

## Application of a Newly Designed Right-sided, Double-lumen Endobronchial Tube in Patients with a Very Short Right Mainstem Bronchus

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FROM the anatomical point of view, the modern right-sided, double-lumen endobronchial tube (rDLT) has a small margin of safety in positioning. However, rDLTs are preferable to left-sided DLTs or bronchial blockers in patients who have proximal left mainstem bronchial lesions such as strictures, endoluminal tumors, or tracheobronchial disruptions and in patients whose left main bronchus is taken off from the trachea approximately 90° because of the external mass.<sup>1</sup> In the cases being reported here, we used the newly designed rDLT (Cliny®; Create Medic Co., Ltd., Yokohama, Japan) in patients characterized by a very short right mainstem bronchus. The Cliny® rDLT has a long oblique bronchial cuff and two ventilation slots for the right upper lobe. The proximal part of the bronchial cuff is located immediately opposite the tracheal orifice (fig. 1).

### Case Reports

#### Case 1

A 70-yr-old man with lung cancer was scheduled to undergo left pneumonectomy. Preoperative chest x-ray and computed tomographic examination revealed that his right upper bronchus originated just below the tracheal carina (fig. 2). According to risk factors described by Benumof *et al.*,<sup>2</sup> there was little margin for error in the placement of a standard rDLT in this patient. Consequently, we used a Cliny® rDLT to manage one-lung ventilation (OLV). After placement of an epidural catheter at T4-T5, anesthesia was induced with propofol followed by fentanyl and vecuronium. The trachea was intubated with a 39-French Cliny® rDLT. Then, radial artery and right internal jugular vein catheters were placed. Anesthesia was maintained with propofol and fentanyl. When the patient was shifted to the right lateral decubitus position, tube placement was adjusted using fiberoptic bronchoscopy: The proximal ventilation slot was matched to the right upper lobe bronchus, and the tracheal lumen orifice was located just above the carina, as shown in figure 3. OLV was started with 100% oxygen and successfully sustained, the independent lung was completely deflated, and

the dependent lung was adequately ventilated during OLV. Oxygen saturation measured by pulse oximetry (SpO<sub>2</sub>) was maintained at 100% and end-tidal pressure of carbon dioxide (PETCO<sub>2</sub>) was maintained at 28-32 mmHg throughout OLV. After the left lung was resected, the fraction of inspired oxygen was reduced to 70%. There was no need to adjust the tube position during surgery. Figure 4 shows the chest x-ray taken just after the operation. Although the tube position did slightly advance after the patient was returned to the supine position, the right upper bronchus was not obstructed. After extubation, the patient was transferred to the ward.

#### Case 2

A 42-yr-old woman with a lung tumor was scheduled to undergo upper segmentectomy of the left upper division. As in case 1, preoperative chest x-ray and computed tomographic examination revealed that her right upper lobe bronchus originated just below the tracheal carina. An epidural catheter was placed at T4-T5. After anesthesia was induced with propofol followed by fentanyl and vecuronium, tracheal intubation with a 35-French Cliny® rDLT was performed, and a radial artery catheter was inserted. When the patient posture was shifted to the right lateral decubitus position, the tube positioning was adjusted using fiberoptic bronchoscopy. At this point, as in case 1, the proximal ventilation slot was matched to the right upper lobe bronchus, and the orifice of the tracheal lumen was positioned just above the carina. Anesthesia was maintained with sevoflurane, and 1.0% lidocaine was intermittently administered *via* epidural catheter. OLV was started with 100% oxygen and, as in case 1, no problems were encountered. SpO<sub>2</sub> was maintained at 100% and PETCO<sub>2</sub> was maintained at 29-34 mmHg throughout the OLV periods. There was no need to adjust the tube position during surgery. After extubation, the patient was transferred to the ward.

