Segmentectomy of the Right Upper Lobe

3

The major branches of the right pulmonary artery are defined herein as follows:
Truncus superior: pulmonary artery of the first major branch to the right upper lobe.
Truncus intermedius: pulmonary artery between the truncus superior artery and A^6.
Basal artery: A^{7-10}.

			Frequency (%)
Bronchus	Three branches into B^1, B^2, and B^3		40
	Two branches into B^{1+3} and B^2		24
	B^{1+2} and B^3		14
	B^1+B^{2+3}		10
	Four branches into others		12
Artery	A^1	Both A^1a and A^1b from truncus superior artery	68
		A^1a branches independently, A^1b from truncus superior artery	32
	A^2	A^2a from recurrent artery; A^2b from ascending artery	72
		Both A^2a and A^2b from ascending artery	16
		Both A^2a and A^2b from recurrent artery	12
	A^3	Both A^3a and A^3b from truncus superior artery	48
		A^3a from truncus intermedius; A^3b from truncus superior artery	34
		A^3a from truncus superior; A^3b from truncus intermedius	18
Vein	Both apical (V^1) and central (V^2) veins		70
	Apical vein without central vein: V^1 and V^2 form common branch, running ventral to the hilum. V^2 branches along this route, running into the lung and between ascending and truncus superior arteries.		22
	Central vein without apical vein: common branch comprising V^1 and V^2 runs as central vein. V^1 branches along this route running cranially inside the lung.		8

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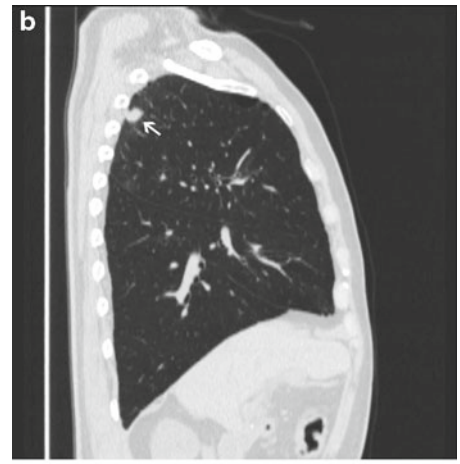
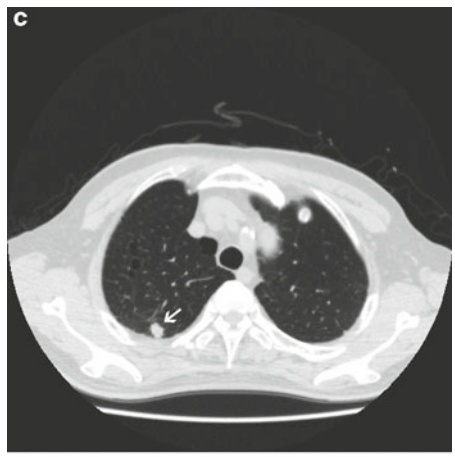
3.4 Right S^2 + S^1a Segmentectomy

coronal view (CT scan)



sagittal view (CT scan)



axial view (CT scan)

Chest X-ray of annual medical examination of a 61-year-old female uncovered a nodule in the right upper lobe. CT defined a 2-cm nodule with spicular formation and pleural indentation located between S^1a and S^2a. The nodule was diagnosed as adenocarcinoma from a bronchoscopic biopsy specimen. S^2+S^1a-segmentectomy was undertaken. The final pathological diagnosis was pT1aN0M0 papillary adenocarcinoma.

