Acupuncture versus Ultrasound-Guided Peribulbar Block in Pediatric Strabismus Correction: A Prospective Randomized Study

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Abstract: Objective: Postoperative emesis after strabismus surgery continues to be a problem, despite the use of anti-emetic measures. The purpose of this study was to identify an anesthetic technique associated with the lowest incidence of vomiting after squint surgery. **Materials and methods:** A prospective, randomized, double-blind study was conducted to evaluate the effect of Acupuncture at P6 versus ultrasound guided medial canthus peribulbar block with propofol infusion on emesis in 180 pediatric patients undergoing strabismus correction.**Results:** The incidence of emesis was significantly lower in the peribulbar (4/90, 4.4%) compared to the acupuncture group (17/90, 18.8%) ($p < 0.01$). **Conclusion:** Among the two techniques, peribulbar block with propofol-based anesthesia is the technique with the lowest incidence of postoperative emesis compared to the acupuncture technique.
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1. Introduction:

Vomiting following strabismus surgery in children is a frequent finding with a reported incidence of approximately 40-50%[1]. Post-surgical vomiting can delay recovery and result in an unplanned hospital admission after outpatient surgery. As anesthetists continue to search for more cost effective approaches to improving patient outcome, attention has focused on acupuncture. It is a simple, inexpensive, and non-invasive method to prevent PONV (post operative nausea and vomiting).

The mechanism by which P 6 acupoint stimulation prevents PONV has not been established. Both the role and efficacy of P6 acupoint stimulation in the prevention of PONV are unclear. P6 acupoint stimulation significantly reduced the risk of PONV in some studies[1,2].

Ultrasound imaging provides information that cannot be otherwise obtained when light transmission into the eye is obstructed or when anatomy around the globe needs to be assessed during local anesthesia injection by using sound waves to produce diagnostic photos. This is done as the sound waves pass through tissues, bouncing off of tissue interfaces, back to the transducer. The ultrasound unit then converts the sound energy to electrical energy and a photo is then displayed in the monitor as selected by the anesthetist[3].

In this study, acupuncture technique versus ultrasound-guided peribulbar block were used in pediatric strabismus correction to assess the technique of choice regarding the lowest incidence of PONV.

2. Materials and Methods:

The study was approved by the Ethics committee of the Research Institute Of Ophthalmology. One hundred and eighty American Society of Anesthesiology (ASA) grade I and II children aged 4 to 15 years undergoing strabismus surgery were allocated in two groups in this study, group 1 receiving peribulbar anesthesia (n =90); group 2 receiving acupuncture (n = 90). Exclusion criteria included: children with ear problems, history of bleeding, diathesis, bronchial asthma, allergy to non-steroidal anti-inflammatory drugs (NSAID) and gastric and intestinal diseases. Informed consent was obtained from the parents. The postoperative data were gathered by an anesthetist blinded to the technique used and who was not present in the operation theatre at the time of surgery.

Children in the study were kept fasting for solid food for six hours preoperatively and clear fluid was allowed until four hours before surgery. An intravenous cannula was inserted in the preanesthetic area in presence of parents under EMLA cream. Both groups were premedicated with midazolam 0.15 mg/kg. Anesthesia was induced in all children by administration of 2-3mg/kg IV propofol, rocuronium 0.6 mg/kg to facilitate proseal laryngeal mask airway introduction[4].

Immediately after induction, all children received IM diclofenac sodium 1mg/kg^{-1} and dexamethasone 1mg/kg^{-1} [5]. A propofol infusion was started at a rate of 300/µg/kg/min for the initial 15 minutes, then decreased to 150/µg/kg/min for the remaining time of surgery and stopped 10 minutes before end of surgery. The children were

mechanically ventilated with 100% oxygen and were fully monitored (ECG, pulse oximeter, capnograph and non-invasive blood pressure). The fluid deficit was replaced with Ringer's Lactate solution after being calculated. Group 1 (n = 90) received peribulbar injection just before the start of surgery by the anesthetist using 0.5% Levobupivacaine. A 12 mm length, 27 gauge needle was inserted in the plica semilunaris, just lateral to the caruncle between it and the globe. The needle was then shifted slightly medially, displacing the caruncle medially away from the globe[6]. The needle was advanced in antero-posterior direction, with the globe directed slightly medially by the needle, until a click was perceived under ultrasound image (Alcon) and 4-6 ml of 0.5% Levobupivacaine was injected.

