Thoracoscopic lobectomy for an aberrant pulmonary artery of mediastinal inferior lobar branch: A case report

Hajime Watanabe¹, Atsushi Wada¹, Tomoki Nakagawa¹, Ryota Masuda², Shunsuke Yamada¹, and Masayuki Iwazaki²

Abstract
We report on a rare case of thoracoscopic surgery for a patient with an aberrant pulmonary artery of the inferior lobar branch (A7) in the right lower lobe. A 69-year-old woman presented with a chief complaint of an abnormal shadow on chest radiography. Computed tomography (CT) revealed a 14-mm solid nodule in the right lower lobe. The patient was diagnosed with lung cancer by bronchoscopic biopsy, and a surgery was planned. Preoperative thin-slice CT and three-dimensional CT showed an aberrant A7 branching from the right main pulmonary artery. The right lower lobe and lymph node dissection was performed safely under a video view. Preoperative evaluation of this anomaly is important for a safe surgery.

Keywords
lung cancer, thoracoscopic surgery, computed tomography, aberrant pulmonary artery

Introduction
We report a case of thoracoscopic surgery for a patient with an aberrant mediastinal basal pulmonary artery (A7) in the right lower lobe. The aberrant vessel flow is completely different from that of a normal pulmonary artery (PA). Thus, the surgical risk of vessel injury during right lower lobectomy is expected to increase. With extreme care, systemic inferior mediastinal nodes dissections is required.

Case report
A 69-year-old woman presented with a chief complaint of an abnormal shadow in the right lung field on chest radiography during a medical check-up, which prompted referral to our department. The patient was a non-smoker with a history of fibroid surgery. Computed tomography (CT) revealed a 14-mm solid nodule in the right lower lobe with no signs of lymph node or distant metastases. Pulmonary adenocarcinoma (cT1bN0M0) was diagnosed based on bronchoscopic biopsy. Preoperative thin-slice CT and 3D-CT showed an aberrant A7 branching from the dorsal side of the right main pulmonary artery, running from the caudal side of the middle lobe pulmonary vein to the mediastinal side of the intermediate bronchus and flowing into S7 (Figures 1 and 2(a)). The patient underwent thoracoscopic resection of the right lower lobe and lymph node dissection (ND2a-1). Interlobar dissection between the middle and lower lobes of the mediastinal side was carefully performed. The mediastinal A7 branch was confirmed between the middle lobe vein and the inferior pulmonary vein (IPV) in the anterior lung hilum (Figure 3). Prior to the transection of the lower lobe bronchus, A7 was dissected in the following order: IPV dissection, interlobar formation, dissection of the interlobar PA, and dissection of the mediastinal A7 branch. The operative time was 169 min, and the amount of blood loss was 5 mL. The histological diagnosis was solid adenocarcinoma (pT1bN0M0). The clinical course was favorable, and the patient was discharged from the hospital on the fifth day postoperatively.

¹Department of Thoracic Surgery, Tokai University Hachioji Hospital, Hachioji, Japan
²Department of Thoracic Surgery, Department of Surgery, Tokai University School of Medicine, Isehara, Japan

Corresponding Author:
Hajime Watanabe, Department of Thoracic Surgery, Tokai University Hachioji Hospital, 1838 Ishikawa, Hachioji, Tokyo 192-0032, Japan.
Email: wh110193@tsc.u-tokai.ac.jp

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Discussion

Pulmonary artery branching varies among individuals. Subotich et al.\(^1\) reported that among 140 patients who underwent anatomical lung resection, variations in pulmonary blood vessels were observed in 23 patients (16.4%). The mediastinal lingular branch of the left PA is the most common anatomical variation.\(^1\) By contrast, a mediastinal inferior lobar branch of the right or left main PA is extremely rare,\(^2,3\) especially on the right side.\(^4\) Since 2007, for patients with thoracoscopic anatomical resections, enhanced multidimensional CT volume data have been used to construct pulmonary vessels from the initial two-dimensional maximum intensity projections to a three-dimensional construction in our institution.\(^5\) Abnormal vessels that might be overlooked by conventional CT can be easily detected using these images which allowed us to perform a safe thoracoscopic anatomic resection.

In this study, we performed right lower lobectomy in a patient with a right aberrant mediastinal basal PA (A7). Generally, the right interlobar PA, which runs in the interlobar...
fissures, follows the common basal trunk and divides into two terminal branches that subsequently divide along the segmental bronchus. A6 was the first branch of the right lobar PA and A7 is the second branch in up to 70% of the cases. Conversely, the right mediastinal inferior lobar A7, which is an anomalous branching from the right main PA, descends to the mediastinum, passes behind the middle lobe pulmonary vein, and flows into the lateral basal segment (S7). This flow is completely different from that of the normal PA. The problem with the surgical procedure was that the right interlobar PA is divided at the proximal part of the A6 branch, so the running segment of A7 was not confirmed during the right lower lobectomy. In thoracoscopic procedures, a magnified narrow view makes it difficult to grasp the wide range of anatomical structures compared to thoracotomy under direct vision. This rare abnormal branching of the PA may increase the risk of vessel injury intraoperatively. The problem with the surgical procedure was that the right interlobar PA is divided at the proximal part of the A6 branch, so the running segment of A7 was not confirmed during the right lower lobectomy. In thoracoscopic procedures, a magnified narrow view makes it difficult to grasp the wide range of anatomical structures compared to thoracotomy under direct vision. This rare abnormal branching of the PA may increase the risk of vessel injury intraoperatively.

In our surgical process, the division of the IPV first improved the deployment around the caudal side of the middle pulmonary vein where A7 is located. Following the division of the fissure between the middle and lower lobes and interlobar PA, A7 was easily divided using an end-stapler. Since injury of the branching point of the right main PA may lead to catastrophic bleeding, A7 was divided into a distal portion of this vessel near the interlobar area in this case.

Conclusion

We report a rare case of a mediastinal inferior lobar branch of the right pulmonary artery for lung cancer surgery. Our report suggests that preoperative assessment of the branching pattern of the anomalous pulmonary artery is important for a safe thoracoscopic anatomical resection.

Availability of data

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

(include full name of committee approving the research and if available mention reference number of that approval): Tokai University Hachioji Hospital does not require ethical approval for reporting individual cases or case series.

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Informed consent

Written informed consent was obtained from the patient for their anonymised information to be published in this article.

ORCID iDs

Hajime Watanabe  https://orcid.org/0000-0001-8964-4942
Shunsuke Yamada  https://orcid.org/0000-0001-5575-1061

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