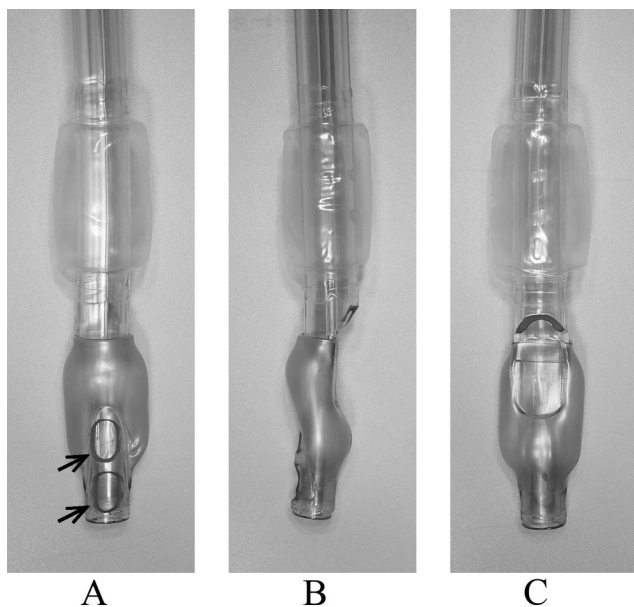
### Discussion

When using a conventional DLT, the bronchial cuff is positioned within the main bronchus. The bronchial cuff should not be allowed to protrude into the trachea. Consequently, a standard rDLT cannot be used in patients whose right mainstem bronchus is less than 10 mm long because the length of the standard rDLT cuff is 10 mm. Benumof *et al.*<sup>2</sup> reported that 11% of American patients had a right mainstem bronchial length (RMSL) of less than 10 mm. After evaluating x-ray data for a series of 80 male and female Japanese patients (unpublished data, dimensions of tracheobronchial tree, Satoshi Hagihira, M.D., Ph.D. [Lecturer, Department of Anesthesiology, Osaka University Graduate School of Medicine, Osaka, Japan], Masaki Takashina, M.D., Ph.D. [Lecturer, Surgical Center, Osaka University Hospital, Osaka], Takahiko Mori, M.D. [Director, Department of Anesthesiology, Osaka Pre-

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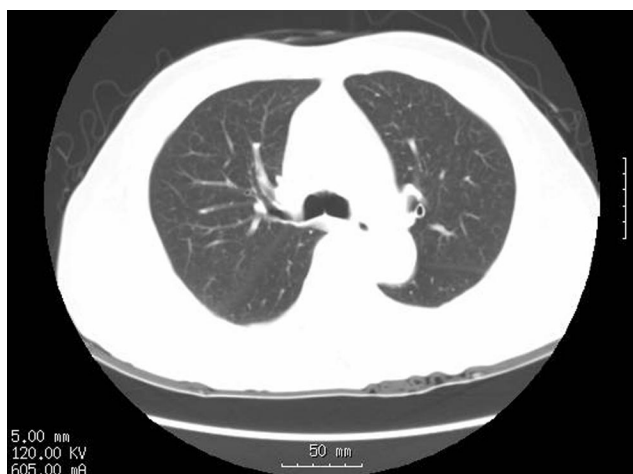
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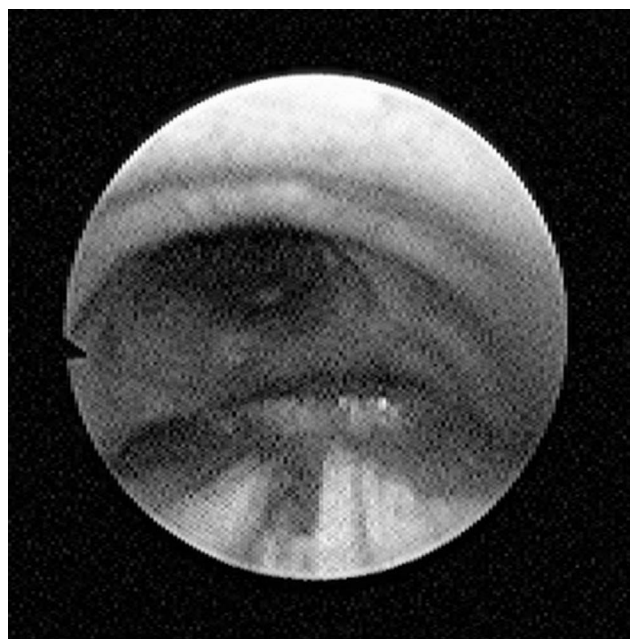


**Fig. 1.** (A–C) Photographs of a 37-French Cliny<sup>®</sup> (Create Medic Co. Ltd., Yokohama, Japan) right-sided, double-lumen endobronchial tube. *Arrows* indicate two ventilation slots.

fectural Osaka General Medical Center, Osaka], Takashi Mashimo, M.D., Ph.D. [Professor and Chairman, Department of Anesthesiology, Osaka University Graduate School of Medicine], November 1997), we found that the average RMSL was 13.5 mm in males ( $n = 55$ ) and 11.7 mm in females ( $n = 25$ ). This was approximately 5 mm shorter than that of the average American patient.<sup>2</sup> Furthermore, the RMSL was less than 10 mm in 20% of Japanese patients (16 of 80), which indicated that use of a standard rDLT would not be feasible for 20% of our patients. Therefore, use of a standard rDLT would be ruled out for 1 in 5 patients. Based on their study, Benumof *et al.*<sup>2</sup> suggested that modern right-sided tubes were designed as well as they could be, and that the margin of safety for positioning right-sided tubes could not be improved because conventional use of a DLT does not permit the bronchial cuff to



**Fig. 2.** Computed tomogram of case 1, just above the tracheal carina level.



A



B

**Fig. 3.** Photographs of fiberoptic bronchoscopy of case 1. (A) View of the tracheal carina from the tracheal lumen. (B) View in the bronchial lumen. The orifice of the right upper bronchus can be seen through the proximal ventilation slot.

protrude into the trachea. Consequently, the design of the standard right-sided tube has remained unchanged for more than 20 yr. Although Bussieres *et al.*<sup>3</sup> modified the design of the bronchial cuff, the changes seem to offer little improvement. Tubes modified in this way would have been unsuitable in the cases presented here.

