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Research Article

Effects of High and Normal Dose Fluid Therapy on Nausea and Vomiting after Pediatric Tonsillectomy: A Comparative Study

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ABSTRACT

Background: Nausea, vomiting, and postoperative pain are common and undesirable complications after anesthesia and tonsillectomy surgery especially in children. This study was designed to evaluate the effects of high and normal dose lactated Ringer infusion on nausea, vomiting, and pain intensity after pediatric tonsillectomy.

Methods: A total number of 100 tonsillectomy surgery candidates at the age range of 1-12 years were selected for this randomized clinical trial. The subjects were randomly assigned to the intervention or control group after signing of their informed consent. The intervention group received high-dose fluid therapy (lactated Ringer 30cc/kg) and the control group received the normal dose (lactated Ringer 10cc/kg) during the perioperative period. The amounts of consumed adjuvant antiemetic drugs, incidence of nausea and vomiting, and pain severity were evaluated in both groups in the recovery room, at 12 and 24 hours after tonsillectomy.

Results: The incidence of nausea and vomiting and the use of rescue antiemetic drugs in the intervention group compared to the control group, were always lower in the recovery room, 12 and 24 hours after surgery; but only the difference in incidence of nausea and vomiting at 24 hours after surgery was statistically significant (P = 0.027).

Conclusion: High-dose fluid therapy significantly reduces the late incidence (24 hours after surgery) of post- tonsillectomy nausea and vomiting in children.

One of the most common surgical procedures in children is a tonsillectomy, which is accompanied by several complications such as bleeding, airway obstruction, as well as post-operative nausea and vomiting (PONV). The prevalence of PONV in children is twice as high as in adults and has been totally reported to be 13% to 42% resulting in pain and anxiety. On the other hand, its frequency or amount can lead to electrolyte imbalance in the patient due to the problems of food and fluid intake associated with postoperative pain [1].

Nausea and vomiting are multifactorial and mainly associated with the risk factors in patients and anesthesia and surgical methods. Eberhart et al. mentioned four risk factors in this regard, including the duration of surgery less than 30 minutes, the age of fewer than 3 years, strabismus surgery, and the history of postoperative nausea and vomiting in parents, siblings, or the patient [2]. Age [3-5], gender [6], surgical technique [6-8], and surgeon's experience [9] have been considered as the risk factors of post-tonsillectomy adverse outcomes. The risk of developing PONV in children is higher than in adults. The lowest incidence is in newborns (3%), 20% in children under school age, while from the age of 3 onwards, for each year of the child age, the risk increases by 0.2 to 0.8 percent [1] and reaches 29% under the age of 12 [10].

Severe nausea and vomiting can lead to problems such as hemorrhage, dehydration, electrolyte imbalance in the body, pulmonary aspiration, dissatisfaction in the parents

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of children, increased hospitalization time, and unexpected expenses due to patient's hospitalization [11].

Today, various methods are used to prevent PONV, such as avoiding long-term prescription of opioid analgesics and prescribing antiemetic and dexamethasone, which may have side effects in addition to cost-ineffectiveness [12]. Therefore, a non-pharmacologic decision with an appropriate strategy and cost-effectiveness seems essential to reduce the incidence of PONV, especially in high-risk patients [13]. The reduction of intravascular fluid may be one of the factors affecting PONV and the management of intravenous fluids (IV) may reduce the incidence of unfavorable outcomes in outpatient surgeries [14]. Administration of sufficient amounts of preoperative intravenous fluids to compensate the deficiency without adverse side effects and high costs may be effective in reducing the incidence of PONV [15]. Few studies have been conducted in this field with contradictory results. Najafi compared the effects of severe hydration and dexamethasone on PONV in tonsillectomy surgery, whose results showed no difference between the two groups regarding the incidence of nausea and vomiting [16]. On the other hand, superhydration during surgery was reckoned as an effective measure that dramatically reduces the incidence of PONV in some researches [17-19].

