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Research Article

Preemptive analgesia by peritonsillar ketamine versus ropivacaine for post-tonsillectomy pain in children

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KEYWORDS

Tonsillectomy;
Ketamine;
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Abstract *Background:* Postoperative pain relief is a desired goal after tonsillectomy. Respiratory depression from opioid, bleeding from nonsteroidal antiinflammatory drugs, and airway edema all these factors make pain control is judges. Peritonsillar infiltration of a local anesthetic has been used for reduction of post-tonsillectomy pain.

Objective: This study aims to compare the postoperative analgesic efficacy and side-effects of preincisional peritonsillar infiltration of either ketamine or ropivacaine in children undergoing tonsillectomy.

Methods: In this prospective randomized double blind study, 60 children 7–12 years scheduled to tonsillectomy were divided into three groups: the tonsils were infiltrated by 0.2 ml kg^{-1} ropivacaine, 0.75% in ropivacaine group R (=21), group 0.5 mg kg^{-1} ketamine in the ketamine group K (n = 20), and 0.2 ml kg^{-1} normal saline in the control group S (n = 19). All drugs were prepared in normal saline (3 ml per tonsil) infiltrated 3 min after induction of anesthesia and before surgical incision. Surgery was performed by a single otolaryngology fellow using the same dissection and snare technique. Postoperative pain was compared during 8-h period using a visual analog scale (VAS). The fast-tracking score was used to determine the post-anesthesia care unit discharge criteria. Patients were evaluated for: time of first request and the total analgesic requirement, time of first oral intake, nausea, vomiting, bleeding, and hallucination.

Results: In the post-anesthesia care unit, groups K and R had comparable pain scores that were significantly lower than S group ($P < 0.04$). Pain scores in the postoperative ward at 2, 6, and 8 h were significantly higher in group S than in K and R groups ($P < 0.05$). The time of first analgesic demand was significantly longer in R group (5.52 ± 1.7) h than in K group (3.83 ± 0.16) h $p = 0.003$. It was

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the shortest in S group (2.57 ± 0.84) h $p = 0.001$. The time of first oral intake was significantly longer in S than in R and K groups (5 ± 1.72 versus 3.2 ± 1.97 and 3.65 ± 1.72 h) respectively = 0.006. Total analgesic consumption (mg) was significantly higher in S group than in R and K (12. ± 5.3 versus 8, 2 ± 2.3 and 8.6 ± 3.1) $p = 0.004$. There were no significant differences between groups regarding nausea, vomiting, or bleeding, and there was no other side-effect recorded.

Conclusion: Perincisional peritonsillar infiltration of both ropivacaine and ketamine was effective in reduction of post-tonsillectomy pain. Ropivacaine was superior to ketamine in reduction of time to first analgesic demand.

1. Introduction

Pain is the most common complaint in the immediate post-tonsillectomy period. Inadequate post-tonsillectomy pain management has many drawbacks including: delayed oral intake, extended hospital stays with increase costs, and greater rate of secondary hemorrhage [1,2]. Doctors still search for an effective post-tonsillectomy analgesia. Peritonsillar infiltration of a local anesthetic solution is used in this aspect although the benefit and complications of this technique is not well established [3] Peritonsillar infiltration is a relatively safe method of pain control in children, who often exhibit resistance to intramuscular or rectal administration of drugs. Both ropivcaine and ketamine were studied for analgesia after tonsillectomy. Ketamine inhibits the early postoperative interleukin IL-6 inflammatory response during surgeries reducing the postoperative pain severity, need for analgesics and antiemetics [4–6]. Locally, 1.0% ropivacaine significantly relieves the pain of pediatric tonsillectomy and reduces postoperative analgesic requirement [7].

This study aims to compare the postoperative analgesic efficacy and side-effects of preincisional peritonsillar infiltration of either ketamine or ropivacaine in children undergoing tonsillectomy.

