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Lung: How To Do It

Uniportal Thoracoscopic Bisegmentectomy of Medial and Posterior Basal Segment (S7+S10)

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When a tumor is located in the medial (S7) or posterior (S10) basal segment, it is sometimes necessary to perform a bisegmentectomy of S7 and S10 (S7+S10) to achieve a sufficient surgical margin. In this report, we present surgical techniques for uniportal thoracoscopic S7+S10 bisegmentectomy. The surgical technique consists of anterior and posterior procedures to dissect the basal pulmonary vein. This approach allows en bloc resection of S7+S10 and en bloc preservation of the remaining lobe.

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S7 or S10 segmentectomy is a surgical option for patients with adenocarcinoma in situ, pulmonary metastasis, or benign diseases located in the mediastinal area of the basal segment of the lung.[1,2] However, a sufficient surgical margin is difficult to achieve by resection of a single segment of the basal segments if the tumor is close to the intersegmental plane.[3] Thus, if the tumor is in the medial (S7) or posterior (S10) basal segment, bisegmentectomy of S7 and S10 (S7+S10) is sometimes required. This bisegmentectomy is difficult because of the complexity of the anatomy of S7 and S10. S7 especially has several anatomic variations, as follows: type a, with B7 running anterior to the basal pulmonary vein (BPV; 74.8%); type b, with B7 running posterior to the BPV (4.8%); type ab, with B7a and B7b running anterior and posterior, respectively (14.8%); and other special branches (5.6%).[4]

In this report, we present surgical techniques, anatomic features, and preoperative management of uniportal thoracoscopic S7+S10 bisegmentectomy that have not yet been described.

TECHNIQUE

CASES. We performed uniportal thoracoscopic S7+S10 bisegmentectomy in 2 cases. In case 1, chest computed tomography revealed a 1.8-cm pulmonary nodule in a 62-year-old man in the S7+S10 segments, diagnosed as adenocarcinoma by bronchoscopic biopsy. The bronchovascular anatomic feature of this patient was type ab (Figures 1A, 1B, 2A, 2B). To support intraoperative anatomic orientation, virtual-assisted lung mapping was performed preoperatively[5] (Figure 2C). In case 2, a localized nontuberculous mycobacterial infection was diagnosed in the S7+S10 segments in a 65-year-old woman. The bronchovascular anatomic feature of this patient was type a (Figures 1C, 1D).

SURGICAL PROCEDURES. The patient is placed in the left lateral decubitus position. The 3-cm access port is placed in the sixth intercostal space at the midaxillary line.

1. Expose the basal vein and divide V7+V10.

One of the most important aspects of the surgical technique for S7+S10 bisegmentectomy is to clarify the anatomic relationship of the BPV to other bronchi and vessels. In the reported cases, we used this intersegmental division-first technique (Figure 3D; Video 1). The subsequent procedures can then be divided into manipulation anterior (ventral) to the BPV and posterior (dorsal) to the BPV.

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Procedures Anterior to the Basal Vein.

2. Identify the B7 and A7 crossing the ventral side of the BPV.

This procedure is facilitated by first dividing the interlobar fissure between the right middle lobe and lower lobe (Figure 3A).

3. Divide A7 and B7 (or A7a, B7a).

If the bronchial anatomy is type ab, only B7a should be divided. Division of all B7 before branching of B7a and B7b should be avoided (details are described later; Figure 2D).

4. Divide the intersegmental plane between S7 and S8.

This procedure helps identify B10 and A10 from the ventral side (Figure 3B).

Procedures Posterior to the Basal Vein.

5. Identify and divide B7 and A7 (or A7b, B7b) crossing the dorsal side of the BPV.

This procedure is facilitated by partially dividing the intersegmental plane between S6 and basal segments along with V6 (Figure 3C).

6. Identify and divide B10 and A10 crossing the dorsal side of the BPV.

This procedure is facilitated by procedure 4 (Figure 3B).

