

Delirium and Pain after Strabismus Surgery in Children Undergo General Anesthesia: A Comparison of Paracetamol and Meperidine

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Background: Strabismus surgery under general anesthesia is one of the most common ophthalmic procedures in children with emergence delirium as an important post-operative complication. Additionally, postoperative pain is another important issue which is considered as a contributing factor to emergence delirium. We conducted a study to compare meperidine with paracetamol on postoperative pain and emergence delirium.

Methods: This double blind randomized clinical trial was carried out on 60 children underwent elective strabismus surgery under general anesthesia. Patients were randomly allocated in two groups of 30 that received intravenous meperidine (1mg/kg) or paracetamol (15 mg/kg). Severity of pain were assessed one minute after extubation and every 5 minutes up to 1 hour by using CHEOPS and PAED was used for assessment of emergence delirium by time interval of every 10 minutes up to 30 minutes. Other complications such as bronchospasm, laryngospasm, nausea and vomiting were also recorded.

Results: Pain severity was significantly higher in paracetamol group while in meperidine group no patients received additional fentanyl in recovery room and emergence delirium was lower 30 minutes after surgery.

Conclusion: Although meperidine and paracetamol are both effective in reducing incidence of emergence delirium and controlling postoperative pain after strabismus surgery, meperidine is significantly more efficient.

Keywords: meperidine; paracetamol; postoperative pain; emergence agitation; strabismus

Strabismus, abnormal ocular alignment, is one of the most common ocular problems in children that causes loss of binocular vision and amblyopia and affects 2-7% of the preschool population from the ages of one to four [1-4]. Strabismus surgery is typically recommended when a patient's eye alignment can no longer be treated with conservative measures such as eyeglasses, eye patching, prisms, and orthotic exercises. Like many other ophthalmic procedures, strabismus surgery is very safe and effective, but complications can occur and need to be diagnosed and treated early to optimize post-operative outcome [5]. These problems may cause injury in pediatric patients, necessitate extra recovery nursing, and associate with decreased satisfaction scores in parents [6-10].

Emergence delirium (ED) is one of the most common complications in children after strabismus surgery under general anesthesia. It is a disturbance in a child's awareness

of (and attention to) his or her environment with disorientation and perceptual alterations, including hypersensitivity to stimuli and hyperactive motor behavior, in the immediate post-anesthesia period. It can cause lots of problems as injuries, extra nursing care and reducing parents' satisfaction [11].

Postoperative pain is another important issue related to strabismus surgery which is widely considered as a contributing factor to ED. Therefore, satisfactory pain control is required to prevent ED and also further injuries due to pain itself [7-8,11-15]. Many researches have been designed and various pharmacological agents have been tested for their ability to reduce the incidence of emergence agitation and to establish a satisfactory pain control after strabismus surgery in pediatrics [7-8,12-15]. However, there is no certain result for these cases.

As result, we designed and performed this study to compare the effects of paracetamol with meperidine on the incidence of ED and postoperative pain in children undergo general anesthesia for strabismus surgery.

Methods

The double-blind randomized-controlled clinical trial was approved by the Ethics Committee of the Tehran University of Medical Sciences and written consent was obtained from parents or guardians of children. The study was

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implemented in accordance with the principles of the Helsinki Declarations.

This survey performed on 60 children underwent elective strabismus surgery. Children ASA physical status I and II, aged 5 to 12, were included. Patients with allergic history to paracetamol or meperidine, congenital genetic disease, mental retardation, behavioral disorders, the use of psychological drugs, kidney and liver disease, non-Persian family and the use of hypnotic drugs prior to surgery, were excluded from this study. Upon entering the operating room, vital signs were recorded and all the patients underwent standard monitoring. After pre-oxygenation with O₂, and premedication with 0.02 mg/kg midazolam and 2 µg/kg fentanyl intravenously, general anesthesia was induced by intravenous 2.5 mg/kg propofol and 400 µg/kg atracorium. Then, tracheal intubation was performed and anesthesia maintained by 2-3% Isoflurane in 100% O₂. Patients were divided into two groups by block randomization. As surgery begins, the first group received 15 mg/kg paracetamol intravenously and the second 1 mg/kg meperidine. Administered medications were completely identical in both groups. After surgery, patients were extubated and transferred to recovery room.

