

Original Research Article

EFFECTS OF ANESTHETIC TECHNIQUES ON PEDIATRIC OUTCOMES: AN OBSERVATIONAL STUDY

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Received : 31/01/2024
Received in revised form : 21/04/2024
Accepted : 08/05/2024

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DOI: 10.5530/ijmedph.2024.2.41

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (2); 200-203

ABSTRACT

Background: The physiological and psychological distinctions between children and adults pose challenges for pediatric anesthesia. The backbone of pediatric surgeries has always been general anesthesia; however, toxic consequences, especially in younger children, have prompted a reevaluation of anesthetic procedures. This concern has led to research into alternatives such as regional and neuraxial procedures. The purpose of the study is to investigate how various anaesthetic techniques affect paediatric outcomes.

Material and Methods: This is prospective observational research with 120 paediatric patients having surgery that is elective. Patients who underwent general, regional, neuraxial, anaesthetic procedures were divided into 3 groups. Data on demographics, intraoperative parameters, and postoperative results gathered and analysed.

Results: A total of 120 study participants were chosen for the study in order to investigate the effects of different anaesthetic techniques. Patients in Group B (regional anaesthesia) experienced 25% less postoperative pain than those in Group A (general anaesthesia) ($p < 0.05$). On the other hand, Group A saw a 20% greater incidence of emerging delirium than Group B ($p < 0.05$). Group C (neuraxial procedures) and Group A did not show statistically significant differences in postoperative pain evaluations. Instead, the scores were determined to be similar.

Conclusion: Our study unfolds the importance of assessing different anaesthetic procedures in paediatric surgery. While general anaesthesia was associated with a higher incidence of emerging delirium, regional anaesthesia demonstrated improved pain control. Postoperative pain results from neuraxial surgeries were similar to those from general anaesthesia. In order to maximize patient care and outcomes, our data highlight the significance of personalized anaesthetic techniques in paediatric surgery.

Keywords: Pediatric anesthesia, Anesthetic techniques, Customized anesthesia, Pediatric surgery, Anaesthesia safety.

INTRODUCTION

The development of paediatric anaesthesia can be attributed to the fundamental biological distinctions between adults and children.^[1] To provide the efficient perioperative care in children, enhanced focus on paediatric anaesthesia is necessary. The selection and application of suitable anaesthetic

techniques are essential in ensuring the safety and efficacy of the perioperative care in children. The type of anaesthesia used can have a significant impact on a variety of various aspects of paediatric outcomes like pain management, emergence from anaesthesia, and overall postoperative recovery.

The use of general anaesthesia in paediatric patients has been reevaluated due to concerns about potential

adverse effects.^[2] There are significant concerns regarding the safety and long-term consequences of general anaesthesia in paediatrics due to recent studies that shows extended exposure to the drug during crucial stages of brain development may have neurotoxic effects.^[3] The mortality attributable to general anaesthesia in children ranges from 0.1 to 1.4 per 10,000.^[4] In light of these concerns, there has been a rise in interest in investigating alternative anaesthetic methods that may provide better results and reduced risks in paediatric patients.

In paediatric surgery, regional anaesthetic methods including peripheral nerve blocks and epidural anaesthesia, as well as neuraxial anaesthesia like spinal and epidural anaesthesia, have shown promising as alternatives to general anaesthesia.^[5] Regional anaesthetic has the potential to expedite recovery by delivering localized pain relief with less systemic drug side effects like delirium, postoperative nausea, and vomiting.^[6,7] Neuraxial methods are especially useful where early mobility and rehabilitation are greatly aided by efficient pain management.

The type of surgical procedure, patient's medical history, and the surgical team's preferences all play a role in determining whether to use regional or neuraxial anaesthesia instead of general anaesthesia. Our study compares the impact on paediatric outcomes of regional and neuraxial anaesthesia vs general anaesthesia. Through an assessment of variables such postoperative pain control, emergence characteristics, and overall recovery, we aim to provide insightful information about the relative benefits and drawbacks of each anaesthetic technique.

Aim: This observational study aims to explore how various anaesthetic techniques affect the outcomes of elective paediatric surgeries.