2. Methods

Approval from the hospital ethics committee to the study protocol and informed written consents were obtained from the parents of 60 children aged 7–12 years, scheduled for tonsillectomy in this prospective randomized double blinded study. The study was conducted in 2011 from January till October under supervision of both anesthesia and otorinolaryngology departments. Exclusion criteria were the following: coagulopathy, allergy to any of the studied drugs, increase intracranial pressure (ICP), psychiatric illness, congenital heart disease, and history of seizure or previous peritonsillar abscess. Patients were randomly divided into three groups using sealed envelope: Group S ($n = 19$) patients received 2 ml normal saline as a control. Group R ($n = 21$) patients received 0.2 ml kg^{-1} 0.75% ropivacine. Group K ($n = 20$) patients received 0.5 mg/kg ketamine. All the medications were prepared as 6 ml in volume with normal saline and injected 3 ml per tonsil via peritonsillar infiltration (PTI) in the tonsillar pillars 3 min after induction of general anesthesia and before surgical incision. The selected doses were chosen according to previous studies [8,4].

All solutions were prepared by a nurse not share in the research to ensure blinding of the operator and observer. Surgery was performed by a single otolaryngology fellow using the same dissection and snare technique. Postoperative pain was compared during 6-h period using a visual analog scale (VAS). Before the operation, all patients received instructions for using a 10-mm visual analog pain scale (VAS), score 0 = no pain, to score 10 = the worst imaginable pain and baseline pain scores were recorded [10]. Patients were evaluated for: time of first request of analgesia (defined as time from end of surgery till first analgesic intake), the total analgesic requirement, nausea, vomiting, bleeding, and hallucination or abnormal behavior. All the patients were premedicated with midazolame 0.05 mg/kg and atropine 0.02 mg/kg intravenously and monitored with pulse oximetry, ECG, capnography, and noninvasive blood pressure. Induction of anesthesia was done with fentanyl 1 μg/kg, propofol 2–2.5 mg/kg. Endotracheal intubation was facilitated by 0.5 ml/kg atracurium. Anesthesia was maintained with isoflurane1–2% using controlled ventilation. At the end of surgery, inhalation agent was discontinued and neuromuscular blocker was reversed by neostigmine 0.05 mg and atropine 0.02 mg/kg. Then, patients were extubated and admitted to the recovery room at which VAS as time zero (T_0) was recorded. Patients were discharged to the ward according to accepted clinical criteria, the VAS was continued to be assessed in the ward at predetermined intervals (1, 2, 4, 6, and 8 h). Pain was assessed by a single interviewer who was not aware of the study medication. The fast-tracking score [11] was used to determine the post-anesthesia care unit discharge criteria (appendix 1). A minimum score of 12 would be required for a patient to be transmitted to the ward after general anesthesia. Meperidine 0.4 mg/kg in titrated dose (Total 1 mg/kg) was administered intravenously for rapid pain relief to patients who had pain score >3.

In the ward the standardized postoperative analgesic technique was acetaminophen suppository (initial dose 40 mg/kg) then 20 mg/kg every 8 h. To control postoperative nausea or vomiting, metoclopramide 0.2 mg/kg was given.

3. Statistical analysis

Data were analyzed by using SPSS version 19 (Chicago-USA). Data were expressed as mean ± SD or number (%). Age, duration of surgery, duration of anesthesia, and analgesic consumption were analyzed by ANOVA test. Percentage and frequencies of patients were compared using Chi-square test. P value <0.05 was considered statistically significant.

4. Results

The study included 60 patients 34 males and 26 females. The mean age was 9.5 ranged from 7 to 12 years. There were no significant difference ($P < 0.05$) regarding surgical and anesthetic duration for the three groups (Table 1).

The time to first demand for analgesic was significantly longer in R group (5.52 ± 1.7) h than in K group

Table 1 Clinical and surgical characteristics of the patients in the studied groups.

