



Epidemiological studies of accessory cardiac bronchus and a new variant

Liqiang Sun, Liqing Dong, Xiuchuan Jia, Yingmin Chen, Shuqian Zhang, Hui Zhang

Department of Radiology, Hebei General Hospital, Shijiazhuang, China

Correspondence to: Yingmin Chen. Department of Radiology, Hebei General Hospital, 348 Heping West Road, Shijiazhuang 050051, China.
Email: yingmin_chen@foxmail.com.

Abstract: Accessory cardiac bronchus (ACB) is a rare tracheobronchial branching abnormality which originates from the medial wall of the intermediate or main bronchus and is directed to the heart. Three types of ACB have been recognized: type (a) is similar to a short diverticulum, type (b) is a long bronchus ventilating a small undeveloped lobule, and type (c) is an intermediate type with a long diverticulum but no bronchial or alveolar arborization. Herein, we report 40 consecutive cases of ACB detected in 10,287 routine spiral computed tomography (CT) examinations of the chest. The frequency of the anomaly was 0.39%. The study included 17 females and 23 males (female to male ratio 1:1.35). A total of 24 cases belonged to type (a), 14 cases were type (b), and 2 cases were type (c). The mean largest diameter of ACB was 7.9 (range, 4.0 to 12.0) mm and the mean length was 7.5 (range, 3.0 to 18.0) mm. The mean ratio of the largest diameter to length was 1.1, the ratio for (a) was often greater than 1, and the ratios of (b) and (c) were often less than 1. The ACB originated from the intermediate bronchus in 29 cases, which accounted for the largest proportion. The ACB originated from the basal bronchus of the lower lobe in 11 cases (6 cases from the right lower lobe and 5 from the left), which has never been reported before and may be a new variant.

Keywords: Epidemiological studies; accessory cardiac bronchus (ACB); new variant

Submitted Jan 21, 2022. Accepted for publication May 26, 2022.

doi: 10.21037/qims-22-68

View this article at: <https://dx.doi.org/10.21037/qims-22-68>

Introduction

Accessory cardiac bronchus (ACB) is a rare tracheobronchial branching abnormality that was first described in 1946 by Brock (1). An ACB is lined by normal bronchial mucosa and has cartilage within its wall, with defects occurring at gestational days 29–30 (2). Previous studies and classifications have shown that ACB originates from the medial wall of the intermediate or main bronchus and is directed to the heart (3). Prior to lung resection, and especially before video-assisted thoracoscopic surgery, it is important that ACB is observed to avoid complications. Surgeons should be aware of the ACB when performing bronchoscopic procedures to reduce the operation time and complications (4). This article examines epidemiological studies of ACB. Interestingly, we found 11 cases of ACB

from the basal bronchus of the lower lobe, and we have attempted to broaden current understanding of the origin and definition of ACB.

Methods

We used Revolution ES 128 slices spiral computed tomography (CT) scanners [General Electric Company (GE), Boston, MA, USA] with the following parameters: 100 kV, 1.0 mm section thickness, 420 mm × 420 mm field of view, and 512×512 matrix. Two-dimensional (2D) and three-dimensional (3D) reconstructed images of the tracheobronchial tree were made for all patients. The included cases were all outpatients, inpatients, and those who underwent physical examination and chest CT scan in the same time frame regardless of age in Hebei General

Hospital. Patients were excluded if they underwent a double lower lobectomy, bronchial resection, or lung transplantation. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by Hebei General Hospital Ethics Committee (IRB No. 2022045). Written informed consent was not required because of the retrospective design.

Results

A total of 40 consecutive cases of ACB were detected in 10,287 routine spiral CT examinations of the chest in Hebei General Hospital from February to March 2021 (*Table 1*). Of these cases, 17 were female, 23 were male, and the age range was 20 to 91 years with a mean age of 52.4 years. The female to male ratio was 1:1.35.

