ORIGINAL ARTICLE

Effect of Intravenous Fluid Therapy on Postoperative Vomiting in Children Undergoing Tonsillectomy

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ABSTRACT

Objective: To compare the efficacy of 30ml/kg/hr Ringer's lactate with 10ml/kg/hr to prevent postoperative vomiting (POV) in children undergoing tonsillectomy in general anesthesia.

Study Design: A Randomized Control trial.

Place and Duration of Study: The study was conducted for a period of 06 months from 15th May 2017 to 16th November 2017 at Holy Family Hospital, Rawalpindi.

Materials and Methods: This study was conducted in the Department of Anesthesia at Holy Family Hospital after approving it from the hospital ethical board. Informed consent (written) was taken from 130 patients. Included patients were between 6 -12 years of age and belonged to American Society of Anesthesia Physical status (ASA class) I or II. They were divided randomly into 2 equal groups by using computer generated numbers. Group A got 10 ml/kg Ringer's lactate and Group B got 30 ml/kg Ringer's lactate as perioperative fluid from the time of induction till the surgery ended. Postoperative vomiting (POV) was recorded at 0, 4 , 8 , 12, 16 , 20 and 24 hours of surgery. Therapy was found to be effective if no episode of Postoperative vomiting was observed in 24 hours. Data was analyzed using SPSS 17.

Results: 30 ml/kg Ringer's lactate was found effective in preventing postoperative vomiting in 69% cases and 10 ml/kg Ringer's lactate prevented it in 15% cases. Post operative vomiting occurred in 85% cases in Group A in comparison with 31% cases in B Group. The difference between two groups was statistically significant (P<0.05).

Conclusion: Super hydration with 30 ml/kg Ringer's lactate is an effective way to reduce the frequency of POV in children undergoing tonsillectomy in general anaesthesia.

Key Words: *General Anesthesia, Nausea, Postoperative Vomiting, Super Hydration, Tonsillectomy.*

Introduction

Postoperative vomiting (POV) is one of the major concerns for patients undergoing general anesthesia (GA). [1,2] Incidence of POV is 30% in patients having surgeries in GA and may rise to 80% in high risk patients.[2,3] POV is the ejection of stomach contents through the mouth in the postoperative period. Risk factors for POV may include GA, female sex, use of intra-operative opioids [4], history of POV, duration of anesthesia and surgery, type of surgery (upper airway surgeries, abdominal or pelvic surgeries, breast surgery), smoking (decreased risk of POV with the use of tobacco) and age < 40 years.[5,6]

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Tonsillectomy is one of the most common surgeries done in children across the world.[7] The POV incidence is up to 73% without any antiemetic medications (prophylactic) in children undergoing tonsillectomy.[8] POV may result in increased rate of aspiration, patient dissatisfaction, delayed discharge and unanticipated hospital admission.[9,10,11]

Prevention of POV is very important for improvement of patient satisfaction and to enhance medical outcome. Nowadays, in the era of ambulatory surgery, it is necessary to prevent POV to speed up recovery.[12] There are various strategies used to decrease the incidence of POV in patients undergoing GA. Local anesthetic infiltration in addition to NSAIDS and paracetamol could serve as multimodal analgesia and thus decrease the incidence of POV attributed to postoperative pain. Pharmacological antiemetic includes benzamides (e.g metoclopramide), phenothiazines(e.g perphenazine), antihistamines(e.g dimenhydrinate), midazolam, steroids(e.g dexamethasone) and serotonin receptors antagonists (e.g ondansetron).[8]

Pharmacological prophylaxis for POV might not be cost effective and may also result in various side effects like agitation, bradycardia, dizziness, sedation, and extra pyramidal symptoms etc.[13]

Intravenous fluid therapy has shown a major role in decreasing the incidence of POV.[14] Lactated Ringer's solution is a crystalloid used in routine as per-operative fluid. A study conducted by Elgueta and colleagues have shown a decrease in POV using 30ml/kg as compared to 10ml/kg from 82% to 62% (relative reduction of 24%, P=0.026).[13]

Studies on decreasing the incidence of POV in the pediatric population scheduled for tonsillectomy using super-hydration (30ml/kg/hr) have been conducted internationally but no such study has been done in Pakistan yet. Aim of this study was to observe the antiemetic effect of super-hydration on prevention of POV in children undergoing surgical removal of tonsils (tonsillectomy), so that a cost-effective antiemetic strategy could be established and implemented in resource-stricken countries such as ours.