The severity of pain was assessed and recorded 1 minute after extubation and per 5 minutes up to 1 hour using Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) (Table 1). The CHEOPS is a behavioral scale for evaluating postoperative pain in young children. It can be used to monitor the effectiveness of interventions for reducing the pain and discomfort. We administered 0.5 µg/kg fentanyl in condition of CHEOPS more than 10. ED was assessed and recorded 1 minute after extubation and per 10 minutes up to 30 minutes using The Pediatric Anesthesia Emergence Delirium (PAED) (Table 2). The PAED scale is recently validated and might provide a comprehensive measure of the severity of ED. This scale attempts to differentiate delirium from pain behavior and other causes of agitation. All these assessments were done by another person who was completely unaware of randomization.

All of complications like bronchospasm, laryngospasm, nausea and vomiting were recorded. Also, all patients were

discharged by matching with Aldrete scale (Table 3) and recovery nurse satisfaction was assessed by numerical scale from 1 (unsatisfied) to 5 (satisfied) for each one. The observation and assessment after surgery and in the recovery, were done by an unaware medical student who was not a member of research team and doesn't know anything about randomization and patient's group.

The data were analyzed by SPSS 18 and we used "Chi square" for qualitative parameters and T-test for quantitative ones.

Table 1- Children's Hospital of Eastern Ontario Pain Scale (CHEOPS)

Score	0	1	2
Cry	No cry	Crying, moaning	Scream
Facial	Smiling	Composed	Grimace
Verbal	Positive	None or other complaints	Pain complaint
Torso	Neutral	Shifting, tense, upright	Restrained
Legs	Neutral	Kicks, squirm, drawn up	Restrained
Touch	Not touching	Reach, touch, grab	Restrained

Table 2- Pediatric Anesthesia Emergence Delirium (PAED)

	score
The child makes eye contact with the caregiver	4: not at all 3: just a little
The child's actions are purposeful	2: quite a bit
The child is aware of his/her surrounding	1: very much 0: extremely
The child is restless	0: not at all
The child is inconsolable	1: just a little 2: quite a bit 3: very much 4: extremely

Table3- Aldrete scale

Activity	Respiration	Circulation	Consciousness	Oxygen
				Saturation
2: Moves all extremities voluntarily/ on command	2:Breaths deeply and coughs freely.	2: BP+ 20mm of preanestheti c level	2:Fully awake	2: Spo2 >92% on room air
1: Moves 2 extremities	1: Dyspneic, shallow or limited breathing	1: BP+ 20-50 mm of preanestheti c level	1: Aro usable on calling	1 :supplemental O2 required to maintain Spo2 >90%
0: Unable to move extremities	0: Apneic	0: BP+ 50mm of preanestheti c level	0: Not responding	0: Spo2 <92% with O2 supplementation

Results

60 patients were included and equally allocated to two groups: first that received paracetamol and second that received meperidine. There were 18 boys (60%) and 12 girls (40%) in first group and 17 boys (56%) and 13 girls (44%) in the second one. There is no statistically significant difference between two (P=0.773). Patients' age and weight are shown in (Table 4).

4 patients of group one had CHEOPS more than 10 that received fentanyl regarding to study design. However, there was no patient with CHEOPS more than 10 in group two. So, this is significant that in meperidine group, no patients received additional fentanyl in recovery room (P=0.037).

There was no report of nausea and vomiting, laryngospasm or bronchospasm in both groups.

Recovery nurse satisfaction for both groups is shown in (Chart 1). There was no level 1 or 2 of satisfaction in both groups. There is a significant difference between two groups (P=0.039). The criteria for patient discharge were matched with Aldrete scale, the mean of score was 9.4 in group one and 9.5 in group two which is not significant (P=0.9). Regarding repeated measurements, the pain severity was significantly high in paracetamol group (P=0.044) (Table 5). The ED was significantly lower in meperidine group 30 minutes after surgery (P=0.029), however it is not significant in other times (Table 6).

