Original Article

Anatomical distribution and clinical significance of translobar bronchi, arteries, and veins hidden in the interlobar fissure

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Background: The interlobar bronchovascular structures hidden in the incomplete interlobar fissures (IFs) are often inadvertently transected during pulmonary resections, which could inevitably lead to accidental injury and potentially compromise the function of the preserved area. A thorough examination of the anatomical distribution of translobar bronchi, arteries, and veins holds significant clinical importance.

Methods: Three-dimensional computed tomography bronchography and angiography (3D-CTBA) data from patients who underwent pulmonary resection between December 2018 and November 2019 were retrospectively analyzed. The translobar bronchi, arteries, and veins were categorized based on their origin and distribution. Surgical results of patients who underwent surgery involving translobar structures were further reviewed.

Results: Among the 310 enrolled patients, incomplete IFs (IIFs) were most frequently observed in horizontal fissures (68.7%), followed by right upper oblique fissures (42.3%), left lower oblique fissures (32.6%), left upper oblique fissures (12.9%), and right lower oblique fissures (11.0%). The incidence of bronchovascular structures was significantly higher in IIFs than in complete IFs (CIFs; 85.5% *vs.* 5.2%, χ^2=1,021.1, P<0.001). A total of three subtypes of translobar bronchi, five subtypes of translobar arteries, and 14 subtypes of translobar veins were identified. Primary subtypes of translobar arteries (frequency >5%) included the left $A^{4/5}$ (18.7%) that branched from $A^{7/8/7+8}$ and the common trunk of right Asc.A^2+A^6 (6.1%). Primary subtypes of translobar veins (frequency >5%) included the right V^2 draining into inferior pulmonary vein (IPV) (5.8%), the interlobar V^3b (58.4%) within horizontal fissures, the right $V^{4/5}$ draining into $V^{2/3}$ (26.1%), the left $V^{4/5}$ draining into IPV (7.4%), the right V^6 draining into V^2 (38.4%), and the common trunk of left IPV and superior pulmonary vein (SPV; 9.4%). Moreover, 12.0% of translobar arteries and 75.0% of translobar veins were mistransected during anatomical pulmonary resection, resulting in gas-exchanging dysfunction in the preserved territory.

Conclusions: Translobar bronchovascular structures exhibited a high incidence and were more commonly present in IIFs. Surgeons should pay increased attention to these structures to prevent accidental injuries during anatomical pulmonary resection.

Keywords: Translobar bronchovascular structure; incomplete interlobar fissure (IIF); anatomical pulmonary resection; three-dimensional computed tomography bronchography and angiography (3D-CTBA)

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Introduction

The lung lobe represents an independent anatomical unit separated by interlobar fissures (IFs) and supplied by its own bronchi and vessels. However, existing reports indicate that an incomplete IF (IIF) is discovered in 83.1% of right lungs and 50.0% of left lungs (1), and certain bronchovascular structures cross or pass through two adjacent lobes within the fused region (2,3). Given that anatomical pulmonary resection necessitates IF separation, hasty dissection could inevitably lead to accidental injury during surgery and potentially compromise the function of the preserved area (4). Nevertheless, the translobar bronchi, arteries, and veins within IFs have not been thoroughly examined.

Preoperative three-dimensional computed tomography bronchography and angiography (3D-CTBA) allows the visualization of anatomical structures and has become an indispensable tool in thoracic surgery (5,6). Accumulated 3D-CTBA data have significantly enhanced our understanding of lung anatomy (7). In this study, 3D-CTBA was employed to analyze the anatomical distribution of translobar bronchi, arteries, and veins hidden in IFs. Surgical results of patients who underwent surgery involving translobar structures were further reviewed to investigate their clinical significance. We present this article in accordance with the STROBE reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-1534/rc).

Highlight box

Key findings
- The incidence of bronchovascular structures was significantly higher in incomplete interlobar fissures (IIFs) compared to complete interlobar fissures (IFs) (85.5% *vs.* 5.2%, χ^2=1,021.1, P<0.001).
- A total of three subtypes of translobar bronchi, five subtypes of translobar arteries, and 14 subtypes of translobar veins were identified.

What is known and what is new?
- An IIF is frequently encountered during pulmonary surgery and certain bronchovascular structures pass through two adjacent lobes within the fused region.
- Anatomical distribution and clinical significance of translobar bronchi, arteries, and veins hidden in the IFs were thoroughly examined herein using three-dimensional computed tomography bronchography and angiography and perioperative findings.

