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EXPERIENCE OF INTRAVENOUS PARACETAMOL USE AFTER ORTHOPEDIC SURGERIES

Summary. The efficacy of postoperative analgesia of patients operated on for orthopedic pathology has been assessed. In the study, pediatric patients were divided into 2 groups. In first group analgesia analgesia was carried out using intramuscular injections of promedol, in second one promedol was used in combination with intravenous paracetamol. The analysis of the analgesic effect of paracetamol, the incidence of side effects has been carried out. The study demonstrated the usefulness of intravenous paracetamol use in addition to opioids for the treatment of postoperative pain following orthopedic surgeries.

Key words: pain syndrome, paracetamol, narcotic analgesics, anesthetic efficacy.

Introduction

For many years, interest has been focused on postoperative analgesia in children. Patients tend to experience severe pain syndrome after orthopedic surgeries. According to different authors, up to 75% of patients are suffering from pain of varying intensity in the early postoperative period. The consequences of inadequate pain treatment in terms of physical and emotional trauma are rather considerable.

Postoperative pain impairs the quality of life and leads to a slower rehabilitation, late recovery of body functions, emotional tension, as well as contributes to changes in pain modulation mechanisms that can result in the development of persistent postoperative neuropathic pain [4].

Many professional efforts are also aimed at the search for the optimal combination of analgesics belonging to various pharmaceutical classes. The combination of non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol with opioid analgesics in the early postoperative period allows to improve the quality of analgesia, and reduce the need for opioids, resulting in improved respiratory function, decreased incidence of nausea and vomiting, and minimization of sedation effect [1, 11, 20]. This explains the growing number of studies on the combined use of non-opioid drugs with narcotic analgesics [8, 9]. Meanwhile, the isolated use of NSAIDs after surgery is controversial, as not all the studies demonstrate significant advantages [11, 18].

When choosing analgesics for children, focus should be made on high-performance medicinal products with the lowest risk of adverse reactions. Currently, paracetamol fully meets the criteria for high efficacy and safety, and is recommended by the World Health Organization. Paracetamol (acetaminophen) is one of para-aminophenols, which are used in clinical practice as an effective analgesic and antipyretic. Due to the rapid absorption in the intestine after oral administration, a good analgesic effect is ensured. Furthermore, the drug is widely used rectally and intravenously [2, 7, 15].

Paracetamol is not contraindicated in patients with gastric mucosa lesions, bleeding disorders or respiratory failure [3, 13]. The drug is effective in treating postoperative pain [10, 11], and has a comparable to morphine analgesic effect [8]. Several authors demonstrated that the administration of paracetamol significantly reduced opioid consumption after orthopedic surgery [10, 14].

This study was conducted to evaluate the efficacy of analgesic effect and frequency of adverse events after intravenous administration of paracetamol in combination with intramuscular administration of Promedol.

The drugs used in the study have different points of application in their effect on the nervous system that can potentially provide a better quality of analgesia. Paracetamol has a predominantly central mode of action, and is associated with the inhibition of cyclooxygenase isozymes

[5], although there are various hypotheses about the mechanism of action, such as through inhibition of prostaglandin synthesis or activation of descending serotonergic pathways [12, 16]. Meanwhile, the opioids exert the analgesic effect by their agonistic action on the opiate receptors in the central nervous system [5]. Therefore, these agents provide an additional analgesic effect functioning at the level of the peripheral and central nervous system.

Materials and methods

In the setting of the Department of Anesthesiology and Intensive Care of the M.I. Sytenko Kharkov Institute of Spine and Joint Pathology of the Academy of Medical Sciences of Ukraine, a prospective, randomized study was conducted involving 30 patients aged 5 to 12 years (mean age 7.9 ± 2.0 years) of both genders (19 girls and 11 boys) with ASA performance status I and II, which underwent orthopedic hip surgery. Exclusion criteria were: mental disorders, hypersensitivity to opioids or paracetamol, renal and/or hepatic impairment. The written informed consent was obtained from parents of all patients.

Patients were divided into two groups to evaluate the efficacy of postoperative analgesia, . In Group I, in the postoperative period for 3 days, patients (n = 15) were administered intramuscularly the opioid analgesic Promedol on demand, sticking to age dosage recommendations, but no more than one injection per 4 hours (mean dose was 6.6 ± 1.2 mg/kg for 3 days). In Group II, in addition to intramuscular administration of Promedol (mean dose 4.8 ± 0.5 mg/kg for 3 days), patients (n = 15) received paracetamol intravenously in a dose of 15 mg/kg every 8 hours on day 1 and every 12 hours on days 2 and 3. The total amount of paracetamol did not exceed 8 injections.

The assessment of pain relief was performed every 8 hours using a Visual analogue scale (VAS). Sedation was evaluated by the Ramsay score [17], where R0 — awake, oriented; R1 — agitated, anxious, fear; R2 — the patient is awake, co-operative; R3 — drowsy, but co-operative (opens eyes to loud auditory stimulus, responds to simple commands, quickly exhausted); R4 — deep sedation (opens eyes to a loud auditory stimulus, facial dolorosa, does not responds to commands); R5 — sluggish response to painful stimuli; R6 — deep coma (no response to painful stimulus). At the end of each 24-hour period, the patient was asked to assess pain management over the day as satisfactory or unsatisfactory. Postoperative nausea, vomiting, pruritus, and urine output were recorded during the entire observation period. Routine monitoring was conducted (blood pressure, heart rate, respiratory rate, body temperature, evaluation of the general condition).

