Thoracoscopic B^7ab-type medial–basal segment segmentectomy

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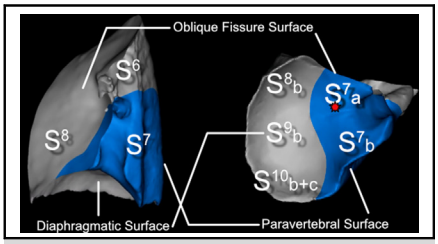


The lesion (*red star*) was in the B^7ab-type S^7.

CENTRAL MESSAGE

The right B^7ab-type S^7 adjoins S^6 and $S^{8\text{-}10}$. B^7a and B^7b straddle V^{10}. We resected the B^7ab-type S^7 with an innovative approach.

Video clip is available online.

The right S^7 adjoins S^6 and $S^{8\text{-}10}$ and distributes to the inferior oblique fissure, paravertebral, and posterior diaphragmatic surfaces of the right lower lobe. B^7a and B^7b straddle the basal vein (BV) or the inferior pulmonary vein (IPV) in B^7ab-type S^7. Challenges in B^7ab-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^7ab-type S^7 segmentectomy.[1-5] This study was approved by the ethics committee of The First Affiliated Hospital of Nanjing Medical University (2022-SR-760, December 30, 2022) with a waiver of individual consent.

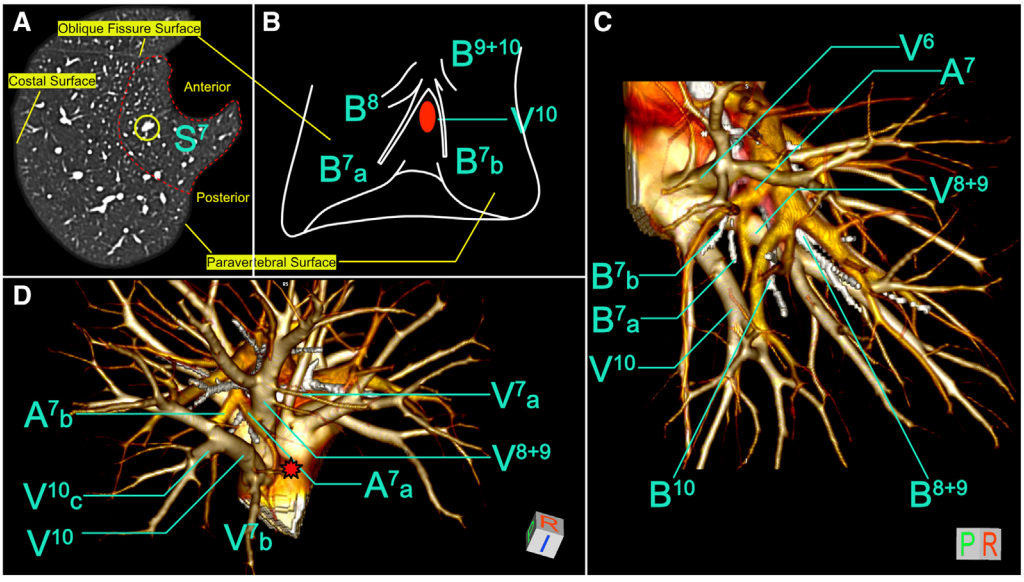


FIGURE 1. The lesion on CT scan and pulmonary structures reconstructed by 3D-CT bronchography and angiography (3D-CTBA). A, A pure solid lesion (*yellow ring*) was illustrated in S^7 (*red dotted line*). B, B^7a and B^7b straddled V^{10}. C, B^7a and B^7b were located anteriorly and posteriorly V^{10} in 3D-CTBA. D, The lesion (*red star*) was adjacent to A^7a. *P*, Posterior; *R*, right; *I*, inferior.