What is the implication, and what should change now?
- Translobar bronchovascular structures exhibited a high incidence and were more commonly present in IIFs. Surgeons should pay increased attention to these structures to prevent accidental injuries during anatomical pulmonary resection.

Methods

Patient collection

Patients who underwent thoracoscopic lung resection from December 2018 to November 2019 at the First Affiliated Hospital of Nanjing Medical University were retrospectively enrolled. Patients who underwent preoperative enhanced computed tomography (CT) examination were included. Patients who had a pulmonary surgery history, blurring CT images, or a missing datum were excluded. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the First Affiliated Hospital of Nanjing Medical University Institutional Review Board (No. 2019-SR-123) and waiver of consent was granted due to its retrospective nature.

Classification of the IFs

An IF is identified on CT images as a thin line of increased attenuation located between lobes. CT images with a 1-mm slice thickness were acquired using a multidetector CT unit (SOMATOM Definition AS, Siemens, Munich, Germany). A discontinuous linear shadow that was not in contact with the mediastinum or interlobar pulmonary artery trunk (IPAT) was considered to represent an IIF. The IF between the right upper lobe (RUL) and the right middle lobe (RML) was horizontal IF (HIF). The IF between RUL (or upper division segment of the left upper lobe) and lower lobe was upper oblique IF (UOIF). The IF between RML (or lingular segment of the left upper lobe) and lower lobe was lower oblique IF (LOIF).

Table 1 Frequency of IIF and its association with translobar bronchovascular structures

Location	IIF	CIF	P
Right lung, n (%)	248 (80.0)	62 (20.0)	
HIF	213 (68.7)	97 (31.3)	
V	205 (96.2)	7 (7.2)	<0.001
A	1 (0.5)	0 (0.0)	>0.99
AV	1 (0.5)	0 (0.0)	>0.99
BV	3 (1.4)	0 (0.0)	0.555
UOIF	131 (42.3)	179 (57.7)	
V	107 (81.7)	22 (12.3)	<0.001
A	3 (2.3)	2 (1.1)	0.724
AV	13 (9.9)	1 (0.6)	<0.001
LOIF	34 (11.0)	276 (89.0)	
V	12 (35.3)	0 (0.0)	<0.001
A	7 (20.6)	2 (0.7)	<0.001
Left lung, n (%)	114 (36.8)	196 (63.2)	
UOIF	40 (12.9)	270 (87.1)	
V	19 (47.5)	0 (0.0)	<0.001
LOIF	101 (32.6)	209 (67.4)	
V	34 (33.7)	0 (0.0)	<0.001
A	38 (37.6)	20 (9.6)	<0.001
AV	1 (1.0)	0 (0.0)	0.326

IIF, incomplete interlobar fissure; CIF, complete interlobar fissure; HIF, horizontal interlobar fissure; V, vein; A, artery; B, bronchus; UOIF, upper oblique interlobar fissure; LOIF, lower oblique interlobar fissure.

Definition of translobar structures

According to the criteria described by Otsuji *et al.* (1), translobar structures could be classified as cross-lobar type and inter-lobar type. Cross-lobar type branches originated from the predominate lobe and crossed IF into the adjacent non-predominate lobes. Inter-lobar type branches followed the extended line of IF and gave off ramus into adjacent lobes. 3D-CTBA images were reconstructed with Deepinsight software (Key Laboratory of Intelligent Computing in Medical Image, Ministry of Education, Northeastern University, Shenyang, China). We tried to apply nomenclature to bronchovascular structures according to their origin and distribution on 3D-CTBA images unless some branches were too small to be named. For instance, if the vein originated from S^4 and drained to the inferior pulmonary vein (IPV), it was named V^4.

Analysis of surgical results

Surgical results of patients who underwent surgery involving translobar structures were further reviewed based on surgical videos and 3D-CTBA images. When the branches distributed at the nontarget surgical region were mistransected and the diameter of the branches measured on CT images was more than 2 mm, accidental transaction was recorded.

Statistical analysis

Continuous variables were presented as mean ± standard deviation, whereas categorical variables were presented as numbers and percentages. The chi-squared test or Fischer's exact test was used to analyze the association between the completeness of IF and translobar structures. A P value less than 0.05 was considered statistically significant. All the statistical analyses were performed using IBM SPSS version 22.0 for Mac (SPSS Inc., Chicago, IL, USA).

