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Evaluation of the Effects of Sub-Tonsillar Marcaine Injection in Tonsillectomy for reducing Postoperative Nausea and Vomiting

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Abstract

Background: Injections of topical analgesics such as lidocaine and bupivacaine control agitation and relieve pain without the unwanted side effects of drugs such as nausea, vomiting, and respiratory failure. Therefore, the present study was performed to determine the possible effect of topical injection of bupivacaine on the reduction of nausea, vomiting, and agitation after tonsillectomy.

Methods: The present study was performed as a double-blind randomized controlled clinical trial on 50 patients aged 5 to 12 years under tonsillectomy surgery in Imam Khomeini Hospital in Ahvaz in 2018-2019. Patients were randomly divided into two intervention (I) and control (C) groups, each consisting of 25 patients. Anesthesia was induced with 0.02 mg/kg atropine, 2 µg/kg fentanyl, 4-5 mg/kg sodium thiopental, and 0.5 mg/kg muscle relaxant atracurium, and nasotracheal intubation was performed in patients. Group I received a topical injection of 1 cc of bupivacaine 0.2% (20 mg/4 ml) with epinephrine 0.001% and group C injection received 1 cc of normal saline with epinephrine 0.001%. Pain intensity, the presence of nausea, vomiting, and agitation at 1, 4, 8, 16, and 24 hours after injection were recorded, evaluated, and compared.

Results: The mean age and gender distribution of patients in the two groups were not significantly different (P >0.05). At all measurement times, the mean score of the measurement criterion was significantly higher in the control group (P <0.05). At all times, the mean score of the measurement of the incidence of vomiting and agitation in the control group was higher, but this rate was statistically significant only in 1, 4, and 8 hours after injection in both groups (P <0.05). At all measurement times, the mean score of the pain intensity in the control group was significantly higher (P <0.05).

Conclusion: The results of the present study showed that the sub-tonsillar injection of Marcaine was a safe method for pain control, reduction of nausea, vomiting, and postoperative agitation in children undergoing tonsillectomy.

Keywords: Marcaine; Nausea; Vomiting; Agitation; Tonsillectomy

Introduction

Tonsillectomy or removal of the palatine tonsils is one of the most common surgical procedures in ENT surgery [1]. 59% of the main causes of tonsillectomy were respiratory causes, 42% were recurrent infections and 39% were obstructive sleep apnea [2-6]. The most common complication after tonsillectomy is bleeding. Sore throat, mild fever, and earache are also common [6-11]. A common way to relieve pain is to use drugs that have been tried to be limited to severe cases due to side effects such as nausea, vomiting, and respiratory depression [12,13]. Postoperative nausea and vomiting are an unpleasant experience that can lead to more serious complications such as dehydration, electrolyte disturbances, the opening of surgical sutures, increased intravenous pressure (and consequently increased intracerebral and ocular pressure), and delayed discharge of outpatients and inpatients, which also increases hospital costs [14-16]. Various studies have examined the effects of various drugs such as intravenous dexamethasone, gabapentin, ketamine, morphine, lidocaine, bupivacaine, and ropivacaine [17-23] as the main drug or supplement in local anesthesia and effective in reducing pain, nausea, and vomiting. Among these, the efficacy of lidocaine and bupivacaine was more important due to their cheapness and availability [24,25]. Post-anesthesia agitation is a common problem in children after surgery and is of particular importance [26-30]. Preventive and curative factors in this condition are classified into three general categories, including the use of pharmacological agents before anesthesia, effective prevention of postoperative pain, and prevention of verbal and physical activities by waking the child in a calm environment [31,32]. Another method that appears to have fewer side effects than narcotics is the use of topical anesthetics [33]. There are several ways to control agitation, including injections of painkillers such as lidocaine, bupivacaine, and dexamethasone, which control agitation and relieve pain without the unwanted side effects of drugs such as nausea, vomiting, and respiratoy failure [34-36]. However, in some studies, patients who received bupivacaine or dexamethasone to reduce the pain of tonsillectomy surgery were unsatisfied [37]. Marcaine is a class of topical anesthetic that acts by

inhibiting the passage of sodium through its specific channels and blocking nerve impulses. This drug increases the stimulation threshold by reducing sodium permeability and subsequently slowing neuronal depolarization [38]. Bupivacaine, as a topical anesthetic of the amide-type, causes long-term analgesia at concentrations of 0.25% and 0.5%, and have a slow onset of action (15 minutes), high potency, and long duration of action (2-4 hours) [34]. Local anesthetics have few side effects and are relatively "cheap, effective, and available." Infiltration injection of topical anesthetics has been shown to be effective in relieving postoperative pain in several studies, but some studies have refuted its benefits, and therefore medical literature is unclear in this case [39].