Table 1 Study participant characteristics

No.	Gender	Age (years)	Origin of ACB	Type	Largest diameter (mm)	Length (mm)	Largest diameter/length	Ventilated lobulus	Anomalous fissure
1	F	48	RI	a	8.0	6.5	1.2	–	–
2	M	52	RI	c	6.0	13.0	0.5	–	–
3	F	61	RI	b	9.0	10.0	0.9	+	–
4	F	67	RI	b	11.5	14.0	0.8	+	+
5	M	30	RI	a	9.0	7.0	1.3	–	–
6	M	27	RI	a	8.0	6.0	1.3	–	–
7	M	29	RI	a	11.0	6.0	1.8	–	–
8	F	41	RI	b	5.5	8.5	0.6	+	+
9	F	69	RI	b	10.0	18.0	0.6	+	+
10	M	66	RI	b	8.0	11.0	0.7	+	+
11	F	48	RI	a	8.0	5.0	1.6	–	–
12	M	61	RI	a	8.0	5.0	1.6	–	–
13	F	58	LB	a	7.0	4.0	1.8	–	–
14	M	72	RI	a	8.0	4.0	2.0	–	–
15	M	65	RI	a	9.0	5.5	1.6	–	–
16	M	20	RI	a	9.0	6.5	1.4	–	–
17	F	50	RB	a	5.5	4.5	1.2	–	–
18	F	68	RI	b	9.5	9.5	1.0	+	–
19	M	55	RI	b	5.5	11.5	0.5	+	+
20	M	53	LB	b	5.5	10.5	0.5	+	–
21	F	50	RB	b	4.0	4.5	0.9	+	–
22	M	54	RI	a	9.0	5.0	1.8	–	–
23	M	38	RI	b	9.5	13.0	0.7	+	+
24	F	50	RI	b	5.5	6.5	0.8	+	+
25	F	47	LB	a	9.0	3.0	3.0	–	–
26	M	20	LB	a	5.0	4.5	1.1	–	–
27	F	51	RI	a	12.0	6.0	2.0	–	–

Table 1 (continued)

Table 1 (continued)

No.	Gender	Age (years)	Origin of ACB	Type	Largest diameter (mm)	Length (mm)	Largest diameter/length	Ventilated lobulus	Anomalous fissure
28	M	81	RI	b	11.0	12.0	0.9	+	+
29	M	67	RB	a	6.5	4.5	1.4	-	-
30	M	36	RI	a	9.0	8.5	1.1	-	-
31	F	53	RI	b	8.0	13.0	0.6	+	+
32	M	91	RI	c	7.5	8.5	0.9	-	-
33	M	74	RB	a	6.0	3.5	1.7	-	-
34	M	61	RI	a	10.0	7.0	1.4	-	-
35	F	37	RI	a	9.0	7.5	1.2	-	-
36	F	50	LB	a	7.0	6.5	1.1	-	-
37	M	46	RI	a	4.5	2.5	1.8	-	-
38	M	43	RI	b	11.0	11.0	1.0	+	+
39	F	58	LB	a	6.0	3.5	1.7	-	-
40	M	49	RB	a	6.0	3.0	2.0	-	-

Type (a): the largest diameter is often longer than length, the ratio of the largest diameter to length of type (a) is often greater than 1 (range, 1.1 to 3.0; mean ratio, 1.5). Type (b): the largest diameter is often shorter than length, and the ratio of the largest diameter to length of type (b) is often less than 1 (range, 0.5 to 1.0; mean ratio, 0.7). In this type, all cases had ventilated lobulus, and 10 cases had anomalous fissures (71%). Type (c): the ratio of the largest diameter to length of this is often less than 1 (range, 0.5 to 0.9). F, female; M, male; ACB, accessory cardiac bronchus; RI, right intermediate bronchus; LB, basal bronchus of the left lower lobe; RB, basal bronchus of the right lower lobe; a, type (a) of ACB; b, type (b) of ACB; c, type (c) of ACB.