Results

Patient characteristics

A total of 310 of 324 patients were finally included, with eight cases excluded because of blurring CT images, four cases excluded because of a pulmonary surgery history, and two cases excluded because of missing datum. There were 107 males and 203 females with an average age of (53.47±11.46) years. Wedge resections were performed in 53 patients, segmentectomy in 64, and lobectomy in 193.

Frequency of IIF

In the right lung, IIFs were most frequently observed in HIFs (68.7%), followed by UOIFs (42.3%) and LOIFs (11.0%) (*Table 1*). In the left lung, 32.6% of LOIFs and 12.9% of UOIFs were incomplete. More than 85.5% (444/519) of the IIFs were associated with bronchovascular structures, while only 5.2% (54/1,031) of the complete IFs (CIFs) contained bronchovascular structures. The incidence of bronchovascular structures was significantly higher in patients with an IIF (χ^2=1,021.1, P<0.001).

Table 2 Subtypes of translobar bronchovascular structures

Subtype	Classification	Origin	Location	Number (%)
Bronchus				
Right B^3	Cross-lobar	MLB	HIF	1 (0.3)
Right B^{2+3}	Cross-lobar	MLB	HIF	1 (0.3)
Right ULB + MLB	Inter-lobar	RMB	HIF	1 (0.3)
Artery				
Right A^3	Inter-lobar	A^{4+5}	HIF	2 (0.6)
Right A^2+A^6	Inter-lobar	IPAT	UOIF	19 (6.1)
Right $A^{4/5}$	Inter-lobar	$A^{7/8/7+8}$	LOIF	9 (2.9)
Left $A^{4/5}$	Inter-lobar	$A^{7/8/7+8}$	LOIF	58 (18.7)
Left A^8	Cross-lobar	LPA	LOIF	1 (0.3)
Vein				
Right V^3b	Inter-lobar	SPV	HIF	181 (58.4)
Right $V^{4/5}$	Cross-lobar	$V^{2/3}$	HIF	81 (26.1)
Right V^2	Cross-lobar	IPV	UOIF	18 (5.8)
Right V^2	Cross-lobar	SPV	UOIF	4 (1.3)
Right V^2	Cross-lobar	LA	UOIF	7 (2.3)
Left V^{1+2}	Cross-lobar	IPV	UOIF	3 (1.0)
Left V^{1+2}	Cross-lobar	LA	UOIF	2 (0.6)
Right V^6	Cross-lobar	V^2	UOIF	119 (38.4)
Left V^6	Cross-lobar	V^{1+2}	UOIF	14 (4.5)
Right $V^{4/5}$	Cross-lobar	IPV	LOIF	14 (4.5)
Left $V^{4/5}$	Cross-lobar	IPV	LOIF	23 (7.4)
Right V^4+V^6	Inter-lobar	LA	LOIF	1 (0.3)
Right V^{4+5}+V^6+V^7a+V^8	Inter-lobar	LA	LOIF	1 (0.3)
Left SPV + IPV	Inter-lobar	LA	LOIF	29 (9.4)

B, bronchus; MLB, middle lobe bronchus; HIF, horizontal interlobar fissure; ULB, upper lobe bronchus; RMB, right main bronchus; A, artery; IPAT, interlobar pulmonary artery trunk; UOIF, upper oblique interlobar fissure; LOIF, lower oblique interlobar fissure; LPA, left pulmonary artery; V, vein; SPV, superior pulmonary vein; IPV, inferior pulmonary vein; LA, left atrium.

Translobar bronchi

Translobar bronchi were observed in three patients, and all were located in RUL (*Table 2*). The B^3 and B^{2+3} branched from the bronchus of RML and crossed HIF into RUL in each patient. A common stem bronchus of RUL and RML originated from the right main bronchus in one patient (*Figure 1*). The HIFs in these three cases were totally undeveloped.

Translobar arteries

Translobar arteries could be classified into five subtypes (*Table 2*). Within the right UOIF, Asc.A^2 and A^6 branched from a common stem in 6.1% of cases (*Figure 2A-2C*). The right A^3a originated from A^{4+5} and crossed HIF into anterior segment in only two cases. The most frequent subtype (18.7%) was the left $A^{4/5}$ that branched from $A^{7/8/7+8}$ and crossed LOIF into the lingular segment (*Figure 2D-2F*), which occurred in only 2.9% of cases in the right lung. A mediastinal basal artery A^8 originated from left pulmonary artery and crossed LOIF into the anterior basal segment in one case.

