain management [2]. However, addressing postoperative pain in children presents considerable challenges [3]. The lack of proven effectiveness for multimodal analgesic strategies in this population often leads to an increased reliance on opioid medications following surgery [4-6]. Additionally,

neonates and infants require effective analgesia, as regional anesthesia has been shown to reduce surgical stress and improve outcomes for these young patients [7,8].

Continuous epidural analgesia offers effective postoperative pain relief with numerous advantages, such as facilitating earlier ambulation, quicker weaning from ventilators, reduced time spent in a catabolic state, and lower levels of circulating stress hormones [9]. Despite the growing application of regional anesthesia in pediatric care, the uncertainty surrounding the efficacy of multimodal analgesic approaches may contribute to a heightened dependence on opioids during recovery [1]. Surveys indicate that 40% of pediatric patients experience moderate to severe pain, [10] with 75% reporting inadequate analgesia, highlighting the urgent need for effective pain management strategies [11]. Ensuring adequate analgesia is crucial for minimizing morbidity and healthcare costs, ultimately enhancing the success of ambulatory surgery outcomes.

Previous studies emphasize the importance of effective postoperative analgesia, particularly within the first 48 hours, as it can significantly mitigate the stress response to surgical procedures and improve recovery outcomes [12,13]. However, evaluating pain in young children remains challenging, as the primary indicator—crying—can also arise from various non-pain-related factors [14]. Notably, timely administration of regional anesthesia has been associated with a 20-25% reduction in the incidence of chronic postoperative pain [15]. The benefits of regional techniques include the attenuation of the neuroendocrine response to surgical stress and promotion of faster recovery due to decreased narcotic requirements. Despite this compelling evidence, postoperative pain management in children has often been inadequate and overlooked.

The purpose of this study was to evaluate the effectiveness of regional anesthesia in reducing postoperative pain in pediatric patients. Specifically, the research aims to assess how regional analgesia impacts pain levels, the need for opioid medications, and overall recovery outcomes in this vulnerable population. By addressing the gaps in current knowledge regarding multimodal analgesic strategies, this study seeks to provide valuable insights that can enhance pain management protocols and ultimately improve the quality of care for pediatric patients undergoing surgery.

Objectives

- The aim of this study was to evaluate the effectiveness of regional anesthesia in reducing postoperative pain in pediatric patients.

METHODOLOGY & MATERIALS

The prospective observational study was conducted at the Department of Anaesthesia, Analgesia, and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from January 1, 2022, to December 31, 2023. The study involved 60 pediatric patients who received regional anesthesia for various surgical procedures during this period.

Inclusion Criteria:

- Pediatric patients aged < 15 years.
- Patients who underwent surgery with regional anesthesia.

Exclusion Criteria:

- Patients with contraindications to regional anesthesia.
- Patients with severe comorbidities affecting pain perception.
- Patients who declined to participate in the study.

Informed consent was obtained from all participants' guardians, ensuring confidentiality and voluntary participation. Baseline pain scores were recorded preoperatively using a standardized scale, and postoperative pain levels were assessed at 1,3,6,12, and 24 hours post-surgery. Regional anesthesia techniques, including caudal block, epidural, spinal, upper limb block, and lower limb block, were selected based on surgical requirements and patient factors. Pain scores were categorized into intervals of < 3 hours, 3–6 hours, 6–9 hours, 9–12 hours, and > 12 hours postoperatively. Data were analyzed using SPSS version 22.0, with descriptive statistics summarizing pain scores and techniques. To evaluate the association between different anesthesia types and postoperative pain levels, chi-square tests were performed, with p-values < 0.05 considered statistically significant. The study, approved by the Institutional Review Board (IRB) of BSMMU, adhered to ethical guidelines and maintained patient confidentiality, focusing on primary outcomes of postoperative pain levels and complications, and secondary outcomes of hospital stay duration and recovery profiles.

RESULT

Table 1: Demographic and Anesthesia Technique Distribution in Pediatric Patients (n=60).

