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Research Article

A Comparison of Laryngospasm in "No Touch" and "Head Down Deep Extubation": A Randomized Clinical Trials

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ABSTRACT

Background: Tonsillectomy and adenotonsillectomy are simple surgical procedures that can cause laryngospasm as complications which blocks airflow causing serious issues. The laryngospasm incidence decreases in patients undergoing deep extubation. Present study aimed to compare laryngospasm in innovative method of head down deep extubation with No Touch method.

Methods: Forty-two patients were enrolled in the study in (23 females and 19 males) between the ages of 5 up to 15 who were referred for tonsillectomy or adenotonsillectomy. The patients were divided into two randomized No Touch (n=21) and head down deep extubation (n=21) intervention groups according to permuted block randomization. All patients received standard general anesthesia. The first group received the no-touch extubation and the second group received head down deep extubation method. The duration of surgery, Time interval between the injection of reverse drugs and the return of spontaneous breathing (TRDRSB), time interval between anesthesia drug withdrawal and extubation (TIDWE), SPO2, incidence of laryngospasm, and cough were recorded and graded according to their severity at 0, 5, 10, 15 minutes and 2 hours after extubation, respectfully.

Results: The age, weight, gender and duration of surgery, TRDRSB was not statistically different between the two groups but TIDWE showed a significant difference between groups (P<0.001). The SPO2 levels in 0, 5, 10, 15 minutes, and 2 hours after surgery were not significantly different between the “no touch” and “head down deep extubation” groups as well as the severity of coughing and laryngospasm. However, the rate of laryngospasm and cough in "No touch" group was higher than " head down deep extubation " group.

Conclusion: HDDE is an innovative technique that it seems in comparison to No Touch method can reduce the incidence of laryngospasm. However, further comprehensive trials are needed to confirm these findings.

The authors declare no conflicts of interest.

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Introduction

Tonsillectomy and adenotonsillectomy are simple surgical procedures that can cause many acute problems including bleeding, airway obstruction, arrhythmia as well as laryngospasm as complications [1-2]. Laryngospasm is the aggravated form of Glottic Closure Reflex, an essential reflex preventing the foreign body from entering tracheobronchial tree [3], which is especially common in patients under light anesthesia following upper respiratory tract surgeries [1, 2, 4-9]. The contraction of larynx muscles that results in laryngospasm blocks air flow causing serious issues including hypercarbia and hypoxia [5, 7]. The incidence of this life-threatening complication after tonsillectomy and adenotonsillectomy have been reported to be between 20 to 26 percent [5, 10]. Factors causing laryngospasm include but are not limited to blood discharge, surgical debris, airway manipulation techniques such as endotracheal intubation, and stimulation of the upper abdomen.

While little consideration has been given to utilizing preventive extubation techniques, previous studies have been mainly focused on pharmacological interventions in an attempt to prevent the incidence of laryngospasm. These interventions include injection of intravenous lidocaine, intravenous magnesium, diazepam, pethidine, and the use of topical lidocaine or acupuncture [1, 5-7]. Although these drug combinations have shown some efficacy, the incidence of laryngospasm has been reported to decrease in patients undergoing deep extubation or are in virtually conscious state [2].

This clinical study aims to examine different extubation techniques to reduce the incidence of laryngospasm in a group of patients who have undergone tonsillectomy or adenotonsillectomy. An innovative method of “Head Down Deep Extubation (HDDE)” is introduced and compared to the “No touch” method [4] with regards to the frequency of laryngospasm in the two groups of patients after extubation.

Methods

The present study was carried ot in Amir-Alam hospital and approved by the ethics committee of Tehran university of medical sciences (IR.TUMS.VCR.REC.1398.458) and written informed consent was obtained from all participants of the trial. This randomized trial was registered prior to participant's enrolment at IRCT.ir in registration date: 06/04/2020 with certification number (IRCT20191006044995N1) as well as, date of registration: 06/04/2020). We performed this study with adhere to CONSORT guidelines [11]. Forty-two patients were enrolled in the study in both sex (23 females,19 male) between the ages of 5 up to 15 who were referred for tonsillectomy or adenotonsillectomy. The participants were selected by an ordinal method and studied in two groups of “No touch” and “HDDE.”

The patients were divided into two intervention groups according to permuted block randomization. The inclusion criteria were such as children of age between 5-15, required tonsillectomy or adenotonsillectomy based on an ENT specialist's diagnosis and volunteered to participate in the study. As well Exclusion criteria including history of Asthma and other diseases affecting lungs, regular consumption of supplements and previous history of problems with Intubation/ Extubation for surgeries. Deep extubation is defined as removing the endotracheal tube whilst the patient is still falling anesthetized.