Objectives

- To assess the incidence of postoperative pain in children undergoing general, regional, and neuraxial anaesthetic procedures.
- To evaluate the risk of developing delirium in young children receiving various anaesthetic methods.
- To provide insights into customized anaesthetic procedures for enhancing paediatric surgical outcomes.

To evaluate and compare intraoperative factors between various anaesthesia methods, including the duration of the procedure, hemodynamic stability.

MATERIAL AND METHODS

Study Setting: This study was carried out at RVM Institute of Medical Sciences, Laxmakkapalli Village, Siddipet District. This tertiary care facility provides a wide range of healthcare services, including pediatric care, to a varied patient base.

Study Design: The study adopts a prospective observational design to investigate how various anaesthetic techniques affect paediatric outcomes during elective surgery.

Study Period: The data collecting period extended from January 2023 to December 2023, ensuring a thorough examination of possible perioperative incidents in children within the allotted time range of one year.

Inclusion Criteria: Children, regardless of gender, between the ages of 1 to 18 years, who were having elective procedures performed at RVM Institute of Medical Sciences with consent from their guardians.

Exclusion Criteria: Children who are allergic to anaesthetic drugs, require emergency surgery, have incomplete medical records, have comorbidities that could affect the outcome of the surgery are excluded from the study.⁸

Data Collection: The process of collecting data involved prospectively gathering information about the demographics, intraoperative parameters, and postoperative outcomes of paediatric patients having elective surgeries. Using standardized data collection forms, data on age, gender, surgical procedure, anaesthesia modality, length of surgery, hemodynamic stability, postoperative pain scores, and incidence of emerging delirium were systematically recorded.

Statistical Analysis

The statistical analysis encompassed descriptive statistics to summarize demographic characteristics and surgical variables, employing measures such as mean, median, standard deviation, and frequency distributions. Additionally, inferential statistics including chi-square tests and analysis of variance (ANOVA) were utilized to compare outcomes between different anesthesia modalities, determining significance levels and elucidating associations between variables of interest.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee of the RVM Institute of Medical Sciences before the study began. Patient confidentiality was strictly maintained.

RESULTS

120 pediatric patients undergoing elective surgeries in RVM hospital were selected to study postoperative outcomes with different anaesthetic techniques. Group A (general anaesthesia) patients were compared with group B (regional anaesthesia) and group C (neuraxial anaesthesia). The summary of results were tabulated into table 1 to 4.

Table 1 reports that Compared to 90% of patients in Group A (general anaesthesia), only 67% of patients in Group B (regional anaesthesia) reported having postoperative pain. This indicates that the incidence of postoperative pain in Group B was 25% lower than in Group A which is statistically significant ($p < 0.05$). Between patients receiving general

anaesthesia (Group A) and those undergoing neuraxial procedures (Group C), there was no statistically significant difference in postoperative pain; both groups showed similar pain scores.

Table 2 explains that a higher percentage of patients (55.56%) in Group A (General Anesthesia) than in Group B (37.21%) reported delirium. It shows that the incidence of delirium in Group B was 18.35% lower than in Group A, which is statistically significant ($p < 0.05$). Though there is a slightly higher incidence in Group A (55.56%) when compare to Group C(48.78%) , the difference between the two groups does not reach statistical significance ($p > 0.05$).

Intra operative parameters like mean duration of surgery and hemodynamic stability are summarized

in Table 3. The duration of the procedure ranged from 95 to 110 minutes across the three groups and all the patients were hemodynamically stable. There is no statistical significance.

Table 4 illustrates intraoperative surgical complications and hospital stay of the patients. Group A has the incidence of highest surgical complications (22%) whereas in group b and c are 12% and 17 % respectively. Group A experienced a 20-day average hospital stay due to general anaesthesia; Group B had the shortest stay (8 days) from regional anaesthesia; and Group C, who underwent neuraxial procedures (10 days), was in between Group A and Group B.

