

Original Research Article

Effect of budesonide aerosol inhalation on postoperative complications and foreign body sensation in the throat of goiter resection patients

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Abstract

Purpose: To study the effect of budesonide aerosol inhalation on postoperative complications and foreign-body sensation in the throat of patients who underwent goiter resection.

Methods: One hundred and twenty patients who underwent goiter resection at The Affiliated Hospital of Putian University (Fujian, China) from January 2019 to January 2020 were included in the study, and then equally and randomly assigned to groups A and B. During the perioperative period, group A patients were given budesonide aerosol inhalation, while group B patients received aerosol inhalation of equivalent volume of normal saline. Postoperative complication rate (CR), complication pain scores, scores on mucosal response in the throat, and scores on foreign body sensation in the throat were determined for both groups.

Results: Postoperative complications in patients were hoarseness, sore throat and cough. Group A had significantly lower postoperative CR, lower complication pain scores, lower scores on mucosal response in the throat, and lower scores on foreign body sensation in the throat, when compared to group B ($p < 0.001$).

Conclusion: Budesonide aerosol inhalation in patients who underwent goiter resection is effective in relieving throat injury from general anesthesia, minimizing likelihood of postoperative complications, and easing foreign-body sensation in the throat. Thus, this strategy may be suitable for the management of postoperative complications.

Keywords: Budesonide, Aerosol inhalation, Thyroid postoperative complications

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INTRODUCTION

Goiter is found mostly among female patients, and it is generally treated with surgical resection in the clinic. However, patients experience throat discomfort and foreign body sensation caused by

the intraoperative intubation of general anesthesia, and even suffer from more serious postoperative complications, leading to a greatly reduced operative effect [1-3]. Aerosol inhalation of glucocorticoids is an important means of relieving throat inflammation. Glucocorticoids are

preliminarily applied in the postoperative treatment of patients with throat diseases [4-6]. However, few theoretical studies linking glucocorticoids with postoperative complications in patients who underwent goiter resection have been published. In addition, not much is known about the potential of a glucocorticoid such as budesonide to reduce the incidence of postoperative complications in patients.

The present study was carried out to investigate the effect of budesonide aerosol inhalation on postoperative complications and foreign-body sensation in the throat of patients who underwent goiter resection.

METHODS

General information on patients

A total of 120 patients who underwent goiter resection at The Affiliated Hospital of Putian University (Fujian, China) from January 2019 to January 2020 were chosen for the study. They were equally and randomly divided into two groups: groups A and B. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) [7]. The study received the approval of the Ethics Committee of The Affiliated Hospital of Putian University (approval no. = 20181146). Patients and/or their family members were fully briefed on the study process and signed the informed consent forms.

Inclusion criteria

Patients who met the following criteria were included: those who were diagnosed with goiter through medical examination, and were treated surgically; those with normal articulation and no other throat diseases, and those who underwent orotracheal intubation under general anesthesia.

Exclusion criteria

Patients who met the following criteria were excluded: those with mental problems or communication disorders; patients with other organic diseases, those with abnormal levels of plasma calcium, and those for whom the duration of intubation for general anesthesia was under 1 h.

Treatments

During the perioperative period, group A was given budesonide aerosol inhalation, while group B was given aerosol inhalation of equivalent volume of normal saline, with the following specific steps: At 1 h before operation, 7 h after

operation, and 24 h after operation, group A received 2 mg of budesonide suspension (CHIA TAI TIANQING Pharmaceutical Group Co. Ltd; NMPA approval no. H20203063) via aerosol inhalation driven by oxygen, at an oxygen flow rate of 6 L/min. At the same time points, group B received equivalent amount of normal saline via aerosol inhalation. Comprehensive nursing and preventive measures were given to patients in both groups to avoid the factors that could affect the study results.

Evaluation of treatment outcomes

Postoperative complication rate (CR)

The complications included dyspnea, hoarseness, incision site infection, numbness of hands and feet, subcutaneous emphysema, sore throat and cough. The number of patients with complications was recorded.

Pain complication score

At 1, 7 and 24 h after operation, a visual analogue scale of pain complication was applied (0-100 points), with lower scores suggesting lower pain sensation caused by the symptoms [8-11].

Score on mucosal reaction in the throat

This was calculated based on the WHO grading of mucosal reaction at 1, 7 and 24 h after operation [12,13].

