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Thoracoscopic B7ab-type Medial-basal Segment Segmentectomy

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Disclosure Statement

All authors reported no conflict of interest.

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Central Picture Legend

The lesion (red star) was in the B7ab-type S7.

Central Message

The right B7ab-type S7 adjoins S6 and S8-10. B7a and B7b straddle V10. We resected the B7ab-type S7 with an innovative approach.
Abbreviations

Right Lower Lobe: RLL
Basal Vein: BV
Inferior Pulmonary Vein: IPV
Intersegmental Interface: ISI
3D-CT Bronchography and Angiography: 3D-CTBA
Gate Opening Technique: GOT

The right $S^7$ adjoins $S^6$ and $S^{8-10}$ and distributes to the inferior oblique fissure, paravertebral, and posterior diaphragmatic surfaces of the right lower lobe (RLL). $B^7a$ and $B^7b$ straddle basal vein (BV) or inferior pulmonary vein (IPV) in $B^7\text{ab-type } S^7$.

Challenges in $B^7\text{ab-type } S^7$ segmentectomy include preserving BV/IPV straddled by $B^7a$ and $B^7b$ and tailoring the intersegmental interface (ISI). There has been no report of $B^7\text{ab-type } S^7$ segmentectomy.$^{1-5}$

ETHICS AND CONSENT

The study was approved by the Ethics Committee of The First Affiliated Hospital of Nanjing Medical University (2021-SR-164, 12/30/22) with a waiver of individual consent.

CASE SUMMARY

A 37-year-old woman was hospitalized for a chest CT with increased density of a 7-mm RLL nodule in $S^7$ (Fig. 1-A). Fig. 1-B illustrates the schematic $B^7\text{ab-type } S^7$...
bronchus with B\textsuperscript{7}a and B\textsuperscript{7}b straddling V\textsuperscript{10}. Figs. 1-C and D show DeepInsight-
reconstructed 3D-CT bronchography and angiography (3D-CTBA) pulmonary
anatomy\textsuperscript{6}. The BV bifurcated into the superior BV (V\textsuperscript{8+9}) and the inferior BV (V\textsuperscript{10}). The
intersubsegmental vein V\textsuperscript{7}a (between S\textsuperscript{7}a and S\textsuperscript{8}b) drained into V\textsuperscript{8+9}, and V\textsuperscript{7}b (between
S\textsuperscript{7}a and S\textsuperscript{7}b) drained into V\textsuperscript{10}. B\textsuperscript{7} branched from the basal bronchus and bifurcated into
B\textsuperscript{7}a and B\textsuperscript{7}b, which straddled V\textsuperscript{10}. A\textsuperscript{7} originated from the basal artery and bifurcated
into A\textsuperscript{7}a and A\textsuperscript{7}b, accompanying B\textsuperscript{7}a and B\textsuperscript{7}b. Video 1 shows the 3D-CTBA image.

The 3D model demonstrates the ISIs and the relationship of S\textsuperscript{7} with adjacent
segments (Video 2). The ISI between S\textsuperscript{7}a and S\textsuperscript{8}b is visible on the oblique fissure (Fig.
2-A). Fig. 2-B illustrates the ISI between S\textsuperscript{7} and S\textsuperscript{8}b, S\textsuperscript{9}b, and S\textsuperscript{10}b+c on the
diaphragmatic surface. Fig. 2-C reveals ISI on the paravertebral surface between S\textsuperscript{7}b
and S\textsuperscript{6}c, S\textsuperscript{10}a.

**SURGICAL TECHNIQUE**

Interlobar pleura incision exposed B\textsuperscript{7} and B\textsuperscript{8-10}. Dissect B\textsuperscript{7} and the adjacent A\textsuperscript{7}a.

Dissect A\textsuperscript{7}a distally to a sufficient length, ligate, and transect. B\textsuperscript{7} was dissected and cut
using an endostapler. A\textsuperscript{7}b, posterior to the proximal stump of B\textsuperscript{7}, was ligated and cut.