Translobar veins

Translobar veins could be classified into 14 subtypes (*Table 2*). It was identified in 98.1% of incomplete HIFs and 7.2% of complete HIFs. The interlobar V^3b ran along HIF, gave off ramus into upper and middle lobes, and drained into superior pulmonary vein (SPV) in 58.4% of cases. The branches of $V^{4/5}$ ran inward and upward, crossed HIF, and drained into $V^{2/3}$ in 26.1% of cases (*Figure 3*).

Within the UOIF, the branch of V^6 originated from the apex of S^6, crossed UOIF, and drained into V^2 in 38.4% of cases in the right lung, which only accounted for 4.5% of cases in the left lung. In addition, the branch of V^2 originated from the back of S^2, crossed UOIF, descended along the posterior bronchus intermedius, and drained into IPV, SPV, and left atrium (LA) in 5.8%, 1.3%, and 2.3% of cases, respectively, in the right lung (*Figure 3A,3B*). Similarly, the branch of V^{1+2} drained into IPV and LA in 1.0% and 0.6% of cases, respectively, in the left lung.

Within the LOIF, the branch of V^{4+5} ran inward and downward, crossed LOIF, and drained into IPV in 4.5% of cases in the right lung (*Figure 3D-3F*), which occurred in 7.4% of cases in the left side. Notably, the right V^{4+5}+V^6+V^7a+V^8 formed a common trunk and directly drained into LA at the bottom of fused LOIF in one patient. Another patient had the same variation with a common trunk of V^4+V^6. The common trunk of SPV and IPV existed in 9.4% of cases in the left side, which exceeded 1 cm in 4.8% (15/310) of cases (*Figure 3G-3I*).

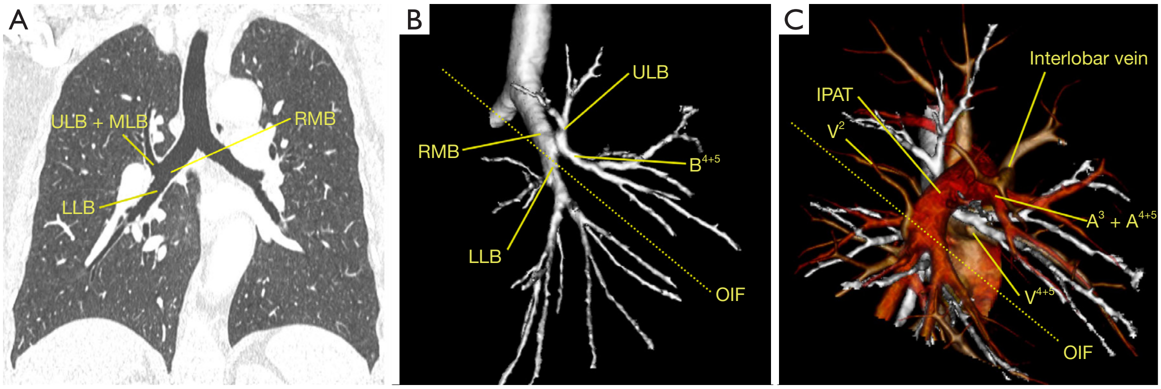


Figure 1 Translobar bronchus. (A) CT images showed a common stem of ULB and MLB originating from RMB. The RUL and RML was completely fused with no evident fissural line. (B,C) 3D-CTBA conformed the common stem of ULB and MLB. The right pulmonary ran downward between the ULB and MLB. The RUL and RML was separated by an interlobar vein. A translobar V^2 crossed the OIF and drained into the IPV in this case. RMB, right main bronchus; ULB, upper lobe bronchus; MLB, middle lobe bronchus; LLB, lower lobe bronchus; OIF, oblique interlobar fissure; IPAT, interlobar pulmonary artery trunk; CT, computed tomography; RUL, right upper lobe; RML, right middle lobe; 3D-CTBA, three-dimensional computed tomography bronchography and angiography; IPV, inferior pulmonary vein.

