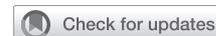


Uniportal thoracoscopic segmentectomy of medial-basal segment (S7) and its variants



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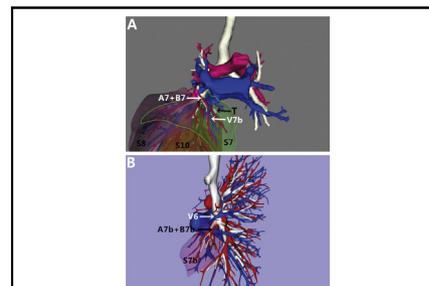
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Three-dimensional computed tomography of patient 1 (A) and 2 (B). A, Artery; B, bronchus; T, tumor; V, vein; S, segment.

CENTRAL MESSAGE

The anterior (surgical procedure 1) and posterior (surgical procedure 2) approaches described in this article are designed to perform the uniportal thoracoscopic segmentectomy of all S7 variants.

See Commentaries on pages 149 and 151.

▶ Video clip is available online.

Cases of thoracoscopic medial-basal segment (S7) segmentectomy are rarely reported,¹⁻³ possibly because S7 is the smallest² and deepest segment of the lungs. The advent of computed tomography screening has increased the detection of ground-glass opacity (GGO) nodules,⁴ which are commonly found in S7. Currently, only 2 publications^{1,2} have described the technical details of 3-port or 4-port thoracoscopic S7 segmentectomy, and there is still no specific treatment for some anatomic variations of S7. We introduce step by step our uniportal thoracoscopic S7 segmentectomy and S7b sub-segmentectomy, and discuss the surgical treatment principles for all S7 variants.

PREOPERATIVE PREPARATION

Two patients underwent uniportal thoracoscopic S7 segmentectomy or sub-segmentectomy at our institution on October 29, 2019, and November 12, 2019. Three-dimensional computed tomography (Figure 1, A) of patient 1 (64-year-old man) showed the most common S7^a anatomic type (found in ~75% of the population), where S7 is located ventral to the pulmonary ligament (2). Patient 2 (59-year-old woman) (Figure 1, B) showed anatomic features belonging to the S7^{ab} type (found in ~15% of the population), where S7^a is located ventral to the pulmonary ligament, and S7^b is located dorsally.²

A uniportal incision, approximately 3 cm long, was located at the fifth intercostal space posterior to the right

midaxillary line. The assistant operating the thoracoscope was located on the cranial ventral side of the patient. The patient(s) provided informed consent for the publication of the study data.

SURGICAL PROCEDURE 1 (S7 SEGMENTECTOMY OF PATIENT 1)

- I The lower part of the major fissure was divided first, the pulmonary artery branches of the middle and lower lobes were identified, and the segmental artery A7 was dissected (Figure 1, C).
- II Because the incision was placed dorsally, B7, which is running alongside of A7, was stapled at an angle perpendicular to the incision (Figure 1, D). Then the intersegmental boundary was identified using the “pulmonary modified inflation-deflation method,”⁵ which consists of reinflating the right lungs and then deflating them for 15 minutes to visualize the intersegmental boundary.

