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Clinical research on airway intervention before tracheal extubation after general anesthesia on snoring children

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Abstract. – OBJECTIVE: To analyze the method and the effect of airway intervention before tracheal extubation in post-anesthesia cure unit (PACU) after anesthesia when removing the tonsil under general anesthesia and adenoidectomy under nasal endoscope on children with snoring.

PATIENTS AND METHODS: 46 cases diagnosed as snoring were executively selected in this study. The cases were randomly divided into the control group (n = 22) and the observation group (n = 24). For airway intervention after general anesthesia during the recovery period, the control group was treated with intravenous injection of 0.5 μg/kg remifentanil, whereas the observation group was treated with atomization inhalation of 15 mg ambroxol hydrochloride and 0.5 mg budesonide suspension.

RESULTS: The clinical effects of both methods were compared and analyzed for statistical analysis. The blood pressure, heart rate and blood oxygen saturation at 30 min and 10 min after extubation in the control group was significantly more stable than those in the observation group ($p < 0.05$). The alertness/sedation (OAA/S) score in the observation group was significantly higher than that in the control group ($p < 0.05$). The prevalence rate of complications after extubation in the two groups was not statistically significant ($p > 0.05$). The levels of serum cortisol (Cor) and IL-8 in the control group were significantly lower than those in the observation group ($p < 0.05$).

CONCLUSIONS: Both methods are effective for treatment of airway intervention concerned with snoring children after general anesthesia during the recovery period. The effect of remifentanil on hemodynamics is relatively huge compared with that of atomization inhalation.

Key Words:

Children snoring, Post-anesthetic recovery, Airway intervention, Remifentanil, Atomization inhalation.

Introduction

Children snoring is also called obstructive sleep apnea-hypopnea syndrome (OSAHS). Long-term development can affect the growth, development, spirit and intelligence level. Relative studies have shown that the hypertrophy of the tonsil and (or) adenoid is a very important factor in the pathogenesis of OSAHS[1]. The clinical symptoms after treatment with the resection of tonsil and adenoid are relieved and the prognosis gets better. However, underdeveloped disease resistance in children and poor regulation mechanism of nerve, airway, endocrine and cardiovascular system, result in poor tolerance of general anesthesia and more complications of tracheal extubation during postoperative recovery period, which is about 56.7%. It is also an important part of serious adverse reactions appearing after surgery[2]. Therefore, it is suggested that the method of airway intervention can reduce the occurrence rate of complications before extubation to the lowest level. Currently, there are mainly two types of methods-available intravenous anesthesia drugs and local airway atomization inhalation. This study further explored the differences of the effects of the two methods in the treatment of airway intervention, so as to provide a reference basis for clinical application.

Patients and Methods

Patients

A total of 46 cases admitted to our hospital from March 2013 to March 2015 and diagnosed with children snoring were consecutively selected. By scrutinizing the size of the tonsil and the size of the adenoid, all children fulfilled the diagnostic criteria of OSAHS, and at the same time met the surgical indications of the removal

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of tonsil and adenoidectomy under nasal endoscope. Exclusion criteria: (1) Patients with severe snoring and those whose surgical effects were predicted to be ineffective; (2) Patients sensitive to surgery and allergic to anesthesia drugs; (3) Patients with congenital malformations and mental retardation, and those who reject to be studied, etc. The study was approved by the Ethics Committee of our hospital and the informed contents of the guardians of the patients were obtained. The patients were randomly divided into two groups according to the admission time, namely the control group with 22 cases and the observation group with 24 cases. In the control group, there were 13 males and 9 females aged from 6 to 15 years with an average age of 10.3 ± 4.2 years. Body mass index (BMI) was 18.7-25.6 kg/m^2 and the average BMI was 21.3 ± 2.4 kg/m^2; apnea hypopnea index (AHI) was 7.5-13.6 and the average AHI was 9.8 ± 2.3. In the observation group, there were 14 males and 10 females aged from 5 to 17 years with average age of 12.4 ± 3.5 years. BMI was 18.9-26.4 kg/m^2 and the average BMI was 22.2 ± 2.1 kg/m^2; AHI was 7.3-13.7 and the average AHI was 9.5 ± 2.4. The baseline data of the two groups were compared and the difference was found to be not statistically significant ($p > 0.05$).

