

Right Apical-Posterior Segmentectomy with Abnormal Anterior Segmental Bronchus and Artery: A Case Report

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Case report

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Abstract

Background: Displaced anterior segmental bronchus and pulmonary artery is extremely rare. A keen knowledge of such variations is required in the field of pulmonary segmentectomy, for unawareness of the structural variation could lead to intra- and postoperative complications.

Case presentation: A 50-year-old female presented to our department with suspected lung adenocarcinoma. Preoperative 3-dimensional computed tomographic bronchography and angiography revealed anterior segmental bronchus and anterior segmental pulmonary artery variation: the anterior segmental bronchus derived from the middle lobe bronchus, accompanied by a distally distributed anterior segmental pulmonary artery branch. A right apical-posterior segmentectomy was performed successfully.

Conclusions: The keen observation and proper application of modern imaging technology and operative technique could greatly aid segmentectomy, preventing intra- and postoperative complications from happening.

Introduction

Bronchial variation, which is most commonly seen in right upper lobe¹, encompasses a spectrum of less-than-common distributional patterns of bronchus. There has been case report concerning bronchial variation associated with pulmonary vessel anomalies and incomplete fissure². Unawareness of such anomalies could lead to intraoperative and postoperative complications, especially when using a thoracoscopic approach. There has been a small number of surgical cases reporting apical and posterior bronchial (B1 and B2) abnormalities^{3,4}, however, report of segmentectomy involving anterior segmental bronchus (B3) and artery (A3) is still scant.

It is well documented that anomalous bronchus is frequently associated with under-developed fissure. The appropriate approach to the intersegmental fissure is essential to reduce air leakage, minimize postoperative ventilation-perfusion mismatch and lung function loss. The inflation-deflation technique (IDT)⁵ plays an important role in identifying the intersegmental plane for a thoracoscopic procedure.

Herein we present a case of thoracoscopic right apical-posterior segmentectomy for lung cancer with displaced anterior segment structures and absence of any fissure in the right upper-middle lobe region in which IDT was applied to delineate proper intersegmental plane.

Case Report

A 50-year-old female presented to our department with a part-solid ground-glass nodule. The patient was asymptomatic, and chest CT revealed a part-solid ground-glass nodule of maximum diameter 19*14*19 mm in the right upper lobe (Fig. 1A). An abnormal right B3 was identified in the Chest CT: the right upper bronchus gave rise to apical and posterior segmental bronchi, and the B3 derived from the

right middle lobe bronchus (Fig. 1B); A3 was the third branch of the pulmonary trunk, following apical and posterior branches. Those variations are more clearly displayed in the 3-dimensional computed tomographic bronchography and angiography (3D-CTBA) (Fig. 1C and 1D). The distribution of pulmonary vein was relatively normal. No fissure was detected in the right upper-middle lobe region.

Preoperative examinations include physical examination, electrocardiogram, abdominal ultrasound, hematology examinations, lung function tests, bone scan and echocardiography. All results were normal without evidence of metastasis. According to the eighth edition of TNM staging system, the clinical staging of this patient was stage IA2 (T_{1b}N₀M₀).

A dual-portal thoracoscopic S1 + 2 segmentectomy was determined as the procedure of choice. The apical segmental artery and vein were divided and dissected first. The B1 + 2 was then identified, ligated and divided after the peri-bronchial lymph node dissection. With retraction of the right upper lobe caudally, the posterior segmental pulmonary artery was dissected and divided. Finally, the central vein was dissected and divided. IDT was then applied to delineate the boundary between apical-posterior and anterior segments, which was dissected using multiple staplers (Fig. 2A). Then the right S1 + 2 is retrieved (Fig. 2B and 2C). Intraoperative frozen-section pathologic examination confirmed the diagnosis of invasive adenocarcinoma, a systematic lymph node sampling was then performed. The operation lasted 1 hour and 34 minutes, and the blood loss was less than 50 ml. The postoperative course was uneventful and the patient was discharged on postoperative day 4. Postoperative pathologic examination indicated an acinar predominant adenocarcinoma. There was no sign of involvement of visceral pleural or lympho-vascular invasion. No metastasis was found in the lymph nodes, the pathologic stage was stage IA2 (T_{1b}N₀M₀).

Discussion And Conclusion

Two features of our case are of interest here: the identification of displaced B3, which stemmed from right middle lobe bronchus, and the delineation of intersegmental plane using IDT. To our best knowledge, this is the first surgical case in which the intersegmental plane was determined by IDT in a patient with lung cancer with displaced B3 and A3.

