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Research Article

BIS-Guided Sedation and Prevention of Cough Reaction in Patients with General Anesthesia Caused by Extubation: A Randomised Controlled Trial

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ABSTRACT

Background: The multiple modes of SARS-CoV-2 transmission including airborne, droplet, contact, and fecal–oral transmissions that cause coronavirus disease 2019 (COVID-19) contribute to a public threat to the lives of people worldwide. Heavy aerosol production by coughing and the big peak expiratory flow during recovery from general anaesthesia in patients with respiratory infections (especially COVID-19) are the highest risk factors for infection in healthcare workers. To perform sedation before extubation significantly reduced the incidence of choking reactions during recovery from general anesthesia. However, there are few studies on endotracheal tube removal with BIS-guided sedation in PACU. We speculated that the BIS-guided sedation with dexmedetomidine and propopfol would better prevent coughing responses caused by tracheal extubation.

Methods: A total of 101 patients with general anaesthesia were randomly assigned to Group S (51 cases, dexmedetomidine was infused in the operating room for 30 minutes, and the Bispectral Index (BIS) value in was maintained 60-70 by infusion propofol at 0.5 ~ 1.5 μg/ml in the PACU until the endotracheal tubes were pulled out) and Group C (50 cases, no dexmedetomidine and propofol treatment, replaced with the saline treatment). The incidence of coughing, agitation and active extubation, endotracheal tube tolerance and the peak expiratory flow at spontaneous breathing and at extubation were asessed.

Results: The incidence of coughing, agitation and active extubation were significantly lower in Group S than in Group C ($P<0.05$ or $P<0.01$, respectively); the scores of cough was significantly reduced in Group S than in Group C ($P<0.01$); the endotracheal tube tolerance was significantly improved in Group S than in Group C ($P<0.001$). And the peak expiratory flow at spontaneous breathing and at extubation was significantly reduced in Group S than in Group C.

Trial registration: Chinese Clinical Trial Registry: ChiCTR2200058429 (registration date: 09-04-2022) "retrospectively registered".

Conclusion: BIS-guided sedation with dexmedetomidine and propopfol significantly prevented cough and reduced peak expiratory flow during recovery from general anaesthesia, which may play an important role in preventing medical staff from contracting COVID-19.

Keywords: BIS-guided sedation; Cough reaction; Peak expiratory flow; Extubation; General anaesthesia

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INTRODUCTION

This COVID-19 pandemic has caught global healthcare workers off-guard. Study suggested that generation of respiratory aerosols in exhaled breath can occur by the force of the fast airflows in the upper airways that arise when we breathe, talk, cough, and sneeze; especially coughing produces a lot of aerosols and aerosols contain large amounts of COVID-19 [1]. Coughing response caused by tracheal tube in general anesthesia is the most common in clinic medicine, especially when the tracheal tube is intubated and extubated, the incidence is between 38% and 96% [2]. However, study suggest that tracheal extubation, particularly when the patient coughed, produced a detectable aerosol which was 15-fold greater than intubation, therefore, during COVID-19 epidemics, tracheal extubation is more dangerous for healthcare workers. One study suggest the 80% people infecting with COVID-19 caused by exhaled aerosol [3,4]. Study suggested that viral particles are released by all expiratory events (coughing, talking, and exhalation) and do not require an aerosol-generating procedure to be detectable in the local environment [5]. The other studies suggested that the exhaled airflow can travel a distance of approximately 100 cm during tracheal extubation and the amount of aerosol produced was related to peak expiratory flow [6,7]. Therefore, preventing the choking and reducing airflow velocity during tracheal extubation are beneficial to reducing the infection of healthcare workers with COVID-19, especially for anesthesiologists to prevent secondary covid-19 infection due to removal of endotracheal tube after giving general anesthesia to patients with potential covid-19 infection. Tracheal tube removal under sedation is performed very early in clinical practice especially heart surgery. Postoperative sedation using midazolam and propofol enables early extubation and is safe [8]. Intramuscular dexmedetomidine significantly reduced the incidence of choking reactions from 66% to 20% during recovery from general anesthesia [9]. Continuous postoperative infusion of remifentanil at 0.3 μg/kg/min reduced the incidence of choking reactions to 10% in patients under general anesthesia caused by tracheal extubation [10]. Therefore we speculate that endotracheal tube removal can be performed during recovery under intravenous sedation. Bispectral Index (BIS) monitoring is a standard tool for monitoring sedation levels in the clinic [11]. There are few studies on endotracheal tube removal with BIS-guided sedation in PACU. The purpose of this study was to explore whether BIS-guided sedation can prevent extubation induced the choking response and increased respiratory flow under recovery anesthesia.