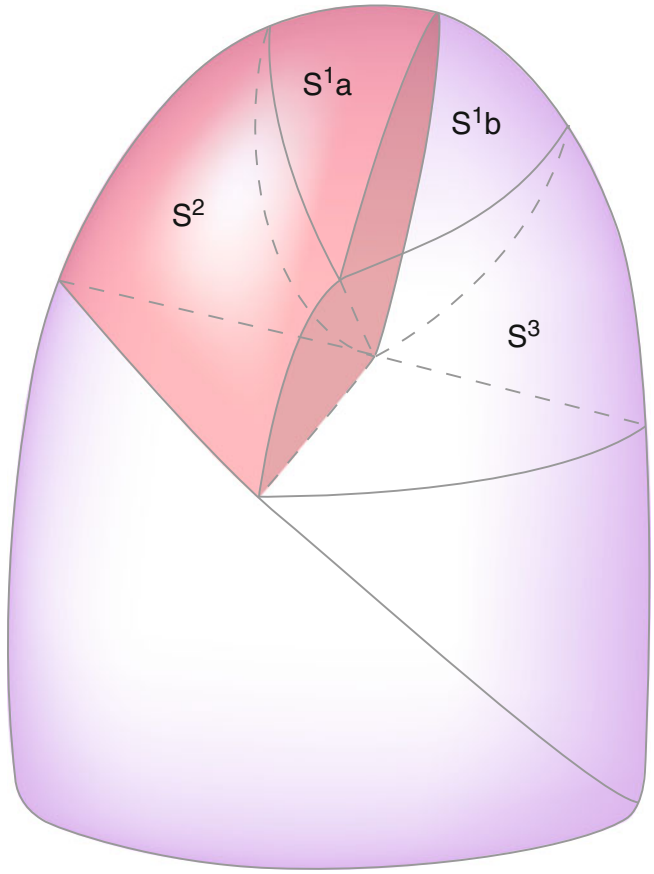


Fig. 3.4.1 The branching profile of segmental artery, vein, and bronchus branching is confirmed from axial, coronal, and sagittal HRCT views. The B^1, B^2, and B^3 branching and sizes are reconfirmed using bronchoscope after tracheal intubation. The anatomical configuration of the segmental bronchus, artery and vein in the figures of this session is the most frequent type as follows: the bronchus branches into B^1, B^2, and B^3; the artery branches into A^1, A^3 and a recurrent A^2a from the truncus superior artery; the A^2b branches as an ascending A^2; and the vein branches into apical and central veins. The optimal site for thoracotomy is generally the third intercostal space.

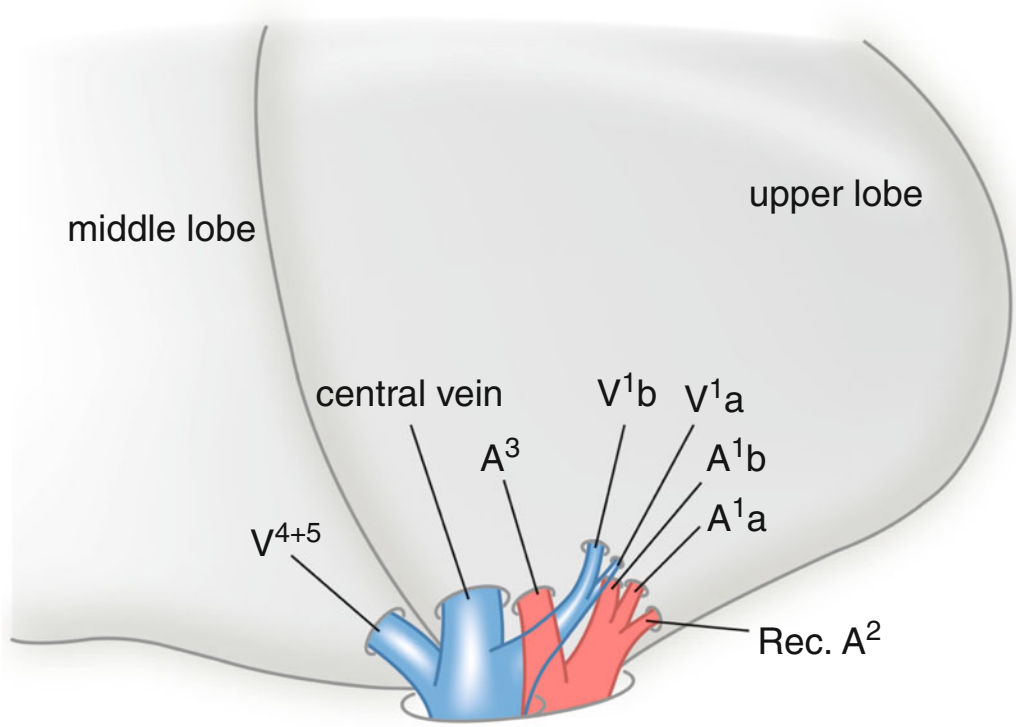


Fig. 3.4.2 The hilum of the right upper lobe is exposed from the ventral to the dorsal side to expose the superior pulmonary vein, truncus superior artery, upper lobar bronchus, and the bifurcation between the upper lobar bronchus and truncus intermedius bronchus.