To deal with cases like this, we designed a new rDLT to improve the margin of safety. The design is based

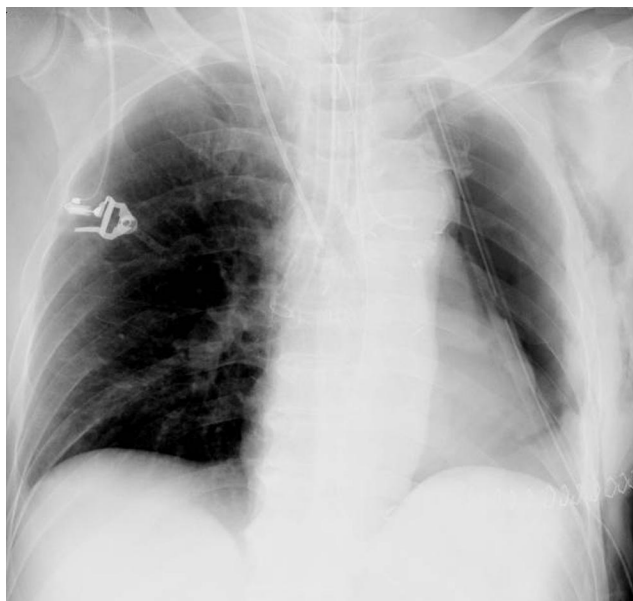


Fig. 4. Chest x-ray image of case 1 just after the operation.

on the concept that as long as the bronchial cuff does not impede the left-side airway, the cuff is allowed to partially protrude into the trachea. Based on this new concept, one of the authors (S.H.) has been working to improve the design of the rDLT, and now tubes made with this improved design are commercially available in Japan (Cliny®). The bronchial tip is shorter than on the standard DLT. Because a single long ventilation slot might narrow when the bronchial cuff is inflated, two ventilation slots are present to accommodate widely varying RMSLs. As figure 1 shows, the proximal part of the bronchial cuff is placed just opposite the tracheal orifice. Table 1 shows the dimensions of 32-, 35-, 37-, and 39-French Cliny® rDLTs. The distances here are the lengths labeled a through i in figure 5.

Because there may be some error when the cuffs are manually attached during the manufacturing process, these values are ideal lengths. Our modifications allow the use of this rDLT in patients whose RMSL is shorter than 10 mm. Furthermore, they increase the margin of safety for positioning the right-sided tube. We have successfully managed OLV in more than 40 patients using the Cliny® rDLT without any problem. The bronchial cuff

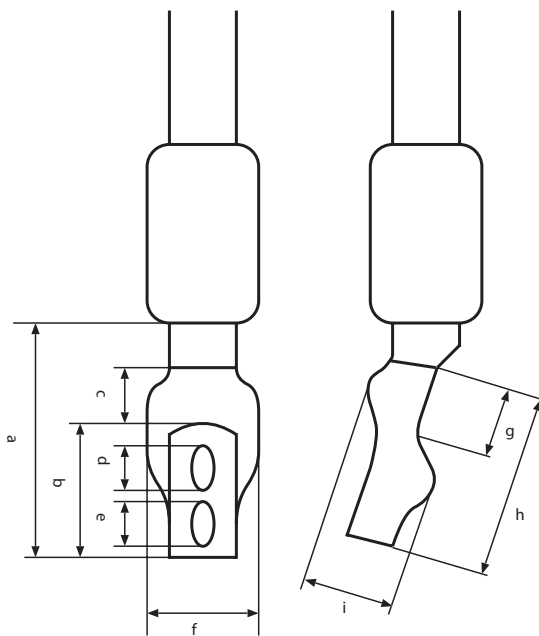


Fig. 5. Scheme of the Cliny® (Create Medic Co. Ltd., Yokohama, Japan) right-sided, double-lumen endobronchial tube.

of the Cliny® rDLT is larger than that of the standard DLT. Usually 3–5 ml of air is required to inflate the cuff to achieve adequate lung separation, which occurs when the bronchial cuff pressure reaches approximately 25–35 cm H<sub>2</sub>O.