Results and discussion

Patients did not differ in age, weight, and time of the surgery between groups (Table 1).

There were also no differences in the nature and extent of surgical intervention between groups (Table 2).

On day 1 after surgery, patients in both groups evaluated the pain intensity as 3 points by the VAS, i.e. on average 2.9 ± 0.6 cm and 2.8 ± 0.5 cm, respectively ($p > 0.05$). Later, the difference in the pain assessment increased, and on day 3 it was about 40%, but the differences were not significant ($p > 0.05$) (Table 3).

The need for opioid analgesics (Promedol) was higher in Group I, where patients did not receive paracetamol (Table 4). It should be noted that in Group II patients needed 1-2 injections of Promedol on day 3, while in Group I – 2-3 injections.

Table 1. Patient characteristics by groups

Parameter	Group I (n = 15)	Group II (n = 15)
Age, years	8.1 ± 2.1	7.8 ± 1.9
Weight, kg	18.5 ± 2.7	18.9 ± 2.2
Duration of surgery, min	115.6 ± 18.1	118.3 ± 17.8

Table 2. Comparison of surgical interventions in groups (P ± Sp, %)

Type of surgery	Group I (n = 15)	Group II (n = 15)
Intertrochanteric corrective osteotomy of the femur	7 (47 ± 13)	8 (53 ± 13)
Soft-tissue hip decompression	4 (27 ± 12)	3 (20 ± 11)
Modelling resection and bringing down of the greater trochanter	1 (7 ± 7)	2 (13 ± 9)
Reconstruction of the supra-acetabular groove	1 (7 ± 7)	1 (7 ± 7)
Removal of surgical hardware	2 (13 ± 9)	1 (7 ± 7)

Table 3. Comparative evaluation of pain intensity by VAS (cm)

Group	Day		
	1	2	3
I	2.9 ± 0.6	2.3 ± 0.6	1.5 ± 0.5
II	2.8 ± 0.5	1.7 ± 0.4	0.9 ± 0.2

The degree of sedation in all patients was generally moderate. Deep depression of consciousness has not been observed in patients. Nevertheless, there was a downward trend in the degree of sedation in patients treated with paracetamol, but the differences were not significant ($p > 0.05$) (Table 5).

The frequency of nausea or vomiting, pruritus, and urinary retention did not differ significantly (33 vs 27%, 20% vs. 13 and 27 vs. 13% in groups I and II, respectively). No cases of respiratory depression, which would require respiratory support, were reported in the patients during the observation period (Table 6).

The postoperative survey of patients (and their parents) revealed a greater satisfaction with analgesia in Group II. Most patients (80 ± 11%) reported that the quality of postoperative analgesia was excellent or good as compared to Group I (60 ± 13%).

The study demonstrated a high analgesic effect of paracetamol in combination with Promedol for postoperative analgesia after orthopedic surgery in paediatric patients. The use of paracetamol in a dose of 45 mg/kg on day 1 and 30 mg/kg on days 2 and 3 allowed to reduce the total need for Promedol from 6.6 ± 1.2 mg/kg to 4.8 ± 0.5 mg/kg, along with improving the quality of analgesia. Similar advantages have been demonstrated in earlier studies of the combined use of NSAIDs with opiates, where it was possible to reduce the consumption of opioids with the additional use of analgesics [9]. The obtained data are consistent with the results of the previous studies, in which the need for opioids during the first 24 hours after surgery also decreased [14].

Table 4. Comparison of the need for narcotic analgesics

Drug	Group I	Group II
Promedol, mg/kg	6.6 ± 1.2	4.8 ± 0.5

Table 5. Sedation by Ramsay score

Day after surgery	Group I (n = 15)	Group II (n = 15)
1	2.5 ± 0.9	2.5 ± 0.6
2	1.5 ± 0.7	1.1 ± 0.8
3	0.4 ± 0.6	0.3 ± 0.6

Table 6. Frequency of adverse reactions in postoperative period, n (%)

Type of adverse reactions	Group I (n = 15)	Group II (n = 15)
Nausea, vomiting	5 (33 ± 13)	4 (27 ± 12)
Pruritus	3 (20 ± 11)	2 (13 ± 9)
Urine retention	4 (27 ± 12)	2 (13 ± 9)
Respiratory depression	0 (0 + 7)	0 (0 + 7)

Despite the reduction in the need for narcotic analgesics, paracetamol did not significantly affect the degree of sedation and adverse effects of opioids, with the exception of urinary retention. As did the studies, evaluating the analgesic effect of the combination of drugs, our results did not show a significant reduction in the frequency of adverse effects, which could be expected due to the decrease in the total dose of opioids [6, 19]. A study involving more patients could possibly show a decrease in the frequency of adverse effects of opioids.

Conclusions

1. The use of paracetamol in a dose of 45 mg/kg on day 1 and 30 mg/kg on days 2 and 3 for pain management in paediatric patients after orthopedic surgery reduces the need for opioids.

2. The use of paracetamol did not significantly affect the number of adverse effects caused by opioids.

3. Intravenous administration of paracetamol is an effective method of pain management in paediatric patients after orthopedic surgery.

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