

Original Article

Application of new endoscopic nasal mask in painless fiberoptic bronchoscopy

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Abstract: *Objective:* This study was to explore the application of new endoscopic nasal mask in painless fiberoptic bronchoscopy, and investigate a safe, comfortable, convenient, economic and easy anesthesia for clinical fiberoptic bronchoscopy. *Methods:* Sixty patients undergoing fiberoptic bronchoscopy during intravenous anesthesia with dexmedetomidine and low dose propofol were randomly assigned to nasal catheter oxygen supply group (Group A) and new endoscopic nasal mask oxygen supply group (Group B). Mean arterial pressure (MAP), heart rate (HR) and blood oxygen saturation (SPO₂) were recorded before anesthesia (T₀), after anesthesia (T₁), immediately after insertion of fiberoptic bronchoscope into the airway (T₂), immediately after fiberoptic bronchoscope contacting tracheal carina (T₃), during fiberoptic bronchoscopy (T₄), and 5 minute after withdrawal of fiberoptic bronchoscope (T₅). *Results:* MAP in both groups decreased at T₁ and T₅, and HR in both groups decreased at T₁-T₅ as compared to those at T₀. S_pO₂ in Group A decreased at T₁-T₄ as compared to that at T₀; S_pO₂ in Group A at T₁-T₄ was lower than that in Group B. The proportion of patients who needed lifting of the jaw or mechanical ventilation in Group A was higher than that in Group B. The incidence of adverse effects was comparable between 2 groups. The anesthetic effectiveness was favorable in both groups. Patients in both groups were satisfactory with the fiberoptic bronchoscopy. *Conclusion:* In the intravenous anesthesia with dexmedetomidine and low dose propofol, oxygen supply via nasal catheter or new endoscopic nasal mask is safe and effective for fiberoptic bronchoscopy.

Keywords: New endoscopic nasal mask, fiberoptic bronchoscopy, nasal catheter, dexmedetomidine, propofol, intravenous anesthesia

Introduction

Fiberoptic bronchoscopy was introduced as a medical examination to clinical practice in the 1970s [1]. Since the 1980s, fiberoptic bronchoscopy has been used in China for the examination and treatment of lung diseases due to minimal invasiveness [2]. Conventional fiberoptic bronchoscopy is implemented in the airway surface anesthesia, but it may cause fear and sense of suffocation, and induce breath-hold and cough. In addition, routine fiberoptic bronchoscopy may also increase blood pressure and heart rate increased, resulting in increased risk for cardiovascular and cerebrovascular accidents during the operation [3]. In recent years, with the introduction of the concept of comfortable personalized medicine, painless technology that is mainly implemented by anesthesiologists achieves rapid development, and has

been widely used in abortion, childbirth, gastrointestinal endoscopy and other examinations and treatments. Some anesthesiologists also attempt to use painless technique in the fiberoptic bronchoscopy. However, in the fiberoptic bronchoscopy, the airway is shared by anesthesia and fiberoptic bronchoscopy, and thus the airway management is often difficult. Of note, most general anesthetics may cause glossoposis and respiratory depression. In the fiberoptic bronchoscopy, patients often develop reduced blood oxygen saturation (SPO₂), and sometimes the operation is needed to stop for assisted mechanical ventilation. Thus, to improve the anesthetic technique in the painless fiberoptic bronchoscopy, how to make patients receive the examination in a safe and comfort condition has been a hot focus in the anesthesiological studies. In the present study, a new endoscopic nasal mask was used in