CASE SUMMARY

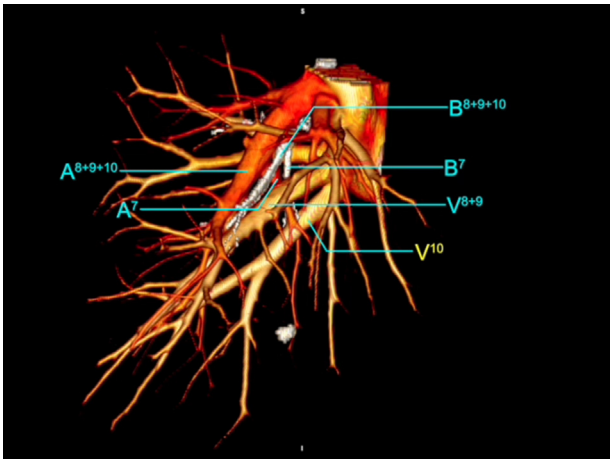
A 37-year-old woman was hospitalized for computed tomography (CT) scan of the chest with increased density of a 7-mm right lower lobe nodule in S^7 (Figure 1, *A*). Figure 1, *B*, illustrates the schematic B^7ab-type S^7 bronchus with B^7a and B^7b straddling V^{10}. Figure 1, *C* and *D*, shows DeepInsight-reconstructed 3-dimensional CT bronchography and angiography pulmonary anatomy.[E1] The BV bifurcated into the superior BV (V^{8+9}) and the inferior BV (V^{10}). The intersubsegmental vein V^7a (between S^7a and S^8b) drained into V^{8+9}, and V^7b (between S^7a and S^7b) drained into V^{10}. B^7 branched from the basal bronchus and bifurcated into B^7a and B^7b, which straddled V^{10}. A^7 originated from the basal artery and bifurcated into A^7a and A^7b, accompanying B^7a and B^7b. Video 1 shows the 3-dimensional CT bronchography and angiography image.

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

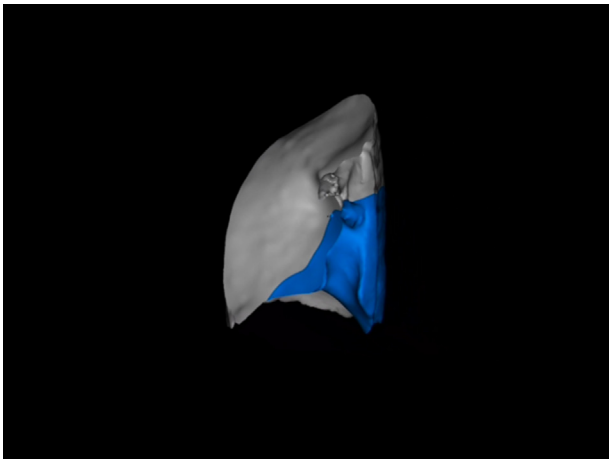
SURGICAL TECHNIQUE

Interlobar pleura incision exposed B^7 and $B^{8\text{-}10}$. B^7 and the adjacent A^7a were dissected. A^7a was dissected distally to a sufficient length, ligated, and transected. B^7 was dissected and cut using an endostapler. A^7b, posterior to the proximal stump of B^7, was ligated and cut. ISIs were visualized using the modified inflation–deflation method.[E2] Figure 2, *D* to *F*, shows the real ISIs between S^7 and adjacent segments, perfectly corresponding with the virtual ones (Figure 2, *A*–*C*). We dissected distally along IPV, V^{8+9}, and V^{10} and cut V^7b and Intra.V (S^7). The distal stump of B^7a and B^7b straddled V^{10} was cut into B^7a and B^7b stumps. Complete V^{10} distal dissection from S^7 was achieved.

The initial step in S^7 tailoring involved the gate-opening technique (GOT)[E3]: placing the anvil of the endostapler into the segmental hilar in an inside-out direction along the anterior ISI between S^7a and S^8b and firing. The GOT was applied again to excise the posterior ISI between S^7b and S^6c. The ISIs between S^7a and S^8b+S^9b, S^7b and S^{10}b+c, and S^7b and S^{10}a were divided sequentially until the complete excision of B^7ab-type S^7 (Video 3). Frozen section and postoperative pathology revealed minimally invasive adenocarcinoma. The minimal surgical margin was 1.5 cm.



VIDEO 1. 3D-CT bronchography and angiography (3D-CTBA) image. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00403-0/fulltext.



VIDEO 2. 3D model of the relationship between S^7 and adjacent segments. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00403-0/fulltext.