Recently, the use of some drugs, such as bupivacaine, has been recommended, but previous studies have not yet yielded definitive results. Therefore, this study was designed to determine the possible effect of topical injection of bupivacaine on reducing nausea, vomiting, and agitation after tonsillectomy.

Materials and Methods

After obtaining permission from the ethics committee in Ahvaz Jundishapur University of Medical Sciences and approving the plan (Code of Ethics: IR.AJUMS.REC.1398.193), this study was performed as a double-blind randomized controlled clinical trial (IRCT: IRCT20191016045134N1) on 50 patients aged 5 to 12 years under tonsillectomy surgery in Imam Khomeini Hospital in Ahvaz in 2018-2019.

Before including patients in the study, informed consent was received from their parents. All patients underwent tonsillectomy by the same surgeon. Patients were randomly divided into two groups: intervention (I) (n=25) and control (C) (n=25). The randomization of patients' inclusion into two groups was performed by random number table method. Both groups underwent the same anesthesia. In this way, after measuring blood pressure, heart rate, ECG monitoring, and arterial oxygen saturation percentage (SpO2), anesthesia was induced with 0.02 mg/kg atropine, 2 µg/kg fentanyl, 4-5 mg/kg sodium thiopental, and 0.5 mg/kg muscle relaxant atracurium, and nasotracheal intubation were performed in patients. At the beginning of the operation, the group I received a topical injection of 1 cc of bupivacaine 0.2% (20 mg/4 ml) (manufactured by MYLAN SAS company of France) with epinephrine 0.001% by 1-CC insulin syringe, group C injection received 1 cc of normal saline with epinephrine 0.001%. Epinephrine was used to reduce the possible vascular absorption of Marcaine. After induction of anesthesia and fixation of the tracheal tube, if there were no complications before the operation, the surgeon injected the solution into the lateral and upper parts of the peritonsillar space. The injector did not know the type of drug. At the end of the surgery, after the last suture, inhaled gas was closed and the patient was reversed. Extubation of the tracheal tube was performed while the head was down, and the child was transferred to recovery while lying on his left side. In both recovery and inpatient wards, in addition to intravenous fluid therapy, more than 3 to 10 mg/kg acetaminophen was injected into the child under VAS conditions. Pain intensity, the presence of nausea, vomiting, and agitation at 1, 4, 8, 16, and 24 hours after injection were recorded, evaluated, and compared. The criteria for measuring nausea and vomiting in patients based on the scoreboard of the following table were evaluated as none (1), low (2), moderate (3), and severe (4):

Nausea Score			
None		0	
Able to eat		1	
Oral intake significantly decreased		2	
Intravenous (IV) fluids required		3	
Grade the severity of nausea			
4	3	2	1
Severe	Moderate	Mild	None
Vomiting Score			
None		0	
1 Episode in 24 hours		1	
2-5 Episode in 24 hours		2	
6 Episode or more in 24 hours or need for IV fluids		3	
Hospitalization required		4	
Grade the severity of vomiting			
4	3	2	1
Severe	Moderate	Mild	None

For the relief of nausea and vomiting in patients in grades 2 and above, androsterone was used as 0.1 mg/kg and repeated every 4 hours as needed.

Signs of agitation were assessed using The Pediatric Anesthesia Emergence Delirium (PAED) scale criteria.

The Pediatric Anesthesia Emergence Delirium (PAED) Scale					
Behaviors	None	a little	Quite a bit	Very much	Extremely
Eye contact with the caregiver	4	3	2	1	0
Actions are purposeful	4	3	2	1	0
Aware of his/her surroundings	4	3	2	1	0
Restlessness	0	1	2	3	4
Inconsolable	0	1	2	3	4

Measurement of pain intensity was recorded using visual acuity scale (VAS) quantitatively and with scoring (0 to 10) so that 0 was attributed to painlessness and 10 to maximum pain.