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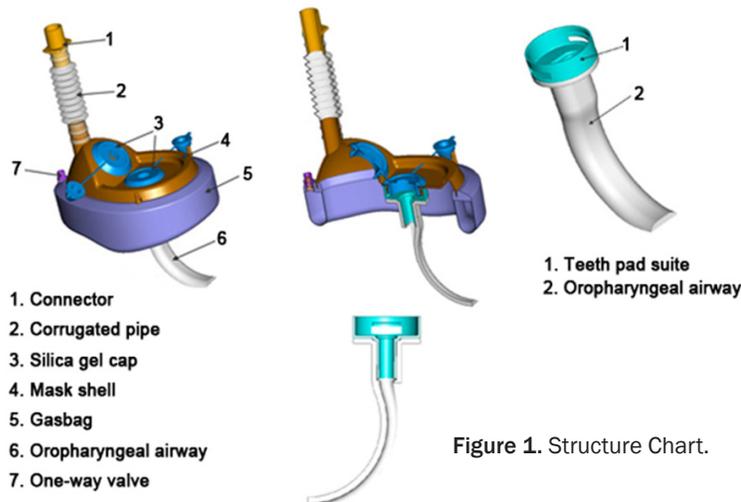


Figure 1. Structure Chart.

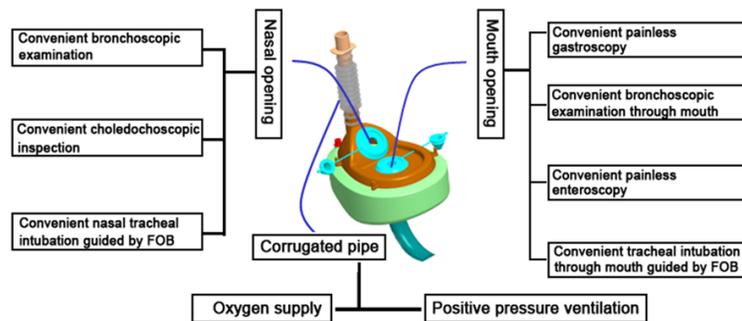


Figure 2. To solve clinical problems.

painless fiberoptic bronchoscopy, aiming to identify a safe, comfortable, convenient, economic anesthesia which is easy to be applied in clinical fiberoptic bronchoscopy.

The new endoscopic nasal mask is an innovative product and has been patented in China to Dr. Bin Yu, who is also a co-author of this study. This mask integrates both oropharyngeal airway and nasal mask (rotationally fixed), aiming to effectively prevent airway obstruction caused by glossoptosis. The clinicians can examine the mouth and/or nasal cavity through the same mask without interfering oxygen supply (Figures 1 and 2).

Material and methods

Patient enrollment

This study was approved by the Ethics Committee of People's Hospital of Shanghai Putuo District (Shanghai, China). Written con-

sents had been obtained from patients before study. The study was implemented in accordance with the principles of the Helsinki Declarations. A total of 60 patients receiving fiberoptic bronchoscopy were recruited into the present study. The ASA grade was I-II and the age ranged from 18 years to 70 years. Patients with serious systemic diseases, body mass index (BMI)>35 kg/m², inflammation of the throat, increased risk for reflux aspiration, potentially difficult ventilation, coagulation dysfunction, abnormality in neck activity and small mouth were excluded from this study. The recruited patients were randomly divided into two groups: Group A: nasal catheter was used for oxygen; Group B: new endoscopic nasal mask was employed for oxygen supply. Patients in both groups received intravenous anesthesia with dexmedetomidine plus low dose propofol.

Anesthetic procedures

Patients received food deprivation for 6 h and water deprivation for 2 h before fiberoptic bronchoscopy [4]. After airway surface anesthesia, patients were transferred into the bronchoscope room.

The vital signs were recorded with the PHILIPS-Intlivue MP30 multifunction monitor and EKG, MAP, HR and S_pO₂ were continuously monitored. In both groups, patients were intravenously given dexmedetomidine at a loading dose (1 µg/kg) within 15 min, and then sufentanil at 0.2 µg/kg was pumped within 10 min. After that, dexmedetomidine was infused intravenously at a speed of 0.4 µg/kg/h for maintenance. Oxygen was administered via the nasal catheter in the presence spontaneous breath with the flow rate of 6-8 L/min [5].