Variable	Group K (n = 20)	Group R (n = 21)	Group S (n = 19)	P
Age (years)	8.05 ± 2.53	7.6 ± 2.3	7.4 ± 1.3	0.619
Sex (male/female)	8-December	9-December	9-October	0.89 1
Duration of surgery (min)	32.3 ± 5.4	30.6 ± 9.1	31.1 ± 1.3	0.67 1
Duration of anesthesia (min)	44.3 ± 11	41.7 ± 1.0	43.1 ± 1.5	0.4 36

Data were expressed as mean ± SD. $^{*}P < 0.05$ (significant).

Table 2 Time of first oral intake, first request of analgesia, total analgesic consumption, and the fast-tracking score used to determine the post-anesthesia care unit discharge criteria.

Variable	Group K (n = 20)	Group R (n = 21)	Group S (n = 19	P
Time of first oral intake (h)	3.65 ± 1.72	3.2 ± 1.97	5.03 ± 1.72	0.006
Time of first request of analgesia (h)	3.83 ± 0.16)	5.52 ± 2.7	2.57 ± 0.84	0.001
Total analgesic consumption (mg)	8.6 ± 3.1	8.2 ± 3.1	12.1 ± 5.3	0.004
Fast-tracking score ⩾12 before leaving OR (n, %)	17 85%	18 85.71%	16 84.21%	0.99

(3.83 ± 0.16) h $p = 0.003$. It was the shortest in S group (2.57 ± 0.84) h $p = 0.001$.

The time to the first oral intake was significantly longer in S group (5 ± 1.72) h than in R group (3.2 ± 1.97) h and K group (3.65 ± 1.72) h $p = 0.006$.

Total analgesic consumption (mg) was significantly higher in S group (12. ± 5.3) than in the R group (8, 2 ± 2.3) and K group (8.6 ± 3.1) $p = 0.004$ (Table 2).

The fast-tracking score was used to determine the post-anesthesia care unit discharge criteria. Score ⩾12 before leaving the operating room was (85%, 85.71%, 84.21%) in group K, R, and S, respectively, with nonsignificant difference $p = 0.99$.

- VAS score determined since admission to recovery room was higher in S group than the other groups K and R, respectively. There was significant decrease in pain score in group R and group K at 2 h ($P = 0.04$). Also, there was significant increase in pain score at 4 h and 6 h in comparison with that of 2 h within each of the three groups but still less than that of S group ($P < 0.05$). After 8 h, all patients had already received postoperative analgesics (acetaminophen) which would interfere with our assessment of pain and the patient mostly discharged to home (Fig. 1).

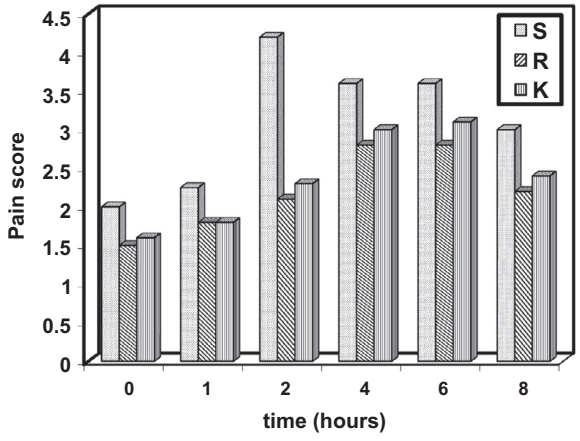

Figure 1 Postoperative visual analog scale scores at different time intervals in the three groups during the first 8 h (VAS was high in S group than R, K groups).

The prevalence of nausea and vomiting shows nonsignificant difference between the studied groups 30% in ketamine group, 23.81% in ropivacaine group, and 36.84% in placebo group, which did not reach significance. Hallucinations were not observed in ketamine or other groups.