Score of foreign body sensation in the throat

This was rated on a scale of 0-10 at 1, 7 and 24 h after operation, with the self-prepared scale of The Affiliated Hospital of Putian University.

Statistical analysis

The data were processed using SPSS20.0 software. GraphPad Prism 7 (GraphPad Software, San Diego, USA) was used for graphics. Enumeration data and measurement data were included. Statistical analysis was done using χ^2 test and *t*-test. Differences were considered statistically significant at $p < 0.05$.

RESULTS

Patients' general profile

No marked differences in the general information were observed between the two groups ($p > 0.05$). These results are shown in Table 1.

Patients' postoperative CR

As shown in Table 2, there were no cases of dyspnea, incision site infection, numbness of hands and feet or subcutaneous emphysema in patients in both groups. Compared with group B, fewer patients in group A suffered from hoarseness, sore throat and cough, which were the main symptoms ($p < 0.001$).

Pain complication scores

Hoarseness pain scores were 8.59 ± 1.21 , 6.51 ± 2.21 and 1.88 ± 0.56 in group A at 1 h, 7 h and 24 h after operation, while the corresponding scores for group B were 30.56 ± 5.89 , 29.11 ± 4.57 and 17.55 ± 4.58 . Throat pain scores in group A were 25.65 ± 3.21 , 21.12 ± 3.55 and 17.62 ± 2.54 at 1 h, 7 h and 24 h after operation, while the corresponding scores in group B were 60.55 ± 12.56 , 58.56 ± 15.45 and 42.15 ± 6.25 . Cough pain scores were 1.42 ± 0.56 , 3.12 ± 1.12 and 2.21 ± 0.54 in group A at 1 h, 7 h and 24 h operation after, while the corresponding scores for group B were 2.31 ± 0.54 , 4.01 ± 0.27 and 2.89 ± 0.68 . The pain complication scores were markedly lower in group A compared with group B ($p < 0.001$), as presented in Figures 1 - 3.

Comparison of patients' scores on mucosal response in the throat

The scores on mucosal response in the throat were markedly lower in group A than in group B ($p < 0.001$), as presented in Table 3.

Scores on foreign body sensation in the throat

As shown in Table 4, scores on foreign body sensation in the throat were lower in group A than in group B ($p < 0.001$).

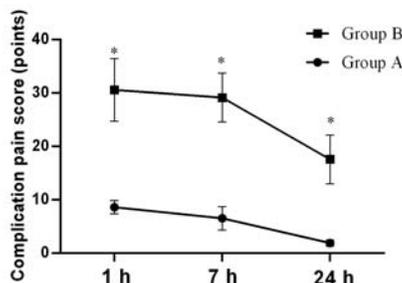


Figure 1: Comparison of patients' hoarseness pain scores (points). Data are presented as mean ± SD. * $P < 0.001$, hoarseness pain scores in group A vs scores in group B

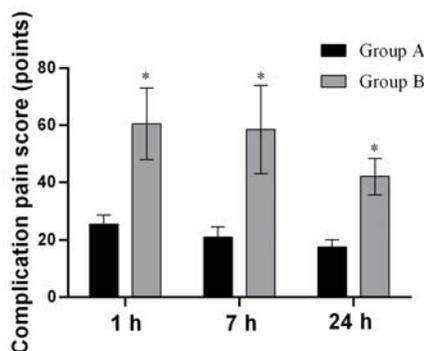


Figure 2: Comparison of patients' throat pain scores (points). Data are presented as mean ± SD. * $p < 0.001$, throat pain scores in group A vs scores in group B

Table 1: Comparison of patients' general information

Group	Group A (n = 60)	Group B (n = 60)	X ² /t	P-value
Gender			0.100	0.752
Male	5	6		
Female	55	54		
Age (years)				
Range	22-74	23-74		
Mean age	41.21 ± 6.20	41.23 ± 6.21	0.018	0.986
Hypertension	10	9	0.063	0.803
Coronary heart disease	6	5	0.100	0.752
Swelling classification				
Thyroid adenoma	31	30	0.033	0.855
Thyroid nodular goiter	14	15	0.046	0.831
Thyroid hyperfunction	10	11	0.058	0.810
Hashimoto's disease	5	4	0.120	0.729
Anesthesia grade			0.034	0.853
I	35	34		
II	25	26		

Table 2: Comparison of patients' postoperative CR [n (%)]