Materials and Methods

This RCT was conducted in the operation theatres of Holy Family Hospital, from 15-05-2017 to 16-11-2017. Sample size of 65 was calculated in each group with the help of WHO Sample Size calculator with the level of significance set at 5%. The patents included were children between the ages of 6-12 years belonging to either ASA class I/ II undergoing planned surgery (Tonsillectomy with or without adenoidectomy). Whereas patients with co-morbidities such as diabetes mellitus, obesity (BMI > 95th percentile for age and sex), mental retardation, Known GERD and those with history of antiemetic intake within 24 hours before surgery were not included.

After getting approval of the ethical committee of the hospital, an informed consent was received from all the parents, 130 patients were selected based on the above-mentioned criteria. All patients underwent preoperative evaluation by an anaesthetist before surgery. Patients were instructed to observe fasting according to the ASA guidelines. They were then randomly sorted into two equal groups by the computerized system.

Group A received 10ml/kg/hr Ringer's lactate during surgery.

Group B received 30ml/kg/hr Ringer's lactate during surgery.

No premedication was given. On reaching the operation theatre, standard ASA monitors such as pulse oximeter, ECG leads, and NIBP cuff were applied. General Anesthesia induction was done with sevoflurane at 4MAC in oxygen 100% as carrier gas at fresh gas flow rate of 6 L/min via a facemask.

After gaining an intravenous access, Atracurium 0.5 mg/kg and Nalbuphine 0.2 mg/kg were given intravenously. Tracheal intubation was done 3 minutes after giving muscle relaxant and maintenance of anesthesia was done with sevoflurane at 1 MAC with FiO2 set at 0.5%. Interventional therapy was started after induction. Patients as well as the anesthesiologists were blinded to the group assignment. Ringer's lactate was continuously given with the help of a pump with screen and solution bag hidden with a cover for maintaining blinding. On completion of surgery, all inhalational agents were turned off and FiO2 turned to 1. Reversal agent Neostigmine and glycopyrrolate 0.05 mg/kg and 0.001 mg/kg respectively, were given upon return of some degree of airway reflexes. Patient was extubated when criteria of tidal volume was fulfilled. After tracheal extubation, Ringer's lactate was stopped. When patients were sufficiently awake to maintain the airway without needing any assistance, they were shifted to the post-anaesthesia care unit (PACU). One parent was allowed to stay in PACU. In PACU patients were observed by a post graduate trainee, who was blinded to group allocation, for any episode of vomiting in post-operative period every four hours up till 24 hours. The episode of vomiting was recorded in the proforma specifically designed for the study. The frequency was recorded as 0 in case of no POV in 24hours, as 1 if one episode of POV occurred in 24hours and 2 if more than 1 episode of POV occurred in 24hours. The time span of hospital stay was also noted.

In PACU no additional I.V. fluid was given and the patient was allowed to drink liquid after 3-4 hours. If severe vomiting occurred, it was treated with first line drug Ondansetron 0.15mg/kg I.V. If vomiting persisted, a 2nd rescue antiemetic diphenhydramine 0.015mg/kg I.V. was administered. Patient was discharged a day after surgery. Data collection was

done on a structured proforma and SPSS (version 17) was used for the analysis. Mean with S.D was calculated for quantitative variables such as weight, height, and age in both study groups. Frequency & percentages were presented for qualitative variables such as gender and effectiveness of both groups. The Chi-square test was used to compare the proportion of vomiting between the two groups. A *P*-value of less than 0.05 was regarded to be statistically significant. Effect modifiers such as age and gender were controlled with stratification and following stratification chi square test was also applied.

Results

In this study an aggregate of 130 patients were enrolled and divided into 2 equal groups of 65 each, randomly with the help of computer-generated numbers. There was no notable contrast among the two groups in terms of mean age, weight, height, BMI, and gender distribution as shown in **[Tables I and II]**.