7. Divide the intersegmental planes between S6 and S10 and between S10 and S9.

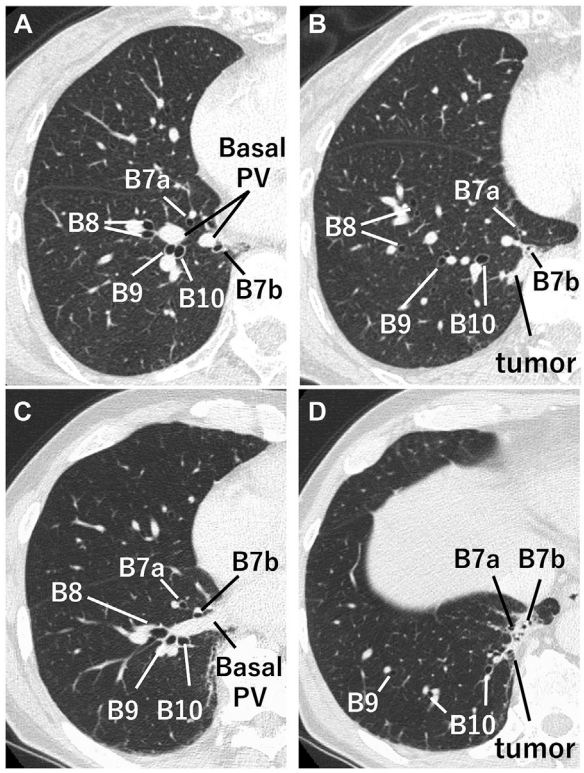

FIGURE 1 Preoperative computed tomography images. (A, B) Relationship between bronchial bifurcation and tumor in case 1, a case of type ab. (C-D) Relationship between bronchial bifurcation and tumor in case 2, a case of type a. (B, bronchos; PV, pulmonary vein.)

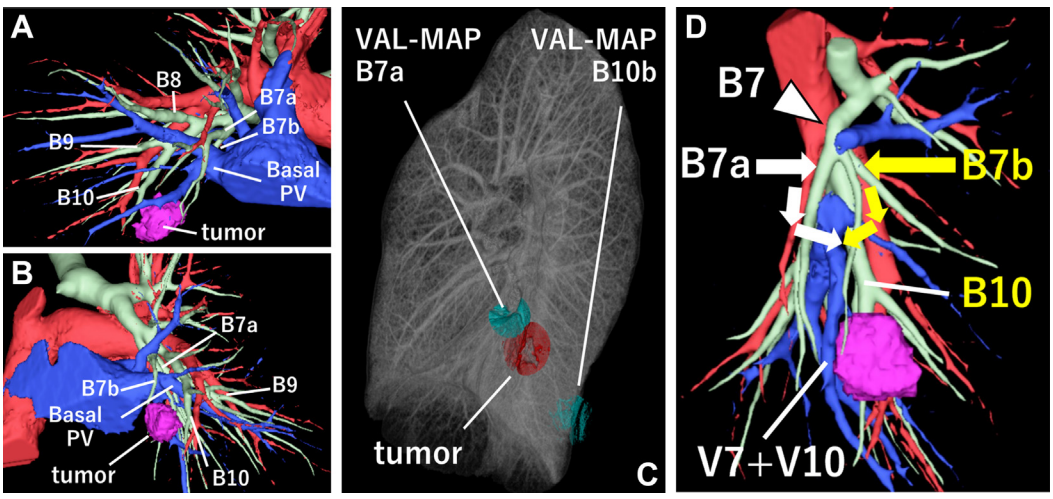

FIGURE 2 Preoperative 3-dimensional computed tomography image simulation of case 1. (A) Anterior view of the basal pulmonary vein (PV). Only B7a is visible. (B) Posterior view of the basal PV. B7b and B10 are visible. (C) Virtual-assisted lung mapping (VAL-MAP) was performed on B7a and B10b to achieve a surgical margin and to help identify the intersegmental plane. (D) Simulation of the relationship between the bronchi and the basal PV from the mediastinal side. Anterior approaches to the basal PV are indicated by white arrows and posterior approaches by yellow arrows. The white arrowhead indicates B7 before branching of B7a and B7b. When B7 is divided at this level, the stump of B7 forms a ring around the basal PV, forming a lock. (B, bronchus; PV, pulmonary vein; VAL-MAP, virtual-assisted lung mapping.)

