MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2023.226.229

Evaluation of Oral Administration of Gabapentin for Preoperative Pediatric Analgesia

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Key Words
Gabapentin, fentanyl, pain, child analgesia

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Received: 7 June 2023
Accepted: 17 June 2023
Published: 30 June 2023

Citation: Kinjalben Jethalal Prajapati, Ratna Dhanesh Bhojak, Kinjal Oza and Archana Patel, 2023. Evaluation of oral administration of Gabapentin for preoperative Pediatric Analgesia. Res. J. Med. Sci., 17: 226-229, doi: 10.59218/makrjms.2023.226.229

ABSTRACT

Urogenital surgery and adenotonsillectomy are frequently conducted surgical procedures in the advanced pediatric age group. This study aims to investigate the impact of a single administration of gabapentin at a dosage of 15 mg kg^{-1} on acute pain experienced during the immediate postoperative period in patients between the ages of 8 and 14 years who undergo surgeries under general anesthesia. A total of 78 patients within the ASA categories I and II, aged 8-14 years, who were scheduled for urogenital surgeries such as orchidopexy or urethroplasty under general anesthesia, were selected as participants for this study. These patients were randomly assigned to one of two treatment groups. Group A received an oral administration of gabapentin at a dose of 15 mg kg^{-1}, dissolved in 5 mL of honey, two hours prior to the surgical procedure. Conversely, group B received an oral administration of 5 mL of honey alone, also two hours before the surgery. Those in gabapentin group exhibited significantly reduced perioperative fentanyl consumption compared to the control group. Additionally, patients in the gabapentin group experienced a longer duration until the first administration of rescue analgesia compared to those in Group B. It is worth noting that the treatment group exhibited an increase in sedation scores. The findings of our clinical study indicate that administering a single preemptive oral dose of gabapentin at 15 mg kg^{-1} may potentially decreases the need for analgesics during the perioperative period in pediatric patients. However, it is important to note that this intervention could also lead to undesirable effects, including an increase in sedation.

INTRODUCTION

In the advanced pediatric age group, surgical procedures such as urogenital surgery and adenotonsillectomy are frequently conducted. Effective pain management strategies for these surgeries typically involve a multimodal approach. This approach encompasses various methods, like regional anesthesia (such as caudal anesthesia), intravenous opioids, paracetamol and NSAIDs (non-steroidal anti-inflammatory drugs). By employing this comprehensive approach, healthcare providers aim to optimize pain control and improve the overall surgical experience for pediatric patients.

Recently, gabapentin, which acts as a structural analog of gamma-aminobutyric acid (GABA), has emerged as an analgesic option for managing pain in the immediate post-operative period. Its utilization has been observed in a range of surgical procedures, like cholecystectomy, hysterectomy and spinal surgical procedures, as evidenced by previous research studies[1-7].

The majority of the existing studies investigating the use of gabapentin as an analgesic in the postoperative period primarily focus on adult patients, with limited trials conducted specifically on pediatric patients[8-11]. Consequently, the objective of this study was to assess the impact of administering a single preoperative dose of gabapentin on acute pain experienced in the immediate postoperative period in patients between the ages of 8 and 14 years who undergo surgeries under general anesthesia.

MATERIALS AND METHODS

A total of 78 patients within the American Society of Anesthesiologists (ASA) categories I and II, aged 8-14 years, who were scheduled to undergo urogenital surgeries such as orchidopexy or urethroplasty under general anesthesia, were enrolled in this study. Prior to the surgery, written and informed consent was obtained from the parents or legal guardians of the patients[12]. The day preceding the surgery, all patients were provided with detailed information about the study protocol which included the utilization of a patient-controlled analgesia (PCA) pump for administering analgesics, as well as the use of numerical rating scores (NRS) and Ramsay sedation scores (RSS) for pain assessment and sedation evaluation, respectively.

Patients meeting any of the following criteria were excluded from participation in the study: Individuals classified as ASA III or higher, those with a documented allergy to gabapentin, patients with preexisting neurological conditions or spinal disorders and individuals undergoing surgery under regional anesthesia. Additionally, patients who lacked the necessary skills to operate PCA pumps were also excluded.

To ensure the random assignment of participants, a computer-generated randomization table was employed. This table was used to allocate the children to one of the two groups, with 39 patients assigned to each group. In Group A, patients were administered oral gabapentin at a dosage of 15 mg kg^{-1}, which was dissolved in 5 mL of honey, two hours prior to their scheduled surgery. On the other hand, patients in Group B received an oral administration of 5 mL of honey alone, also two hours prior to their surgery.

Anesthesia was administered to the patients in a standardized manner throughout the surgical procedure. This involved the use of propofol at a dosage of 2 mg kg^{-1}, atracurium at a dosage of 0.5 mg kg^{-1} and fentanyl at a dosage of 2 mcg kg^{-1}. The maintenance of anesthesia was achieved by administering sevoflurane in a mixture of air, aiming to maintain a minimum alveolar concentration (MAC) of 1. Bispectral index monitoring was employed to maintain a target range of 40-60 for monitoring the depth of anesthesia. During the surgery, any increase in heart rate (HR) or mean arterial pressure (MAP) exceeding 20% from baseline values was promptly addressed by administering additional doses of fentanyl at a dosage of 0.5 mcg kg^{-1}.

Upon completion of the surgery, the patients were transferred to the postoperative ward. At this stage, they were connected to a PCA pump, which administered fentanyl in the following regimen: Bolus dose of 0.5 mcg kg^{-1} every 5 min until the patient's NRS for pain was less than 3, with a maximum dose of 5 mcg kg^{-1} hr^{-1} or until the patient's respiratory rate (RR) dropped below 12 breaths per minute. No basal infusion of fentanyl was allowed in this protocol.