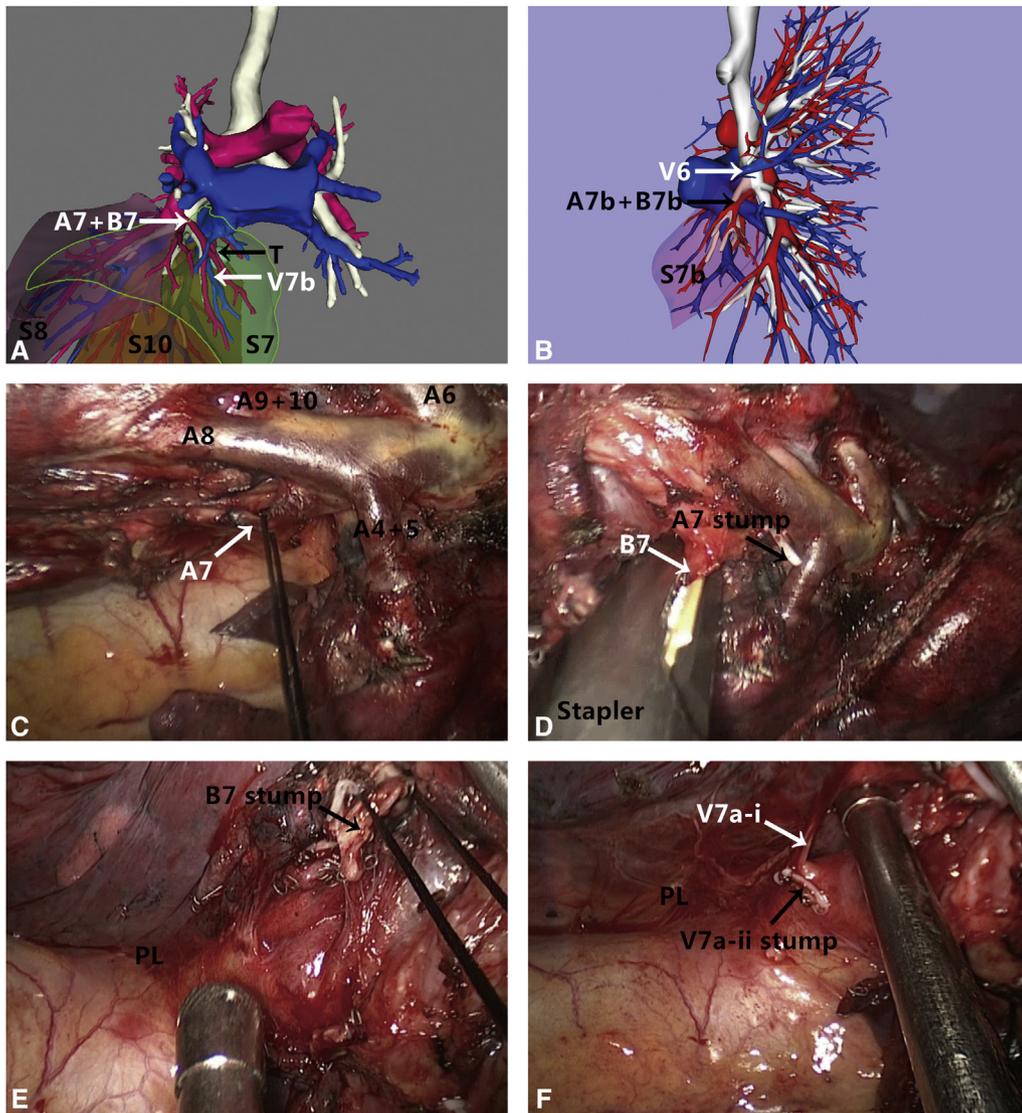


FIGURE 1. A and B, Three-dimensional computed tomography. A, In patient 1, A7 and B7 branch from the basal segmental artery and bronchus, respectively, and run ventral to the inferior pulmonary vein. V7b drains from the intersegmental plane between S7 and S10 to the inferior basal vein. B, In patient 2, A7b and B7b run dorsal to the inferior pulmonary vein. C-F, First half of the surgical procedure in patient 1. C, Pulmonary artery branches of the middle and lower lobes as identified via the interlobar fissure approach. D, B7 stapled in the vertical direction. E, B7 stump lifted to ensure S7 exposure with the help of the reserved lung ligament. F, Identification and dissection of the 2 sub-branches of V7a. A, Artery; B, bronchus; T, tumor; V, vein; S, segment; PL, pulmonary ligament.

- III The B7 stump was lifted (**Figure 1, E**), and the 2 sub-branches of V7a located ventral to the pulmonary ligament were dissected and resected (**Figure 1, F**).
- IV The root of the intersegmental plane between S7 and S8 segments was dissected using a harmonic scalpel. The mark of success for this dissection is complete dissection of the superior basal vein. This was followed by the root place dissection between S7 and S10, for which the mark of success is complete dissection of the inferior basal vein, and particularly the dissection of V7b (**Figure 2, A**). At this point, the intersegmental boundary is dimensionally reduced to a straight line.

- V Along the boundary between the oxygen-enriched area (S7) and the oxygen-starved area (S8 and S10) on the pulmonary basal surface, the intersegmental boundary was stapled in line (**Figure 2, B**). (For more details, see **Video 1**).

SURGICAL PROCEDURE 2 (S7B SUB-SEGMENTECTOMY OF PATIENT 2)

This procedure used the same incision position as the previous one. B7b and A7b were dissected and resected between V6 and the basal vein. Aside from some very thin veins, there was no major vein drained from the S7b