In group 2, the acupuncture group (n = 90), the P6 acupoint which lies between the tendons of the palmaris longus and flexor carpi radialis muscles, 4 cm proximal to the wrist crease, was identified and acupuncture needles were used under complete aseptic conditions[7].

Any signs of inadequate depth of anesthesia (for example: tachycardia, tachypnea, increased end tidal carbon dioxide) were noted. The rate of propofol infusion was increased by 25 μg/kg if signs of light anesthesia were observed.

At the end of the surgery, the stomach was decompressed using a nasal catheter through the proseal LMA (laryngeal mask airway). Residual neuromuscular block was reversed with neostigmine 50 μg/kg and glycopyrolate 10 μg/kg IV, and when respiration and reflexes were satisfactory the proseal LMA was removed. The children were then transferred to the recovery room. The level of wakefulness was assessed by the Alderete recovery score[2] immediately after surgery then after 15 minutes, 30 minutes, 60 minutes and 2 hours postoperatively or until the children were fully awake. Patients who experienced persistent moderate pain for more than 2 hours postoperatively were given proparacetamol 15mg/kg IV. Postoperative vomiting was assessed by a numerical rank score (Table 1). Patients with one or more episodes of vomiting were administered palonosetron[8,9].

The children were allowed to eat when they so desired. They were observed in the postanesthesia care unit (PACU) for 2 hours or until they were having only mild pain and no vomiting, then were transferred to the ward and kept there overnight.

Statistical analysis

Statistical analysis was performed using the Chi-square test, Fisher test and Kruskal-Wallis test. Probability value (p value) less than 0.05 was considered statistically significant.

Table (1): Emesis score

No vomiting	1
1 or 2 episodes of vomiting	2
More than 2 emetic episodes in 30 minutes	3

3. Results

The two groups of patients were comparable with respect to age, sex, weight and duration of surgery (Table 2). No bradycardia, hypotension or laryngospasm were observed during induction in any of the two groups. No involuntary movements, sweating or tachycardia suggestive of light anesthesia were observed at any time in any of the two groups. A large number of patients in group 1 and 2 (42.8% and 37.1% respectively) were able to respond to verbal commands, as well as to maintain their airway unassisted immediately after extubation. At 15 minutes postoperatively, 87 out of 90 patients (96.6%) in group 1 and 85 out of 90 patients (94.4%) in group 2 were fully awake. At 30 minutes postoperatively, all patients in the two groups were fully awake and had achieved maximum Aldrete recovery score. The intraoperative phase was smooth and uneventful except for some episodes of bradycardia induced by surgical manipulation of eye muscles. These episodes occurred more commonly in the acupuncture group (group 2); (12 out of 90 patients, 13.3%) compared to the peribulbar group (group 1); 2 out of 90 patients; 2.2%) indicating a significant statistical difference ($p < 0.05$).

The number of patients who required treatment for pain was comparable in the two groups in the first 24 hours postoperatively. However, the mean time to first analgesic requirement varied significantly among the two groups; the peribulbar group (group 1) was 6.1±1.8 hours and the acupuncture group (group 2) was 3.5±2.0 hours ($p = 0.001$). No patients in any of the two groups experienced severe pain at any time. Comparison of the incidence of postoperative emesis over the first 24 hours revealed a significant difference between the 2 groups ($P < 0.01$) 17 out of 90 patients (18.8%) in group 2 experienced vomiting during the first 24 hours postoperatively compared to 4 out of 90 patients (4.4%) in group 1. Severe persistent vomiting that required anti-emetic drugs was found in 2 patients out of the 4 in group 1 and 8 patients out of the 17 in group 2 (Table 3).