Table 1: Incidence of Postoperative Pain

Anesthetic technique	Number of Patients	Incidence of Postoperative Pain (%)
Group A (General Anesthesia)	40	36 (90%)
Group B (Regional Anesthesia)	43	29 (67%)
Group C (Neuraxial Procedures)	41	41 (100%)

Table 2: Incidence of Delirium (%)

Anesthetic Modality	Total Number of Patients	Incidence of Delirium (%)
Group A (General Anesthesia)	36	20 (55.56%)
Group B (Regional Anesthesia)	43	16 (37.21%)
Group C (Neuraxial Procedures)	41	20 (48.78%)

Table 3: Intraoperative Factors

Anesthetic Modality	Total Patients	Mean Duration of Procedure (minutes)	Hemodynamic Stability
Group A (General Anesthesia)	36	110	Stable
Group B (Regional Anesthesia)	43	95	Stable
Group C (Neuraxial Procedures)	41	105	Stable

Table 4: Operative Factors and Average Hospital Stay

Anesthetic Modality	Total Patients	Intraoperative Surgical Complications (%)	Average Hospital Stay (days)
Group A (General Anesthesia)	36	22	20
Group B (Regional Anesthesia)	43	12	8
Group C (Neuraxial Procedures)	41	17	10

DISCUSSION

Our study offers significant insight on how various anaesthetic techniques affect the outcome of elective surgeries in paediatric patients. Through a comparative analysis of patient outcomes following general, regional and neuraxial anaesthesia, we were able to determine the possible advantages of regional anaesthesia, including decreased rates of delirium and postoperative analgesia. The study suggests that personalized paediatric anaesthesia methods could improve patient outcomes and potentially reduce hospital stays.

In previous studies, the benefits of regional anaesthesia were proved, but they were mostly in adult patients, whereas our study was in the paediatric population.^[9,10] The incidence of postoperative pain differed significantly between Group B (regional anaesthesia) and Group A (general anaesthesia), according to our results. This supports earlier studies showing the advantages of

regional anaesthesia in providing better pain management than general anaesthesia.^[11,12]

In our research, there was no statistically significant difference in postoperative pain between patients in Group C (neuraxial operations) and Group A (general anaesthesia). This finding contrasts with some previous studies that suggested that neuraxial and general anaesthetic techniques had differences in pain outcomes.^[13,14] However Our research indicates that neuraxial treatments may offer as efficient pain management as general anaesthesia for paediatric patients undergoing elective operations.

The incidence of delirium differed significantly between Group A and Group B, according to the results. The results of our study indicate that regional anaesthesia may be associated with a lower incidence of delirium in paediatric patients undergoing elective surgeries, which is like previous studies.^[15] The study found no significant difference in delirium incidence between patients in Group A

(general anaesthesia) and Group C (neuraxial anaesthesia), despite a slightly higher incidence in Group A. In contrast to previous studies, where general anaesthesia was proved to be significantly causing more delirium compared to neuraxial anaesthesia.^[16]

The study analysed intraoperative data of paediatric patients undergoing elective surgeries, focusing on hemodynamic stability and mean surgery length, finding no statistically significant differences among all the groups. These results are in line with other studies showing similar intraoperative results in paediatric surgeries using different anaesthetic methods. For example, Viderman, Dmitriy et al. (2023) conducted a comprehensive study and found no significant differences in the above parameters.^[17]

Group A, who received general anaesthesia, showed higher rates of intraoperative surgical complications and longer hospital admissions when compared to Groups B (regional anaesthesia) and C (neuraxial anaesthesia). According to prior studies, regional anaesthesia is preferable to general anaesthesia for reducing the risk of complications during intraoperative surgery, such as autonomic dysreflexia and heart problems.^[18] This is consistent with our study's findings, even though it dealt with adult patients while our study focused on children. Other similar studies have demonstrated the advantages of regional anaesthetic techniques in reducing surgical morbidity, accelerating recovery, and reducing hospital stays.^[19,20]

CONCLUSION

Our study provides important insights concerning the importance of the selection of anaesthetic methods for paediatric patients having elective surgeries. We found possible benefits of regional anaesthesia, such as lower rates of delirium and better postoperative pain control, through comparative analysis. Our findings imply that customized anaesthetic techniques based on each patient's demands may improve patient outcomes and maybe shorten hospital stays.

It is essential to recognize the limitations of the study, such as its observational methodology, small sample size, single-center design, and the possible bias due to the skills and expertise of anaesthetists. To validate these results and identify the best anaesthetic strategy for paediatric patients, further research is required, including bigger cohorts and randomized controlled trials, long-term outcomes, cost-effectiveness, and potential biases due to anaesthesiologists' differences

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