Anesthetic Management for an Elderly Patient With Severe Bronchiectasis

Tamayo Takahashi, DDS, PhD;[1] Mitsuhiro Yoshida, DDS, PhD;[1] Nanako Ito, DDS, PhD;[2] Koichi Koizumi, DDS, PhD;[2] Hisanobu Kamio, DDS, PhD;[1] Aya Oda, DDS, PhD;[1] Kana Oue, DDS, PhD;[1] Mitsuru Doi, DDS;[3] and Yoshitaka Shimizu, DDS, PhD[3]

[1]Department of Dental Anesthesiology, Division of Oral and Maxillofacial Surgery and Oral Medicine, Hiroshima University Hospital, Hiroshima, Japan; [2]Department of Oral Oncology, Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan; [3]Department of Dental Anesthesiology, Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan

Bronchiectasis is a clinical syndrome characterized by coughing and sputum production in the presence of abnormal thickening and dilatation of the bronchial walls. We report the successful anesthetic management of a 91-year-old patient with severe bronchiectasis undergoing left marginal mandibulectomy for squamous cell carcinoma of the mandibular gingiva. In this case, we utilized respiratory prehabilitation for preoperative optimization of the patient's respiratory function and intravenous moderate sedation with dexmedetomidine and pentazocine plus excellent local anesthesia intraoperatively rather than an intubated general anesthetic. During the procedure, the patient's vital signs were stable, and she did not have any psychological or physical complaints like anxiety or pain and was discharged from the hospital without any complications. Considering the high risk of respiratory complications, intravenous moderate sedation may be a better option than general anesthesia for some surgeries in patients with severe bronchiectasis. These strategies may be useful options for older patients with impaired respiratory function undergoing oral surgery procedures.

Key Words: Bronchiectasis; Respiratory prehabilitation; Analgesia; Sedation; Dexmedetomidine.

Bronchiectasis is a chronic lung disease of diverse etiology characterized by a clinical syndrome of chronic cough, sputum production, and recurrent infections and pulmonary exacerbations. It is defined radiologically by abnormal bronchial dilatation,[1] and the airway lesions and sputum in bronchiectasis can cause obstructive and restrictive ventilatory disease. In addition, a previous study reported that approximately 40% of patients with bronchiectasis have airway hyperresponsiveness.[2] The signs and symptoms of bronchiectasis, such as sputum and hemoptysis, may cause airway obstruction, atelectasis, and respiratory tract infections.[3,4] Tracheal intubation also increases the risk of postoperative respiratory infections.[5]

Therefore, intravenous (IV) sedation without tracheal intubation may be a better choice than general anesthesia in patients with bronchiectasis undergoing surgery. The patient in this case report had not only severe bronchiectasis but also was elderly. Hence, we also utilized respiratory prehabilitation for the patient to help avoid perioperative complications.

There is a paucity of information in the dental anesthesia literature on the management of cases involving bronchiectasis. Thus, we report the anesthetic management of an elderly patient with bronchiectasis undergoing oral surgery. Written consent to publish this case report was obtained from the patient.

CASE PRESENTATION

A 91-year-old woman (height, 146 cm; weight, 30 kg; body mass index, 14.0 kg/m^2) was scheduled for left marginal mandibulectomy within cortical bone due to squamous cell carcinoma of the mandibular gingiva. Approximately 7 months before presenting to our hospital, the patient was diagnosed with bronchiectasis by her family doctor for which she was prescribed clarithromycin (200 mg/d) and L-carbocisteine (500 mg/d), a mucolytic. The patient denied any other

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Address correspondence to Dr Mitsuhiro Yoshida, Department of Dental Anesthesiology, Division of Oral & Maxillofacial Surgery and Oral Medicine, Hiroshima University Hospital, 1-2-3 Kasumi Minami-ku, Hiroshima, 734-8551, Japan; mh-yoshida@hiroshima-u.ac.jp.

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Table. Spirometry Results

	Patient's results	*Predicted value*	*Normal value*
VC	0.83 L	1.94 L	
%VC	42.80%		>80%
FEV_1	0.82 L	1.27 L	
FEV_1%	77%		>70%

Abbreviations: VC, vital capacity; FEV_1, forced expiratory volume in 1 s.

pertinent past medical history, social history, medications, or allergies.

As part of the preoperative assessment, we performed routine blood tests, an electrocardiogram (ECG), pulmonary function tests, an arterial blood gas analysis, and chest radiographs. Her preoperative bloodwork revealed hypoalbuminemia (3.5 g/dL; normal range, 4.1–5,1 g/dL) and an estimated glomerular filtration of 77 mL/min/1.73 m^2. The ECG revealed complete right bundle branch block, prompting consultation with a cardiologist who performed an echocardiogram that revealed a normal ejection fraction of 60%.