MATERIALS AND METHODS

Trial design

The Affiliated Hospital of Yan'an University, China organised this RCT. The trial was performed according to the CONSORT-2010 guidelines. The Ethics Committee of The Affiliated Hospital of Yan'an University approved the study protocol (NO. 2020042), and all subjects provided written informed consent before the trial.

Participants and setting

Patients were included in the trial when they were 1864 years old and scheduled for laparoscopic cholecystectomy or cholecystectomy combined with common bile duct exploration under general anaesthesia using endotracheal tube intubation from March 2020 through December 2020. The following major exclusion criteria were used: difficult airway; allergies to lidocaine, tetracaine or any other ingredients in compound lidocaine cream; bradycardia; intraoperative bronchospasm; preoperative chronic pharyngitis, cough or other upper respiratory tract lesions; concurrent hypertension with or without drug therapy; operation time greater than 2.5 hours; intraoperative bleeding (>300 ml); or American Society of Anesthesiologists (ASA) grade greater than III. We randomly assigned the patients to Group S and Group C at a 1:1 ratio. The primary end points included endotracheal tube tolerance cough events during the recovery period, peak airflow velocity during spontaneous respiration recovery and extubation, and the overall incidence of cough and sore throat within the first 24 h after extubation. Figure 1 shows a flowchart for the assignment of participants in the study.

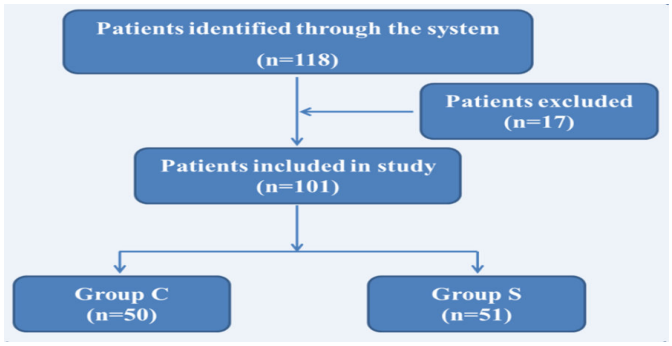

Figure 1: Consolidated standards of reporting trials flow diagram.

A total of 118 patients were included in the study according to the inclusion criteria of the trial design. Among them, 17 patients were excluded according to the exclusion criteria. A total of 101 patients were enrolled into the study and randomly divided into 2 groups, 51 patients in Group S and 50 patients in Group C.

Randomisation and blinding

A total of 118 random numbers were generated by IBM SPSS Statistics 25 (IBM Corp. Released 2017. IBM SPSS statistics for windows, Version 25.0. IBM Corp, Armonk, NY, USA), and the software randomly divided the 118 numbers into two groups. Cases were enrolled according to the order of enrolment time corresponding to random numbers from small to large, and a random number corresponded to the admission ID number of the patient. A full-time staff member with anaesthesiologist qualification (Investigator A) performed these assignments. When the patients entered the operation room and Post Anesthesia Care Unit (PACU), the investigator A performed the present procedure according to the study design. Another anaesthesiologist (investigator B) performed extubation and collected data until the end of the study. All of the collected

data were handed over to Investigator A for sorting into different groups, and Investigator C performed statistical analyses. The patients and Investigators B and C were all blinded to the grouping information.

Intervention

The recruited patients were treated according the group information by Investigator A. The patients in Group S were infused dexmedetomidine (100 ug of dexmedetomidine was diluted in 50 ml of normal saline) at 0.5 μg/kg/h after entering the operating room for 30 minutes. And the patients in Group C were infused normal saline at 0.1 ml/kg/h after entering the operating room for 30 minutes. all of patients were performed general anesthesia during surgery is administered in accordance with daily habits and experience, rocuronium bromide was used as the muscle relaxant, and the remifentanil and propofol were used according to the BIS value of patients during the surgery, the BIS was maintained at the 40 ~ 60 level. After all the enrolled patients entered the PACU, the BIS value in Group S was maintained 60-70 as previous study described by sedation with intravenous infusion propofol (propofol: 0.5 ~ 1.5 μg/ml), until the endotracheal tubes were pulled out, the degree of sedation is guided by BIS and the BIS was maintained at the 60 ~ 70 level; the patients in control group (Group C) were given intravenous infusion normal saline (5 ml/h) until the endotracheal tubes were pulled out [12,13].