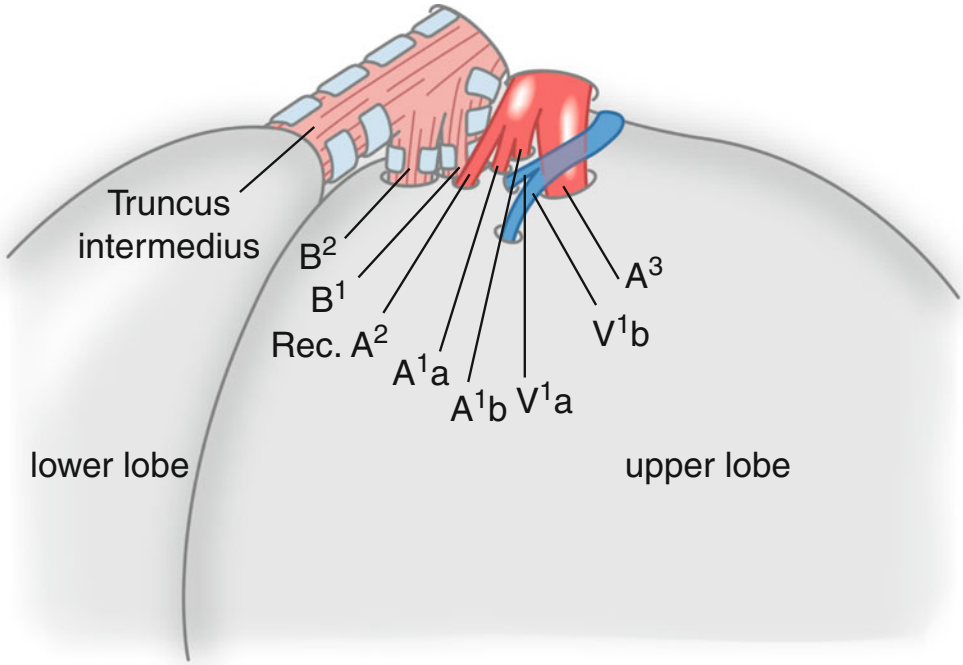


Fig. 3.4.3 The dorsal site of the upper lobar bronchus is exposed peripherally to reveal the bifurcation of B^1 and B^2, which facilitates the identification of a recurrent A^2 later. The V^1 is exposed peripherally, and then V^1a and V^1b are identified. The V^1a is the intersegmental vein between S^1a and S^1b that runs dorsally and is usually thinner than V^1b. The V^1b is the intersegmental vein between S^1 and S^3, running near the surface of the lung and towards the lung apex. A^1 is exposed peripherally to reveal A^1a and A^1b.