Table 4- Demographic information of patients

	N	Age		Weight	
		Mean	Std. Deviation	Mean	Std. Deviation
Group 1	30	7.34	1.154	23.3	3.88
Group 2	30	7.43	1.642	22.8	3.83
Total	60	7.39	1.398	23.05	3.85
Sig.		0.37		0.43	

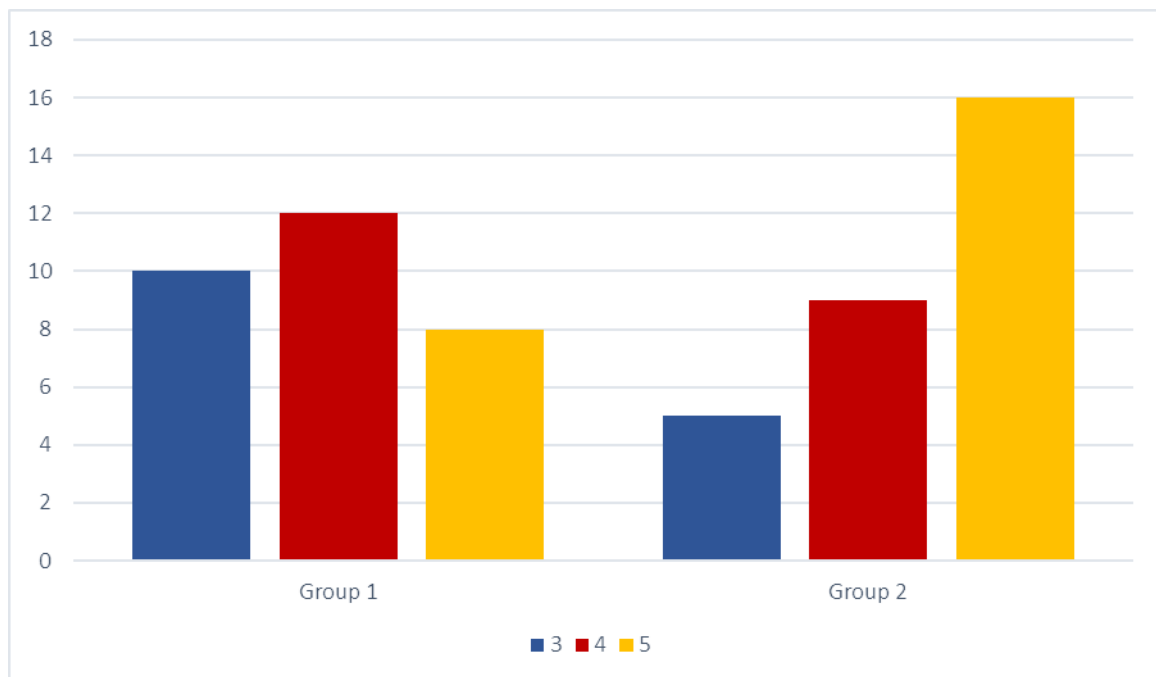
Table 5- Mean of CHEOPS scores

Time	0	5	10	15	20	25	30	35	40	45	50	55	60
group 1	6.82	6.82	6.88	6.88	7.12	7.4	7.42	8.22	8.31	8.36	8.42	8.11	8.05
group 2	6.92	6.92	6.84	6.84	6.86	6.92	6.92	7.24	7.29	7.32	7.38	7.26	7.15
Sig.	0.72	0.52	0.86	0.86	0.61	0.61	0.21	0.041	0.039	0.031	0.027	0.033	0.041

Table 6- Mean of PAED

	0	10	20	30
Group 1	11.3	11.4	11.2	11.5
Group 2	11.1	11.2	11.1	10.9
Sig.	0.64	0.39	0.57	0.029

Chart 1- Recovery nurse satisfaction scores



Discussion

Strabismus surgery is one of the most common ophthalmologic operations in children under 5 years old and can be associated with moderate postoperative pain caused by the conjunctiva and a high incidence of ED (40-86%) [5,7,16-17].