Parameter measurement

The primary outcome measure was the incidence of induced coughing reaction due to endotracheal extubation. The definition of induced cough was patients with coughing induced by sputum aspiration and extubation during recovery from anaesthesia. Secondary outcome measures were the incidence of agitation, active extubation, and endotracheal tube tolerance, peak expiratory flow at spontaneous breathing and at extubation, postoperative cough and postoperative pharyngeal pain caused by extubation. The degree of endotracheal tube tolerance was scored as follows: 0=no response during breathing, including spontaneous and mechanical ventilation conditions; 1=no response during breathing, including spontaneous and mechanical ventilation conditions, but slight action response to aspiration of sputum (inconspicuous coughing reaction); 2= tolerance to mechanical ventilation, but moderate action response to aspiration of sputum (single coughing); 3=tolerance to ventilation, severe coughing reaction (multiple coughs that lasted shorter than 5 s) caused by sputum aspiration; 4=could not tolerate mechanical ventilation, severe coughing reaction caused by sputum aspiration; and 5=extubation behaviour. Coughing was scored as follows: 0=no cough; 1=mild cough; 2=moderate cough, multiple coughs that lasted shorter than 5 s; and 3=severe cough, multiple coughs that lasted longer than 5 s. The definition of agitation was patient showed thrashing or violent behavior with removal of tubes and tracheal tube during recovery from anaesthesia according to previous reports [14]. The definition of active extubation was the patient tried to pull the tracheal tube out by hand, but it was not pulled out (special staff ensured that the tube was not removed) during recovery from anaesthesia. The definition of postoperative cough was more than 5 spontaneous coughs that lasted longer than 5 s within the first 24 h after extubation, as previously described [15]. The peak expiratory flow was assessed by an electronic peak expiratory flow meter (Pulmonary Data Services, Louisville, Kentucky). The swivel connector with the suction catheter partially inserted was then attached to the patient's endotracheal tube, which was in turn connected to a viral/bacterial respiratory filter (GTS, Hong Kong), allowing a pneumotachograph- calibrated Piko-I Electronic Peak expiratory flow Meter (Pulmonary Data Services, Louisville, Kentucky) to be placed in series as the previous described [16].

Conditions of endotracheal tube extubation

The following conditions were used for tracheal tube extubation: 1) spontaneous breathing tidal volume greater than 6 ml/kg; 2) breathing of air for at least 10 min with SPO_2 not lower than 95%.

Sample size calculation

According to our previous pre-experiment, the incidence of cough response induced by extubation was 25 % in Group C, 2% in experimental Group T. We set α=0.05 and the test power is 0.85, with a sample drop-out rate of 20%. Using PASS 15, we calculated a minimum sample size of 59 cases in each group (a total of 118 cases).

Statistical analysis

Shapiro-Wilk test was used to test normality of the continuous variables followed by Student's t test for normally distributed data, and Wilcoxon rank sum test was for comparison of the data that were not normally distributed. Pearson's chi-squared test was used to compare the categorised data in the groups. We set $p<0.05$ as statistically significant. SPSS 25 was used to process the data.

RESULTS

Patients

A total of 118 patients at the Affiliated Hospital of Yan'an University were enrolled in the randomised trial. Seventeen patients were excluded from this study, including 8 cases in Group C (difficult airway: 2 cases; preoperative chronic pharyngitis: 2 cases; allergies to compound lidocaine cream: 1 case; patients with concurrent hypertension: 2 cases; operation time longer than 2.5 hours: 1 case), 9 cases in Group L (difficult airway: 3 cases; preoperative chronic pharyngitis: 1 cases; allergies to compound lidocaine cream: 1 case; patients with concurrent hypertension: 2 cases; operation time longer than 2.5 hours: 2 case). The study started on March 1, 2020 and ended on December 31, 2020. The endpoint of the study was the incidence of cough within the first 24 hours after extubation. All of tracheal tubes were applied 2g compound lidocaine cream onto the front end of the tracheal tube up to the two black marked lines near the cuff, then spray 2 ml of 10 % tetracaine injection onto the front end of the tracheal tube