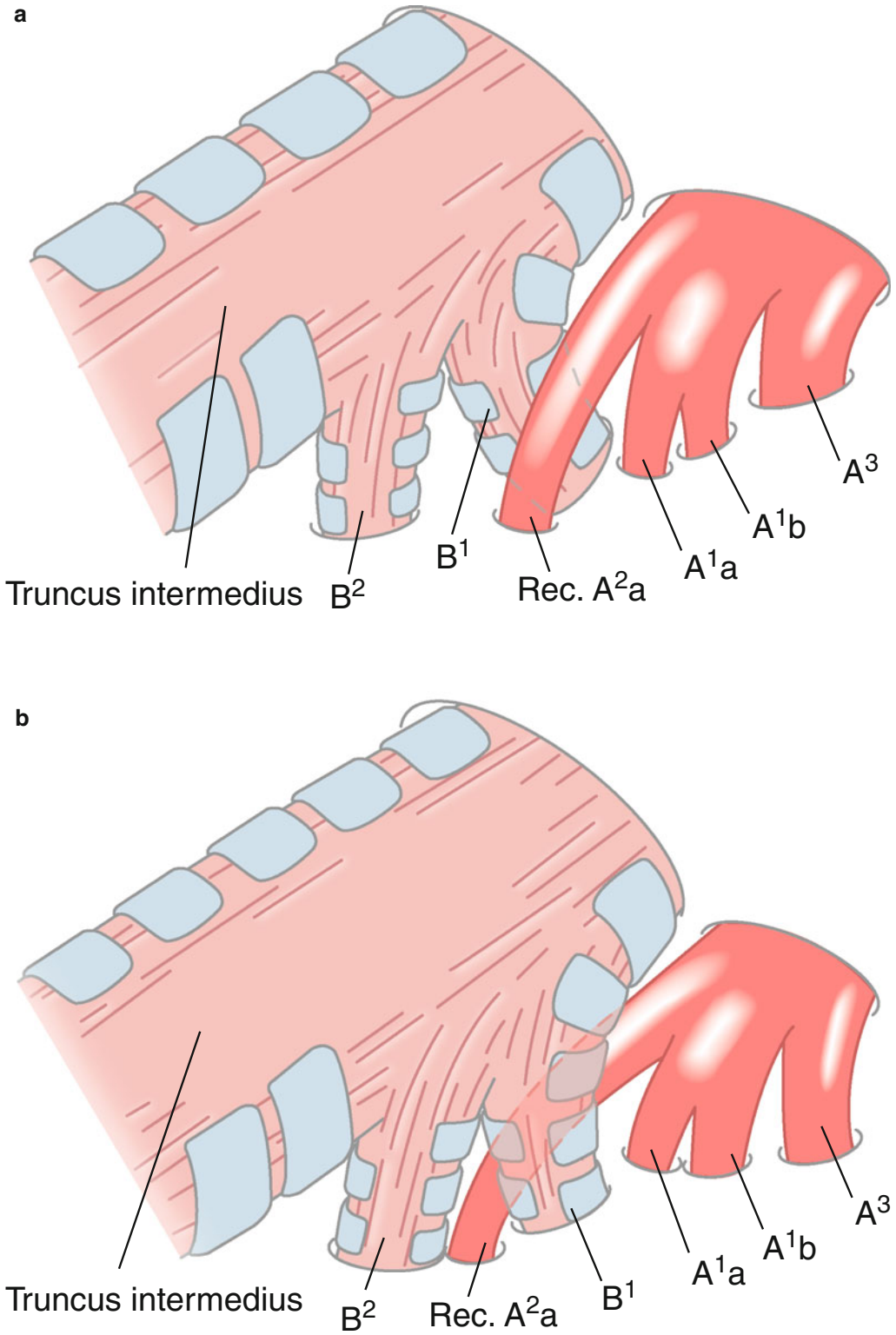


Fig. 3.4.4 There are two patterns of the recurrent A^2-route as follows: one is that a recurrent A^2 runs at the dorsal side of B^1 and then along B^2 (**a**) and another is that it runs at the ventral side of B^1 and then along B^2 (**b**). The former is more frequent than the latter and is thus presented herein.

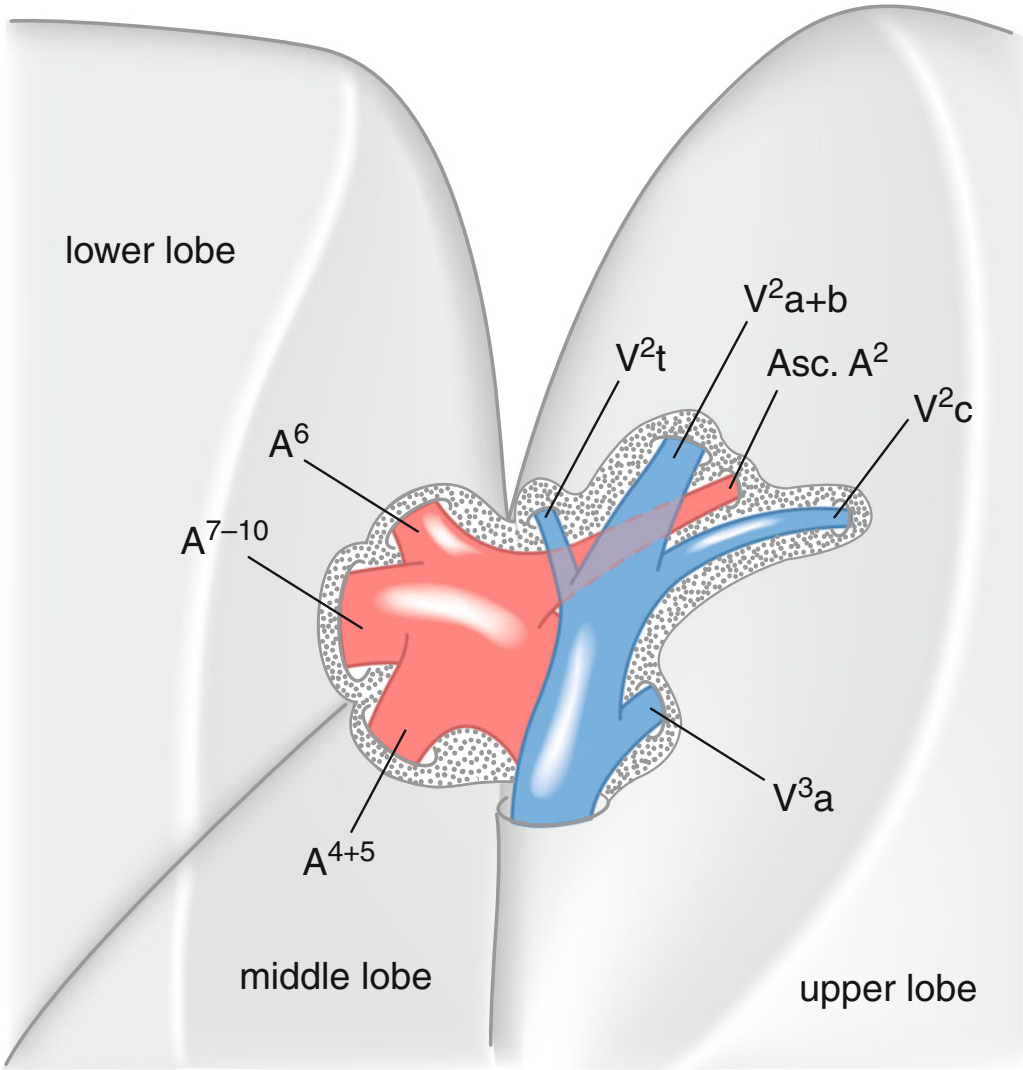


Fig. 3.4.5 The fissure between the right upper lobe and lower lobe is divided using electrocautery but not a stapler, because the staple line would impair identification of the peripheral route of V^2 and also complicate identifying the border between S^2 and S^3. The following technique facilitates the fissure-identification. A bronchoscope is inserted into B^2 followed by jet ventilation, which creates an inflation–deflation line between an inflated S^2 and a deflated lower lobe. The fissure is divided along the inflation–deflation line using electrocautery. The central vein can be visualized by dividing the fissure.