Given what was mentioned, and since there have been few studies on the effectiveness of high-dose fluid therapy in reducing the risk of postoperative nausea, vomiting, and pain severity, particularly in pediatric patients, this study compared the effects of high- and normal-dose fluid therapy on nausea, vomiting, and pain severity after pediatric tonsillectomy.

Methods

This study is a randomized clinical trial whose population included all children aged 2 to 12 years referring to one of Hamadan hospitals for tonsillectomy under general anesthesia. A total number of 100 patients were selected through available random sampling (ASA physical status I or II). The subjects were included in the study after the parents' written and informed consent and were then placed in an intervention (Superhydration = S) and a control group (C) using randomized blocks. Permission was also obtained from the Ethics Committee of Hamadan University of Medical Sciences. After insertion of a catheter, the intervention group (high dose) received 30 ml of ringer lactate serum per k/h, while the control group (normal dose) received only 10 ml of ringer lactate serum per k/h. Restrictions on milk intake and other solid foods were applied on patients 6 hours before the surgery, and clear liquids were not permitted either 3 hours before the surgery. Premedication was used in none of the patients and induction of general anesthesia was the same in all of them. The surgical procedure was performed by the same surgeon using a sharp dissection with snake method, while cauterization was applied for hemostasis. Fifteen minutes before surgery finished, infusion of intravenous Paracetamol at a dose of 15 mg / kg was performed for both groups in 15 minutes. At the end of the surgery, reversal of muscle relaxants was carried out with injection of 50 g/kg Neostigmine and 20 g/kg Atropine, after which the endotracheal tube was removed and the intravenous fluid injection was discontinued simultaneously with the patient's transfer to the recovery. Both groups were evaluated for the frequency of nausea and vomiting in recovery as well as 12 and 24 hours later in the ward. Since it's difficult to examine nausea in children, gagging was considered to be equivalent to nausea, in which case 0.15 mg/kg dose of intravenous Ondansetron was injected. If the gagging or vomiting continued, Metoclopramide would be used with a dose of 0.1 mg/kg. Accordingly, the frequency of administrating antiemetic drugs was recorded in the questionnaire. Postoperative pain severity was evaluated based on CHEOPS Pain Score or Visual Analogue Scale (VAS). If the pain score was higher than 4 according to CHEOPS or VAS, the patient would receive 0.25 mg/kg of Pethidine injection and maximum of 0.5 mg/kg in order to stop pain.

The study was double-blind, in which patients and the individual who measured the incidence of PONV were unaware of the intervention group (double-blind study). In addition to the above-mentioned factors, BMI <95th percentile for age, not having diabetes, not taking antiemetic or psychedelic drugs 24 hours before tonsillectomy, lack of gastroesophageal reflux, and mental health were also considered as inclusion criteria. Data analysis was performed using SPSS-16 software.

Results

(Table 1) indicates gender, age, and weight of subjects in both experimental and control groups. There was no significant difference between the two groups in terms of age and weight, while there was a statistically significant difference in gender between them (P = 0.049). However, considering the gender of the patients was not confounding in this study, it didn't have any effects on the results.

Table 1- Demographic characteristics in two study groups

	Gender N (%)		Age M (SD)	Weight M (SD)
	Male	Female		
Superhydration	30 (60%)	20 (40%)	7.34 (2.83)	28.34 (14.21)
Control	20 (40%)	30 (60%)	7.40 (2.83)	27.71 (13.18)
P-value	0.049		0.91	0.90

According to the results of (Table 2), the incidence of nausea and vomiting was significantly lower in the high-dose fluid therapy group than that of the normal-dose group (P=0.027) 24 hours after tonsillectomy. However, two study groups didn't show any significant differences in recovery and 12 hours after tonsillectomy.