5. Discussion

The main concern of both the anesthetist and the surgeon is to provide early patient mobilization, his oral intake, and decreased hospital stay and cost. This is achieved by a good postoperative analgesia with the least analgesic intake. The main target of the present study was to prove the efficacy of preoperative peritonsillar infiltration (PTI) as preemptive and postoperative analgesia. The PTI of either ropivacaine or ketamine was more effective than placebo to control postoperative pain. This is proved by decrease time of first oral intake, delayed time of first request of analgesia, and decreased total analgesic consumption. The pain score was low and the fast track score was good, allowing early patient discharge. These findings agreed with the report of Costas-Gastiaburgo et al. [12] who found locally administered ketamine during tonsillectomy to decrease PACU, pain intensity, and analgesic requirements.

Ayatollahi et al. [13] did a comparison to study the effect of (PTI) of ketamine and tramadol on post-tonsillectomy pain, both provided good analgesia but hallucinations and negative behavior was recorded with ketamine. Also El Sonbaty et al. [14] studied the Preemptive peritonsillar ketamine infiltration: combined with bupivacaine, they provided efficient postoperative analgesia after adenotonsillectomy and achieved higher parents' satisfaction. Honarmand et al. [9] studied two doses of ketamine 0.5 or 1 mg kg^{-1} given 3 min before surgery by (PTI); it provided efficient pain relief during 24 h after surgery without side-effects in children undergoing adenotonsillectomy. Ketamine, a compound with analgesic and antihyperalgesic properties, interacts with a number of receptors like opioids, muscaranic, and N-methyl-D-aspartate receptors (NMDAr).

Evidence suggests that NMDAr located in peripheral somatic and visceral pain pathway play an important role in nociception which was responsible for decreased postoperative pain and opioid requirements [15]. Oghan et al. [7] reported that patients receiving 1.0% ropivacaine hydrochloride soaked swabs packed in their tonsillar fossae decreased postoperative analgesic consumption and this agreed with the result of the present study.

In contrast to that Gemma et al. [16] used 0.75% ropivacaine in peritonsillar infiltration for analgesia after adenotonsillectomy in children but did not provide any major postoperative analgesic effect. A possible clinically minor analgesia 6 h after surgery was suggested. Park et al. [17] found that the injection of 0.5% ropivacaine with epinephrine immediately following adenotonsillectomy did not reduce pain postoperatively. This may be explained by low concentration used. So, the present study used 0.75% ropivacaine.

Peritonsillar infiltration of local anesthetics was reported to cause complications such as bilateral vocal cords paralysis, severe obstruction of upper airways, acute pulmonary edema (vagus and hypoglossal block) and deep neck abscesses; these complications may be due to deep infiltration or high doses of local anesthetics [18,19].

No complications were reported in this study.

6. Conclusion

Peritonsillar analgesic infiltration is a safe method for post-tonsillectomy pain control. Both ropivacaine and ketamine are effective but ropivacaine is superior to ketamine in reduction of time to first analgesic demand.

Appendix A. Fast-tracking score[11]

I. Level of consciousness *Awake and oriented	2
*Arousable with minimal stimulation	1
*Responsive only to tactile stimulation	0
II. Physical activity	
*Able to move all extremities on command	2
*Some weakness in movement of extremities	1
*Unable to voluntarily move extremities	0
III. Hemodynamic stability	
*Blood pressure <15% below baseline MAP value	2
*Blood pressure within 15–30% of baseline MAP value	1
*Blood pressure >30% below baseline MAP value	0
IV. Respiratory stability	
*Able to breathe deeply	2
*Tachypnea with good cough	1
*Dyspneic with weak cough	0
V. Oxygen saturation	
*Maintains value >90% on room air	2
*Requires supplementary oxygen (nasal prongs)	1
*Saturation <90% with supplementary oxygen	0
VI. Postoperative pain assessment	
*None or mild discomfort	2
*Moderate to severe pain controlled with i.v. analgesics	1
*Persistent severe pain	0
VII. Postoperative emetic symptoms	
*None or mild nausea with no active vomiting	2
*Transient vomiting or retching	1
*Persistent moderate-severe nausea and vomiting	0
Total score	14

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