Fluid therapy with 30ml/kg/hr i.e the superhydration group or Group B was effective 69% in preventing POV whereas fluid therapy with 10ml/kg/hr i.e Group A was found to be only 15% effective. After application of the Chi square test, with a P value of less than 0.05 regarded as significant, the difference between the two groups was statistically significant as shown in **[Table III]**. POV occurred in 85% patients in A group as compared to 31% in Group B.

The data was again analyzed post-stratification for age and gender and the difference in frequency of POV was found to be statistically significant between the two groups **[Tables IV and V]**. Therefore, the data strongly indicates super-hydration to be an effective remedy against POV in young children.

Table I: Comparison of Age, Weight, Height and BMI between the Two Groups (n= 130)

Variable	Study Groups	Mean	Std. Deviation
Age/year	Group A	8.92 ±.02	1.99
	Group B	9.12 ±.11	1.89
Weight	Group A	35.65 ±.21	7.37
	Group B	36.43 ±.28	7.08
Height	Group A	130.48 ±.20	10.54
	Group B	131.37 ±.06	9.99
BMI	Group A	20.67 ±.49	1.64
	Group B	20.85 ±.79	1.47

Table II: Comparison of Gender Distribution between the Two Groups

Gender	Group A (n=65)		Group B (n= 65)	
	No. of Subjects	%Age	No. of Subjects	%Age
Male	39	60.00	28	43.08
Female	26	40.00	37	56.92
Total	65	100	65	100

Table III: Comparison of Frequency of POV between the Two Groups (n= 130)

Group	Frequency of POV* (%)			Total	P-Value
	0	1	2		
A	10 (15)	42 (65)	13 (20)	65	<0.01
B	45 (69)	19 (29)	1 (1)	65	
Total	55 (42)	61 (47)	14 (11)	130	

Frequency of POV*

0= no POV in 24 hours

1= 1 episode in 24 hours

2=>1 episode in 24hours

Table IV: Comparison of Frequency POV between the Two Groups; Stratified According to Age (n= 130)

Age	Group	Frequency of POV (%)			Total	P-Value
		0	1	2		
6-9 Years	**A**	8 (22)	22 (59)	7 (19)	37	<0.01
	B	24 (70)	10 (30)	0 (0)	34	
	Total	32 (45)	32 (45)	7 (10)	71	
10-12 Years	**A**	2 (7)	20 (71)	6 (22)	28	<0.01
	B	21 (68)	9 (29)	1 (3)	31	
	Total	23 (39)	29 (49)	7 (14)	59	

p value < 0.05 is significant

Discussion

Tonsillectomy is one of the commonest procedures in the paediatric age group[15] that is done under general Anesthesia[13]. POV is the most frequent complication occurring post operatively,[16] which not only is troublesome for patients but may result in longer hospital stay. The average frequency of POV is about 40% or higher in children aged three years and above [21.]

In our study, we observed a substantial reduction in POV with superhydration, 31% of the patients

Table V: Comparison of Frequency of POV between the Two Groups; Stratified According to Gender (n=130)

Gender	Group	Frequency of POV (%)			Total	P-Value
		0	1	2		
Female	A	6 (23)	16 (62)	4 (15)	26	<0.01
	B	27 (73)	10 (27)	0 (0)	37	
	Total	33 (52)	26 (41)	4 (6)	63	
Male	A	4 (10)	26 (67)	9 (23)	39	<0.01
	B	18 (64)	9 (32)	1 (3)	28	
	Total	22 (33)	35 (52)	10 (15)	67	

hThe jjp-value < 0.05 is significant*

experienced no episode of POV in the first 24 hours by use of 30ml/kg perioperative fluids as compared to 85% in the group with 10 ml/kg perioperative fluids. The use of antiemetic for treatment of POV was also much less in group with superhydration, 64% of the patients in the group with 10ml/kg perioperative fluid experienced one episode of POV and had to be given rescue antiemetics while 29% of the patients in the superhydration group experienced 1 episode of POV and required rescue antiemetics, similarly 20% of the patients in the group with 10ml/kg perioperative fluid experienced more than one episode of POV while only 1% of the patients in the superhydration group experienced more than 1 episode of POV. Similar results were generated after stratification for age, gender and BMI, thus the superiority of superhydration as antiemetic therapy was repeatedly established.