Visualize ISIs using the “Modified Inflation-Deflation Method\textsuperscript{7}.” Fig.2-D, E, and F
show the real ISIs between S\textsuperscript{7} and adjacent segments, perfectly corresponding with the
virtual ones (Fig.2-A, B, and C). Dissect distally along IPV, V\textsuperscript{8+9} and V\textsuperscript{10}, and cut V\textsuperscript{7}b
and Intra.V(S\textsuperscript{7}). The distal stump of B\textsuperscript{7}a and B\textsuperscript{7}b straddled V\textsuperscript{10} was cut into B\textsuperscript{7}a and B\textsuperscript{7}b
stumps. Complete V\textsuperscript{10} distal dissection from S\textsuperscript{7}.
The initial step in S⁷ tailoring involved the "Gate Opening Technique" (GOT): to put the anvil of the endostapler into the segmental hilar in an inside-out direction along anterior ISI between S⁷a and S⁸b, and fire. GOT was applied again to excise the posterior ISI between S⁷b and S⁶c. The ISIs between S⁷a and S⁸b+S⁹b, S⁷b and S¹⁰b+c, and S⁷b and S¹⁰a were divided sequentially until the complete excision of B⁷ab-type S⁷ (Video 3). The frozen section and postoperative pathology were minimally invasive adenocarcinoma. The minimal surgical margin was 1.5cm.

DISCUSSION

In 1951, Ferry and Boyden classified B⁷ into four types according to the relationship between B⁷ and BV: in Type I and II, B⁷ is located in front of BV; in Type III, B⁷a and B⁷b straddle BV; in Type IV, B⁷ is absent. In 1978, Yamashita classified B⁷ into three types: type I (B⁷a type, Boyden's type I and II); Type II (B⁷ab type, Boyden's type III), and type III (B⁷b only and B⁷ab absent type, Boyden's type IV). Since then, some experts classified B⁷ into four or five types. Based on Boyden and Yamashita's classifications, our new classification divides B⁷ into four types (Supplemental Figure): B⁷a type, B⁷ab type, B⁷b type (B⁷b only or B⁷b+B⁎), and B⁷ absent type (replaced by BX⁷). Few previous reports were limited to resection of B⁷a type S⁷ and B⁷ab-type S⁷a or S⁷b. This case was the first report of B⁷ab-type S⁷ resection. The main problem was the release of the V¹⁰ straddled by B⁷a and B⁷b. The key step is to cut the distal stump of B⁷ into B⁷a and B⁷b stumps to free V¹⁰. In addition, the GOT was used on each side of the...
target segmental hilum to minimize lung parenchyma compression and ensure the safety margin.

CONCLUSIONS

Cutting the distal stump of B7 into B7a and B7b stumps to release the straddled BV and using the GOT to cut ISIs on each side of the target segmental hilum can precisely resect the B7ab-type S7.

References:


Supplemental References


**FIGURE LEGENDS**
**Fig.1:** The lesion on CT scan and pulmonary structures reconstructed by 3D-CT bronchography and angiography (3D-CTBA). (A) A pure solid lesion (yellow ring) was illustrated in S⁷ (red dotted line). (B) B⁷a and B⁷b straddled V¹⁰. (C) B⁷a and B⁷b were located anteriorly and posteriorly V¹⁰ in 3D-CTBA. (D) The lesion (red star) was adjacent to A⁷a. P: Posterior; I: Inferior; R: Right.

**Fig.2:** The intersegmental interfaces (ISIs) of S⁷. (A, B, C) the virtual ISIs on the oblique fissure, posterior diaphragmatic, and paravertebral surfaces. (D, E, F): the real ISIs, perfectly corresponding with the virtual ones.

Video 1: 3D-CT bronchography and angiography (3D-CTBA) image
Video 2: 3D model of the relationship between S⁷ and adjacent segments
Video 3: Brief surgical procedure for S⁷ resection

**Supplemental Figure:** Diagram depicting the types of B⁷. Boyden identified four B⁷ types. Type I is when the B⁷ bronchus lies in front of the basal vein (BV) or inferior pulmonary vein (IPV), B⁷a distributes the inferior oblique fissure surface, and B⁷b distributes the paravertebral surface. When the B⁷b distribution shifts anteriorly, type II is identified from type I. B⁷ab type (III) has B⁷a and B⁷b in front of and behind BV or IPV. BX⁷a and BX⁷b arise from nearby bronchus like B⁸, B⁹+¹⁰, rather than the basal bronchus, which is B⁷ab absence (IV) type. Yamashita classified B⁷ into three types: type I (B⁷a type, Boyden's type I and II); Type II (B⁷ab type, Boyden's type III), and type III (B⁷b only and B⁷ab absent type, Boyden's type IV). B⁷b only type is basal bronchus-derived B⁷b behind the BV or IPV. Based on Yamashita categorization, we
identified the paravertebral surface's segmental bronchi and B^7b co-stem as type III
B^7b+*.
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