Benumof *et al.*<sup>2</sup> defined the margin of safety for rDLT placement as RMSL minus the length of the bronchial cuff. They reported that the average margin of safety was 9 mm in males and 5 mm in females. For Japanese patients, it is only 3.5 mm in males and 1.7 mm in females. Therefore, it is necessary to carefully evaluate the length of the right main bronchus from x-ray images when we attempt to use the standard rDLT. The most proximal positional tolerance of the Cliny® rDLT is with the distal part of bronchial cuff located just below the carina. For patients with an RMSL greater than 10 mm, the most distal allowable position is when the orifice of the tracheal lumen is located just above the carina. Taking these two facts together, the margin of safety with this tube is 20 mm (distance g in table 1), which is greater than that of standard rDLTs.

Table 1. Specifications of Cliny® (Create Medic Co. Ltd., Yokohama, Japan) Right-sided, Double-lumen Endobronchial Tube

Size, French	Length, mm								
	a	b	c	d	e	f	g	h	i
32	60	30	15	9	9	22	20	45	22
35	60	30	15	9.5	9.5	24	20	45	24
37	60	30	15	9.5	9.5	24	20	45	24
39	60	30	15	9.5	9.5	24	20	45	24

The table shows the dimensions, indicated by labels a through i in figure 5, of the Cliny® right-sided, double-lumen endobronchial tube.



The availability of the Cliny<sup>®</sup> rDLT enables more flexible choice of the rDLT or left-sided DLT after considering the side or the type of operation. However, the Cliny<sup>®</sup> rDLT cannot be used in patients whose right upper bronchus originates directly from the trachea. Fortunately, direct origination of the right upper lobe bronchus from the trachea is relatively rare, affecting 0.1–3% of patients.<sup>4–6</sup>

In conclusion, the Cliny<sup>®</sup> rDLT can be safely used in patients with a very short right main bronchus.

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## Abnormal Bleeding after an Oral Surgical Procedure Leading to Airway Compromise in a Patient Taking a Selective Serotonin Reuptake Inhibitor and a Nonsteroidal Antiinflammatory Drug

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SELECTIVE serotonin reuptake inhibitors block the uptake of serotonin into thrombocytes. One of the functions of serotonin in thrombocytes is to promote platelet aggregation. When serotonin levels are depleted after several weeks of treatment, the altered platelet function leads to prolonged bleeding time, thereby increasing the risk of abnormal bleeding. Selective serotonin reuptake inhibitors may contribute substantially to the burden of abnormal bleeding after surgical procedures in the general population, due to the large number of users of selective serotonin reuptake inhibitors. In patients taking the combination of selective serotonin reuptake inhibitors and nonsteroidal antiinflammatory drugs, the risk of abnormal bleeding is thought to be even higher. We report a case of abnormal bleeding after an oral surgical procedure leading to airway compromise in a patient taking a selective serotonin reuptake inhibitor and a nonsteroidal antiinflammatory drug.

### Case Report

A 53-yr-old man presented with a painful ulcerative lesion in the left retromolar area with a diameter of 1.5 cm. Histologic examination of an excision biopsy revealed carcinoma *in situ*, with focally infiltrative

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squamous cell carcinoma in one of the resection margins. He smoked 20 cigarettes per day and drank 5 units of alcohol per day. He used naproxen, 500 mg twice daily, and for a major depressive disorder he used sertraline, 100 mg once daily.

During general anesthesia, a wide reexcision was performed with periosteal stripping of the mandibular bone. The wound was closed primarily, and hemostasis was reached.

Severe dyspnea developed in the recovery room 1 h postoperatively with upper airway compression due to a large hematoma in the floor of the mouth. Limited access to the airway, due to the massive hematoma, made reintubation impossible. An emergency tracheotomy was performed during local anesthesia.

Postoperatively, sertraline and naproxen were discontinued. Paracetamol combined with codeine was prescribed instead of naproxen. Careful analysis of the patient's medical history elicited multiple episodes of abnormal bleeding after surgical procedures during the use of sertraline: Hemorrhage occurred some days after nasal septal surgery, and prolonged bleeding occurred after tooth extraction and recently after the first excision biopsy of the lesion in the retromolar area. The family history was negative for bleeding disorders.

Laboratory screening tests for hemostasis were performed. The results are listed in table 1. A marked decrease in the level of serotonin in thrombocytes was found.

### Discussion

To the best of our knowledge, this case is the first report of life-threatening abnormal bleeding after a surgical procedure associated with selective serotonin reuptake inhibitor (SSRI) and concomitant nonsteroidal antiinflammatory drug use.

Sertraline is an SSRI. SSRIs are used for the treatment of major depressive disorder, obsessive-compulsive disorder, panic disorder, posttraumatic stress disorder, and social anxiety disorder. The mechanism of action of SSRIs is linked to the inhibition of neuronal uptake of serotonin in the central nervous system. Apart from this