Numerous bronchial anomalies have been described previously. According to Yaginuma¹, the prevalence of bronchial variation is 0.76%, and the majority (84.8%) of bronchial abnormality involves right upper lobe region, however, there have been few surgical cases pertinent to B3 variation reported. This variation is considered extremely rare, especially in patients with lung cancer. One similar case was reported by Nakanishi², in which they performed a right upper lobectomy in a patient with lung cancer and displaced B3.

Various intersegmental plane detecting methods was developed recently. Generally, the majority of them is homogeneous to the “hilum first, fissure last” technique, which is frequently applied when incomplete interlobar fissure is encountered in a lobectomy. Different from Nakanishi et. al, who used intravenous

indocyanine green (ICG) with fluorescence imaging² to recognize intersegmental plane, IDT⁵ is routinely performed in our center. IDT is able to distinctly delineate the proper intersegmental plane in about 10 minutes, bears no risk of anaphylactic reaction and doesn't require fluorescence imaging.

Evidences have been gathering suggesting the equivalency between segmentectomy and lobectomy in early-stage NSCLC provided that margin handling and lymph node harvesting be executed properly^{6,7}. It is generally accepted that segmentectomy with adequate lymph node dissection is appropriate for tumor \leq 2 cm⁸. Therefore, the apical-posterior segmentectomy with systemic lymph node sampling was deemed the procedure of choice for this patient.

In conclusion, the variations of major structures similar to our case warrant particular attention. An appropriate way to address rare abnormalities is to routinize preoperative 3D-CTBA. Surgeons must stay aware of both the common and uncommon patterns of bronchus and pulmonary vessels.

List Of Abbreviations

B1	apical segmental bronchus
B2	posterior segmental bronchus
B3	anterior segmental bronchus
A3	anterior segmental pulmonary artery
IDT	inflation-deflation technique
3D-CTBA	3-dimensional computed tomography bronchography and angiography

Declarations

Ethics approval and consent to participate

This case report was approved by the local institutional and ethics review board. Because it was not a trial, consent to participate was not required.

Consent for publication

Appropriate written informed consent was obtained for the publication of this case report and accompanying images.

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Competing interests

None of the authors declared competing interests.

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Authors' contributions

XZ, GL, and JL carried out the operation and postoperative care of the patient. XZ was a major contributor in writing the manuscript. All other authors contributed to data collection and interpretation, and critically reviewed the manuscript. All authors read and approved the final

manuscript.

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Disclosure:

No authors report any conflict of interest

References

1. Yaginuma H. Investigation of displaced bronchi using multidetector computed tomography: associated abnormalities of lung lobulations, pulmonary arteries and veins. *General thoracic and cardiovascular surgery*. 2020;68(4):342-9.
2. Nakanishi K, Kuroda H, Nakada T, Ueno H, Sakakura N. Thoracoscopic lobectomy using indocyanine green fluorescence to detect the interlobar fissure in a patient with displaced B3 and absence of fissure: A case report. *Thorac Cancer*. 2019;10(7):1654-6.
3. Shiina N, Kaga K, Hida Y, Sasaki T, Hirano S, Matsui Y. Variations of pulmonary vein drainage critical for lung resection assessed by three-dimensional computed tomography angiography. *Thorac Cancer*. 2018;9(5):584-8.
4. Hayashi K, Motoishi M, Horimoto K, Sawai S, Hanaoka J. Left upper division segmentectomy with a simultaneous displaced bronchus and pulmonary arteriovenous anomalies: a case report. *J Cardiothorac Surg*. 2018;13(1):40..
5. Chen L, Wu W. [The Main Technical Points of Thoracoscopic Anatomical Lung Segment Resection]. *Zhongguo fei ai za zhi = Chinese journal of lung cancer*. 2016;19(6):377-81.
6. Stiles BM, Mao J, Harrison S et al. Extent of lymphadenectomy is associated with oncological efficacy of sublobar resection for lung cancer ≤ 2 cm. *The Journal of thoracic and cardiovascular surgery*. 2019;157(6):2454-65.e1.

7. Lin G, Liu H, Li J. Lobectomy versus sub-lobar resection in patients with stage IA right middle lobe non-small cell lung cancer: a propensity score matched analysis. *Journal of thoracic disease*. 2019;11(6):2523-34.
8. Roman M, Labbouz S, Valtzoglou V et al. Lobectomy vs. segmentectomy. A propensity score matched comparison of outcomes. *European journal of surgical oncology: the journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology*. 2019;45(5):845-50.