The pulmonary function tests showed findings mainly consistent with a restrictive ventilation disorder (Table). We considered that this patient had primarily mixed obstructive/restrictive pulmonary disease because of her advanced bronchiectasis; however, the obstructive effects were mostly mitigated by the mucolytic. The arterial blood gas analysis showed a pH of 7.408, a pCO_2 of 50.2 mm Hg, a pO_2 of 86.0 mm Hg, an HCO^{3-} of 31.1 mEq/L, and an actual base excess of 5.8 mEq/L at room air. Preoperative chest radiographs and computed tomography imaging showed bronchiectasis in the middle lobe and lingular segment caused by nontuberculous mycobacterium. The left lung volume was reduced, and nodular shadows with bronchiectasis and consolidation with frosted shadows were seen predominantly in the subpleural areas of both lungs.

Based on the patient interview, her Hugh–Jones dyspnea level and modified Medical Research Council dyspnea scale grade were both determined to be a 3, which indicated a dyspnea level of moderate to severe. After we confirmed her respiratory problems during the preoperative assessment, we had her evaluated by the respiratory medicine department who prescribed inhaled tiotropium and olodaterol to optimize her pulmonary function before surgery. Furthermore, respiratory prehabilitation, such as huff coughing (a technique that helps mobilize mucus from the lungs), abdominal breathing, and walking exercises, was performed with the assistance of a physical therapist for 3 days before surgery.

The patient's activities of daily living (using the Barthel index) were evaluated and showed that she was fully independent, and her cognitive function showed no abnormalities. Nevertheless, there were many risk factors for postoperative cognitive dysfunction such as her advanced age, plus the physical and psychological stress caused by surgery. We opted to refer the patient to the psychiatry department where she received additional prehabilitation instructions like getting out of bed to help prevent postoperative cognitive dysfunction.

During our preoperative assessment, we determined that the possible intraoperative and postoperative complications associated with an intubated general anesthetic might include airway obstruction, atelectasis, respiratory infection, and a high probability of postoperative respiratory failure. Also, we considered that the patient's preserved cognitive function might allow the surgery to be performed under moderate sedation as opposed to deep sedation or general anesthesia. Therefore, we elected to proceed with surgery under IV moderate sedation with sufficient analgesia by using continuous dexmedetomidine (DEX) infusion and pentazocine without tracheal intubation and artificial ventilation after reviewing the cardiologist's and the respiratory physician's assessments.

On the day of surgery, the patient entered the operating room without premedication. Standard anesthetic monitoring (noninvasive blood pressure, ECG [lead II], and pulse oximetry) was instituted. The patient's baseline heart rate (67 beats/min), blood pressure (106/56 mm Hg), and SpO_2 (94% on room air) were recorded before the IV moderate sedation began.

Thereafter, oxygen was delivered via a nasal cannula at a flow rate of 3 L/min. A 22-gauge cannula was inserted into the vein on the dorsum of the left hand. Ringer acetate solution was infused, and DEX at a loading dose of 3 μg/kg/h was administered intravenously for 10 minutes, which led to moderate sedation. During loading, 8% lidocaine spray and 2% lidocaine jelly were applied to the gingiva. After DEX loading, IV pentazocine (7.5 mg) was administered twice.

More than 10 minutes after application of the topical anesthesia, a left inferior alveolar nerve block, mental nerve block, and periosteal infiltration anesthesia were performed using a total of 7 mL of 2% lidocaine with 1:80,000 epinephrine. The total dose of lidocaine and epinephrine was 140 mg and 0.0875 mg, respectively. Approximately 10 minutes after local anesthesia, the procedure was started.

Moderate sedation was maintained according to the Observer's Assessment of Alertness/Sedation Scale of 3 to 4 using a continuous infusion of DEX at 0.2 μg/kg/h. The patient was cooperative, comfortable, and not moving throughout the procedure. Her SpO_2 remained at 98% to 99% at 3 L/min via nasal cannula. Hemodynamically, she was stable except for only 1 episode of hypotension (71/38 mm Hg), which responded quickly to 0.05 mg of IV phenylephrine. No physical activity interfered with the surgery, and the surgical procedure was completed without any need for a secure airway. IV acetaminophen (450 mg) was administered at the end of surgery. The patient was conscious and had no complaints of pain after the surgery was finished. The total

anesthetic time was 159 minutes, and the surgical time was 132 minutes.

After the surgery, the patient's pain was well controlled with oral acetaminophen (1350 mg/d). Respiratory prehabilitation was resumed 3 days after surgery because fibrin glue and polyglycolic acid sheets (NEOVEIL sheet, GUNZE Medical) were used to cover her surgical wounds. This required prohibition of oral intake and mouth opening/closing movements for 2 days to avoid exfoliation of the bioabsorbable sheet. The patient's respiratory function did not deteriorate in comparison with her preoperative status. Although she was considered at high risk of delirium because of her advanced age, she did not develop postoperative delirium or cognitive decline/dysfunction. On postoperative day 9, she was discharged from the hospital after confirming she could eat by herself without assistance.