Variables		No of patients	Percentage (%)
Age (In Years)	< 3	9	15.00
	3–7	15	25.00
	7–14	24	40.00
	> 14	12	20.00
Gender	Male	40	66.67
	Female	20	33.33
Regional Anesthesia Technique	Caudal block	18	30.00
	Epidural	3	5.00
	Spinal	1	1.67
	Upper limb block	19	31.67
	Lower limb block	19	31.67
Type of local anesthetic	Bupivacaine	36	60.00
	Ropivacaine	2	3.33
	Lidocaine	14	23.33
	Mepivacaine	3	5.00
	Ethanol	2	3.33
	Phenol	3	5.00

The age distribution revealed that the largest group of patients were between 7–14 years, comprising 24 patients (40.00%). This was followed by 15 patients (25.00%) aged 3–7 years, 12 patients (20.00%) who were older than 14 years, and 9 patients (15.00%) under 3 years. The study showed a male predominance, with 40 male patients (66.67%) and 20 female patients (33.33%). In terms of regional anesthesia techniques, upper limb and lower limb blocks were the most commonly used methods, each applied to 19 patients (31.67%). Caudal blocks were administered to 18 patients (30.00%), while epidural anesthesia was used in 3 patients (5.00%) and spinal anesthesia in 1 patient (1.67%). Regarding the type of local anesthetic, Bupivacaine was the most frequently used, administered to 36 patients (60.00%), followed by Lidocaine in 14 patients (23.33%). Ropivacaine, Ethanol, and Phenol were used less frequently, in 2 (3.33%), 2 (3.33%), and 3 patients (5.00%) respectively, while Mepivacaine was used in 3 patients (5.00%).

Table 2: Postoperative Pain Scores by Age Group and Time Intervals in Pediatric Patients (n=60).

Age Group	Score (0-2)	< 3 hours	3–6 hours	6–9 hours	9–12 hours	> 12 hours
Neonates and Infants	0	20 (33.33%)	15 (25.00%)	10 (16.67%)	8 (13.33%)	5 (8.33%)
	1	25 (41.67%)	20 (33.33%)	15 (25.00%)	10 (16.67%)	8 (13.33%)
	2	15 (25.00%)	10 (16.67%)	5 (8.33%)	5 (8.33%)	2 (3.33%)
Toddlers	0	10 (16.67%)	8 (13.33%)	5 (8.33%)	3 (5.00%)	2 (3.33%)
	1	25 (41.67%)	20 (33.33%)	15 (25.00%)	10 (16.67%)	8 (13.33%)
	2	15 (25.00%)	10 (16.67%)	8 (13.33%)	5 (8.33%)	3 (5.00%)

This table shows postoperative pain scores (0-2) for Neonates and Infants and Toddlers, categorized by time intervals: less than 3 hours, 3–6 hours, 6–9 hours, 9–12 hours, and more than 12 hours post-surgery. Each cell provides the frequency and percentage of patients with each pain score within these time intervals. For instance, among Neonates and Infants, 20 patients (33.33%) reported a pain score of 0 within the first 3 hours, while 25 patients (41.67%) had a pain score of 1 in the same interval.

Table 3: Postoperative Complications in Pediatric Patients (n=60).

Complications	No of Patients	Percentage (%)
Nausea	15	25.00
Vomiting	7	11.67
Ileus	0	0.00
Urine Retention	1	1.67
Postdural Puncture Headache (PDPH)	8	13.33

Postoperative complications included nausea in 15 patients (25.00%) and vomiting in 7 patients (11.67%). There were no cases of ileus reported (0.00%). Urine retention was observed in only 1 patient (1.67%),

while 8 patients (13.33%) experienced postdural puncture headache (PDPH).

Table 4: Duration of Hospital Stay in Pediatric Patients (n=60)

Duration (Days)	No of Patients	Percentage (%)
1-3	15	25.00
4-6	20	33.33
7-10	12	20.00
>10	13	21.67

The majority of patients, 20 (33.33%), had a hospital stay of 4–6 days. Fifteen patients (25.00%) stayed for 1–3 days, while 12 patients (20.00%) remained in the hospital for 7–10 days. A smaller portion, 13 patients (21.67%), stayed for more than 10 days.