In Group A, propofol at 1 mg/kg was intravenously injected before fiberoptic bronchoscopy.

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Table 1. Hemodynamic parameters at different time points

Group	n.	Parameters	T ₀	T ₁	T ₂	T ₃	T ₄	T ₅
A	30	MAP (mmHg)	89.8±13.8	81.6±12.3 ^a	91.7±12.3	93.1±13.5	92.3±14.3	82.3±11.7 ^a
		HR (bpm)	80.3±13.6	61.8±13.7 ^a	75.7±13.9 ^a	74.3±11.8 ^a	75.1±12.7 ^a	63.4±15.3 ^a
B	30	MAP (mmHg)	90.1±14.7	81.3±11.9 ^a	92.3±12.7	93.5±14.2	92.6±13.6	82.9±12.8 ^a
		HR (bpm)	81.7±12.3	58.9±14.3 ^a	73.7±14.2 ^a	75.2±12.1 ^a	74.6±11.5 ^a	62.3±12.1 ^a

Notes: ^aP<0.05 vs T₀; bpm: beat per minute.

Table 2. S_pO₂ at different time points in two groups

Group	n.	Index	T ₀	T ₁	T ₂	T ₃	T ₄	T ₅
A	30	S _p O ₂	98.6±2.3	93.1±1.8 ^{a,b}	92.5±1.9 ^{a,b}	93.3±1.4 ^{a,b}	94.2±1.5 ^{a,b}	97.5±2.2
B	30	S _p O ₂	98.5±2.6	97.6±2.1	99.5±1.6	99.3±1.4	99.6±1.1	97.1±2.0

Notes: ^aP<0.05 vs T₀; ^bP<0.05 vs Group B.

Table 3. Number of events occurring in fiberoptic bronchoscopy in two groups

Group	Jaw lifting needed		Assisted ventilation needed	
	n.	%	n.	%
A	25	83.3 ^a	4	13.3 ^b
B	0	0	0	0

Notes: ^aP<0.05, ^bP<0.05 vs Group B.

- jaw lifting needed
- assisted ventilation needed
- ▨ smooth bronchoscopy

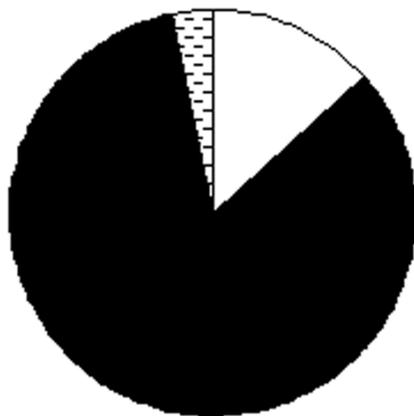


Figure 3. Airway maintenance situation of A-group.

When the OAA/S score (alertness sedation score) was ≤3, fiberoptic bronchoscopy was initiated. In case of uncontrollable coughing and body movement, a bolus of propofol was administered until the patient became calm. If glos-

sptosis was present, the jaw was lifted; if respiratory depression was observed, bronchoscope was withdrawn and pressurized oxygen was given via the simple respiration mask until the respiration became stable and SPO₂ was normal. Oxygen was given via the nasal catheter during the fiberoptic bronchoscopy.

In Group B, propofol at 1 mg/kg was intravenously injected before fiberoptic bronchoscopy. When the OAA/S score (alertness sedation score) was ≤3, the new endoscopic nasal mask was placed and then fixed. Fiberoptic bronchoscopy was performed through the nasal or mouth hole, and oxygen was supplied via the other hole with the simple respirator. Once cough or body movement was present, a bolus of propofol was intravenously infused until the patient became calm. If respiratory depression was observed, the balloon of the respirator was pressed for assistant respiration.

If the heart rate (HR) reduced significantly, atropine was administered; when hypertension or hypotension was observed, nitroglycerin, alamin, or ephedrine was administered to maintain blood pressure stable.