Figures

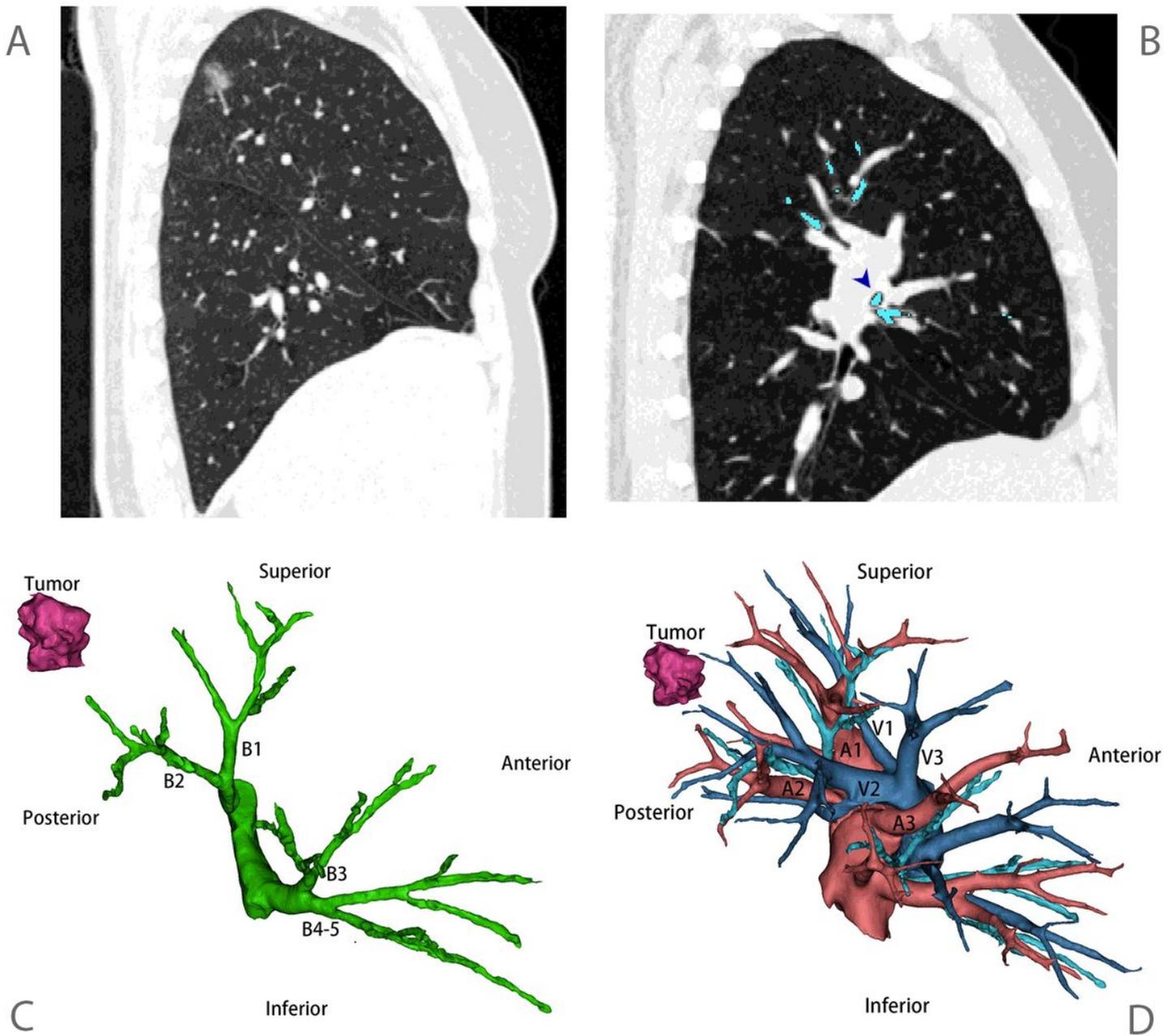


Figure 1

Preoperative computed tomographic and 3-dimensional computed tomographic bronchographic and angiographic images. 1A: sagittal image showing a nodule resides in the apical-posterior segment. 1B: sagittal image showing the anterior segmental bronchus derives from the middle lobe bronchus (arrow). 1C: The distribution of right upper and middle lobe bronchi, noted that the anterior segmental bronchus derived from middle lobe bronchus. 1D: The distribution of right upper and middle lobe vessels, noted that the anterior segmental pulmonary artery branched from the pulmonary trunk distally to the branching sites of apical and posterior arteries. The distribution of pulmonary vein is relatively normal.