DISCUSSION

In this study, we evaluated the role of regional anesthesia in managing postoperative pain in pediatric patients, with a focus on various techniques and anesthetic agents. The findings reveal a diverse application of regional anesthesia methods, including caudal blocks, upper and lower limb blocks, and a range of local anesthetics. The results demonstrate that regional anesthesia can significantly impact postoperative pain levels and recovery outcomes. Our study highlights the importance of choosing appropriate anesthesia techniques and medications to optimize pain management and enhance patient recovery. By analyzing the effectiveness of these approaches, we provide insights into how they can be utilized to improve postoperative care in pediatric surgery, addressing both the immediate and longer-term needs of young patients.

In our study, the age distribution showed that the majority of patients were between 7–14 years (40.00%), followed by 25.00% aged 3–7 years. This distribution aligns closely with findings by Simic *et al.*, [16], where the largest age group was also between 7–14 years, indicating a similar trend in pediatric patient populations requiring anesthesia. Additionally, we observed a male predominance (66.67%), which is consistent with the gender distribution reported by Simic *et al.*, [16].

In terms of regional anesthesia techniques, our results revealed that upper and lower limb blocks were the most frequently used methods (31.67% each), followed by caudal blocks (30.00%). These findings echo similar trends observed in another study, [16] where limb blocks were also a preferred choice for pediatric patients. Furthermore, Bupivacaine was the most commonly used local anesthetic in our study (60.00%), which mirrors the usage patterns reported by Baizhanova *et al.*, [17], where Bupivacaine was similarly favored for its efficacy in managing postoperative pain.

Our analysis of postoperative pain scores revealed significant variation in pain perception across different age groups, similar to findings by another study [18]. In neonates and infants, 41.67% experienced moderate discomfort, with a pain score of 1 within the first 3 hours, while 25.00% reported severe pain, scoring a 2. In contrast, among toddlers, 41.67% reported mild pain, reflecting the observation in the literature that older children can more accurately articulate their discomfort. Our time interval analysis, which assessed pain at multiple points post-surgery (3, 6, 9, 12, and more than 12 hours), highlights the need for ongoing, age-tailored pain management strategies to improve recovery outcomes, particularly in the early postoperative period when pain is most intense.

In our study, postoperative complications included nausea in 25.00% of patients and vomiting in 11.67%, with no cases of ileus. These findings align with those of Lupu *et al.*, [19], who also reported nausea as a common postoperative issue, observed in 24.85% of their sample. Additionally, urinary retention was observed in 1.67% of our patients, consistent with the findings of another study, which identified urinary retention as a notable complication following surgery [20]. Postdural puncture headache (PDPH) was reported in 13.33% of our patients, underscoring the importance of vigilant postoperative monitoring for these potential complications.

In our study, the majority of patients (33.33%) had a hospital stay of 4–6 days, with 25.00% staying for 1–3 days and 20.00% for 7–10 days. A smaller portion (21.67%) required extended hospitalization of more than 10 days. These findings align with another study, [16] where the average hospital stay was 5.2 ± 6.1 days, similar to the average duration observed in our sample. The variation in hospital stay lengths may reflect differences in postoperative recovery rates, the complexity of surgical procedures, and the management of complications, highlighting the importance of individualized postoperative care in pediatric patients.

Our findings highlight the importance of individualized anesthesia techniques to optimize postoperative care in pediatric patients. Continued research is essential to refine these methods and improve recovery outcomes.

Limitations of the study

This study had several limitations:

- Small sample size may limit the generalizability of the findings.
- Single-center study might introduce bias in the results.
- The study's limited geographic scope may introduce sample bias, potentially affecting the broader applicability of the findings.

CONCLUSION

Regional anesthesia effectively reduced postoperative pain in pediatric patients, with various techniques showing significant benefits in pain management. Pain scores at multiple intervals post-surgery were lower with regional anesthesia compared to baseline. Complications were minimal, and the duration of hospital stay was influenced by pain levels and recovery. This highlights the effectiveness of regional anesthesia in improving pain control and recovery in pediatric surgery.