Patient characteristics	Group S	Group C	t	p
Age(year)	42.53 ± 10.23	42.74 ± 7.88	0.1157	0.454
Weight(kg)	69.67 ± 8.397	68.30 ± 10.68	0.7139	0.4771
BMI	26.01 ± 2.921	25.30 ± 3.440	1.12	0.1327
Sex (male n (%))	15 (29.41%)	14 (28.0%)	0.08	0.777
Smoking (n (%))	10(19.61%)	12(24%)	0.286	0.593
Operation time (min)	52.67 ± 22.60	53.44 ± 25.06	0.1629	0.4355
Anaesthesia time (min)	67.67 ± 22.60	66.76 ± 24.05	0.1953	0.6642

Table 1: Patient characteristics.

where compound lidocaine adhered used a small container with a spray function 2 mins before endotracheal tube intubation. There were no significant differences in the baseline characteristics (such as age, weight, BMI, sex, smoking, operation time, anaesthesia time and BIS) of the patients between the groups (Table 1).

Each group was anaesthetised with general anaesthesia via tracheal intubation. We performed topical anesthesia of the airway mucosa by compound lidocaine cream combined tetracaine. We firstly used two grams of compound lidocaine cream (compound lidocaine cream, 10 g, containing 25 mg each of lidocaine and prilocaine, Tongfang Pharmaceutical Group Co., Ltd. Beijing China) to apply onto the front end of the tracheal tube up to the two black marked lines near the cuff according to a previous study, secondly used a small container with a spray function to evenly spray 2 ml of 10% tetracaine injection onto the front end of the tracheal tube where compound lidocaine adhered. The endotracheal tube sizes were selected according to our anesthesiology department protocol (males: 22-24 size, females: 20-22 size), and according to the size of the glottis observed under the video laryngoscope [17]. The depth of anaesthesia was maintained by intravenous anaesthesia procedures performed by continuous infusion of remifentanil and propofol and intermittent intravenous injections of cisatracurium. All continuous infusion anaesthetics, including remifentanil, were discontinued when the incision was closed. The postoperative analgesia in this study used a multimodal analgesic strategy, in which 40 mg sodium parecoxib was intravenously injected before skin incision, 20 ml of 0.2 % ropivacaine was given at an intraperitoneal location, and ~ 1 ml/cm of 0.2 % ropivacaine was given at the site of incision at the end of surgery. No patients required additional analgesics in the PACU.

Primary outcomes

We found that sedation significantly reduced the incidence of induced coughing, the incidence of induced coughing 1.96 % in Group T was lower than Group C (22 %), p=0.006 (Table 2).

Secondary outcome

Then we assessed the degree of coughing and tracheal tube tolerance, the peak expiratory flow and BIS at extubation, the SpO_2 at 2 minutes after extubation, time to extubation, the duration of PACU stay and laryngeal discomfort complications after extubation. We found that the scores of coughing were significantly reduced in sedation group (Group T) compared to Group C ($p<0.01$, Table 2). And it's important that the scores of tracheal tube tolerance were also significantly improved in sedation group (Group T) compared to Group C ($p<0.001$, Table 2). To further verify the reliability of endotracheal tube tolerance after patient sedation, we assessed the incidence of agitation and active extubation, the incidence of agitation and active extubation were significantly reduced in Group T compared to Group C ($p<0.05$, $p<0.01$, respectively, Table 2). Aerosol and droplet generation associated with peak expiratory flow may have significant infection control and safety implications during the COVID-19 pandemic. Therefore, the reduction of peak expiratory flow may reduce the production of aerosols and droplet has important implications for preventing the spread of the COVID-19. We found the peak expiratory flow at spontaneous breathing and extubation were significantly reduced in Group T compared to Group C ($p<0.001$, Table 2). At the same time, we assessed the BIS value of the depth of sedation at the time of extubation, the SpO_2 at 2 minutes after extubation and the duration of PACU stay. We found that the BIS value in Group T was lower than Group C ($p<0.001$, Table 2), but the SpO_2 was no statistical difference between the two groups. However, time to extubation and duration of PACU stay in Group T was longer than Group C ($p<0.05$ and $p<0.001$, respectively, Table 2). In addition, we assessed the incidence of postoperative cough and pharyngeal pain, the results showed that there were no statistical difference between Group T and Group C (Table 2).