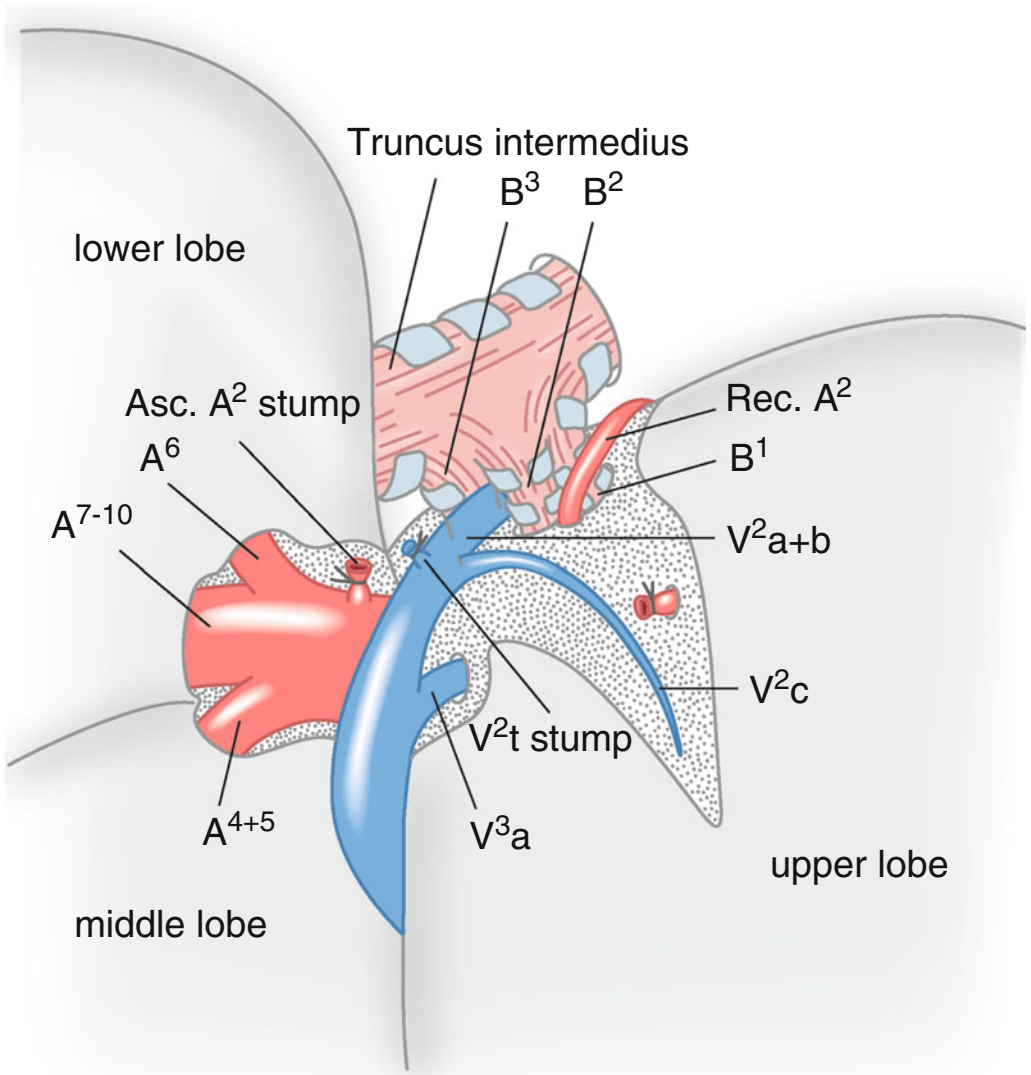


Fig. 3.4.6 V^2 is exposed and encircled with tape. V^2t runs to the dorsal direction at the fissure, which is cut. V^2c is identified and exposed peripherally. V^2c often runs alongside V^2a+b immediately after branching, where the former runs in the front and the latter runs behind in this operative view. Thereafter, V^2c runs towards the lateral side of the upper lobe near the lung surface. V^2c is exposed peripherally to clarify the border between S^2 and S^3. The ascending A^2 is identified. Because the ascending A^2 and ascending A^3a occasionally form a common truncus, the ascending artery is exposed peripherally to confirm the presence or absence of an ascending A^3a running towards the ventral side of V^2c. A confirmed ascending A^3a is preserved. The artery dorsal to the V^2c is cut because it must be the ascending A^2. After cutting the ascending A^2, B^2 is identified. B^2 runs in front, while B^3 runs behind V^2a+b in this operative view, which enables their discrimination. The upper lobar bronchus is exposed peripherally from the apical side, which enables the identification of B^1 and B^2. The B^2 is encircled with thread. Illumination from a bronchoscope can also help to reconfirm the identification of B^1, B^2, and B^3.