Outcome measurements

The MAP, HR and S_pO₂ were recorded before anesthesia (T₀), after anesthesia (T₁), immediately after the insertion of fiberoptic bronchoscope into the airway (T₂), immediately after the fiberoptic bronchoscope contacting the tracheal carina (T₃), during fiberoptic bronchoscopy (T₄) and 5 minutes after fiberoptic bronchoscopy (T₅). When the jaw was needed to lift to maintain airway patency due to reduced SPO₂ and

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Table 4. Incidence of adverse effects in two groups

Group	Coughing		Agitation		Bronchospasm		Intra-operative adverse memory					
	n	%	n	%	n	%	NO		Unclear		Clear	
							n	%	n	%	n	%
A	2	6.7	0	0	0	0	28	93.3%	2	6.7	0	0
B	3	10	0	0	0	0	27	90%	3	10	0	0

Table 5. Anesthetic effectiveness in two groups

Group	Good		Medium		Poor	
	n	%	n	%	n	%
A	28	93.3	2	6.7	0	0
B	29	96.7	1	3.3	0	0

Table 6. Satisfaction score of patients and clinicians in two groups

Group	n	Patients'	Clinicians'
A	30	8.9±1.4	7.0±1.3
B	30	9.1±0.8	9.2±0.9 ^a

Notes: ^aP<0.05 vs Group A.

when the fiberoptic bronchoscope was needed to withdraw for assisted ventilation, it was recorded.

The adverse effects such as cough, agitation, bronchospasm, intraoperative adverse memory (no, unclear, clear) were recorded. The intra-operative adverse memory was obtained through post-operative follow up at 6 h.

The anesthetic effectiveness was evaluated as follows. Good: the vocal cord was favorably opened, fiberoptic bronchoscope was placed smoothly, and there were no coughing and body movement in the fiberoptic bronchoscopy. Medium: the vocal cord was generally opened and fiberoptic bronchoscope was placed once or twice; there was coughing and/or body movement without influence on fiberoptic bronchoscopy. Poor: the vocal cord was poorly opened and fiberoptic bronchoscope was placed several times (often>2); there were coughing and/or body movement which affected the fiberoptic bronchoscopy.

The satisfaction of patients was scored according to the intra-operative adverse memory with 10-point score (0, unsatisfactory; 10, very satisfactory), whole the satisfaction of clinicians was scored according to whether fiberoptic

bronchoscopy was affected, the overall safety and convenience (0, unsatisfactory; 10, very satisfactory)

Statistical analysis

Statistical analysis was performed with SPSS version 13.0. Quantitative data are expressed as mean ± standard deviation (SD) and compared with t test between two groups. Data at different time points were compared with repeated measures analysis of variance in the same group. Qualitative data were compared with Chi square test. A value of $P < 0.05$ was considered statistically significant.

Results

General condition in two groups

There were no significant differences in the gender, age, BMI and ASA score between two groups ($P > 0.05$).

Hemodynamic parameters at different time points

The MAP in both groups decreased significantly at T_1 and T_5 ($P < 0.05$), and the HR in both groups reduced markedly at T_1 - T_5 ($P < 0.05$) as compared to those at T_0 (**Table 1**).

SPO₂ in two groups

The S_pO₂ in Group A at T_1 - T_4 was significantly lower than that at T_0 ($P < 0.05$). Moreover, the S_pO₂ at T_1 - T_4 in Group A decreased markedly as compared to Group B ($P < 0.05$) (**Table 2**).

Comparison of airway maintenance situation between two groups

The number of events (the jaw was needed to lift to maintain airway patency because S_pO₂ was ≤90% and fiberoptic bronchoscope was needed to withdraw for artificial ventilation because S_pO₂ was ≤85%) in Group A was significantly higher than in Group B ($P < 0.05$) (**Table 3** and **Figure 3**).

Incidence of adverse effects in two groups

The incidence of adverse effects in two groups was low, and there was no significant difference between them ($P > 0.05$) (**Table 4**).