DISCUSSION

Endotracheal intubation-related mechanical stimulation is clinically common and associated with various airway

Primary outcomes of anesthesia	Group S	Group C	χ2/k/ z/t	p
Incidence of induced cough #	1 (1.96%)	11 (22%)	7.53	0.006
Scores of cough[b]	1(1,1)	1(1,2)	-2.782	0.005
Tracheal tube tolerance[b]	0(0,1)	1(1,3)	-4.456	<0.001
Incidence of emergence agitation*	0 (0%)	8 (16%)	-	0.027
Active extubation rate*	0 (0%)	5 (10%)	-	0.003
Peak expiratory flow at spontaneous breathing [a] (L/min)	5(5,7)	8(5,10)	-14.15	<0.001
Peak expiratory flow at extubation a (L/min)	6.5(6,8)	21(9,32)	-17.99	<0.001
BIS[c]	68.96 ± 2.925	99.40 ± 0.7284	72.13	<0.001
SpO_2[c]	99.06 ± 1.018	99.20 ± 0.9596	0.6909	0.4913
Time to extubation (min)	11.76 ± 3.664	5.980 ± 2.722	8.993	0.0391
Duration of PACU stay[c]	48.65 ± 4.151	39.58 ± 5.496	9.367	<0.001
Incidence of postoperative cough #	6 (11.76%)	9 (18%)	0.776	0.378
Incidence of postoperative pharyngeal pain #	11 (21.57%)	13 (26%)	0.274	0.601

Note: #: Pearson chi-square test; *: Fisher's exact test, a: Mann-Whitney U test, b: Wilcoxon rank sum test, c: independent samples t test.

Table 2: Findings during recovery from general anesthesia and recovery outcomes.

complications, such as severe coughing, laryngeal injury and postoperative sore throat [18,19]. Coughing in patients with lung disease produces large amounts of aerosols that contain viruses and pathogenic microorganisms, such as mycobacterium tuberculosis infection [20,21], pseudomonas aeruginosa, and especially SARS- CoV-2 [22,23]. These aerosols containing viruses and pathogenic microorganisms may spread respiratory diseases, especially COVID-19 [23,24]. Although the main application of local anesthetic to the tip of the tracheal tube can significantly reduce the choking response to extubation, some choking still occurs. Therefore, it is very important to prevent the choking reaction caused by the endotracheal tube. The current study compared the application of BIS-guided sedation to no sedation procedure on extubation and demonstrated a significant reduction in the incidence of induced coughing and in the peak expiratory flow at extubation, which suggest significantly reduced aerosol and droplet generation during endotracheal tube extubation in patients during PACU. Therefore, endotracheal tube removal under BIS-sedation is beneficial for infection control and prevention of disease transmission during the COVID-19 pandemic.

During the recovery period of general anaesthesia, sputum aspiration and tracheal tube extraction are the strongest stimulators of the tracheal mucosa and are most likely to induce cough. Although the incidence of coughing reactions was low in Group C after application of compound lidocaine cream combined with tetracaine, there were still 22% of patients suffer from coughing. Study showed that topical anesthesia with 0.75% ropivacaine before intubation can significantly reduce the incidence of cough during peri-extubation, the incidence of cough can still reach 34.62% [25]. Another study showed that incidence of cough still reached 26.3% induced by extubation in patients with general anesthesia which was performed by topical anesthesia with 2% lidocaine before intubation [26]. These results were similar to our findings. However, there is still a need