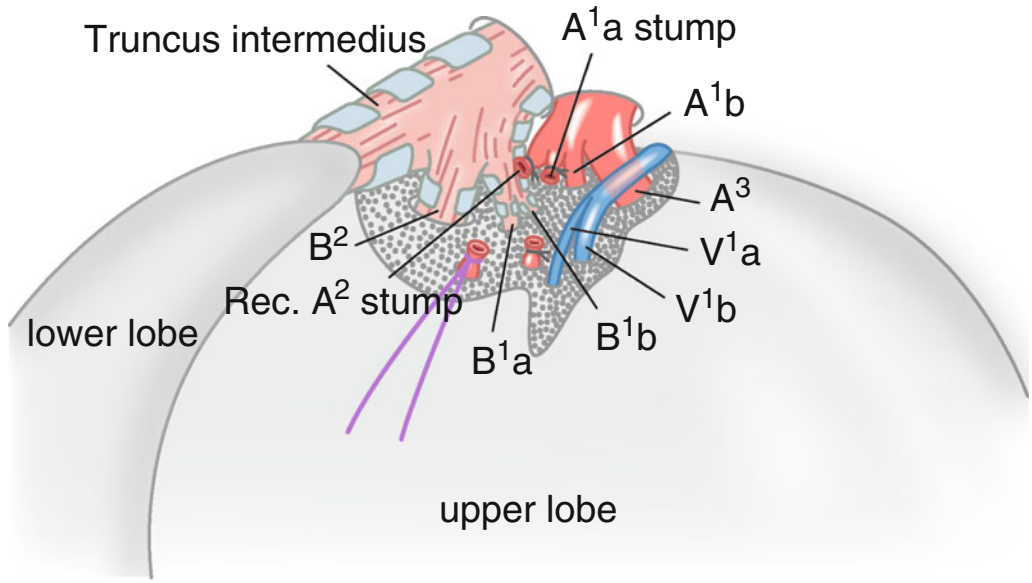


Fig. 3.4.7 A^1a is cut to exposes B^1a and B^1b. The B^1a is encircled with thread.

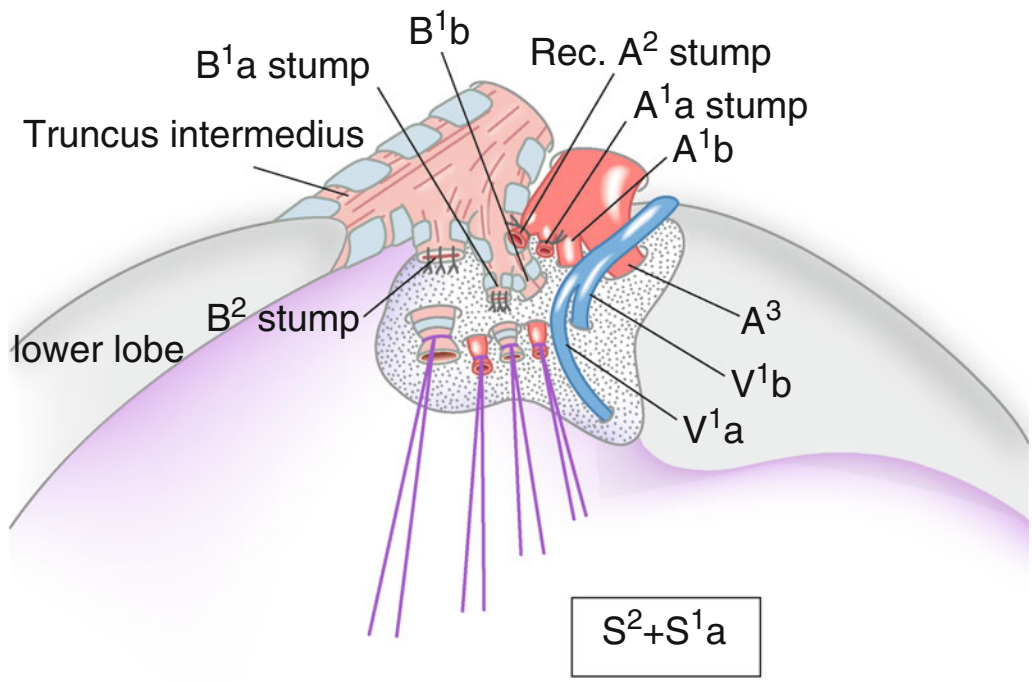


Fig. 3.4.8 S^2 and S^1a can be selectively inflated either by inserting a bronchoscope into B^2 and B^1a followed by jet ventilation, or by cutting the B^2 and B^1a and inserting a catheter into the distal stumps followed by air inflation. The distal stumps are closed to trap air within S^2 and S^1a. The proximal stumps of B^2 and B^1a are closed with suture or ligation.