The frequency of the anomaly was 0.39%, which was higher than that reported previously in Europe or other regions. The patients with ACB were often asymptomatic and some patients had clinical indications, such as a cough, pneumonia, tuberculosis, bronchiectasia, chronic obstructive pulmonary disease (COPD), or cancer. Five patients were diagnosed with pneumonia. Four patients were diagnosed with a mild or slight fever of unknown origin. Five patients were diagnosed with pulmonary nodules. Three patients were diagnosed with malignant tumors. Three patients were diagnosed with tuberculosis, bronchiectasia, and COPD, respectively. Some 20 patients were asymptomatic, and had presented only for a physical examination. The ACBs were observed accidentally or by chance in patients with pneumonia or a fever. However, for patients with pulmonary nodules or lung cancer, especially for those who were preparing for bronchoscopic procedures, prior awareness of the ACB greatly facilitated the reduction of operation time and complications. The mean largest diameter of the 40 ACBs was 7.9 (range, 4.0 to 12.0) mm and the mean length was 7.5 (range, 3.0 to

18.0) mm. The mean ratio of the largest diameter to length was 1:1. The characteristics of each ACB are detailed in *Table 1*.

Three types of ACB were diagnosed in this study. A total of 24 cases (60%) belonged to type (a), 14 cases (35%) were type (b), and 2 cases (5%) were type (c). Type (a) was similar to a short diverticulum; the largest diameter was often longer than the length, and the ratio of the largest diameter to length was often greater than 1 (range, 1.1 to 3.0; mean ratio, 1.5; *Figure 1*). Type (b) was a long type that ventilated a small undeveloped lobule; this type is similar to a long 'ox horn', the largest diameter was often shorter than length, and the ratio of the largest diameter to length was often less than 1 (range, 0.5 to 1.0; mean ratio, 0.7; *Figure 2*). Among the type (b) ACB, all cases had a ventilated lobulus, and 10 cases had anomalous fissures (71%). Type (c) was an intermediate type with a long diverticulum; however, there was no bronchial or alveolar arborization, and the ratio of the largest diameter to length was often less than 1 (range, 0.5 to 0.9; *Figure 3*).

The ACB originated from the intermediate bronchus in

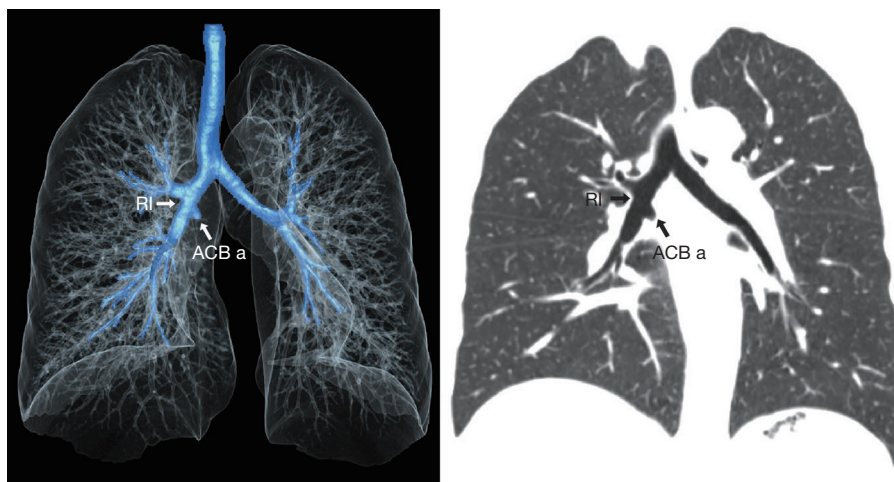


Figure 1 ACB arising from RI in an asymptomatic 48-year-old woman. A 3D image of the tracheobronchial tree shows that ACB arises from the medial wall of the RI. Coronal reformatted CT image reveals that the ACB is a short diverticulum type (a). The largest diameter is longer than the length, and the ratio of the largest diameter to length of type (a) is greater than 1. RI, right intermediate bronchus; ACB, accessory cardiac bronchus; 3D, three-dimensional; CT, computed tomography.