to reduce the incidence of extubation-induced cough during the epidemic. Endotracheal tube removal under sedation began to be used in ICU and special patients' recovery from anesthesia. The incidence of choking reaction was significantly reduced by intramuscular dexmedetomidine, continuous postoperative infusion of remifentanil at 0.3 μg/kg/min and intravenous infusion propofol combined with remifentanil [9,10,27]. Therefore, it is feasible to remove the endotracheal tube under sedation. Our study showed that the incidence of choking reaction was significantly reduced by BIS-guided sedation, and the incidence was reduced from 22% to 1.96%. During recovery from general anaesthesia, the patient exhibits emergence agitation. The main factor is delayed extubation, and the risk is 16.7 times higher than removing the endotracheal tube [28]. Our results showed that BIS-guide sedation significantly increased tracheal tube tolerance, and the tracheal tube tolerance scores were reduced to 0 (0, 1) compared to no sedation group (1(1,3)). We also found that BIS-guide sedation significantly reduced the incidence of emergence agitation by 16% compared to no sedation group. The most serious effect is the voluntary removal of the endotracheal tube during recovery of general anaesthesia patients with endotracheal intubation. Our study found that BIS-guide sedation significantly reduced the active extubation rate by 10% compared to no sedation group. Study showed that remifentanil 0.025-0.05 microg.kg(-1).min(-1) achieves satisfactory tracheal tube tolerance in awake and spontaneously breathing patients performed under general anaesthesia, the respiratory response sub score of comfort scale of patients is all 3 [29]. Another study showed that both dexmedetomidine and remifentanil are effective sedatives for awake intubation, but remifentanil exhibited better tracheal tube tolerance (well tolerated in dexmedetomidine 26% vs. remifentanil 65%) and moderately increased risk of desaturation [30]. LI Jing, et al suggested that dexmedetomidine can provide an effective sedation as propofol for the patients without affecting the awakening and extubation time [31]. Leonard U. Edokpolo,etal suggested that to perform sedation at BIS 60 by combining low dose dexmedetomidine with propofol can maintain spontaneous breathing [13].Therefore, we adopted the method of intraoperative pump injection of dexmedetomidine combined with target-controlled infusion of propofol in the PACU for sedation. Koceroglu I, et al. demonstrated that dexmedetomidine was more effective than tramadol for mitigating post-operative pain and agitation in paediatric patients following an adenotonsillectomy with sevoflurane. Although dexmedetomidine was associated with a longer time to extubation, it was also associated with fewer complications following extubation compared with tramadol [32]. However Aouad, et al. demonstrated that dexmedetomidine (1 μg/kg with total dose 100 μg, 0.5 μg/kg with total dose 50 μg, 0.25 μg/kg with total dose 25 μg) provided the best quality of emergence from general anesthesia including the control of cough, agitation, hypertension, tachycardia, and shivering at the end of surgery, and the 3 doses did not delay extubation (the average value the time to extubation: 16 ~ 19 min) [33]. Although the time to extubation (11.76 ± 3.664 min) in our study was shorter than MT, et al. result, there was no clinical significance. In our study show that the sedation group was longer about 10 min than the no sedation group for duration of PACU stay. The study of the Aouad MT, et al. showed that the average duration of PACU stay was from 58 min to 63 min in 3 groups, which was consistent with our results in the sedation group (48.65 ± 4.151 min). Study showed that the amount of aerosol produced was not only related to cough but also to peak expiratory flow during recovery from general anesthesia [1]. We further assessed the peak expiratory flow at spontaneous breathing and extubation, the results suggested that the peak expiratory flow at spontaneous breathing and extubation were significantly decreased in the sedation group compered control group [7]. We speculated that sedation increased patient tolerance to the endotracheal tube, the cerebral cortex was less responsive to endotracheal tube-induced airway stimulation, therefore, the expiratory flow rate decreased. Almeida, et al. suggested that cough induced by intense airway water stimulation increased peak expiratory flow by 15 L/min compared with spontaneous cough [34]. Ultrafine particles (0.02–1 μm) were generated during peak flow measurement, and particles smaller than 5–10 μm have been defined as “aerosols” or “droplet nuclei” and can remain airborne for extended periods of time, traveling greater distances, and can cause transmission by settling into the lower respiratory tract [7,35]. Furthermore, considerable levels of SARS-CoV-2 RNA was detected in two definite size ranges: submicron particles (0.25-1.0 μm) with concentrations 9 and 40 copies/m3 and supermicron particles (>2.5 μm) with concentrations 7 and 9 copies/m3, whereas particles ≤ 2.5 μm (fine particles) and ≤ 0.1 μm (ultrafine particles) can reach the lungs tissues and settle in the alveolar ducts and sacs [24]. Droplet transmission was commonly reported to occur in particles with diameter >5 μm that can quickly settle gravitationally on surfaces (1-2 m). Instead, fine and ultrafine particles (airborne transmission) can stay suspended for an extended period of time (≥ 2 h) and be transported further, up to 8 m through simple diffusion and convection mechanisms [24, 36]. Our study showed that the median of peak expiratory flow were reduced from 8 to 5 (L/min) at spontaneous breathing and from 21 to 6.5 (L/min) at extubation, which was benefit to prevent infection of medical staff during the COVID-19 epidemic.