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Anesthetic effectiveness in two groups

The anesthetic effectiveness in both groups was favorable and there was no significant difference between them ($P>0.05$) (Table 5).

Satisfaction score of patients and clinicians in two groups

Patients satisfaction scores were higher in group A and B; physician satisfaction scores of group B was higher than group A ($P<0.05$, Table 6).

Discussion

With the deterioration of air pollution, the incidence of pulmonary diseases is increasing and the application of fiberoptic bronchoscopy in the clinical practice is also increasing. It is an invasive examination and usually cause coughing, bronchospasm and breath-holding due to the airway rich in superficial nerves, induce increased blood pressure, elevation of HR and hypoxemia and even result in severe complications such as cardiovascular/cerebrovascular events and respiratory/heart arrest. Moreover, patients often become anxious, nervous and scared. Therefore, it is needed to perform a favorable anesthesia for smooth fiberoptic bronchoscopy and to avoid adverse effects. There are two methods of anesthesia available for fiberoptic bronchoscopy currently. The traditional airway surface anesthesia has no influence on the patients' respiration, but usually achieves a poor anesthetic effect. Patients receiving this anesthesia often develop coughing, agitation, breath-holding and bronchospasm, or even hypoxemia and cardiovascular/cerebrovascular events. Thus, they will no cooperative with clinician in the fiberoptic bronchoscopy. In recent years, propofol, midazolam and other drugs are used for intravenous anesthesia. This anesthesia may avoid the side effects observed in airway superficial anesthesia [6]. However, these drugs may cause glossoptosis, respiratory depression and reduction in oxygen saturation [7]. In painless fiberoptic bronchoscopy, general anesthesia is also employed in which tracheal intubation, high frequency ventilation and placement of laryngeal mask are performed for effective airway management. In this anesthesia, assistant ventilation can be employed, and high concentration oxygen be supplied with high safety and little

influence on the fiberoptic bronchoscopy. Nevertheless, muscle relaxants and/or special instruments are required for this anesthesia, the procedures are complex and the cost for anesthesia is relatively high.

In the present study, dexmedetomidine, propofol and sufentanil were used for sedation and anesthesia, aiming to provide a favorable anesthetic status for following fiberoptic bronchoscopy with little influence on the respiration and circulation. The combined use of drugs for anesthesia may maximize anesthetic effect and minimize adverse effects. In our study, the hemodynamic remained stable in both groups as compared to that before anesthesia and there was no significant difference between two groups. This may be ascribed to the use of dexmedetomidine, propofol and sufentanil. Dexmedetomidine may regulate the circulatory system via central and peripheral mechanisms [8, 9], and therefore may effectively inhibit the stress during fiberoptic bronchoscopy to maintain stable hemodynamics. In addition, α_2 -adrenergic receptor expressed in the spinal dorsal horn mediates the analgesic effect of dexmedetomidine [10], which may also inhibit the stress reaction in fiberoptic bronchoscopy and maintain the stable hemodynamics. Sufentanil can also effectively decrease stress reaction in fiberoptic bronchoscopy [11] and remain stable hemodynamics [12]. Sufentanil, an opioid drug, can bind to the μ , δ and κ receptors in the nucleus tractus solitarii and the 9th and 10th cranial nerves, then inhibiting the stimulation from the throat. Thus, sufentanil has been used as an indispensable anti-nociceptive drug in fiberoptic bronchoscopy. Propofol acts soon and may be metabolized soon after injection. Thus, the half life of propofol is short, and propofol may smoothly induce anesthesia without evidence accumulation in the body. Especially, patients will no develop adverse memory after propofol anesthesia with little adverse effects. Thus, propofol has been used as an ideal anesthetic in intravenous anesthesia. Of note, propofol has a poor inhibitory effect on throat stimulation and a poor analgesia [13]. The combined use of above three drugs not only ensure the stable hemodynamic in fiberoptic bronchoscopy, but also provides a favorable anesthesia and reduces the adverse effectss, achieving a high satisfactory score in both groups. However, most intrave-

