Thoracoscopic Medial-Basal Segment Segmentectomy

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The technical details and anatomic features of medial-basal segment (S^7) segmentectomy have not been reported. We report here thoracoscopic S^7 segmentectomy and S^7a subsegmentectomy and explain the anatomic knowledge necessary to perform S^7 segmentectomy, especially the importance of recognizing bronchus (B^7) branching patterns before surgery.

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The medial-basal segment (S^7) segment is located in the medial-basal part of the right lower lobe, which is observed in only the right lung and is the smallest segment of all pulmonary segments [1–3]. Because of its smallness and anatomic complexities, surgical techniques and anatomic features focusing on S^7 segment have not yet been reported. In this report, we present the anatomic features necessary for S^7 segmentectomy based on our data obtained from an accumulation of three-dimensional computed tomography images [1] and our experiences with the anatomic S^7 segmentectomy.

Technique

Between December 2011 and October 2016, 3 patients underwent thoracoscopic S^7 segmentectomy or S^7a subsegmentectomy at our institution. One patient (case 1, a 58-year-old man) had bilateral pulmonary metastases from renal cancer (Figs 1A, 1B). Another patient (case 2, a 69-year-old woman) had a 1.2-cm-diameter adenocarcinoma in situ. These 2 patients underwent S^7 segmentectomy because their bronchial (B) types were B^7a. Another patient (case 3, a 40-year-old woman) had a localized nontuberculous mycobacterial infection in the right middle lobe and S^7a subsegment; this patient underwent right middle lobectomy and S^7a subsegmentectomy because she was B^7ab type (Figs 1C, 1D). The S^7 segmentectomy or S^7a subsegmentectomy was chosen according to the patient's bronchial branching pattern and disease localization.

The S^7 segmentectomy for B^7a type and S^7a subsegmentectomy for B^7ab type can be performed using the same surgical procedure. The patient is placed in the left lateral decubitus position, with the main surgeon at the ventral side, the assistant operating the thoracoscope at the caudal side, and the main assistant at the dorsal side. Three-dimensional computed tomography angiography and bronchography images are positioned next to the main monitor. Four ports are used. The interlobar fissure is first divided between the right middle lobe and the right lower lobe to identify the interlobar pulmonary artery and the peripheral A^7 artery (Fig 2A). After ligation and resection of the A^7 artery, the B^7a bronchus, which runs on the ventral side of the basal vein (V^7 to V^{10}), is identified. The B^7a bronchus is dissected and isolated from the basal vein.

Next, an anesthesiologist inserts a bronchofiberscope of small diameter through the double-lumen tube into the orifice of the B^7a bronchus, in which selective segmental jet ventilation is begun [4, 5]. The S^7 segment is inflated while the preserved segments remain collapsed, and a line is formed between the inflated and deflated lung parenchyma to allow visualization of the anatomic intersegmental plane (Fig 2B). In general, the segmental bronchus is ligated and dissected using 2-0 silk or a stapling device after lung inflation. The stump of the B^7a bronchus is grasped and lifted using forceps and denuded toward the periphery. Identification and dissection of the central part of the intersegmental plane is achieved by dissecting the lung parenchyma along the central part of V^8 to V^{10} and V^7b, which is the intersegmental vein between the S^7 and S^{10} segments. During these procedures, we can identify and cut one or two thin V^7a veins, the intrasegmental veins that drain directly into the basal vein.

Finally, the peripheral part of the intersegmental plane is dissected using conventional electrocautery along the inflation and deflation lines (Figs 2C, 2D). To avoid postoperative air leakage, the dissected plane is covered