All patients received standard general anesthesia with propofol (3-5mg/kg) and atracurium (0.5mg/kg) to facilitate intubation. Anesthesia withdrawal drug was performed by stopping of inhaled anesthesia and administration of neuromuscular reversal. After induction, ondansetron (0.15mg/kg) and dexamethasone (0.2 mg/kg) were administered to the patients, followed by anesthesia maintenance with 1.5% isoflurane and 50% N2O. At the end of the operation, the patients’ pharynx was fully suctioned, and the patients were then placed in lateral (recovery) position.

In group 1 (No touch), anesthetic drugs were disconnected, reverse drugs (atropine with neostigmine (mg/kg)) were injected and positive ventilation at the end of surgery is done manually with bag until return of spontaneous ventilation with 100% oxygen. Then, the patient’s spontaneous breathing was uninterrupted until the patient was awake and could open his/her eyes. There was absolutely no intervention in patients to enforce waking up.

In group 2 (HDDE), after the patient was placed in the lateral position, the patient's head was lowered to 30 degrees (Head Down Position), the anesthetic drugs were discontinued and the reverse drugs (atropine with neostigmine) were injected. Positive ventilation was continued with 100% oxygen until spontaneous breathing returned. After the improvement of the spontaneous breathing, complete pharyngeal suction was performed, and the patient was intubated while under deep anesthesia.

In both groups the duration of surgery, the time taken prior to the return of spontaneous breathing, and the time interval between drug closure and extubation were measured in minutes. Similarly, SPO2 (Oxygen saturation), incidence of laryngospasm, and cough were recorded and graded according to their severity at 0, 5 minutes, 10 minutes, 15 minutes and 2 hours after extubation. The severity of laryngospasm was evaluated based on four-scale criteria: 0= without laryngospasm, 1= inspiratory stridor, 2= Silence with no air movement (VCs completely closed), 3= Cyanosis. Patients’ coughing was assessed using four scale criteria: 0= No cough, 1= Slight cough, 2= Moderate cough, 3= Severe cough.

Statistical analysis

The collected data were statistically analyzed using SPSS 22 software. All normal variables were reported by (mean ± standard error). Kolmogorov-Smirnov test was used to check the normality of the distribution of the data. Mean (standard error) was used to describe quantitative, and frequency (percentage) was used for qualitative variables. Moreover, the independent t-test was used to compare the mean of quantitative outcomes between the two groups, while the Mann-Whitney U test was used for nonparametric data.

Results

Generally, forty-two individuals are participated in this study. The baseline characteristics of participants are shown in (Table 1). The age, weight, gender and duration of surgery, time interval between the injection of reverse drugs and the return of spontaneous breathing (TRDRSB) was not statistically different between the two groups (P value > 0.05) but the time interval between anesthesia drug withdrawal and extubation (TIDWE) showed a significant difference between groups (P<0.001) (Table 1).

The first group received the "No-touch" (n=21) extubation method and the second group received the "Head down deep extubation" (n=21) method. The results of the present study further indicate that the oxygen saturation levels in 0, 5, 10, 15 minutes, and 2 hours after surgery were not significantly different between the “no touch” and “HDDE” groups (Table 2).

As presented in (Table 3), although the differences in the severity of coughing as well as Laryngospasm at 0, 5, 10 and 15 minutes after surgery was not statistically significant between the groups (p value > 0.05) but the rate of laryngospasm and cough in "No Touch" group was higher than "HDDE" group. Indeed, TIDWE in "HDDE" group was significantly lower than "No touch" group.

Table 1- Baseline information of participants

Variable	Group 1 (No touch method) n=21	Group2 (HDDE) n= 21	P value
Age (year)	6.04±1.39	7.26±2.16	0.16
Weight (kg)	20.40±4.23	22.33±7.36	0.06
Gender Male	10	9	0.54
Female	11	12	
Time surgery (min)	44.85±18.74	50.55±20.68	0.37
TRDRSB (min)	3.91±5.16	3.64±3.18	0.22
TIDWE (min)	14.41±2.95	5.41±3.56	<0.001

All values are expressed as (mean ± standard deviation).
TRDRSB: Time interval between the injection of reverse drugs and the return of spontaneous breathing
TIDWE: Time interval between anesthesia drug withdrawal and extubation

Table 2- The oxygen saturation (SPo2) at different times after surgery in study groups

Variable	Group 1 (No touch method) n=21	Group 2 (HDDE) n=21	P value
SPo2*	95.61 ± 10.74	96.57±2.58	0.11
SPo2.5min*	96.57±2.78	95.52±2.29	0.07
SPo2.10min*	96.9±1.64	96.23±1.22	0.14
SPo2.15min*	97.28±1.41	96.76±1.51	0.24
SPo2.2h*	95.47±1.2	95.8±1.03	0.16