The symptoms of ED and problems followed postoperative pain are worse for pediatric patients. They cry heavily and try to free themselves, pull on their IV-line and impose a heavy burden on medical staff [13]. It may cause injury in pediatric patients, necessitating extra recovery nursing, require additional treatments and increase the length of postoperative care unit (PACU) stay totally associated with decreased satisfaction scores in parents [9,11].

Many researches have been done to prevent ED and control postoperative pain include administering sedatives and analgesics, changing the types of anesthetics or taking other different methods [7-17]. We designed this study to compare the effects of paracetamol with meperidine on ED and postoperative pain after strabismus surgery in pediatric patients.

As mentioned, there was no significant difference among demographic data between two groups that shows patients were homologous without any distortive factor. Recovery nursing team were more satisfied with group 2 that received meperidine ($P=0.039$). Also, meperidine administration significantly lessened the need for extra fentanyl in order to reduce pain ($P=0.037$). However, the difference between two groups among recovery stay was not significant. The pain severity was assessed by CHEOPS score. During the first hour after surgery, the pain severity is significantly lower in meperidine group. So, regarding to the number of patients with CHEOPS more than 10, it's concluded that meperidine is more effective than paracetamol in controlling the pain. In both groups, CHEOPS was increased between 35 and 55 minutes after surgery.

According to PAED score, the incidence of ED was significantly lower in meperidine group during first 30 minutes after surgery and not significant in other times. Results show that during the first hour, always PAED score was higher in paracetamol group. Regarding to this report and the fact of remaining sedative effects of anesthetics, it seems that meperidine is more powerful and effective in preventing ED after strabismus surgery that may statistically be suppressed due to residual sedation.

There are some studies with different sample sizes compared to ours [14,18-20]. It should be considered that the difference between the sample size may lead to different results.

In 2014, 96 pediatric patients were enrolled in a survey to test the effects of adding dexmedetomidine on reducing the incidence of ED. They concluded that the combination of dexmedetomidine with fentanyl was more effective than fentanyl itself in reducing the incidence of ED and controlling pain [7].

Jin Ho Bae et al. performed a study to evaluate the effects of midazolam on ED after ophthalmic surgery. 60 children were included and divided into four groups to compare midazolam with placebo. They concluded that although midazolam reduced the incidence of ED without side effects, it prolonged the length of PACU stay [13].

In 2014, another study was performed on 90 children to compare midazolam with placebo in pediatrics undergoing

strabismus surgery and it showed that administration of midazolam just before the end of surgery reduces emergence agitation without delaying the length of stay in PACU in children having strabismus surgery with sevoflurane anesthesia [8].

These two surveys just examined the effects of single drug compared with placebo. But in this study, two different drugs were compared together without placebo control.

In 2008, 110 healthy children were observed to compare the effects of tramadol with meperidine on postoperative pain management. Regarding the results, meperidine provided better postoperative analgesia than tramadol with minimal hemodynamic changes that were same for both groups [19]. It should be mentioned that the sample size for this study was higher than ours and also it took place on patients undergoing abdominal surgeries that could be considered as distortive factors.

Alhashemi, et al. in 2006, evaluated 80 children to compare paracetamol with meperidine in post-tonsillectomy pain control. It was concluded that paracetamol provided adequate analgesia, less sedation and earlier readiness for recovery room discharge [21]. So, it seems better than meperidine. The study population and sample size were different from our study.

Shende, et al. after a study in 1999, stated that ketorolac at the induction of anaesthesia is as effective as meperidine as an analgesic and is associated with significantly less PONV. After evaluating 52 patients undergoing strabismus surgery, they suggested that ketorolac is preferred to meperidine due to less number of PONV [22]. By the way, in our study, there was no statistically significant difference among two groups of patients on the basis of PONV.

Conclusion

For controlling postoperative pain and the incidence of ED after strabismus surgery in children, paracetamol and meperidine are both effective. But it seems that during the first hour after surgery, meperidine significantly lessened the incidence of ED and pain severity and is more effective than paracetamol. Finally, we suggest to design more studies with different populations, larger sample sizes to compare different drugs in various groups to remove distortive factors as much as possible.

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