The reason behind the antiemetic effect of fluid therapy is not clear yet but it is hypothesized that supplemental intraoperative fluids reduce any preexisting deficit of intravascular volume due to compulsory fasting prior to surgery, so by maintaining fluid balance, it helps prevent vasoconstriction of the splanchnic vessels and possible mesenteric ischemia resulting in suppression of serotonin production -a strong mediator of both nausea and vomiting [17,18,21..]

Another mechanism through mediation by antidiuretic hormone (ADH) has also been suggested[21]. Anesthesia drugs bring about vasodilation resulting in hypovolemia (relative). The decreased negative feedback of stretch receptors located in the right atrium causes an increase in the levels of ADH which then results in higher frequency of POV.[21]

Superhydration not only serves a purpose to replenish the depleted stores of body water but also helps in keeping the body tissues well hydrated in the postoperative period. As they say, 'a dry throat is a sore throat'. The doctrine of Superhydration dictates that an adequate number of fluids is required to keep the saliva flowing. This makes swallowing easier and washes the throat and reduces the risk of infection and bleeding. For this purpose, it is mandatory to encourage oral intake of fluids as soon as the child is able to take oral feeds. This is only possible if there is minimal to none vomiting in the postoperative period.

In an earlier study, Elgueta et al. found a decrease of 82% to 62% in POV (p=0.02) in children receiving superhydration[13] as compared to children with restricted fluid undergoing tonsillectomy.

In another study, Magner et al[17] observed decreased incidence of POV in the group receiving 30ml/kg fluid as compared to the group receiving 10ml/kg (8.6% vs 25.7% P=0.01) in patients undergoing gynecological laparoscopic surgeries. They also observed a substantial fall in incidence of severe nausea in the group with 30ml/kg. Antiemetic use was alsoa decreased.

Schuster et al[18] also found decrease in frequency in POV by larger intra operative fluids used in adult patients undergoing laparoscopic gastric bypass surgeries. Goodarzi et al[19] also found intraoperative superhydration effective in reducing POV (in children undergoing strabismus surgeries). There was a reduction from 54% to 22% (P0.001) in the superhydration group. However, Dagher et al [20] observed no difference in reduction of PONV using 30 ml/kg or 10 ml/kg perioperative fluids in patients undergoing thyroidectomy.

Recently Ashok et al[21] found use of intra operative liberal fluid therapy to be effective in reduction of POV in children undergoing abdominal (lower) surgeries.[21] The incidence was markedly low in liberal group patients in comparison to the restricted group; 45.8% vs 27.4% (P=0.021).[21] The parents of liberal group were more satisfied in comparison to the restricted group (P=0.04).[21]

Some limitations of our study are worth mentioning. We did not use any prophylactic antiemetic for these patients. Tonsillectomies and other otolaryngological surgeries have a higher incidence of POV, so relying alone on fluid therapy might have led to somewhat increased incidence of POV as opposed to the incidence with the use of combination of prophylactic antiemetic and superhydration. However, these patients` parents agreed to this study protocol and had no objections. These patients were monitored for 24 hours and any episode of POV was treated as soon as possible. Based on our results, however, we consider that for this type of surgery, super-hydration on its own is not sufficient as the only antiemetic prophylactic strategy. Our last limitation is that we did not administer steroids which has a proven analgesic and antiemetic effect.

Considering fluid therapy as an antiemetic routine in combination with other strategies in future will be quite helpful especially in our settings where cost effectiveness matters a great deal. Also, it will lead to decreased use of other pharmacological agents and will help to avoid their side effects as well. This will also increase the level of satisfaction of patients and will help to decrease duration of hospital stay.

Conclusion

Super hydration with 30 ml/kg Ringer's lactate is an effective way to reduce the frequency of POV in children undergoing tonsillectomy in general anesthesia.

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.