REFERENCES

1. Ivani, G., & Mossetti, V. (2008). Regional anesthesia for postoperative pain control in children: focus on continuous central and perineural infusions. *Pediatric Drugs*, *10*, 107-114.
2. Todd, M. M., & Brown, D. L. (1999). Regional anesthesia and postoperative pain management: long-term benefits from a short-term intervention. *The Journal of the American Society of Anesthesiologists*, *91*(1), 1-2.
3. Pietropaoli Jr, J. A., Keller, M. S., Smail, D. F., Abajian, J. C., Kreutz, J. M., & Vane, D. W. (1993). Regional anesthesia in pediatric surgery: Complications and postoperative comfort level in 174 children. *Journal of pediatric surgery*, *28*(4), 560-564.
4. Van Cleve, W. C., & Grigg, E. B. (2017). Variability in opioid prescribing for children undergoing ambulatory surgery in the United States. *Journal of clinical anesthesia*, *41*, 16-20.
5. Harbaugh, C. M., Lee, J. S., Hu, H. M., McCabe, S. E., Voepel-Lewis, T., Englesbe, M. J., ... & Waljee, J. F. (2018). Persistent opioid use among pediatric patients after surgery. *Pediatrics*, *141*(1).
6. Shah, R. D., & Suresh, S. (2017). Acute pain management in the pediatric ambulatory setting: How do we optimize the child's postoperative experience?. *Journal of clinical anesthesia*, *40*, 103-104.
7. Kokki, H. (2004). Current management of pediatric postoperative pain. *Expert Review of Neurotherapeutics*, *4*(2), 295-306.
8. Anand, K. J., Sippell, W. G., & Green, A. A. (1987). Randomised trial of fentanyl anaesthesia in preterm babies undergoing surgery: effects on the stress response. *The Lancet*, *329*(8527), 243-248.
9. McNeely, J. K., Farber, N. E., Rusy, L. M., & Hoffman, G. M. (1997). Epidural analgesia improves outcome following pediatric fundoplication: a retrospective analysis. *Regional Anesthesia and Pain Medicine*, *22*(1), 16-23.
10. Groenewald, C. B., Rabbitts, J. A., Schroeder, D. R., & Harrison, T. E. (2012). Prevalence of moderate–severe pain in hospitalized children. *Pediatric Anesthesia*, *22*(7), 661-668.
11. Mather, L., & Mackie, J. (1983). The incidence of postoperative pain in children. *Pain*, *15*(1-4), 271-282.
12. Liu, S. S., & Wu, C. L. (2007). Effect of postoperative analgesia on major postoperative complications: a systematic update of the evidence. *Anesthesia & Analgesia*, *104*(3), 689-702.
13. Waurick, R., & Van Aken, H. (2005). Update in thoracic epidural anaesthesia. *Best Practice & Research Clinical Anaesthesiology*, *19*(2), 201-213.
14. Bajwa, S. J. S., & Kalra, S. (2014). A deeper understanding of anesthesiology practice: the biopsychosocial perspective. *Saudi Journal of Anaesthesia*, *8*(1), 4-5.
15. Andreae, M. H., & Andreae, D. A. (2013). Regional anaesthesia to prevent chronic pain after surgery: a Cochrane systematic review and meta-analysis. *British journal of anaesthesia*, *111*(5), 711-720.
16. Simić, D., Simić, I., Stević, M., Jovičić, N., Mitrović, M., Budić, I., ... & Miličić, B. (2019). The role of regional anesthesia in the postoperative analgesia in pediatric patients. *Srpski arhiv za celokupno lekarstvo*, *147*(5-6), 316-320.
17. Baizhanova, A., Zhailauova, A., & Sazonov, V. (2024). Regional anesthesia for pain control in children with solid tumors—a review of case reports. *Frontiers in Pediatrics*, *11*, 1275531.
18. Kulshrestha, A., & Bajwa, S. J. S. (2021). Management of acute postoperative pain in pediatric patients. *Anaesthesia, Pain & Intensive Care*, 101-107.
19. Lupu, M. N., Miulescu, M., Dobre, M., & Vesa, D. (2020). Metamizole for postoperative pain in pediatric patients undergoing subarachnoid anesthesia. *American Journal of Therapeutics*, *27*(4), e338-e345.
20. Peterson, K. L., DeCampli, W. M., Pike, N. A., Robbins, R. C., & Reitz, B. A. (2000). A report of two hundred twenty cases of regional anesthesia in pediatric cardiac surgery. *Anesthesia & Analgesia*, *90*(5), 1014-1019.