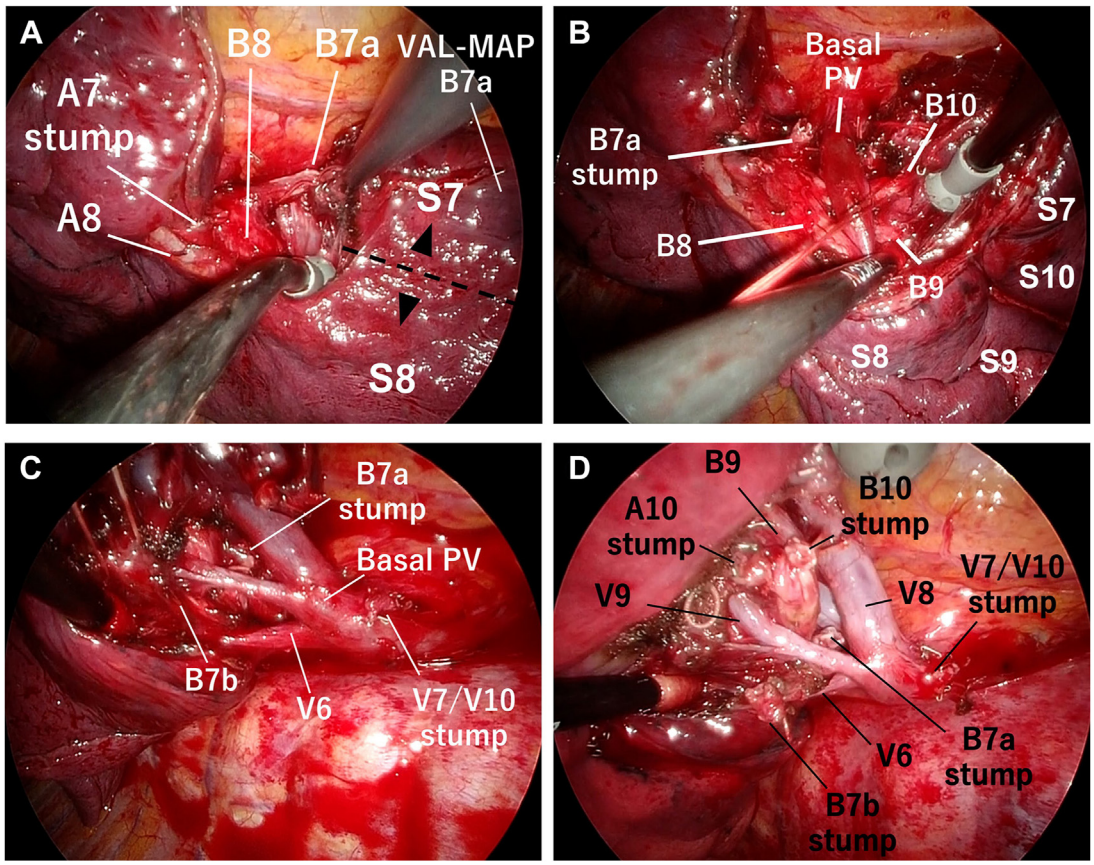

FIGURE 3 Surgical procedure and intraoperative view. (A) Anterior view of the basal pulmonary vein (PV). B7a is shown. Virtual-assisted lung mapping (VAL-MAP) helps to identify the intersegmental plane between S7 and S8. (B) After partial division of the intersegmental plane between S7 and S8. This procedure can expose B10 from the anterior view and help to identify B10 from the posterior view. (C) Posterior view of the basal PV. B7b is shown. (D) After S7+S10 bisegmentectomy. The stump of B7a is shown anterior to the basal PV. The stumps of B7b and B10 are shown posterior to the basal PV. This relationship between the bronchi and the basal PV is the most important anatomic recognition. (A, artery; B, bronchus; PV, pulmonary vein; S, segment; V, vein.)

Although hilar bronchi and vessels are usually divided first and intersegmental planes are divided last, the intersegmental plane can be divided first, even partially, to expose the hilar anatomy when identification of the anatomic features of the hilum is found to be difficult. In the described cases, we used this intersegmental division-first technique (Video).

The operation time was 156 minutes and 165 minutes and blood loss was 10 mL and 20 ml, respectively. The thoracic drain was removed on postoperative day 2 in both patients, and they were discharged on postoperative day 7 with no adverse events.

COMMENT

We have successfully performed uniportal thoracoscopic right S7+S10 bisegmentectomy. This surgical technique is challenging but useful, allowing sufficient surgical margin.

The S7+S10 bisegmentectomy consists of manipulation anterior and posterior to the BPV. The manipulation for S10 consists only of posterior manipulations as S10 is located posterior to the BPV.[2] On the other hand, the manipulation techniques for S7 depend on its anatomic characteristics.[4] According to the frequency of S7 anatomy, almost 90% of cases, type a and type ab, require anterior manipulation for S7 or S7a and posterior manipulation for S10 or S7b. In type b, anterior manipulation can be omitted and all procedures can be completed with only posterior manipulation, like S10 segmentectomy, but this is possible in only about 5% of cases. If the bronchial anatomy is type ab, we must consider when and where to divide B7 in the anterior manipulation. Only B7a should be divided in the anterior manipulation because B7a and B7b run like a ring around the BPV. Therefore, dividing B7 before branching of B7a and B7b forms a lock as shown in

Figure 2D, and it should be avoided. Once the B7 is locked to the BPV, it cannot be removed from the bronchial stump until the B7 is divided again to unlock it. Although there are no reports describing this surgical technique, this caveat can also be applied to type ab S7 segmentectomy.

The Video can be viewed in the online version of this article [https://doi.org/10.1016/j.atssr.2023.08.003] on http://www.annalsthoracicsurgery.org.

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DISCLOSURES

The authors have no conflicts of interest to disclose.

PATIENT CONSENT

Obtained. The ethics committee of The University of Tokyo Hospital (Clinical Pilot Study No. 2406) approved this report.

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