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nous sedatives and opioid analgesics can cause glossoptosis and respiratory inhibition. In this study, propofol and sufentanil may also cause a dose-dependent respiratory depression [11, 14]. Arcangeli [8] et al simultaneously used dexmedetomidine in the anesthesia, which reduced the doses of propofol and opioids. In our study, low dose of propofol and sufentanil were used. The α_2 -A-adrenergic receptors in the nucleus ceruleus of brainstem mediate the dose-dependent sedative and hypnotic effects of dexmedetomidine. The sedative effect is similar to the natural sleep, which is also known as awaken calm or cooperation calm [15]. Koroglu et al [16] found that dexmedetomidine had sedative effect, but could not induce obvious respiratory depression, not reduce oxygen partial pressure and not cause carbon dioxide retention. Dexmedetomidine combined with low dose propofol and sufentanil ensures the necessary anesthesia for fiberoptic bronchoscopy and at the same time reduce the risk for respiratory depression, but patients still have risk for glossoptosis and airway obstruction. Our results showed the SPO_2 at T_1 - T_4 reduced significantly in Group A as compared to that at T_0 . In addition, 83.3% of patients in Group A required lifting of the jaw and 13.3% required withdrawal of bronchoscope for assistant ventilation. In Group B, a new mast was used, and glossoptosis and respiratory depression were not present. SPO_2 at T_1 - T_5 remained stable as compared to that at T_0 , and lifting of the jaw or withdrawal of bronchoscope for assistant ventilation was not needed in patients of Group B.

The fiberoptic bronchoscopy is performed through the airway, which may cause partial obstruction of the tracheal lumen, then increase airway resistance, and reduce alveolar ventilation and flow rate, leading to hypoxemia, arrhythmia and cardiac arrest [17, 18]. Most drugs used for general anesthesia may cause glossoptosis and respiratory depression. Therefore, the ventilation following anesthesia is crucial for the successful fiberoptic bronchoscopy. In some hospitals, traditional mask for endoscopy is used in fiberoptic bronchoscopy [19]. This mask may provide a high concentration oxygen during fiberoptic bronchoscopy and can aid or control the ventilation, which reduces or avoids hypoxemia and improve the safety. However, it cannot improve

the airway obstruction in fiberoptic bronchoscopy. Especially, when patients develop serious glossoptosis, the jaw is required to be lifted to open the airway. Although this procedure does not cause the withdrawal of fiberoptic bronchoscope, it still has certain influence on the fiberoptic bronchoscope and adds burden to anesthesiologists in the examination. To safely and conveniently manage the airway in painless fiberoptic bronchoscopy without affecting the examination, a new endoscopic nasal mask was used in this study.

In Group B, the new endoscopic nasal mask was used in painless fiberoptic bronchoscopy, which avoids the glossoptosis, respiratory depression and resultant hypoxemia in routine intravenous anesthesia, which provide a safe, comfort, convenient and economic way for anesthesia in painless fiberoptic bronchoscopy. Findings confirmed that this mask makes oxygen supply and fiberoptic bronchoscopy more convenient and has unparalleled convenience and economic advantages as compared to general anesthesia via routine intubation or laryngeal mask for airway management.

In summary, both nasal catheter and new endoscopic nasal mask can be safely used for oxygen supply in fiberoptic bronchoscopy following intravenous anesthesia with dexmedetomidine plus low dose propofol. Under this condition, the intra-operative hemodynamics are stable, adverse effects reduce and patients have a high satisfaction. In the intravenous anesthesia with dexmedetomidine plus low dose propofol, new endoscopic nasal mask for oxygen supply assures airway patency and increases safety in fiberoptic bronchoscopy, the management of airway is more convenient, intra-operative SPO_2 is more stable, the requirement for lifting the jaw and/or withdrawal of bronchoscope reduces and the clinicians have a high satisfaction. In addition, the use of new endoscopic nasal mask effectively avoids glossoptosis in intravenous anesthesia, ensure the airway patency, and make the oxygen supply sufficient and convenient. Thus, it is worthy being popularized and applied in painless fiberoptic bronchoscopy.