DISCUSSION

We elected to refer our patient in this case for respiratory prehabilitation to optimize her pulmonary status before surgery because of her advanced age and significant respiratory function impairment (bronchiectasis). Additionally, the patient was started on inhaled tiotropium and olodaterol, which further improved her respiratory function perioperatively. The benefits of respiratory prehabilitation have been reported in the perioperative management of patients with bronchiectasis.[6–8] Perioperative respiratory rehabilitation helps to not only maintain pulmonary function but also reduce fatigue from frequent coughing and expectoration.

Regarding the anesthetic management of patients with bronchiectasis, sputum production can be a serious issue because it could cause airway obstruction, atelectasis, and respiratory tract infections.[3,4] Anticholinergics and weakness secondary to residual effects from neuromuscular paralytics that are commonly used during general anesthesia may impair sputum evacuation. Tracheal intubation and artificial ventilation can also increase the risk of postoperative respiratory infections.

A case was reported that involved pneumonia occurring after general anesthesia in a patient with Kartagener syndrome presenting with bronchiectasis.[9] Other case reports include patients that required frequent suctioning during artificial ventilation with tracheal intubation[10] and episodes of hypoxemia and hypercapnia that occurred during artificial ventilation with a laryngeal mask airway.[11] Furthermore, advanced age was one of the factors that can affect postoperative complications in patients with bronchiectasis.[12] Therefore, in this case, we determined that the risks of perioperative respiratory complications could be lowered by preserving spontaneous breathing without tracheal intubation. Previous publications have detailed the use of IV moderate sedation along with excellent local anesthesia to maintain consciousness, collaboration, and protective reflexes, allowing the safe and comfortable completion of oral surgical procedures despite being relatively invasive.[13,14] After evaluating the patient preoperatively, we were confident that this case could be well managed under IV moderate sedation with sufficient analgesia even though the oral surgeons had initially requested general anesthesia.

We used DEX as the primary sedative in this case because it has not only sedative but also analgesic and opioid-sparing effects. DEX was reported to be a suitable agent for IV moderate sedation in oral surgery because of its analgesic effect and because it results in minimal cognitive impairment.[14] In addition, it was reported that DEX did not result in clinically significant respiratory depression and that accumulation was not observed.[15] Furthermore, a previous randomized controlled trial reported that DEX could decrease the occurrence of postoperative pulmonary complications.[16] However, DEX is often associated with adverse reactions such as hypotension, hypertension, and bradycardia. However, these effects usually occur with higher doses (eg, 1.4 mcg/kg/h).[17] In this case specifically, the patient was at high risk for complications such a cardiovascular depression because of her advanced age. Therefore, DEX was administered at half the usual initial loading and maintenance doses. Nevertheless, we still needed to use phenylephrine for hypotension in this case.

Sufficient analgesia and pain control is essential for any sedation plan. We tried to provide maximum analgesic effects by administering IV analgesics (DEX and pentazocine) in combination with profound local anesthesia via several techniques. Although DEX has analgesic effects, we added pentazocine as an IV analgesic despite fentanyl being more commonly used.[18] Pentazocine is a synthetic mixed opioid receptor agonist/antagonist. It has weak antagonist or partial agonist activity to the μ-type opiate receptors and full agonist activity at κ-type opioid receptors. These actions lead to the typical analgesic effects of opioids at low doses without the respiratory depressant effects. We chose pentazocine specifically because it can produce analgesia with little or no respiratory depression as compared with fentanyl.[19] In this case, pentazocine was administered in divided doses to further avoid adverse effects such as hypotension and respiratory depression because of the age and frailty of the patient.

For local anesthesia, we used topical and infiltration anesthesia as well as inferior alveolar and mental nerve blocks. Topical anesthesia was used to prevent pain from the needle insertion. We initially applied 8% lidocaine spray and 2% lidocaine jelly for topical anesthesia because the patient had complained of surgical site pain. A previous study reported that topical anesthesia paste (eg, 5% lidocaine) can suppress pain related with needle insertion when it was applied for 10 minutes.[20] Therefore, we waited more than 10 minutes after topicalization of the mucosa before beginning the local anesthetic injections. Kanaa et al[21] showed that the onset of pupal and hard tissue anesthesia after infiltration anesthesia of the mandible with lidocaine ranged from 6 to 12 minutes.

Other previous studies have shown that the relative pulpal blood volume decreased 5 to 20 minutes after lidocaine and epinephrine injections.[22,23] On the basis of these studies, the oral surgery procedure was started roughly 10 minutes after the administration of local anesthesia to achieve sufficient analgesia and reduce bleeding risks. Furthermore, to achieve successful perioperative pain control, a combination of inferior alveolar and mental nerve blocks, DEX, and pentazocine was utilized in addition to infiltration anesthesia.

CONCLUSION

We report the successful anesthetic management using IV moderate sedation with DEX and pentazocine for an elderly patient with severe bronchiectasis undergoing left marginal mandibulectomy for squamous cell carcinoma of the mandibular gingiva. Respiratory prehabilitation and IV moderate sedation along with excellent local anesthesia contributed to perioperative management of this patient without complications. Therefore, strategies selected in this case may be useful options for other elderly patients undergoing similar oral surgery procedures despite impaired respiratory function.

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