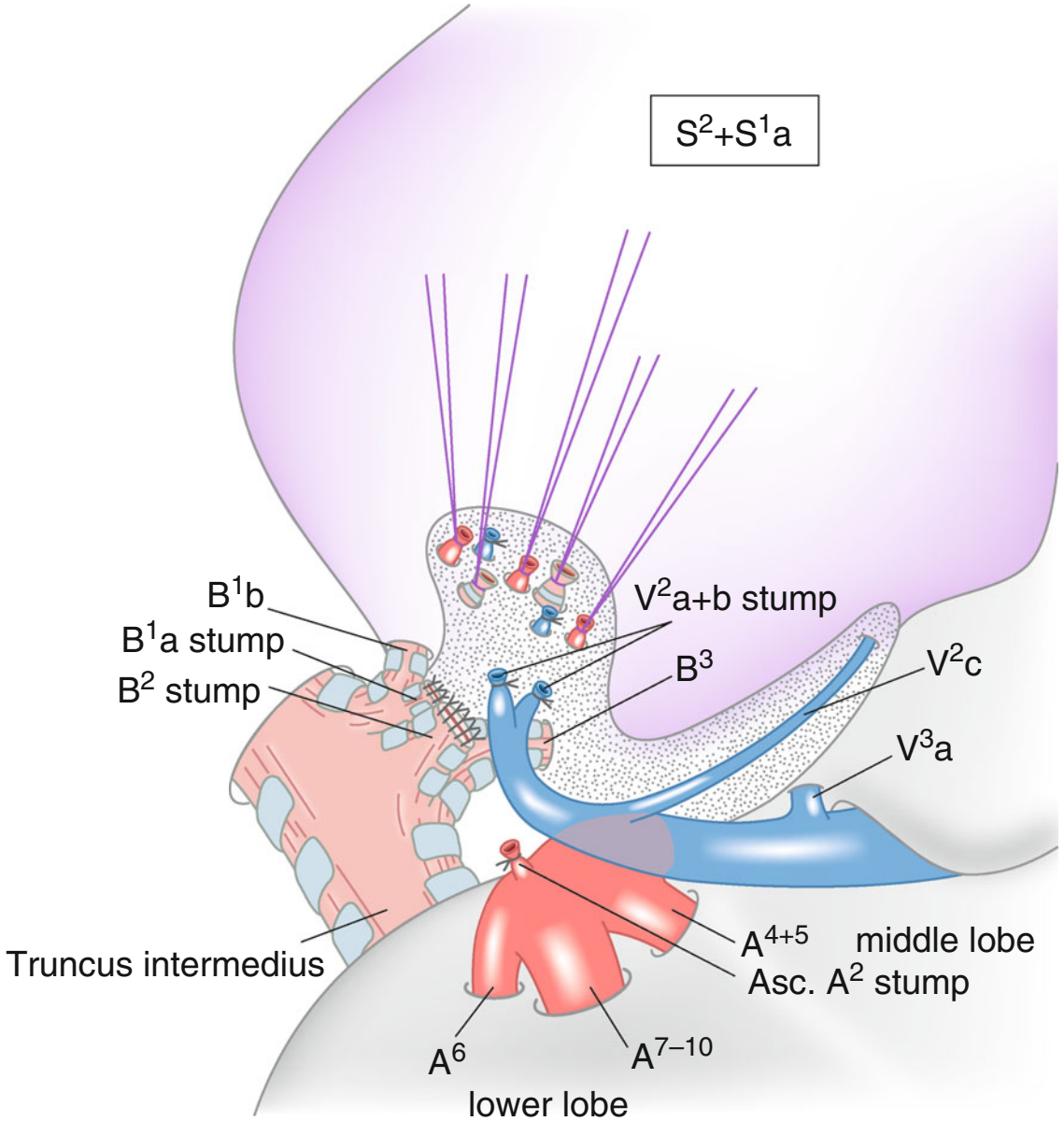


Fig. 3.4.9 The distal stumps of B^2 and B^1a are lifted, and their back side is peripherally denuded, which moves the distal B^2 and B^1a stumps away from the hilum. While V^2a+b can in principle be cut at its root, the complete central vein type has a V^1-branch along the route of the central vein, which should be taken into consideration. If so, then cutting only the vein-branches that run towards the S^2 and S^1a would be secure. Cutting the V^2a and V^2b further elevates the distal B^2 and B^1a stumps and also lifts the lung tissue on both sides of the stumps. The lung tissue on both sides of the stumps is then cut towards the inflation–deflation line using electrocautery and also along V^1a and V^2c while preserving them, if the surgical margin is sufficient. The intersegmental plane is cut from various directions to facilitate simple and accurate intersegmental cutting.