In both group A and B, patients received intravenous paracetamol at a dosage of 15 mg kg^{-1} every 8 hrs. The surgeon did not administer any local anesthetic infiltration in either group. To ensure unbiased assessments, a resident who was unaware of the group allocation evaluated the patients' pain scores using the NRS and RSS at rest. These assessments were conducted at 0, 1, 4, 8, 16 and 24 hrs following the surgery.

The total consumption of fentanyl was recorded for both groups to assess the analgesic requirements. Additionally, any adverse effects experienced by the patients, such as nausea, vomiting, sedation and respiratory depression (indicated by an oxygen saturation level, SP02, below 90%), were documented and monitored throughout the study period.

RESULTS

Table 1 demonstrates that there were no statistically significant differences observed between the two groups in terms of demographic parameters.

Table 1: Demographic parameters in study population

Variables	Group A (n = 39) Mean±SD	Group B (n = 39) Mean±SD	p-value
Age (years)	9.91±1.99	9.22±1.64	0.24
Sex (males/females)	26/13	29/10	0.76
Length of surgery (min)	68.2±24.99	67.11±7.03	0.79
Surgery (orchidopexy/urethroplasty)	14/25	9/30	0.35

Table 2: Perioperative analgesic requirement in study population

Variables	Group A (n = 39) Mean±SD	Group B (n = 39) Mean±SD	p-value
Intraoperative fentanyl consumption (mcg kg^{-1})	1.35±0.68	1.70±0.56	<0.05
Postoperative fentanyl consumption (mcg kg^{-1})	2.44±0.80	2.95±0.50	<0.05
Time till first analgesic dose (hrs)	3.06±0.57	2.32±0.54	<0.05

Table 3: Perioperative NRS Scorein study population

Time (hrs)	Group A (n = 39) Mean±SD	Group B (n = 39) Mean±SD	p-value
0	1.30±0.55	1.82±0.42	<0.05
1	1.95±0.42	2.27±0.45	<0.05
4	2.50±0.86	3.14±0.70	<0.05
8	2.59±0.67	2.41±0.46	0.19
16	1.99±0.50	2.20±0.65	0.07
24	2.15±0.49	2.24±0.42	0.11

Table 4: Perioperative RSS score in study population

Time (hrs)	Group A (n = 39) Mean±SD	Group B (n = 39) Mean±SD	p-value
0	2.47±0.51	1.75±0.50	<0.050
1	2.53±0.59	2.05±0.23	<0.050
4	1.99±0.35	1.90±0.40	0.730
8	1.90±0.60	1.80±0.50	0.147
16	1.78±0.45	1.73±0.48	0.770
24	1.95±0.20	1.98±0.15	0.163
0	2.47±0.51	1.75±0.50	<0.050

The total fentanyl consumption over a 24 hr period was significantly lower in Group A compared to Group B. These differences in fentanyl consumption between the two groups were found to be statistically significant, as indicated in Table 2. Furthermore, the time interval until the administration of the first rescue analgesia was significantly longer in Group A compared to Group B. This difference between the two groups was also highly statistically significant, as presented in Table 2.

During the 48 hr postoperative period, the NRS for pain at rest were lower in Group A compared to Group B. However, this difference in pain scores was statistically significant only within the first 4 hrs following the surgery, as indicated in Table 3.

The RSS was employed to monitor and assess sedation as a potential side effect during the initial 24 hrs of the postoperative period. It was observed that patients in Group A exhibited a higher level of sedation, which was statistically significant, compared to Group B during the early postoperative period, as shown in Table 4.

DISCUSSIONS

Several studies conducted on the adult population have provided evidence supporting the efficacy of gabapentin as an analgesic in various surgical procedures in adult patients. In these studies, oral gabapentin was administered as a single dose, typically ranging from 300-1200 mg, depending on the specific study protocol. The use of gabapentin in these adult surgical settings has demonstrated positive analgesic outcomes.

Our study yielded similar results to Verret *et al*.[11], demonstrating statistically significant findings such as reduced opioid consumption and improved pain scores. However, the clinical relevance of these outcomes remains uncertain, in line with the findings of this systematic review.

In a study conducted by Amin and Amr[13], pediatric patients scheduled for adenotonsillectomy received a single preoperative dose of 10 mg kg^{-1} of gabapentin. The study found that patients in the intervention group experienced reduced analgesic requirements during the first 8 postoperative hours compared to the control group, who received paracetamol. Our study yielded similar findings in terms of reduced analgesic requirements. However, our study also demonstrated a higher incidence of sedation in our patients compared to the findings of Amin and Amr[13].

Gabapentin has been associated with a range of side effects, some of which can be attributed to its binding to voltage-gated calcium channels. These receptors are prominently found in the cerebellum and hippocampus. Binding to these receptors by gabapentin can potentially lead to adverse effects such as dizziness, sedation and ataxia. These effects have

been reported in previous studies[11,14,15]. It is important to consider these potential side effects when using gabapentin as part of a treatment regimen and to monitor patients closely for any signs or symptoms of these adverse effects.

CONCLUSION

The results of our clinical study suggest that administering a single preemptive oral dose of gabapentin at 15 mg kg^{-1} may potentially decrease the need for analgesics during the perioperative period in pediatric urogenital surgery. However, it is important to note that this intervention may also lead to unwanted effects, such as increased sedation. It is crucial to carefully consider the benefits and risks associated with gabapentin administration in this context. Further research and careful monitoring are warranted to fully understand the optimal dosage and potential side effects of gabapentin in pediatric patients undergoing urogenital surgery.

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