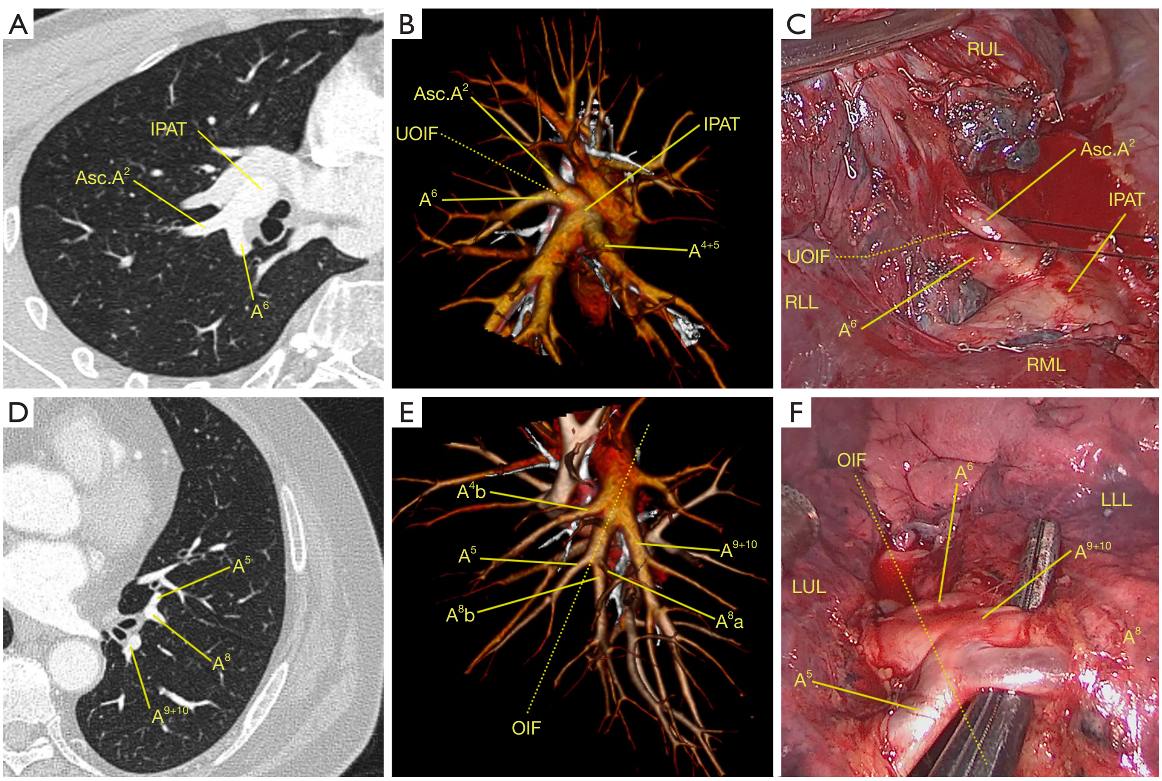


Figure 2 Translobar artery. (A-C) CT images showed a common stem of Asc.A^2 and A^6 originating from IPAT within the well-developed UOIF. Asc.A^2 was severed and A^6 was preserved during the right upper lobectomy. (D-F) CT images showed that the left A^5 branched from A^8 and crossed the fused OIF into the lingular segment. A^8+A^{9+10} and A^6 was severed separately during the left lower lobectomy to preserve A^5. IPAT, interlobar pulmonary artery trunk; UOIF, upper oblique interlobar fissure; RUL, right upper lobe; RLL, right lower lobe; RML, right middle lobe; OIF, oblique interlobar fissure; LLL, left lower lobe; LUL, left upper lobe; CT, computed tomography.