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Disclosure of conflict of interest

None.

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References

- [1] Da Conceicao M, Favier JC, Bidallier I, Armanet L, Steiner T, Genco G and Pitti R. [Fiber-optic intubation with non-invasive ventilation with an endoscopic facial mask]. *Ann Fr Anesth Reanim* 2002; 21: 256-262.
- [2] Liu CT. The diagnosis and therapeutics of fibrobronchoscope. Beijing: peking university Medical Press; 2009.
- [3] JIng HL and Chang LN. Treatment of complications of fiberoptic bronchoscopy. *J Med Forum* 2004; 25: 40, 42.
- [4] American Society of Anesthesiologists Committee. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: an updated report by the American Society of Anesthesiologists Committee on Standards and Practice Parameters. *Anesthesiology* 2011; 114: 495-511.
- [5] Liu J and Deng XM. China anesthesiology guide with expert consensus. Beijing: people's Medical Publishing House; 2014.
- [6] Chen XX and Zhou HE. 25 cases of painless fibre bronchoscopy under general anesthesia clinical experience. *Nat Med Fron Chi* 2010; 5: 41-41.
- [7] Chen PY, Su XH, Wang GL and Wang XL. Clinical Study on Analgesia Technology for Fiber Bronchoscopy. *Chi Pharm* 2010; 21: 907.
- [8] Arcangeli A, D'Alo C and Gaspari R. Dexmedetomidine use in general anaesthesia. *Curr Drug Targets* 2009; 10: 687-695.
- [9] Khan ZP, Ferguson CN and Jones RM. alpha-2 and imidazoline receptor agonists. Their pharmacology and therapeutic role. *Anaesthesia* 1999; 54: 146-165.
- [10] Kamibayashi T and Maze M. Clinical uses of alpha2 -adrenergic agonists. *Anesthesiology* 2000; 93: 1345-1349.
- [11] Dai TJ, Yu T and Tang XL. Anesthetic pharmacology. Beijing: People's Medical Publishing House; 2000.
- [12] Pei H and Luo AL. Sufentanil pharmacological effects and clinical applications. *Herald Med* 2009; 28: 1482-1485.
- [13] Fan HZ, Yu HP, Deng HJ and Wang CL. Clinical analysis on anodynia bronchofiberscopy. *Chi J Endoscop* 2005; 11: 1212-1213.
- [14] Koshy G, Nair S, Norkus EP, Hertan HI and Pitchumoni CS. Propofol versus midazolam and meperidine for conscious sedation in GI endoscopy. *Am J Gastroenterol* 2000; 95: 1476-1479.
- [15] Bilotta F and Rosa G. 'Anesthesia' for awake neurosurgery. *Curr Opin Anaesthesiol* 2009; 22: 560-565.
- [16] Koroglu A, Teksan H, Sagir O, Yucel A, Toprak HI and Ersoy OM. A comparison of the sedative, hemodynamic, and respiratory effects of dexmedetomidine and propofol in children undergoing magnetic resonance imaging. *Anesth Analg* 2006; 103: 63-67, table of contents.
- [17] Shrader DL and Lakshminarayan S. The effect of fiberoptic bronchoscopy on cardiac rhythm. *Chest* 1978; 73: 821-824.
- [18] Katz AS, Michelson EL, Stawicki J and Holford FD. Cardiac arrhythmias. Frequency during fiberoptic bronchoscopy and correlation with hypoxemia. *Arch Intern Med* 1981; 141: 603-606.
- [19] Xiong YC, Chen H, Xu H and Deng XM. Application of endoscopic facial mask in painless fiberoptic bronchial endoscopy. *Aca J Sec Mili Med Univ* 2006; 27: 1156-1157.