

# Application of Ventilating-Bronchoscopy-Adaptor by Fusing a Laparoscopic Trocar during Bronchial Thermoplasty under General Anesthesia

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Bronchial thermoplasty (BT) is a novel procedure for patients with severe asthma who are refractory to pharmacotherapy.<sup>1,2</sup> BT reduces this airway smooth muscle mass by applying radiofrequency energy to large airways.<sup>3</sup> Although BT is generally performed under topical anesthesia and sedation, general anesthesia is needed when a patient is unable to cooperate or when unstable vital signs are expected.<sup>1</sup> General anesthesia is also performed when it is considered necessary in the guidelines of institutional practice.<sup>1</sup> When BT is performed under general anesthesia, air leakage in the bronchoscopy adaptor frequently develops during the procedure and thus mechanical ventilation becomes unstable. We solved this problem by fusing the flexible catheter mount to a trocar used in laparoscopic surgery.

A 61-year-old female who had severe asthma, diagnosed 12 years ago, was scheduled for BT under general anesthesia. When the patient was admitted to the operating room, routine monitorings [noninvasive blood pressure (BP), pulse oxymetry, eletrocardiography, and bispectral index] were performed. Initial BP was 190/90 mm Hg, heart rate was 65 bpm, and oxygen saturation was 97%. After induction with lidocaine (40 mg) and propofol (80 mg), anesthesia was maintained with 2% propofol and remifentanyl through the target controlled infusion pump. The patient was intubated with an 8.0 mm endotra-

cheal tube after injection of rocuronium (50 mg). We started mechanical ventilation with oxygen and air (FiO<sub>2</sub>=0.4). The tidal volume was set to 500 mL, and the respiratory rate was controlled to maintain end-tidal carbon dioxide (ETCO<sub>2</sub>) between 30–35 mm Hg. After induction, a flexible catheter mount (Superset Catheter Mount; Intersurgical, Wokingham, Berkshire, UK) was connected between the endotracheal tube and the corrugate tube for fiberoptic bronchoscopy (CLV-260; Olympus, Tokyo, Japan). However, we encountered a number of problems that resulted in air leakage in the flexible catheter mount used for the bronchoscope adaptor, despite sealing it with a silicone globe (Fig. 1A). The inspiratory airway pressure and minute volume (MV) could not be maintained and there were fluctuations in ETCO<sub>2</sub>. Nevertheless, oxygen saturation and BP remained stable. The procedure was completed without any other complications and the patient was discharged the next day. Because the patient was subjected to a second BT three weeks later, we decided after discussion to construct the instrument, named ventilating-bronchoscopy-adaptor (VBA), by fusing the flexible catheter mount to a laparoscopic trocar used as an adaptor for bronchoscopy to solve the air leakage (Fig. 1B).

At a second BT, we used the VBA for bronchoscopy (Fig. 1B), which resulted in a dramatic reduction in air leakage. As a result, ventilation parameters also improved. Before the use of the VBA, mean±standard deviation (SD) of peak inspiratory airway pressure (P<sub>peak</sub>), MV, and ETCO<sub>2</sub> were 21±8.3 cmH<sub>2</sub>O, 3.9±1.6 L/min, and 39±7.1 mm Hg, respectively. After the use of the VBA, they changed to 29±3.5 cmH<sub>2</sub>O, 6.0±0.5 L/min, and 35±2.7 mm Hg, respectively (the ventilation parameters were obtained from ventilator recordings). Moreover, the operator was able to perform the procedure without discontinuation because the ventilation problem had been eliminated. After the second BT was successfully performed, the patient was discharged the next day without any complications.

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**Fig. 1.** (A) A flexible catheter mount is used as an introducer and entrance for the bronchoscope and is sealed with a silicone globe to prevent air leakage. (B) A ventilating-bronchoscopy-adaptor is used as the bronchoscopy introducer.

When bronchoscopy is performed during general anesthesia, a catheter mount is generally used as the bronchoscope adaptor.<sup>4</sup> As BT takes 45 minutes to 1 hour to complete,<sup>1</sup> prolonged unstable mechanical ventilation is inevitable under general anesthesia because of air leakage between the bronchoscope and the opening of catheter mount. Thus, we designed a new device, termed VBA, to solve this problem, which resulted in a dramatic reduction in air leakage. Flexible silicone seals at the top of the trocar minimized gas leakage. After application of the VBA, Ppeak, MV, and ET<sub>CO</sub><sub>2</sub> were maintained consistently. Mean Ppeak and MV were increased. On the other hand, the SD of Ppeak and MV, representing fluctuations in Ppeak and MV, was decreased after the application of VBA. ET<sub>CO</sub><sub>2</sub> was also decreased because mechanical ventilation was maintained appropriately, resulting in an improvement in CO<sub>2</sub> retention. Although we maintained anesthesia with intravenous anesthetics in this case, VBA facilitates anesthesia with volatile anesthetics without gas leakage. For the operator, VBA provides a more stable procedural environment

without encountering the ventilation problems that sometimes lead to frequent discontinuations during the procedure.

When BT is performed under general anesthesia, a VBA helps reduce air leakage, maintain inspiratory airway pressure, and improve CO<sub>2</sub> retention. It also provides the operator with a more comfortable procedural environment.

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