Experimental Methods

Anesthesia was prepared with 1.5-2 mg/kg propofol, 0.1 mg/kg vecuronium bromide and 1 μg/kg remifentanil. Tracheal intubation was performed after induction of anesthesia by connecting Drager Fabius anesthesia apparatus for mechanical ventilation. During operation, remifentanil and propofol were continuously injected at a pace of 0.2-0.4 μg/kg·min and 4-12 mg/kg·h respectively. Philips V24E monitor was used to detect arterial blood pressure, heart rate and oxygen saturation (SpO_2) during operation. After bilateral posterior was resected by conventional surgery under general anesthesia, it was put into the catheter through bilateral nasal cavity and the soft palate was pulled. 70°C nasal endoscopy was used to observe carefully the structure of adenoid and surrounding tissue with the help of an endoscopic sinus surgery system and imaging system. Electric cutting sucker was used to remove them. After that, any residues left were checked and hemostasis was performed. Tracheal extubation was conducted after that the control group was treated with intravenous remifentanil 0.5 μg/kg in PACU. The extubation indications: tidal volume > 6 mL/kg and respiratory rate > 8 times/min; cough; swallowing reflex recovery; consciousness recovery; arm was lifted by instruction; oxygen inhalation was stopped for 5 min and $SpO_2 > 95\%$. The observation group was treated with atomization inhalation of 15 mg ambroxol hydrochloride and 0.5 mg budesonide suspension, and Y-type connection was used to connect air pathway. One end of the two short arms was connected with the breathing machine interface to control breath and the other end was connected to the inhaler interface to do oxygen (4-6 L/min) atomization inhalation with 15 mg ambroxol hydrochloride, 0.5 mg gabe budesonide suspension and 1 ml 0.9% physiological saline. Long arms were connected with tracheal catheter and repeated every 15 min with a limit of six times until the children woke up and would not be able to tolerate tracheal extubation when placing the catheter.

Observation Index

The level of blood pressure, heart rate and SpO_2 at 10 min and 30 min after extubation, the differences of vigilance/sedation (OAA/S) score, the occurrence rate of postoperative complications, serum cortisol (Cor) and IL-8 levels were compared and analyzed. The scoring criteria of OAA/S: 5 points for sober, rapid response to normal calls, clear pronunciation, normal expression and no eyelid; 4 points for slow response to normal calls, slow talking speed, little relaxed facial expression, and eye gaze or mild eyelid; 3 points for somnolence, response only to loud or repeated calls, not clear pronunciation or slow talking speed, obviously relaxed expression, and eye gaze or obvious sagging eyelid; 2 points for response to pat or nudge and unclear articulation; 1 point for deep sleep and no response to pat or nudge and lethargy. Subsequently, 2-4 ml of upper arm blood were taken and centrifuged at 3500 r/min for 15 min (the model of low speed refrigerator: KDC-2046USTC Chuangxin Co., Ltd., Zonkia Branch, Chuangxin, China). 0.5 ml plasma was taken to preserve at -70°C refrigerator for testing, and serum cortisol (Cor) was detected by using radioimmunoassay (the model of free counter: GC-2016 Chuangxin Co., Ltd., Zonkia Branch, Chuangxin, China) and the kit was provided by the Beijing North Institute of Biotechnology (Beijing, China).

Statistical Analysis

Statistical software SPSS16.0 (SPSS Inc., Chicago, IL, USA) was used to analyze the data.

Quantitative data were expressed as mean ± standard deviation. The *t*-test was used to conduct intergroup comparison. Count data were expressed as percentage and X^2 test was used to conduct intergroup comparison. $p < 0.05$ was considered that the differences were statistically significant.

Results

Comparisons of Blood Pressure, Heart Rate and SpO_2 Level

The mean arterial pressure, heart rate and SpO_2 at 10 min and 30 min after extubation in the control group were much more stable than the observation group, and the differences were statistically significant ($p < 0.05$) (Table I).

Comparisons of OAA/S Score, Serum Cortisol and IL-8 Level

The OAA/S score of the observation group was significantly higher than that of the control group, the serum Cortisol and IL-8 levels were significantly higher than those in the control group, and the differences were statistically significant ($p < 0.05$) (Table II).

Comparisons of the Occurrence Rate of Postoperative Complications After Extubation

There was no significant difference in the occurrence rate of complications after extubation in the two groups ($p > 0.05$) (Table III).