Group	Hoarseness	Sore throat	Cough	Total incidence
A	5(8.3)	10(16.7)	2(3.3)	17(28.3)
B	12(20.0)	32(53.3)	10(16.7)	54(90.0)
χ^2	3.358	17.729	5.926	47.221
P-value	0.067	0.000	0.015	0.000

Table 3: Comparison of patients' scores on mucosal response in the throat (points)

Time after operation (h)	Group A	Group B	t	P-value
1	2.56 ± 1.21	5.30 ± 1.26	12.149	0.000
7	2.55 ± 1.50	5.31 ± 1.24	10.985	0.000
24	0.68 ± 0.01	3.65 ± 1.58	14.560	0.000

Data are presented as mean ± SD

Table 4: Comparison of scores on foreign body sensation in throat

Time	Group A	Group B	t	P-value
1 h after operation	3.01 ± 1.00	5.35 ± 1.32	10.945	0.000
7 h after operation	2.85 ± 1.45	5.20 ± 1.15	9.836	0.000
24 h after operation	1.12 ± 0.56	3.42 ± 1.67	10.115	0.000

Values are mean ± SD

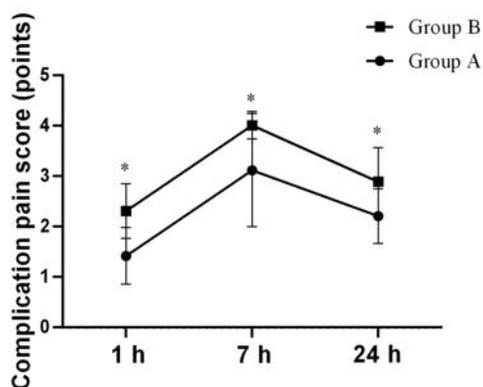


Figure 3: Comparison of patients' cough pain scores (points). Data are presented as mean ± SD. * $p < 0.001$, cough pain scores in group A vs scores in group B

DISCUSSION

Discomfort and foreign body sensation in the throat are typical complaints of patients after general anesthesia through oral intubation. Compared with other patients, those who underwent goiter resection often show more serious symptoms in the throat [14-15]. In this study, the postoperative complications included hoarseness, sore throat and cough, with more number of patients having sore throat than the number of patients with the other two complications. This may be due to the fact that foreign body sensation in the throat increases the frequency of swallowing. Therefore, the patients in group B swallowed more often and had higher throat pain scores.

Since sore throat is the most common postoperative reaction in goiter resection, many scholars in academia have carried out studies to investigate the influence of different drugs on the symptom. Some research results showed that preoperative administration of drugs worked well in prevention, and reduced the possibility of postoperative sore throat [16,17]. Therefore, preoperative administration was selected in this study, and the results showed that the probability of sore throat was lower than that obtained in general research.

Different drugs have different effects on patients' postoperative symptoms. Budesonide relieves the irritation to the throat during intubation under general anesthesia, lowers the release frequency of inflammatory mediators, and reduces vascular permeability, thereby lowering the degree of mucosal exudation in the throat and reducing the possibility of sore throat. Therefore, group A achieved markedly lower scores of mucosal response and foreign body sensation in the throat, relative to group B. In a study by Seitz, budesonide aerosol inhalation was given to patients who underwent goiter resection in the experimental group, while aerosol inhalation of normal saline was given to those in the control group. The results showed that the scores of mucosal response in the throat of the experimental group at 1, 7 and 24 h after operation were 2.51 ± 1.15 , 2.45 ± 1.56 and 0.72 ± 0.05 , which were markedly lower than the corresponding scores in the control group [18]. This is in line with present study. Thus, budesonide played an active role in relieving patients' throat discomfort and foreign body sensation.

Limitations of the study

It should be noted that the hoarseness of patients in group A was milder. However, this study did not deeply investigate the relationship between budesonide and hoarseness. This needs to be further confirmed in subsequent studies.

CONCLUSION

Budesonide aerosol inhalation reduces the possibility of postoperative complications and eases throat discomfort and foreign body sensation in patients who underwent goiter resection. Thus, this treatment strategy may be suitable for the management of postoperative complications.

DECLARATIONS

Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them.