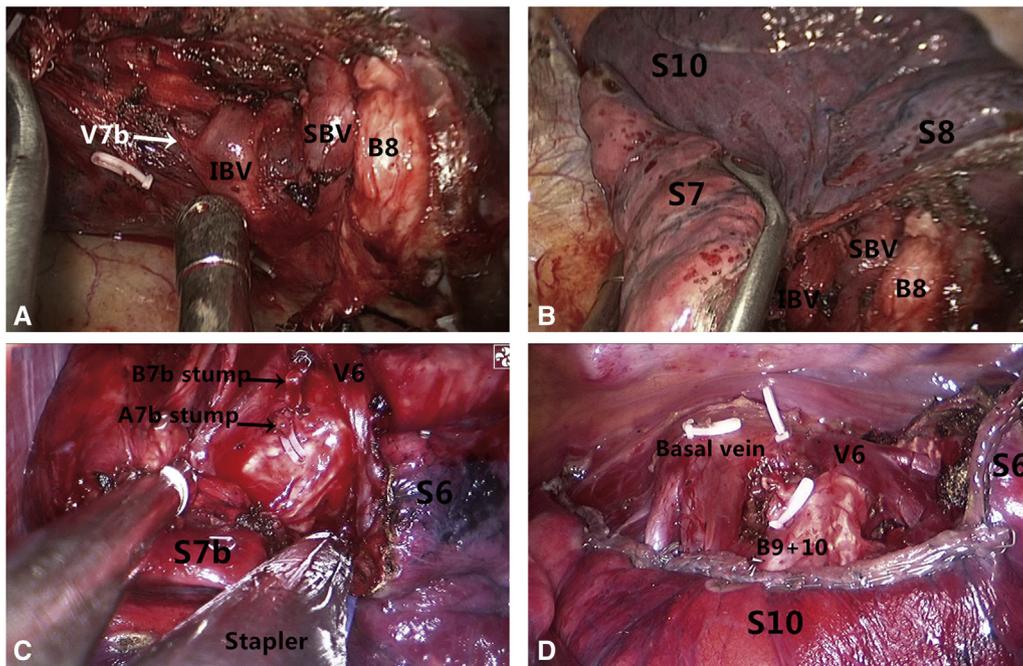


FIGURE 2. A and B, Second half of the surgical procedure in patient 1. A, Dissection of the root of the intersegmental plane. B, Stapling the intersegmental boundary in line. C and D, Intersegmental plane treatment of patient 2. C, Stapling the intersegmental plane between S7 and S6 in the vertical direction. D, Stapling the remaining intersegmental plane in line. V, Vein; IBV, inferior basal vein; SBV, superior basal vein; B, bronchus; S, segment; A, artery.

pulmonary parenchyma. The intersegmental plane between S7 and S6 was separated with the stapler (perpendicular to the incision) (Figure 2, C), and the remaining intersegmental plane was stapled into a straight line (Figure 2, D).

RESULTS

The operation time and blood loss in these 2 cases were 120 minutes and 50 mL in patient 1 and 105 minutes and 20 mL in patient 2, respectively. No postoperative complications were observed in either case.

DISCUSSION

For GGO-predominant small lesions, wedge resection is the most cost-effective option. However, S7 lesions are

usually not amenable to wedge resection, and S7 segmentectomy is a more appropriate choice than lobectomy. In addition, the resection margin in GGO-predominant small lesions often do not require a minimum safe distance of 2 cm⁶ and therefore allows expansion of the indication for S7 segmentectomy.

We have demonstrated the technical steps used for uniportal thoracoscopic S7 segmentectomy and S7b sub-segmentectomy, which can be summarized in 3 parts: (1) the incision is moved dorsally to facilitate the stapling of B7 or dissection of the posterior hilar; (2) complete dissection of the basal vein and remaining pulmonary ligament was helpful in processing the intersegmental plane; and (3) the intersegmental plane was stapled in line after dimensionality reduction.

The surgical procedure 1 described is applicable to S7 segmentectomy in patients with the S^{7a} type and to S7a sub-segmentectomy in patients with the S^{7ab} type. Surgical procedure 2 is applicable to S7b sub-segmentectomy of the S^{7ab} type and to S7 segmentectomy of the S^{7b} type (found in ~5% of the population), where S7 is located dorsal to the pulmonary ligament (2), which is same as the S7b observed in patient 2. As for patients carrying the SX⁷ types, who lack an original B7 (also found in ~5% of the population),² the key is to identify whether B7 and A7 are on the ventral or dorsal side of the inferior pulmonary vein. With the help of preoperative 3-dimensional computed tomography, our surgical procedures are theoretically applicable to S7 segmentectomy of the SX⁷ type.



VIDEO 1. The uniportal thoracoscopic S7 segmentectomy of patient 1 is demonstrated. Video available at: [https://www.jtcvs.org/article/S2666-2507\(20\)30146-2/fulltext](https://www.jtcvs.org/article/S2666-2507(20)30146-2/fulltext).

CONCLUSIONS

A technically improved, safe, and feasible version of uniportal thoracoscopic segmentectomy of S7 and its variants is presented with no visual field blindness or technical obstacles. Perhaps the growing need of S7 segmentectomy will make this particular surgical procedure more popular.

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