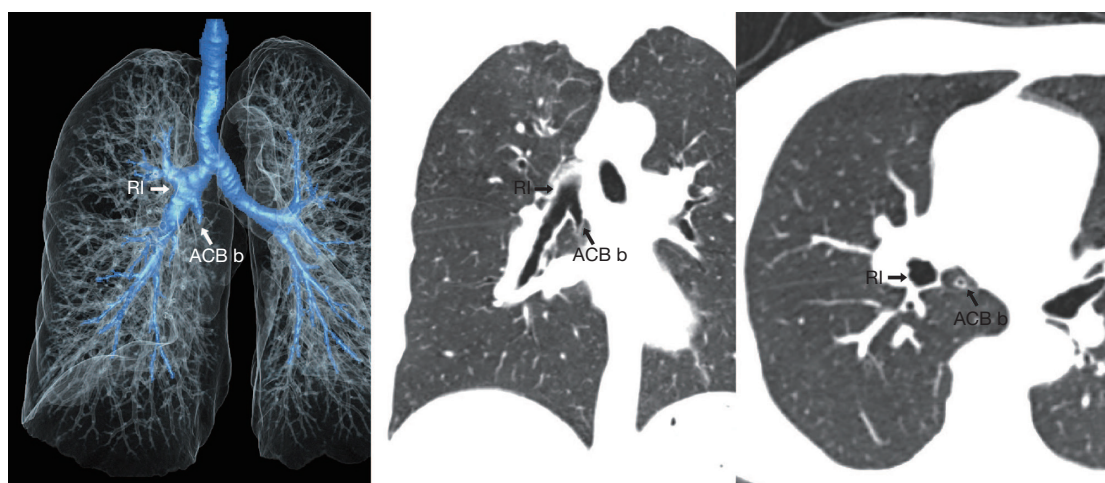


Figure 2 ACB arising from the RI in a 69-year-old woman with pneumonia. A 3D image of the tracheobronchial tree shows that ACB arises from the medial wall of the RI. Coronal reformatted CT image reveals that the ACB is a long type ventilating a small undeveloped lobule with an anomalous fissure categorized as type (b). The largest diameter was shorter than the length, and the ratio of the largest diameter to length of type (b) was less than 1. RI, right intermediate bronchus; ACB, accessory cardiac bronchus; 3D, three-dimensional; CT, computed tomography.

29 cases, which accounted for the largest proportion, and ACB originated from the basal bronchus of the lower lobe in 11 cases [6 cases from the right lower lobe and 5 from the left lobe (*Figures 4-6*)]. The latter had never been reported before and may be a new variant. Regrettably, we did not find an ACB that originated from the main bronchus.

Discussion

Congenital tracheobronchial branching abnormalities are likely to occur early in fetal life. Surgeons need to be aware of ACB when performing bronchoscopic procedures to reduce the operation time and complications. An ACB is a supernumerary bronchus lined by normal bronchial mucosa

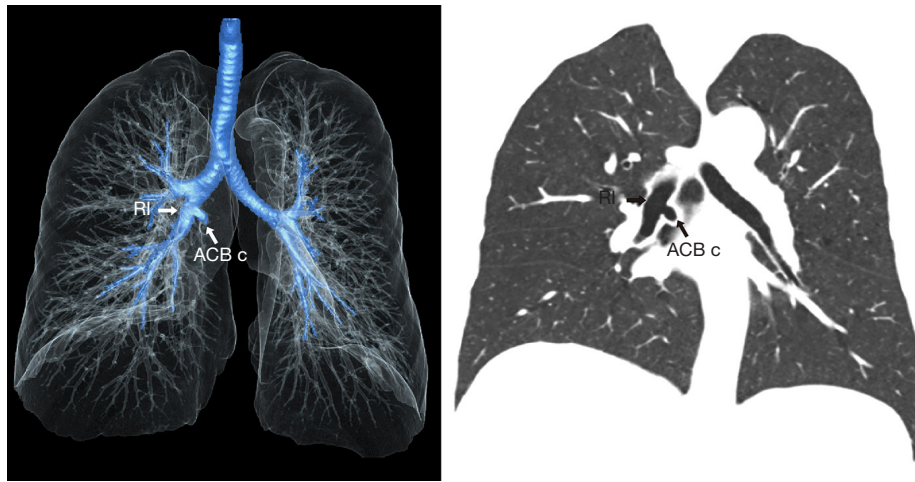


Figure 3 ACB arising from the RI in an asymptomatic 52-year-old man. A 3D image of the tracheobronchial tree shows that ACB arises from the medial wall of the RI. Coronal reformatted CT image reveals that type (c) of the ACB is an intermediate type with a long diverticulum, however, there is no bronchial or alveolar arborization and the ratio of the largest diameter to length of this type was less than 1. RI, right intermediate bronchus; ACB, accessory cardiac bronchus; 3D, three-dimensional; CT, computed tomography.