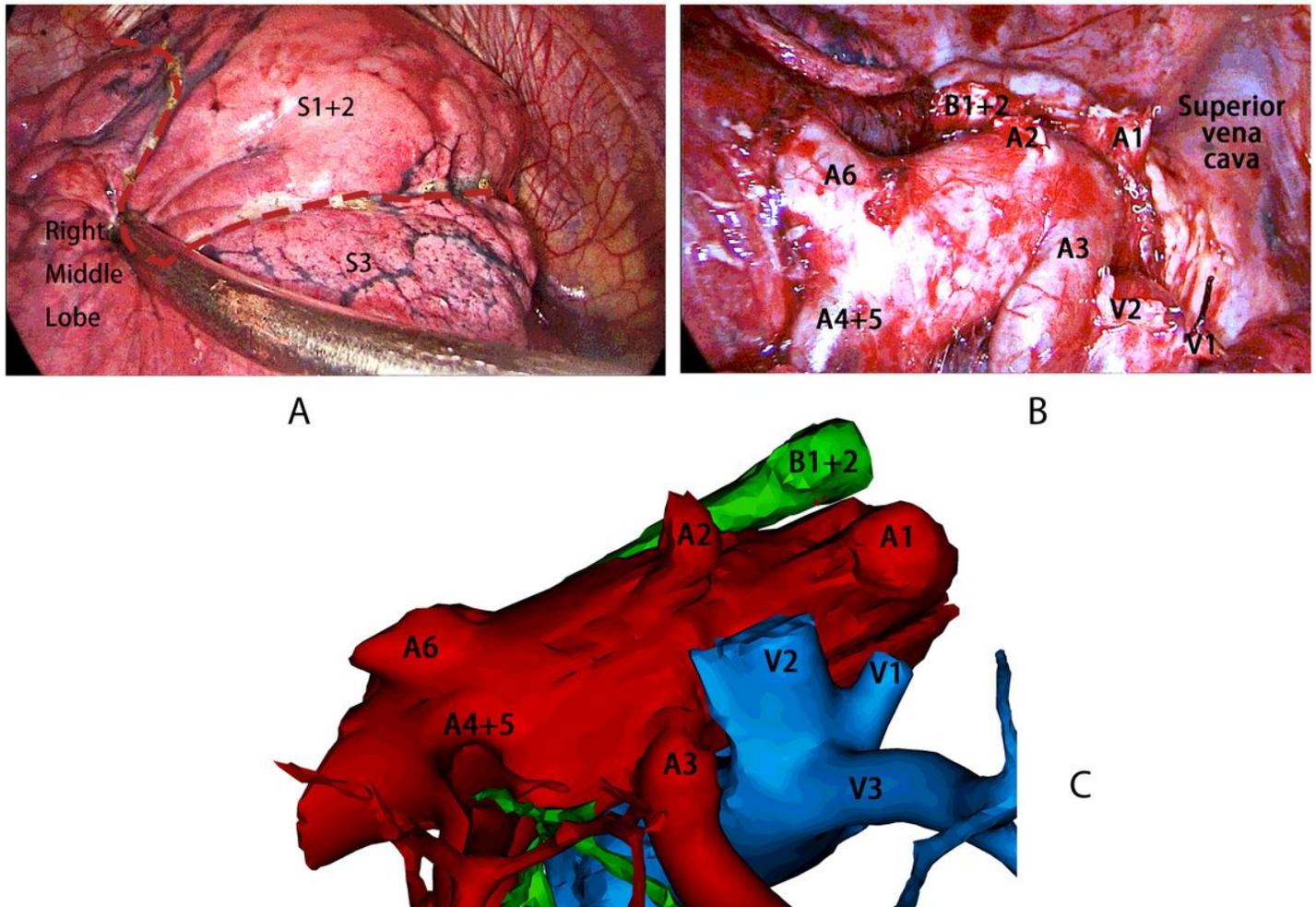


Figure 2

Images of intraoperative findings and simulated 3-dimensional reconstructed hilar structures after apical-posterior segmentectomy. 2A: the intersegmental plane between apical and anterior segments after the inflation-deflation technique is applied (red dashed line). 2B: the hilar structures after the removal of right apical-posterior segments, showing the spatial relationships of branching and tributary points of bronchi, pulmonary arteries and veins. 2C: the simulated 3-dimensional reconstruction graph of hilar structures in a similar view angle of figure 2A.

Supplementary Files

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