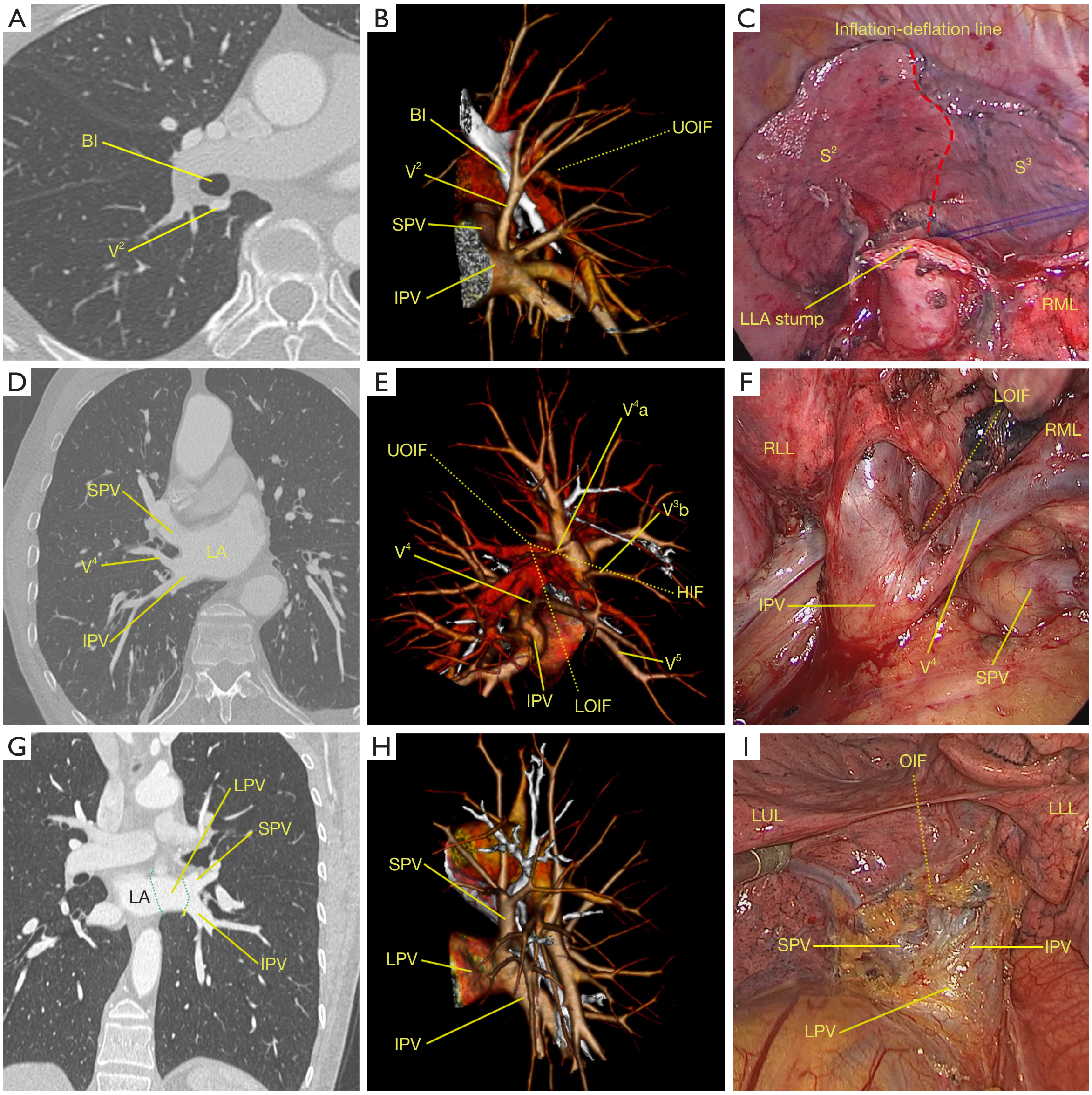
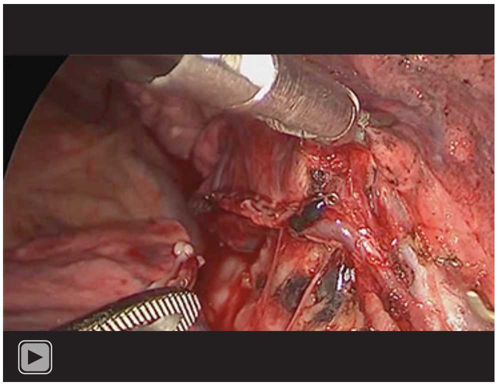


Figure 3 Translobar vein. (A,B) The branches of V^2 originated from the behind of S^2, crossed the incomplete UOIF, descended along the posterior BI, and drained into IPV. (C) The IPV along with V^2 was severed during the right lower lobectomy, forming an inflation-deflation line between S^2 and S^3. (D-F) In this case, V^4 ran inward and downward, crossed the LOIF, and drained into the IPV. The interlobar vein V^3b followed the extended line of HIF, gave off ramus into upper and middle lobes, and drained into SPV. The branches of V^4 crossed the HIF, and drained into V^2. (G-I) The common trunk of left SPV and IPV was 2.14 cm in this case. BI, bronchus intermedius; UOIF, upper oblique interlobar fissure; SPV, superior pulmonary vein; IPV, inferior pulmonary vein; LLA, lower lobe artery; RML, right middle lobe; LA, left atrium; HIF, horizontal interlobar fissure; LOIF, lower oblique interlobar fissure; RLL, right lower lobe; LPV, left pulmonary vein; LUL, left upper lobe; LLL, left lower lobe.