Discussion

Tracheal extubation causes strong stress response to body. The neuroendocrine response based on sympathetic response includes the adrenal medulla and hypothalamus-pituitary-adrenal cortex axis, and a series of changes in functional metabolism occur. Those changes will be reflected as changes in heartbeat, fluctuations in blood pressure, respiratory depression, psychiatric symptoms such as irritability, drowsiness, coma, cough, expectoration in respiratory system, nausea and vomiting in the digestive system. Although there are clear indications for extubation and accurate monitoring instrument, extubation causes a strong stimulus, which can also lead to abnormalities of the nervous, endocrine and biochemical metabolism of the body in a short period[3]. Narcotic analgesics cannot only inhibit the cardiovascular response during the period of extubation to a certain extent, but also can effectively inhibit the cough, restlessness and other side reactions, so vascular dilation drug and β-blocker are not comparable to it[4]. The ideal drug before tracheal extubation should have short-existing function, restore the protective reflex as soon as possible and avoid apnea or deep sedation caused by drug residues. It is exactly the special characteristics of remifentanil that provide an advantage in inhibiting the reaction of tracheal extubation[5]. Some studies have shown that the injection of 1 μg/kg remifentanil enduring more than 30 s after operation can effectively inhibit the reaction of tracheal extubation with no respiratory depression[6]. However, other studies have shown that continuous injection of 0.05 μg/kg·min and 0.1 μg/kg·min remifentanil, can effectively inhibit the reaction of tracheal extubation. Although the dose of the latter can better inhibit tracheal extubation reaction, the time from the end of the operation to the tracheal extubation is significantly prolonged. There are also studies showing that 0.1 μg/kg·min remifentanil does not affect the ventilation function and sober quality[7]. Local airway should be treated with atomization inhalation of ambroxol hydrochloride. Its effectiveness for treatment of bronchial asthma and chronic obstructive pulmonary disease is of

Table I. Comparison of blood pressure, heart rate and SpO_2 level.

	Before extubation			10 min after extubation			30 min after extubation		
Groups	MABP (mmHg)	Heart rate (time/s)	SpO_2 (%)	MABP (mmHg)	Heart rate (time/s)	SpO_2 (%)	MABP (mmHg)	Heart rate (time/s)	SpO_2 (%)
Control	82.5 ± 3.4	66.5 ± 4.2	98.7 ± 2.1	86.7 ± 2.8	75.2 ± 5.2	95.8 ± 3.2	83.4 ± 3.1	69.3 ± 3.7	96.7 ± 2.6
Experimental	82.7 ± 3.5	66.3 ± 4.5	99.3 ± 2.3	93.9 ± 2.6	83.5 ± 5.3	93.1 ± 3.3	86.6 ± 3.3	74.4 ± 3.9	95.2 ± 2.7
t	0.523	0.367	0.628	4.521	4.623	4.825	5.023	5.127	5.326
p	0.412	0.732	0.925	0.043	0.041	0.039	0.037	0.036	0.032

Table II. Comparison of OAA/S score, serum Cortisol and IL-8 levels.

Groups	OAA/S scores	Cor (mmol/L)	IL-8 (μg/L)
Control	3.7 ± 0.6	189.7 ± 46.9	0.4 ± 0.1
Experimental	4.6 ± 0.5	253.6 ± 62.5	0.6 ± 0.1
t	6.524	6.137	6.629
p	0.016	0.018	0.013

Table III. Comparison of the prevalence of postoperative complications after extubation (cases %).

Groups	Cases	Heart rate and abnormal blood pressure	Respiratory depression	Insanity	Cough, nausea and vomiting	Complication rate
Control	22	1	1	0	1	3 (13.6%)
Experimental	24	1	1	1	1	4 (16.7%)
χ^2						< 0.001
p						1.000

good value in phlegm dampness, reducing airway edema and inflammatory reaction[8]. Considering that its specific mechanism involves action on the airway secretory cells, it can change the proportion of slurry concerned with excreta, reduce mucus viscosity, activate ciliary movement function, reduce mucus retention and promote the discharge of sputum. At the same time, it can promote the synthesis and secretion of pulmonary surfactant, reduce the surface tension of the alveolar, improve lung ventilation and respiratory function, and relax trachea and bronchial smooth muscle and clear airway[7,8]. Atomization inhalation of ambroxol can supplement the drug for showing direct effects on surface of bronchiole and alveolar. It improves the airway condition of sick children, increases the comfort level by suppressing edema or obstruction in children and reduces negative emotions and restlessness; at the same time it also helps children to improve the respiratory condition and gain consciousness[9]. Most previous studies[10,11] focused on the sedation, reduction of airway stress, stabilizing of vital signs, improving acid-base imbalance of different anesthetic agents on the airway intervention. In this study, we evaluated the effects of two different strategies of airway intervention for effectiveness. By comparing two different methods of airway intervention, we found that the blood pressure, heart rate and blood oxygen saturation at 30 min and 10 min after extubation in the control group were more stable than those in the observation group (Table I). The OAA/S score of the observation group was significantly higher than that of the control group, and the serum Cor and IL-8 levels in the control group were significantly lower than those in the experimental group (Table II). However, there was no significant difference in the prevalence of complications after extubation in the two groups (Table III).

Conclusions

To sum up, both two methods are effective in the treatment of airway intervention concerned with snoring children after general anesthesia during the recovery period. The effect of remifentanil on hemodynamics is relatively huge compared with that of atomization inhalation.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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