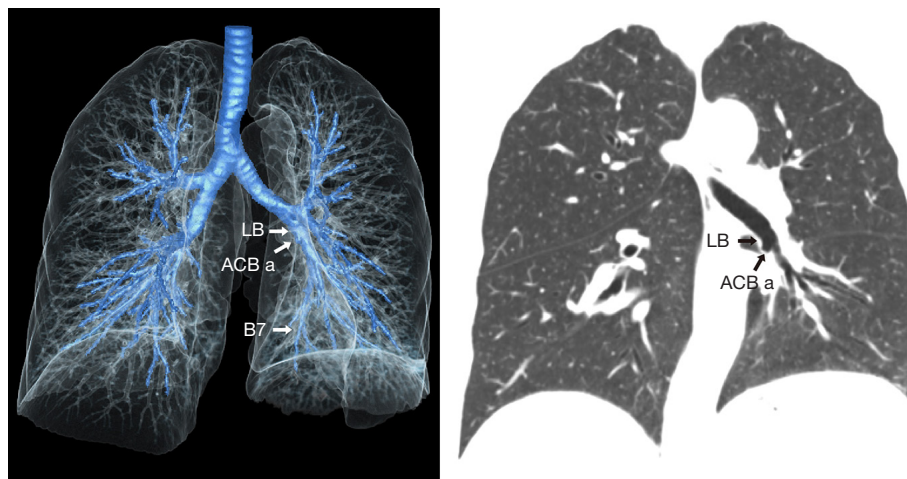


Figure 4 ACB arising from the LB in an asymptomatic 58-year-old woman. A 3D image of the tracheobronchial tree shows that ACB arises from the medial wall of the LB. Coronal reformatted CT image reveals that the ACB is a short diverticulum type (a). The largest diameter is longer than length, and the ratio of largest diameter to length of type (a) is greater than 1. The case displays the complete medial B7 arising from the medial wall of the left lower lobe bronchus besides the ACB. LB, left basal bronchus; ACB, accessory cardiac bronchus; B7, medial basal bronchus; 3D, three-dimensional; CT, computed tomography.

and has cartilage within its wall, with defects occurring at 29–30 days gestation (2). The incidence of ACB is 0.07–0.5% in the general population and it is more common in females (the female to male ratio is 2.8:1) (5). We found that the frequency of the anomaly was 0.39%. Our study identified ACB in 17 females and 23 males (with a female to male ratio of 1:1.35), which differs from previous reports.

Patients with ACB are often asymptomatic; however, some patients might have a cough, hemoptysis (6), recurrent pneumonia, or dyspnea. There are some reports of lung tumors originating from ACB (7). Patients with double or bilateral ACB have been reported. Other bronchial anomalies such as tracheal bronchus and pre-eparterial bronchus have been discovered (8), and the prevalence of