All values expressed as (mean ± standard deviation.)
SpO2 = oxygen saturation

Table 3- Laryngospasm and Cough incidence in the study groups at various time after surgery

Variable		Group1 (No touch method) n=21	Group2 (HDDE) n= 21	P value*
Cough.0min	0	18 (85.71)	19 (90.47)	0.65
	1	2 (9.52)	1 (4.76)	
	2	1 (4.76)	1 (4.76)	
	3	0	0	
Cough.5min	0	19 (90.47)	20 (80)	0.55
	1	2 (9.52)	1 (4.76)	
	2	0	0	
	3	0	0	
Cough.10min	0	18 (85.71)	20 (95.23)	0.29
	1	3 (14.28)	1 (4.76)	

	2	0	0	
	3	0	0	
Cough.15min	0	20 (95.23)	21 (100)	0.31
	1	1 (4.76)	0	
	2	0	0	
	3	0	0	
Laryngospasm.0min	0	18 (85.71)	19 (90.47)	0.64
	1	2 (9.25)	1 (4.76)	
	2	1 (4.76)	1 (4.76)	
	3	0	0	
Laryngospasm.5min	0	19 (90.47)	20 (95.23)	0.54
	1	2 (9.25)	1 (4.76)	
	2	0	0	
	3	0	0	
Laryngospasm.10min	0	21 (100)	21 (100)	> 0.99
	1	0	0	
	2	0	0	
	3	0	0	
Laryngospasm.15min	0	21 (100)	21 (100)	> 0.99
	1	0	0	
	2	0	0	
	3	0	0	

All values expressed as Frequencies (Percent)
Based on a four-point scale (0-3). Based on a four-point scale (0-3).
* Chi-Square Test

Discussion

The present study is a clinical trial focused on examining the efficacy of the Head down deep extubation (HDDE) method in preventing the incidence of laryngospasm compared to the No Touch extubation following tonsillectomy and adenotonsillectomy operations in children. Forty-two participants were randomly divided into 2 groups of HDDE and “no touch” and were consistently monitored after surgery.

The results of the present study demonstrate that the time interval between the injection of reverse drugs and the return of spontaneous breathing was decreased in HDDE, compared to the No Touch group but there weas not statistically significant. In return, the time interval between anesthesia drug withdrawal and extubation decreased significantly in HDDE group Pvalue< 0.001. Importantly, it was found that the incidence of inspiratory stridor at 0 to 5 minutes after extubation in HDDE was diminished (19% in No Touch group versus 9.52% in HDDE group). However, these differences were not significant.

In the No Touch method, the anesthetic drug was discontinued and revers drug was injected after being in the recovery position and receives 100% oxygen until spontaneous breathing returns. Extubation is done after the patient is awake and able to open their eyes. Accordingly, the HDDE innovative method is distinct from the typical No Touch method in two major ways: First, the patient's head is lowered to a 30 degrees angle before discontinuing the anesthetic drugs. Second, the patient is extubated while still under deep anesthesia.

As mentioned above, it was found that in the HDDE was superior to the previously practiced No Touch method in reducing the incidence of laryngospasm in the 0- and 5-minute intervals. In both groups, no laryngospasm and cough were observed after two hours. The results of the present study demonstrate that other measured variables such as coughing and SPO2 were not significantly changed between the two groups and were similar to the levels reported in a previous study by Tsui et al. [4]. On the contrary, our findings challenge those presented by Tsui et al which identifies the No Touch technique (with awake extubation) as a superior technique with no observed laryngospasm in their study. In the present study, it was observed that with the No Touch method, pediatric patients could not often tolerate the tube until open their eyes and usually foreign body sense from the endotracheal tube leads to rising heart rate and blood pressure. We thought the reason of upper incidence of laryngospasm rather than HDDE method is patient's struggling. Also, the patients’ struggle could result in potentially hazardous events including the removal of the IV line and falling off the bed and self-extubation. Additionally, the risk of laryngospasm, bleeding after surgery and rupture of the wound may be increased in patients undergoing No Touch method [12].

Conclusion

Head down deep extubation is an innovative technique that was compared to No Touch method in Tsui et al study to examine its efficiency in reducing the incidence of laryngospasm. However, further comprehensive trials with larger sample sizes are needed.

List of abbreviations

HDDE: Head Down Deep Extubation; SPO2: Oxygen saturation; TIDWE: Time interval between anesthesia drug withdrawal and extubation; TRDRSB: Time interval between the injection of reverse drugs and the return of spontaneous breathing.

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