Surgical results

A total of 257 patients underwent anatomical lobectomy or segmentectomy. None of these surgeries involved translobar bronchi. Of 25 surgeries involving translobar arteries, three cases were mistransected and they were all $A^{4/5}$ originating from $A^{7/8}$. Of 32 surgeries involving translobar veins (V^6 that drained into V^2 was excluded because it was too thin),



Video 1 A "tunnel" method to preserve translobar V^4 and V^3b. A unique tunnel above the interlobar V^3b and central vein was created to separate horizontal interlobar fissure and preserve the translobar V^4 and V^3b during the right upper lobectomy.

24 cases were mistransected. The V^3b and $V^{4/5}$ that drained into $V^{2/3}$ were severed in 22 cases of right upper lobectomy. The V^2 that drained into IPV was severed in a right lower lobectomy. The branch of V^{4+5} that drained into IPV was severed in a left lower lobectomy.

Interestingly, a special phenomenon was observed after prolonged suspension of ventilation in the operated side of the lung. The territory supplied by mistransected translobar arteries or veins failed to completely atrophy, whereas the normal area could atrophy completely. A visible inflation-deflation line was visible between the damaged area and the normal area (*Figure 3C*). In contrast, the preserved lobes were not affected when translobar vessels were preserved. For instance, a unique tunnel was created above interlobar V^3b and central vein to separate incomplete HIF and preserve the translobar V^4 and interlobar V^3b during the right upper lobectomy (*Video 1*).

Discussion

The completeness of IF is crucial for the spread of pulmonary diseases and anatomical lung resection. Previous research on IF anatomy has primarily relied on human lung specimens, limited by a small number of samples (2,3). There has been relatively little research on the anatomy of IFs based on CT scans (1), and the findings have largely depended on the anatomical knowledge and CT image interpretation skills of the researchers. This study, for the first time, utilized CT and 3D-CTBA techniques to investigate the anatomy of IFs. The results of this study revealed that the IIFs were most frequently observed in HIFs (68.7%), followed by right UOIF (42.3%), left LOIF (32.6%), left UOIF (12.9%), and right LOIF (11.0%). The completeness of IFs was closely associated with the presence of translobar bronchovascular structures. Furthermore, damage to interlobar structures may impair the physiological function of the preserved regions.

Based on 140 human specimens, Yamashita (2) reported that an incomplete OIF was present in approximately 30–40% of cases in both sides and an incomplete HIF was present in approximately 76% of cases. Otsuji *et al.* used CT images with a 1.5-mm section thickness to determine the frequency of IIF (1). In their report, an IIF was present in approximately 48% of right UOIFs, 38% of right LOIFs, 62% of HIFs, 22% of left UOIFs, and 42% of left LOIFs. Our rate of incomplete LOIF was lower than that reported by Otsuji. One explanation for this was that the movement of diaphragm and occupation of heart resulted in blurry CT images of the LOIF.

Translobar bronchi are considered extremely rare. According to Yaginuma (8), the prevalence of bronchial variation was 0.76%, and the majority (84.8%) of bronchial abnormality involved RUL. Similarly, all the three translobar bronchi in this study were located in RUL. The $B^{2/2+3}$ that branched from B^{4+5} within the fused HIF posed significant challenges in defining the boundary between RUL and RML during right upper lobectomy, because the HIFs were totally undeveloped in these patients (9,10). In this study, a new anomalous bronchial pattern was identified, namely common stem bronchus of RUL and RML. It could not be classified as the left isomerism because the pulmonary artery ran normally caudal and anterior to the bronchus of RUL rather than above it (11) and the vein of RUL was located behind pulmonary artery. In this case, RUL and RML were separated by an interlobar vein, rather than a HIF. Therefore, if RUL resection was performed in this patient, it cannot be simply treated as left upper division segmentectomy.

As for translobar arteries, wrong treatments always happened to $A^{4/5}$ during lower lobectomy. This was mainly because that 18.7% of the left $A^{4/5}$ and 2.9% of the right $A^{4/5}$ branched from $A^{7/8}$, which were more frequent than noted in previous studies (Otsuji: 6.49% in the right and 3.24% in the left) (1). A possible reason was that the branch of $A^{4/5}$ could be more easily identified in 3D-CTBA images. In order to preserve such these down-displaced branches during lower lobectomy, the common basal artery and A^6 should be severed separately. In addition, mediastinal basal pulmonary artery was a special subtype of translobar arteries, which was also called "pitfall branches" that could cause serious vessel injury (12).