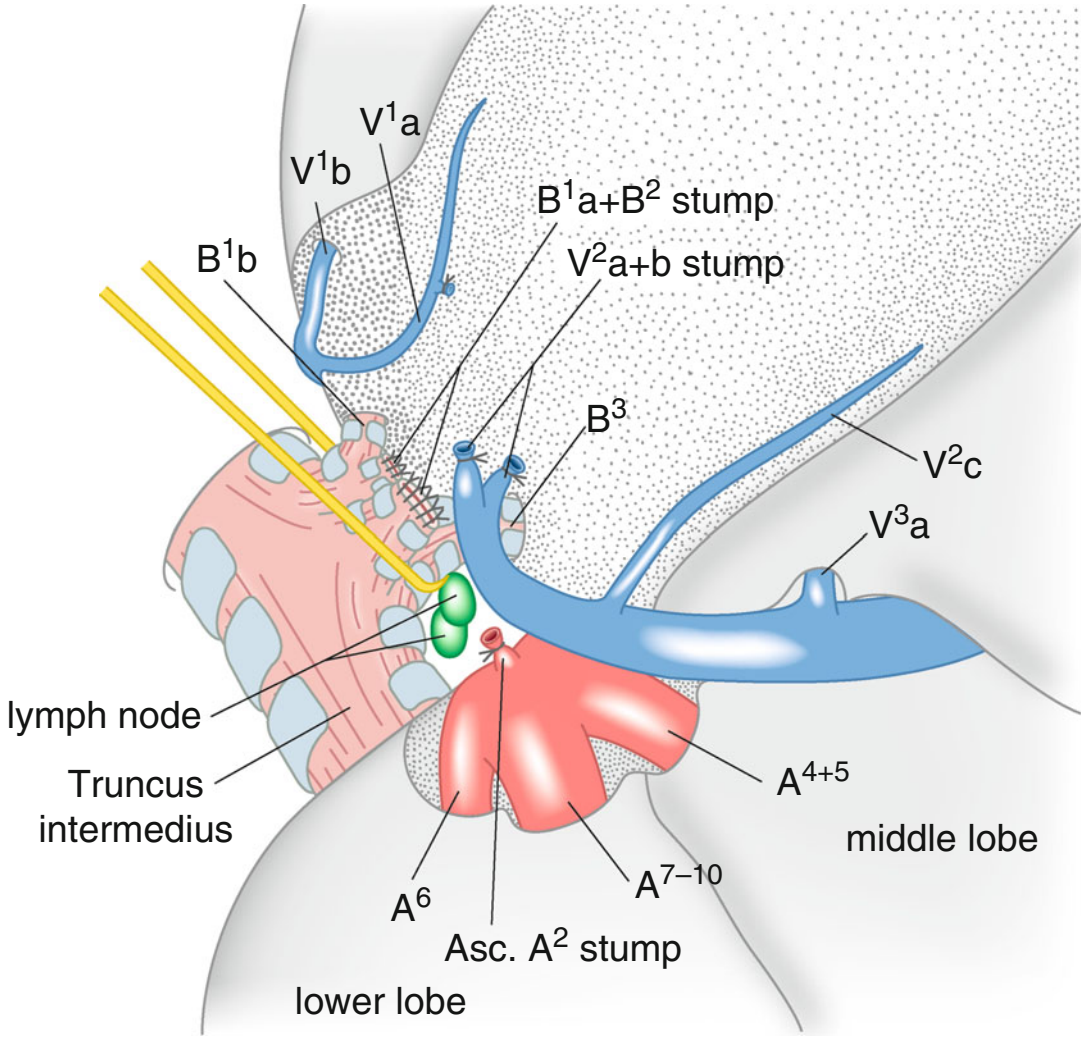


Fig. 3.4.10 V^1a and V^2c run along the intersegmental plane. Hilar lymph node dissection during S^2+S^1a-segmentectomy is relatively simple, because the dorsal site of the hilum is already opened. The right upper lobar bronchus and superior truncus pulmonary artery are encircled with tape to expose the #11s and #12 lymph nodes, which are dissected from both the caudal and cranial sides.