The information was recorded and collected by an anesthesiologist who did not know the groups.

Patients with a history of asthma bronchitis, history of cardiovascular disease, hepatic and hematological disease, sensitivity to bupivacaine or lidocaine, receiving dexamethasone in anesthesia, history or presence of coagulopathy, excessive bleeding, symptoms of acute pharyngitis, regular analgesic, sedative, and hypnotic medications, active respiratory infection with a runny nose, fever, and inability to understand VAS were excluded from the study.

After collecting statistical findings, SPSS statistical software version 20 was used to compare the results. Frequency and qualitative variables were compared using the Chi-square test. The Independent two-sample t-test, Mann-Whitney, or chi-square tests were also used to compare quantitative variables based on the normality of the data. The significance level in the tests was considered to be 0.05.

Results

The mean age of patients was 9.40±2.94 in the intervention group and 2.79±8.20 in the control group and there was no statistically significant difference (P >0.05). The intervention group included 12 women and 13 men and the control group included 11 women and 14 men. Patients in the two groups did not significantly differ in terms of gender distribution (P >0.05).

At all measurements, the mean score of nausea was significantly higher in the control group (P <0.05).

At all measurements, the mean score for vomiting was higher in the control group, but it was significantly different between the two groups only 1, 4, and 8 hours after injection (P <0.05). At all measurement times, the mean agitation score was higher in the control group, but this statistic was statistically significant only in 1, 4, and 8 hours after injection in both groups (P <0.05). At all measuring times, the mean score of pain was significantly higher in the control group (P <0.05) (Table 1).

Table1: Comparison the mean score of nausea, vomiting, agitation and pain in the two groups.

Variables	Time of evaluation	Intervention (n= 25)	Control (n= 25)	P-Value
Nausea score	1 hour	1.68±0.95	3.12±0.73	<0.001*
	4 hour	1.36±0.70	2.20±0.71	<0.001*
	8 hour	1.16±0.37	1.84±0.55	<0.001*
	16 hour	1.04±0.20	1.76±0.52	<0.001*
	24 hour	1.0±0.00	1.60±0.58	<0.001*
Vomiting score	1 hour	1.12±0.33	2.16±0.80	<0.001*
	4 hour	1.04±0.20	1.48±0.71	0.005*
	8 hour	1.00±0.00	1.16±0.37	0.038*
	16 hour	1.00±0.00	1.12±0.33	0.077
	24 hour	0.88±0.33	1.00±0.50	0.322
Agitation score	1 hour	10.96±2.89	12.76±3.42	0.021*
	4 hour	8.68±2.69	10.08±1.23	0.007*
	8 hour	4.24±1.66	6.84±1.11	0.024*
	16 hour	2.16±1.62	3.06±1.76	0.23
	24 hour	1.12±0.60	1.36±0.76	0.22
Pain score	1 hour	4.60±1.58	7.32±1.07	<0.001*
	4 hour	3.84±0.99	6.16±0.99	<0.001*
	8 hour	3.64±1.15	4.96±1.02	<0.001*
	16 hour	2.84±1.41	4.16±0.94	<0.001*
	24 hour	2.32±1.11	3.36±1.47	0.007*
Data are expressed as mean ± SD.				
The statistical test used was t-test.				
*P<0.05 is considered as significant level.				

Discussion

Further examination of the best methods of anesthesia, appropriate planning, and the necessary precautions to control risk factors and reduce the complications of nausea, vomiting, and postoperative agitation to a minimum is essential.

In the present study, at all time measurements, the mean score of the criterion for measuring the incidence of nausea in the control group was significantly higher (P <0.05). Also, at all measurement times, the mean score of vomiting rate was higher in the control group, but this was statistically significant only in 1, 4, and 8 hours after injection in both groups (P<0.05).

In a randomized prospective study, Hung et al. studied the effectiveness of bupivacaine on reducing pain and recovery in children undergoing tonsillectomy. The group receiving bupivacaine had fewer morbidity symptoms, earlier ability to drinking and eating, and significantly shorter recovery periods (P >0.05) [43].