As we previously reported (13), translobar veins had the most incidence and subtypes. Most translobar veins located in the fused HIF. Yamashita (2) described them as $V^{4/5/6}$ draining into the interlobar lateral SPV. From our observations, these veins also included interlobar V^3b. These anomalous veins are more likely to be mistakenly severed, so we described a unique tunneling technique to preserve them. The V^2 draining into IPV/SPV/LA along the posterior bronchus intermedius had an incidence of 1.9% to 8.1% in previous studies (4-7), which was consistent with our result (5.8%). The special location of V^2 would increase the risk of accident injure during dissection of the subcarinal, hilar, interlobar lymph nodes, and UOIF (4,14). The common trunk of SPV and IPV in the left lung had an incidence of 11.1% to 14% reported in the literature (5,15), which was also consistent with our results (9.4%). It could be misidentified as an IPV during lower lobectomy and lead to fatal complications (15). However, if detected in time, the stump of SPV could be anastomosed to the atrium (16). Several new anatomical variants were also identified in this cohort, especially the common trunk of V^{4+5}+V^6+V^7a+V^8 flowing into LA directly, which would be informative for exceptional cases.

We found that 12.0% of translobar arteries and 75.0% of translobar veins were mistakenly transected during resection of the target lobe, resulting in an inflation-deflation line in the preserved lobe. The possible formation mechanism might be the gas-exchanging dysfunction of the territory supplied by severed vessels. After cessation of ventilation, gas was rapidly expelled through the airways under the intrinsic retraction force of the lung. With the collapse of the lungs, the small airways gradually closed and the residual gas could only be absorbed by blood circulation (17). Hence, the territory supplied by severed vessels could not deflate completely, while the area that had normal blood circulation could. This process was similar in principle to the inflation-deflation method widely used to define intersegmental planes (18). Therefore, this phenomenon confirmed that resection of translobar vessels indeed compromised the gas-exchanging function of preserved lobes.

Moreover, patients with translobar structures had more severe fused fissures, which made identification of target vessels and division of the fissure more difficult. Therefore, we thought it would be necessary to perform a 3D-CTBA or 3D-CT model as an imaging adjunct for anatomical lobectomy planning. The tunneling technique could be adopted in order to preserve translobar vessels. A vein approach would be very useful to create a "correct" tunnel to separate the incomplete HIFs. In practice, surgeons often have no choice but to intentionally sacrifice vessels that should be preserved, such as the thin V^6 that drained into V^2. Nevertheless, in cases where the translobar vessels were relatively thick and there were no other significant compensatory vessels, preserving these vessels should be prioritized as much as possible. Besides, previous studies demonstrated that incomplete fissures in patients with early adenocarcinoma were strongly associated with poorer long-term outcomes after lung resection (19). Whether the bronchovascular traffic, subpleural lymphatic network, or the spread through air spaces of the tumor through the incomplete fissure plays a role in it remains unknown. If the tumor is near these translobar structures, extensive lobectomy could be necessary for optimal tumor clearance.

The strength of this study is that it used 3D-CTBA, based on large sample size, to describe the anatomical distribution and clinical significance of translobar bronchovascular structures. However, this study has several limitations. First, this study is a single-center retrospective study with potential selection bias. Second, further analysis of the clinical complications caused by accident injury was not carried out because the low morbidity and mismatched information could not lead to a reliable conclusion.

Conclusions

In conclusion, translobar bronchovascular structures exhibits a high incidence rate and are more commonly present in IIFs. Surgeons should pay increased attention to these structures to prevent accidental injuries during anatomical pulmonary resection.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jtd.

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Data Sharing Statement: Available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-1534/dss

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-1534/coif). L.C. was supported by the National Natural Science Foundation of China (No. 81972175), the Major Program of Science and Technology Foundation of Jiangsu Province (No. BE2018746), and the Program of Jiangsu Medical Innovation Team (No. CXTDA2017006). The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the First Affiliated Hospital of Nanjing Medical University Institutional Review Board (No. 2019-SR-123) and waiver of consent was granted due to its retrospective nature.

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