DISCUSSION

In 1951, Ferry and Boyden[E4] classified B^7 into 4 types according to the relationship between B^7 and BV: in type I and II, B^7 is located in front of BV; in type III, B^7a and B^7b straddle BV; and in type IV, B^7 is absent. In 1978, Yamashita[E5] classified B^7 into 3 types: type I (B^7a type, Boyden's type I and II); type II (B^7ab type, Boyden's type III); and type III (B^7b only and B^7ab absent type, Boyden's type IV). Since then, some experts classified B^7 into 4 or 5 types.[E6,E7] Based on Boyden and Yamashita's classifications, our new classification divides B^7 into

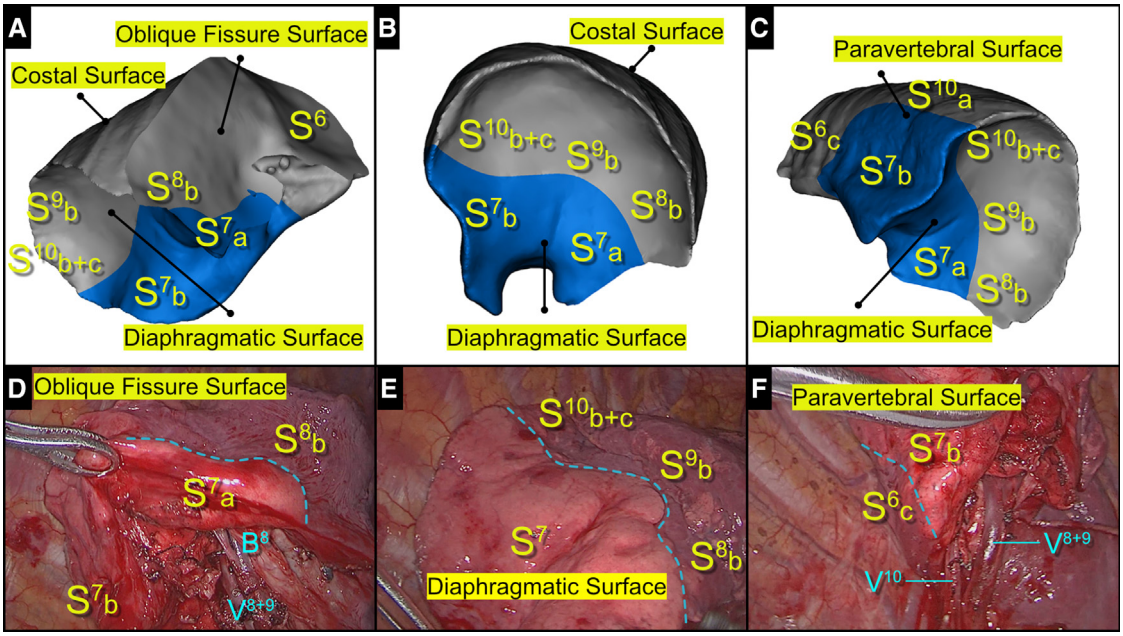
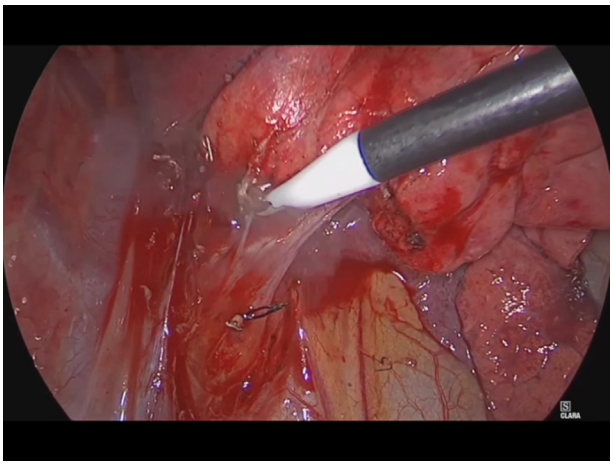


FIGURE 2. The intersegmental interfaces (ISIs) of S^7. A–C, The virtual ISIs on the oblique fissure, posterior diaphragmatic, and paravertebral surfaces. D–F, The real ISIs, perfectly corresponding with the virtual ones.