In a double-blind clinical trial, Costas-Gastiaburo et al. compared the effect of bupivacaine 0.5% injection in combination with adrenaline and normal saline on reducing morbidities after tonsillectomy. The results of the study reported the highest incidence of nausea and vomiting among patients undergoing bupivacaine injection alone (71.4%) and found a greater effect on the type of solution chosen [44]. The results of the Costas-Gastiaburo study et al. were not consistent with the present study. This may be related to the difference in dose and composition of the injected drugs, which in our study was 1 cc of bupivacaine 0.1% (20 mg/4 ml) [45-58].

In a double-blind randomized controlled clinical trial, Yilmaz et al. investigated the effect of 5 ml bupivacaine hydrochloride (25 mg/10 ml) on reducing morbidities after tonsillectomy. The results of the study did not report a significant difference in the incidence of nausea and vomiting in patients in the two groups (P >0.05) [40]. The results of the study by Yilmaz et al. were inconsistent with the present study, which may be related to differences in the dose of the drug injected.

In the present study, at all measurement times, the mean score of the agitation measurement scale in the control group was higher, but this rate was statistically significant only in 1, 4, and 8 hours after injection in both groups (P<0.05). Also, in the present study, the mean score of pain intensity in the control group was significantly higher at all measurement times (P <0.05).

In a double-blind randomized controlled clinical trial, İhvan et al. investigated the effectiveness of bupivacaine injection of 2 ml (0.5 mg/ml) on both sides of the tonsillar on pain control after tonsillectomy surgery. At 2 and 6 hours, the pain intensity was significantly lower in the intervention group (P <0.001). Although the pain intensity in the intervention group was lower in the 24 hours and one week after the start of the evaluation, there was no significant difference between the pain intensity of the two groups (P >0.001). Finally, they concluded that bupivacaine injection was useful in controlling pain in the early hours after tonsillectomy in children undergoing this surgery, but did not have a significant effect after 24 hours [42]. The results of the study by İhvan et al. were consistent with the present study, in which Marcaine injection significantly reduced pain in the intervention group.

In a single-blind randomized controlled clinical trial, Kadar et al. investigated the effect of topical injection of bupivacaine in the tonsillar fossa on pain relief after tonsillectomy surgery. For all patients, 2 ml of bupivacaine 0.5% was injected in the right tonsil and 2 ml of normal saline 0.9% was injected in the left tonsil. The results of the study showed that the use of bupivacaine in the tonsillar fossa significantly reduces postoperative pain and allows drinking and eating early after surgery [33]. The results of the study by Kadar et al. were consistent with the present study, in which a Marcaine injection significantly reduced pain in the intervention group.

In a randomized controlled clinical trial, Somdas et al. used topical administration of bupivacaine 0.5% (3 ml for children under 10 years of age and 4.5 ml for above 10 years) in the the tonsillar fossa to reduce morbidities within 24 hours after tonsillectomy. The results showed a significant difference in pain reduction on the injection site with bupivacaine in the first 8 hours after injection [41]. The results of the study by Somdas et al. were consistent with the present study, in which Marcaine injection significantly reduced pain in the intervention group.

In a study by Yilmaz et al., in the first 24 hours after bupivacaine injection, a significant reduction in pain was reported in the intervention group (P <0.05) [40]. The results of their study were consistent with the present study, in which Marcaine injection significantly reduced pain in the intervention group.

In a randomized controlled clinical trial, Amani et al. compared the possible effect of topical injection of 2 ml of bupivacaine 0.5%, 2 ml dexamethasone, and 2 ml of normal saline on the pain intensity after tonsillectomy. They concluded that the use of dexamethasone and bupivacaine with the dose used in this study not only did not affect the pain intensity but also in the first 6 hours, the pain intensity in the bupivacaine group was slightly higher than in the other groups. Therefore, it was recommended that these drugs with the doses studied not be used for tonsillectomy [37].

Conclusion

The results of the present study showed that the sub-tonsillar injection of Marcaine was a safe method for pain control, reduction of nausea, vomiting, and postoperative agitation in children undergoing tonsillectomy. Finally, despite the results of the present study, due to the limited number of similar studies, further studies are needed to determine the effect of Marcaine on agitation and the recognition of relevant mechanisms.

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