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REFERENCES

1. Castro-Rodriguez JA, Pincheira MA, Escobar-Serna DP, Sossa-Briceño MP, Rodríguez-Martínez CE. Adding nebulized corticosteroids to systemic corticosteroids for acute asthma in children: A systematic review with meta-analysis. *Pediatr Pulmonol* 2020; 55:2508-2517.
2. Hayashi S, Kawada M, Hyakushima N, Saikawa D, Ashitate Y, Suzuki Y, Kawarada Y, Kitashiro S, Tsubota H, Okushiba S. Resection of mediastinal goiter extending to the carina with use of artificial pneumothorax, two-lung ventilation, and thoracoscopy, with the patient in a prone position. *Gen Thorac Cardiovasc Surg* 2019; 67:561-565.
3. Liddy W, Netterville JL, Soylu S, et al. *Surgery of Cervical and Substernal Goiter[M]// Surgery of the Thyroid and Parathyroid Glands*. 2021.
4. Garcia-Alva R, Bobadilla-Rosado LO, Arzola LH, Escobar-Preciado M, Anaya-Ayala JE, Hinojosa CA. A case report of a concomitant total thyroidectomy and carotid body tumor resection in a 43-year-old female. *Int J Surg Case Rep* 2018; 53:17-20.
5. Garcia-Alva R, Bobadilla-Rosado LO, Arzola LH, Escobar-Preciado M, Anaya-Ayala JE, Hinojosa CA. A Case report of a concomitant total thyroidectomy and carotid body tumor resection in a 43-year-old female. *Int J Surg Case Rep* 2018; 53:17-20.
6. Wojtczak B, Aporowicz M, Kaliszewski K, Bolanowski M. Consequences of bleeding after thyroid surgery – analysis of 7805 operations performed in a single center. *Arch Med Sci* 2018; 14:329-335.
7. World Medical Association. *World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects*. *JAMA* 2013 27;310(20):2191-4.
8. Patel R, Almourani R, Srinath M, Uraizee A, Nayyar M, Brietzke S, Regunath H, Gardner M. SUN-574 Exogenous Iodine Supplementation-Induced Thyroid Storm in a Patient with Multinodular Goiter. *J Endocr Soc: Supplement_1*.
9. Lari E, Burhamah W, Lari A, Alsafran S, Ismail A. Amyloid goiter - A rare case report and literature review. *Ann Med Surg (Lond)* 2020; 57:295-298.
10. Zalazar AM, Rossi JL, José M Moreno Negri, et al. Tiroidectomía transoral endoscópica por abordaje vestibular. *Revista Argentina de Cirugía* 2020; 112:185-188.
11. Iijima Y, Nakajima Y, Kinoshita H, Kurihara Y, Nishimura Y, Iizuka T, Akiyama H, Hirata T. Sclerosing thymoma followed up for eight years as mediastinal goiter: A case report. *Int J Surg Case Rep* 2020; 68:115-118.
12. Delliturri A, Pearl J, Zahir I, Weiss MH, Wiesel O. Follicular Thyroid Carcinoma Presenting as a Manubrium Mass. *JAMA Otolaryngol Head Neck Surg* 2019;145:581-583.
13. Peluso G, Masone S, Campanile S, et al. Incidental thyroid papillary microcarcinoma on 1777 surgically treated patients for benign thyroid disease: A monoinstitutional experience and literature review. *Memo* 2020;13.
14. Rajan S, Tosh P, Paul J, Kumar L. Effect of inhaled budesonide suspension, administered using a metered dose inhaler, on post-operative sore throat, hoarseness of voice and cough. *Indian J Anaesth* 2018; 62:66-71.
15. Harounian J, Postevka E, Jamal N. Medications and the larynx. *Curr Opin Otolaryngol Head Neck Surg* 2019; 27:482-488.
16. Parthasarathy S, Nag K, Sivashanmugham T, Karthikeyan P, Ravishankar M. Anesthetic management of excision of laryngocele—role of transtracheal jet

- ventilation. *J Anaesthesiol Clin Pharmacol* 2018; 34:124-125.
17. O'Byrne PM, FitzGerald JM, Bateman ED, Barnes PJ, Zhong N, Keen C, Jorup C, Lamarca R, Ivanov S, Reddel HK. *Inhaled Combined Budesonide-Formoterol as Needed in Mild Asthma. N Engl J Med* 2018; 378:1865-1876.
18. Seitz HJ. *The influence of budesonide on patients undergoing goiterectomy. The Biochem J*, 2019.