4 types (Figure E1): B^7a type, B^7ab type, B^7b type (B^7b only or B^7b+B*), and B^7 absent type (replaced by BX^7).[E8]

A few previous reports were limited to resection of B^7a type S^7 and B^7ab-type S^7a or S^7b. This case is the first report, to our knowledge, of B^7ab-type S^7 resection. The main problem was the release of the V^{10} straddled by B^7a and B^7b. The key step is to cut the distal stump of B^7 into B^7a and B^7b stumps to free V^{10}. In addition, the GOT was used on each side of the target segmental hilum to minimize lung parenchyma compression and ensure the safety margin.



VIDEO 3. Brief surgical procedure for S^7 resection. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00403-0/fulltext.

CONCLUSIONS

Cutting the distal stump of B^7 into B^7a and B^7b stumps to release the straddled BV and using the GOT to cut ISIs on each side of the target segmental hilum can precisely resect B^7ab-type S^7.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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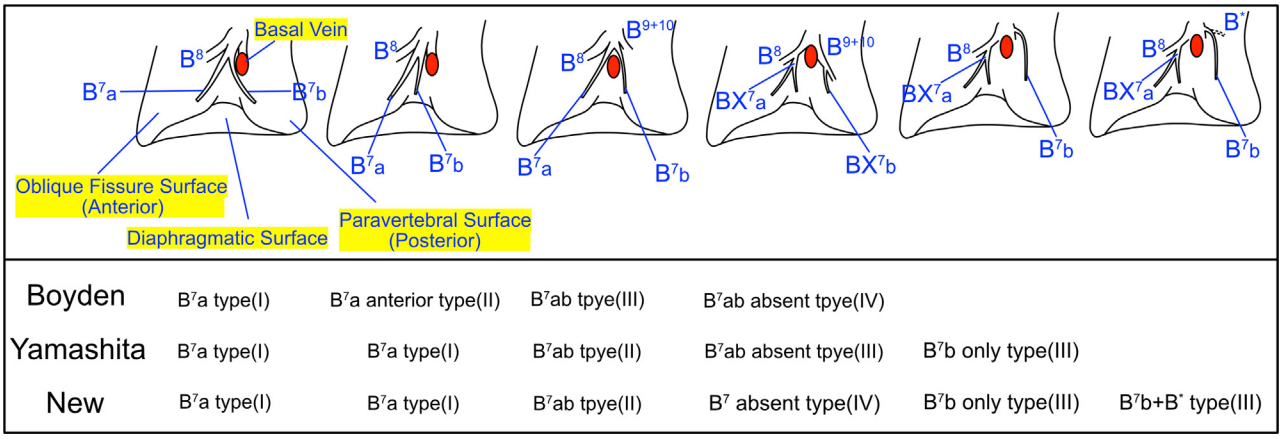

Boyden	B^7a type(I)	B^7a anterior type(II)	B^7ab tpye(III)	B^7ab absent tpye(IV)		
Yamashita	B^7a type(I)	B^7a type(I)	B^7ab tpye(II)	B^7ab absent tpye(III)	B^7b only type(III)	
New	B^7a type(I)	B^7a type(I)	B^7ab tpye(II)	B^7 absent type(IV)	B^7b only type(III)	B^7b+B^* type(III)

FIGURE E1. Diagram depicting the types of B^7. Boyden identified 4 B^7 types. Type I is when the B^7 bronchus lies in front of the basal vein (BV) or inferior pulmonary vein (IPV), B^7a distributes the inferior oblique fissure surface, and B^7b distributes the paravertebral surface. When the B^7b distribution shifts anteriorly, type II is identified from type I. B^7ab type (III) has B^7a and B^7b in front of and behind BV or IPV. BX^7a and BX^7b arise from nearby bronchus like B^8, B^{9+10}, rather than the basal bronchus, which is B^7ab absence (IV) type. Yamashita classified B^7 into 3 types: type I (B^7a type, Boyden's type I and II); type II (B^7ab type, Boyden's type III); and type III (B^7b only and B^7ab absent type, Boyden's type IV). B^7b only type is basal bronchus-derived B^7b 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+B^*.