Table (2): Demographic data

	Peribulbar group (group 1, n = 90)	Acupuncture group (group 2, n = 90)
Age (years)	7.4±3.3	8.1±2.5
Sex (M:F)	43:47	42:48
Weight (Kg)	22.8±10.6	23.0±11.1
Duration of operation (min)	35.5±15.0	36.0±13.0

Values are mean ± Standard deviation (SD)

Table (3): Postoperative nausea and vomiting (PONV) in the 2 groups

Variables	Peribulbar group (group 1, n = 90)	Acupuncture group (group 2, n = 90)
PONV (n)		
During 0-2h	1 (1.1%)	2 (2.2%)
During 2-6h	2 (2.2%)	4 (4.4%)
During 6-24h	1 (1.1%)	3 (3.3%)
During 0-24h	4 (4.4%)	17 (18.8%)*
Number of children requiring anti-emetic treatment	2	8

* *p* value significant < 0.05 n = number of patients with emesis Score ≥ 2.

4. Discussion

PONV is among the most unpleasant experiences associated with squint surgery and one of the most common reasons for poor patient satisfaction rating in the postoperative period.

Macario *et al.* [10] quantified patients preferences for postoperative out come. PONV was among the ten most undesirable outcomes following surgery. Furthermore, the deleterious effect of PONV is not only limited to the patients, but has also profound, economic impact on the surgical unit. Multiple factors are responsible for postoperative vomiting after strabismus surgery in children[11]. The primary causes may be the use of inhalational agents and opiates in the perioperative period and the stimulation of the oculocardiac reflex during surgery. Ocular pain in the postoperative period and early mobilization of the patient also contribute to an increased incidence of postoperative emesis. Propofol-based TIVA is associated with lower incidence of postoperative emesis compared with conventional general anesthesia[12]. **Subramaniam** and his colleagues [13] also reported that the incidence of PONV was 81.39% in group GA (receiving general anesthesia) vs. 54.76% in the other group where patient received double injection peribulbar block and explained this high incidence in both groups by the long duration of vitreoretinal surgery and waned effect of the block.

Chhabra *et al.* [14], could not detect a significant difference in incidence of PONV on comparing peribulbar block as an adjuvant to GA to GA alone in ophthalmic surgery. This may be due to the antiemetic effect of propofol as they used total intravenous anesthesia (TIVA) as an anesthetic technique. Previous researches that investigated the double-injection peribulbar block in pediatrics, used volumes up to 10 ml of local anesthetic mixture[13]. Owing to the fact that the mechanism of increased IOP is related to the mechanical pressure effect from the volume injected, particularly in pediatrics with special anatomical configuration, a smaller volume (4-6 ml) was used in this study. This smaller volume was associated with transient IOP increase with no operative effect.

However incidence of postoperative emesis with opiates and propofol-based TIVA is still high (28%-60%)[11]. Along with propofol-based anesthesia, we used non-steroidal anti-inflammatory and regional anesthesia technique. To ensure adequate and sustained postoperative pain relief, we used adjunctive IM diclofenac sodium 1mg/kg in the two groups of patients, finding a higher incidence of postoperative vomiting in the acupuncture group. In many studies the use of fentanyl with TIVA was associated with low incidence of PONV after pediatric strabismus surgery[8,11] but in our study we used only propofol with peribulbar block which is an acceptable technique in adults[15] and has been safely used in children[16]. A few studies have mentioned the role of peribulbar block in reducing emesis after ophthalmic surgery in children[14] by inhibiting the oculocardiac reflex. We combined peribulbar block with propofol-based TIVA technique which decreased the incidence of OCR 2.9 %.

However, we did not find any significant correlation between the occurrence of OCR and postoperative emesis in any of the two groups. The peribulbar block, by providing good analgesia and akinesia in the postoperative period, may give the

child time to adapt to visual changes. This outcome, in addition to its opiate-sparing effects, contributed to the low incidence' of postoperative vomiting in this group. Also there was statistically significant difference between the postoperative vomiting incidence in the peribulbar and the acupuncture groups (4.4% to 18.8% respectively).

In conclusion, single medial canthus injection peribulbar anesthesia under ultrasound image using a short needle and a small volume is effective in pediatric eye surgery. It provided low incidence of OCR, less intraoperative narcotic requirements, hemodynamic stability, less PONV and improved postoperative analgesia. It also had the advantage of, being simple and safe, with the lowest incidence of complications compared to the acupuncture group.

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