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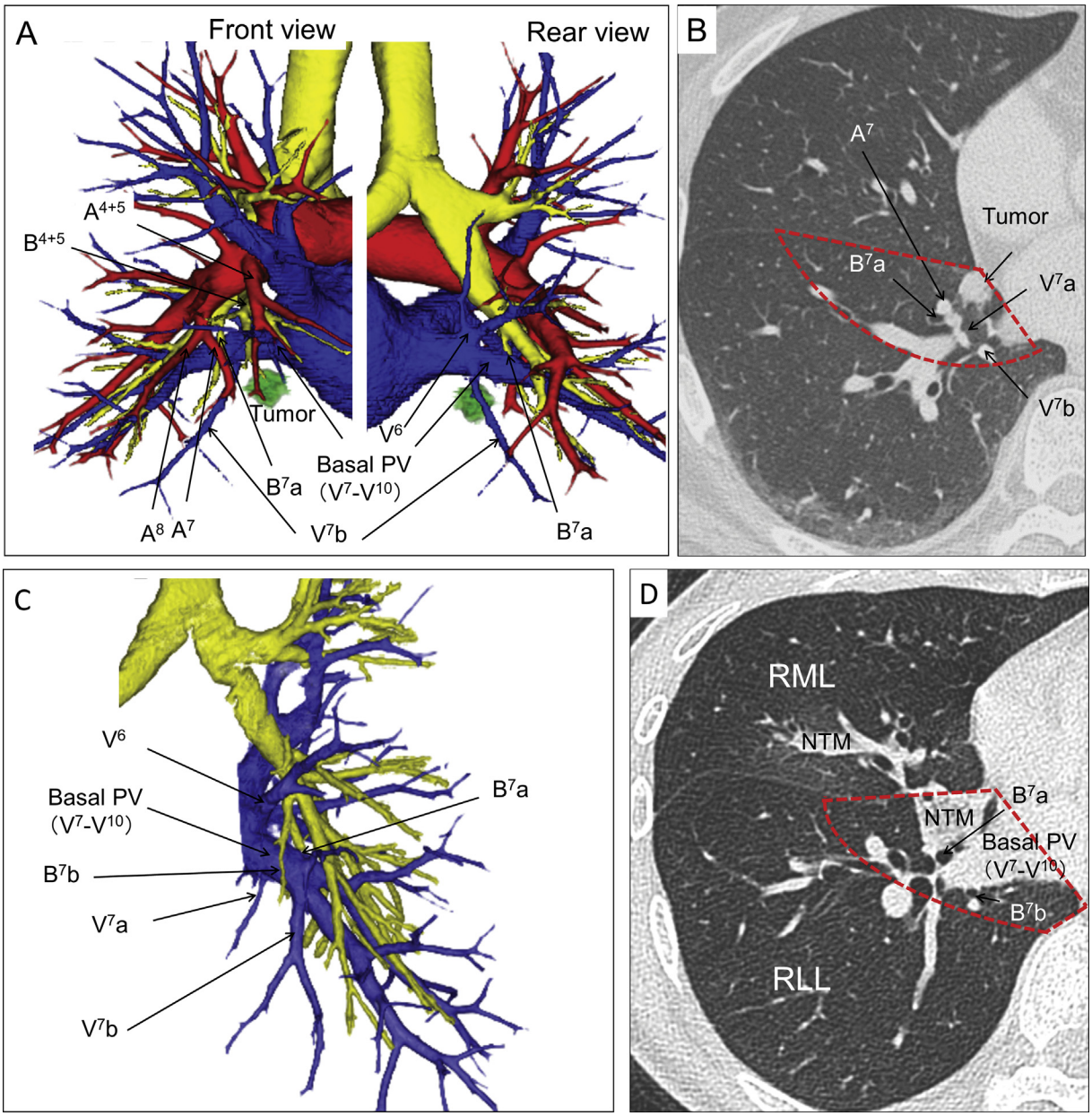

Fig 1. (A, C) Three-dimensional computed tomography angiography and bronchography and (B, D) multidetector-row computed tomography images of case 1 (A, B) and case 3 (C, D). The red dotted line surrounds the S^7 segment. (A = artery; B = bronchus; NTM = nontuberculous mycobacteria; PV = pulmonary vein; RLL = right lower lobe; RML = right middle lobe; V = vein.)

with polyglycolic acid (Neoveil, sheet type; Gunze, Kyoto, Japan) and fibrin sealant (Beriplast P; CSL Behring, King of Prussia, PA). The operation time and blood loss in these cases were, respectively, 140 minutes and 13 g (case 1), 185 minutes and 2 g (case 2), and 225 minutes and 51 g (case 3). No postoperative complications or recurrences were observed in any case.

Comment

The S^7 segment is the smallest segment, and the segment volume is almost one third that of the left S^{1+2} segment, which is the largest segment of all pulmonary segments (Fig 3A) [3]. Therefore, single S^7 segmentectomy is not typically performed in patients with lung cancer because efficient safety surgical margins cannot be secured. However, we believe that S^7 segmentectomy is an appropriate surgical procedure for lung lesions metastasized from other malignancies and pure ground-glass nodules, such as adenocarcinoma in situ, if the nodules are less than 1.0 cm to 1.5 cm in diameter and located in areas unresectable by wedge resection. Furthermore, single S^7 segmentectomy or S^7a subsegmentectomy are highly appropriate surgical procedures for nonmalignant