Table 2- Incidence of nausea and vomiting after tonsillectomy by treatment and evaluation time

Time	Nausea or vomiting	Group Control N (%)	Superhydration N (%)	P value
Recovery	Yes	1 (2%)	0(0%)	1.00*
	No	49 (98%)	50(100%)	
12 hours after Tonsillectomy	Yes	8 (16%)	4 (8%)	0.218**
	No	42 (84%)	46 (92%)	
24 hours after Tonsillectomy	Yes	6 (12%)	0 (0%)	0.027*
	No	44 (88%)	50 (100%)	

* Fisher exact test

**Chi square test

According to (Table 3), although the frequency of drug administration after tonsillectomy in patients with high-dose liquid therapy was lower than the normal dose, there was no statistically significant difference between the two groups.

Table 3- Frequency of antiemetic drug administration after tonsillectomy by treatment group and evaluation time

	Nausea or vomiting	Group Control N (%)	Superhydration N (%)	P value
Recovery	Yes	0 (0%)	2 (4%)	0.678*
	No	50 (100%)	48 (96%)	
12 hours after tancelectomy	Yes	3 (6%)	0 (0%)	0.242*
	No	47 (94%)	50 (100%)	
24 hours after tancelectomy	Yes	2 (4%)	0 (0%)	0.495*
	No	50 (100%)	48 (96%)	

* Fisher exact test

The mean and standard deviation of pain score in the normal- and high-dose liquid therapy groups were 4.40 ± 2.0 and 4.62 ± 2.51, respectively. Regarding the student t-test results, there was no statistically significant difference in terms of pain severity between patients receiving normal and high doses of fluid therapy (p=0.598) (Table 4).

Table 4- Pain severity in experimental and control groups

	Mean	SD	Sig
Superhydration	4.62	2.15	0.598
Control	4.40	2.01	

Discussion

PONV accompanied by pain are among the most common complications of surgical operations, with an estimated incidence of over 80% in high risk patients. However, there is no definite and unique solution to prevent this complication [20]. In the present study, the incidence of nausea and vomiting was always lower (almost half) in the superhydration compared to the control group at different times but the difference was only significant 24 hours after tonsillectomy (0% versus 12%) (P = 0.027). In addition, the incidence of antiemetic usage and mean pain score in the group receiving more intravenous fluids compared to the control group was lower but statistically insignificant.

Goodarzi et al. investigated the effect of fluid therapy on the incidence of nausea and vomiting after strabismus surgery in 100 children. The incidence of PONV during the first 24 hours after surgery was 22% in high-dose fluid therapy compared to 54% in the low-dose group (P=0.001) [17]. The lower incidence of nausea and

vomiting in our study could be interpreted by different types of surgery; since strabismus surgery in pediatric patients has been associated with the highest rates of nausea and vomiting in most studies. But the results of high-dose fluid therapy were comparable to the present study. Sayed et al in another similar study found that suprerhydration combined with dexamethasone 0.1mg/kg in children undergoing strabismus surgery is an efficacious way to reduce the incidence of PONV and post-operative pain [20]. In Ismail et al study; combining super hydration to dexamethasone was considered an effective measure in female patients undergoing laparoscopic cholecystectomy to reduce PONV (22% versus 44%), antiemetic and analgesic consumption significantly [18]. Although different groups of patients and surgeries were evaluated in Ismail and the present study, the results could be compared as both groups are categorized as high risk for PONV. Apfel et al., in their review article, published in 2015 on 15 studies and 1570 patients, investigated the effects of hydration on postoperative nausea and vomiting and concluded that hydration as crystalloid or other fluids decreased the incidence of nausea (in recovery) and delayed nausea (the first 24 hours) [19]. In the present study, unlike the findings of Apfel et al., hydration had no significant effect on early postoperative nausea and vomiting but regarding the late onset PONV, the findings were similar.

Conclusion

High-dose fluid therapy significantly reduces the incidence of delayed post-tonsillectomy nausea and vomiting (24 hours after surgery) in children. However, there is no significant effect on the patients' pain severity, decreased administration of antiemetic drugs, and the incidence of nausea and vomiting in the first 12 hours after the surgery.

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