In addition, we assessed the incidence of postoperative cough and postoperative pharyngeal pain, but there was no statistical difference between the two groups. In summary, although viral loads in the lung parenchyma and pharynx are higher in symptomatic individuals, the disease can be transmitted by those who are presymptomatic and asymptomatic [37]. This is of relevance to coronavirus disease 2019 (COVID-19) patients having inter current surgery and because screening tests used to risk stratify those coming for elective surgery are known to have false negative results [38]. We speculate that the application of BIS-guided sedation with dexmedetomidine and propofol will prevent the choking caused by extubation in patients with COVID-19 and reduce the risk of medical staff COVID-19. Of note, our study population was relatively young with a mean age of approximately 45 years.

Limitations to our study are 3-fold. First, this study did not consider the patient's anxiety state. During recovery from general anaesthesia, the patient exhibits emergence agitation due to poor tolerance to the tracheal tube, which could not be

well revealed in this study based on other factors, such as preoperative anxiety or bladder irritation caused by urine retention. Second, this study did not assess the patient's pain state before extubation, because the degree of pain is an important factor for restlessness during recovery. Third, because the infusion of remifentanil was stopped at the end of surgery and remifentanil is a very rapidly metabolized drug, although this study did not assess the total remifentanil consumption, the total remifentanil consumption affect the result was almost no effect. Fourth, this study didn't reveal that in the setting of extubation of the trachea, neither the distribution of exhaled gases nor the capacity of these gases to carry virus in the peri-extubation period has been fully quantified. The reduction of peak expiratory flow at spontaneous breathing and at extubation reduces the number of aerosols produced and the flight distance to prevent the spread of respiratory infectious diseases, which was unreliable and further research was needed in the future.

CONCLUSION

Our study demonstrated that the application of BIS-guided sedation with dexmedetomidine and propofol inhibited the coughing reaction caused by sputum suction or tracheal tube removal during recovery from general anaesthesia, increased the body's tolerance to the tracheal tube, prevented the occurrence of active extubation and reduced peak expiratory flow at spontaneous breathing and at extubation. Therefore, BIS-guided sedation with dexmedetomidine and propofol may play an important role in preventing medical staff from contracting respiratory infectious diseases. Especially during the COVID-19 epidemic, there are significant clinical implications for anesthesiologists and other medical staffs to provide clinical experience to protect themselves and improve the quality of care for patients undergoing general anaesthesia procedures.

WHAT IS KNOWN

- BIS-guided sedation with dexmedetomidine and propopfol exerted better effect preventing cough reaction caused by tracheal extubation.
- BIS-guided sedation with dexmedetomidine and propopfol exerted better effect reducing peak expiratory flow during recovery from general anaesthesia.

WHAT IS NEW

BIS-guided sedation with dexmedetomidine and propopfol may play an important role in preventing medical staff from contracting COVID-19 during PACU.

BIS-guided sedation was performed by infusion dexmedetomidine in the operating room for 30 minutes combined infusion propofol at 0.5~1.5μg/ml maintained BIS value was 60-70 in the PACU, which was a safe method of sedation to maintain spontaneous breathing.

CONFLICT OF INTEREST

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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AUTHORS CONTRIBUTIONS

Min Wang and Jie gao was responsible for the recruitment, randomization and tracheal tube anesthetic. Hailiang Zhang, Xiaoyan An and Ying li performed anesthesia management and data collection. Erfei zhang, and Xiaoying Zhao analyzed data and wrote manuscript. Erfei zhang reviewed/edited manuscript. All authors contributed equally to the manuscript and read and approved the final version of the manuscript. The author(s) read and approved the final manuscript.

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