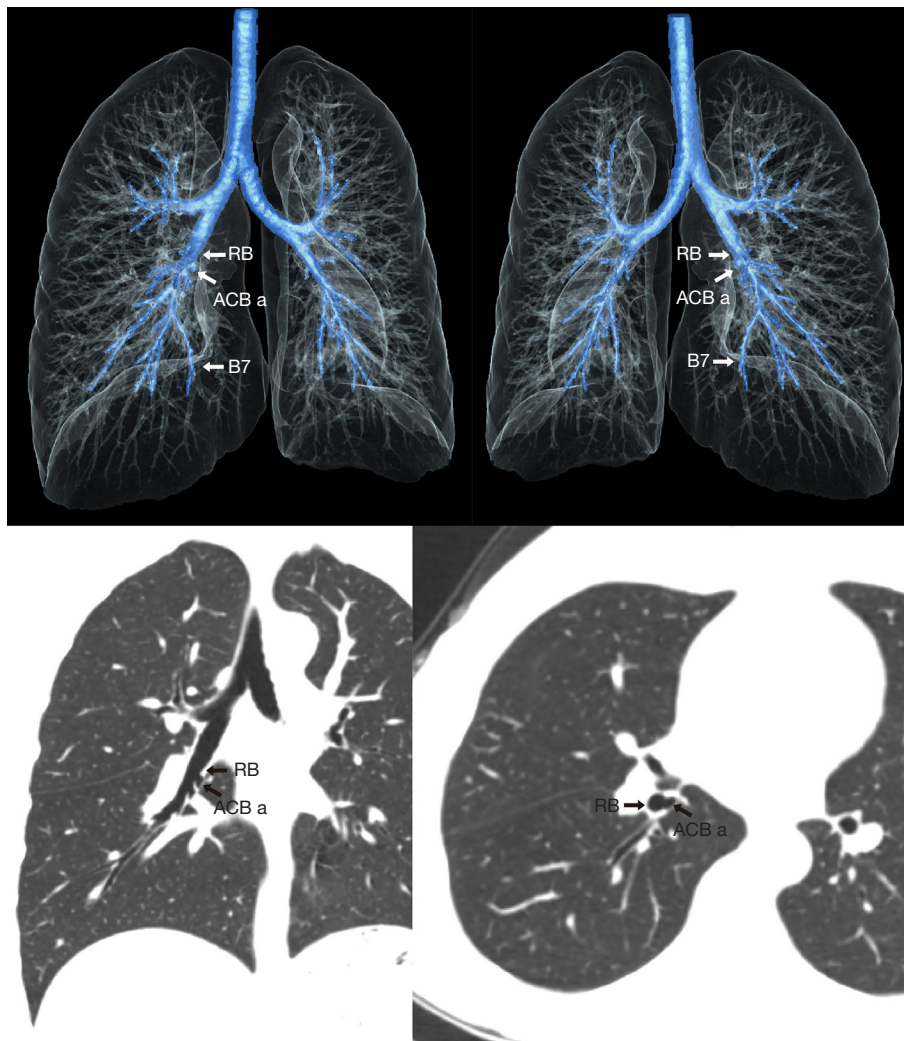


Figure 5 ACB arising from the RB in an asymptomatic 50-year-old woman. A 3D image of the tracheobronchial tree shows that ACB arises from the medial wall of the RB. Coronal reformatted CT image reveals that the ACB is a short diverticulum type (a). The largest diameter is longer than the length, and the ratio of largest diameter to length of type (a) is greater than 1. The case displays the complete B7 arising from the medial wall of the right lower lobe bronchus besides the ACB. RB, right basal bronchus; ACB, accessory cardiac bronchus; B7, medial basal bronchus; 3D, three-dimensional; CT, computed tomography.

ACB in patients with other tracheobronchial positional anomalies is higher (9).

Three types of ACB are currently recognized (5,10): type (a), type (b), and type (c) (11). In our study, the ratio of the largest diameter to length of type (a) was often greater than 1. The ratio of type (b) and type (c) was often less than 1. All cases of type (b) had ventilated lobulus and most had anomalous fissures.

Previous studies and classifications found that ACB originates from the medial wall of the intermediate bronchus or the main bronchus and is directed to the

heart (3). Trisolini *et al.* (12) reported the first case of ACB originating from the tracheal carina. However, the ACB arising from the basal bronchus has never been reported. Although Ghaye *et al.* (13) reported a case of ACB originating from left main bronchus, we are the first to report on 11 cases of ACB that originated from the basal bronchus of the lower lobe (6 cases from the right lower lobe and 5 from the left). The differential diagnose is the medial basal segmental bronchus (B7). The B7 is a kind of bronchus that arises from the medial wall of the lower lobe bronchus (14). The cases herein display the complete B7

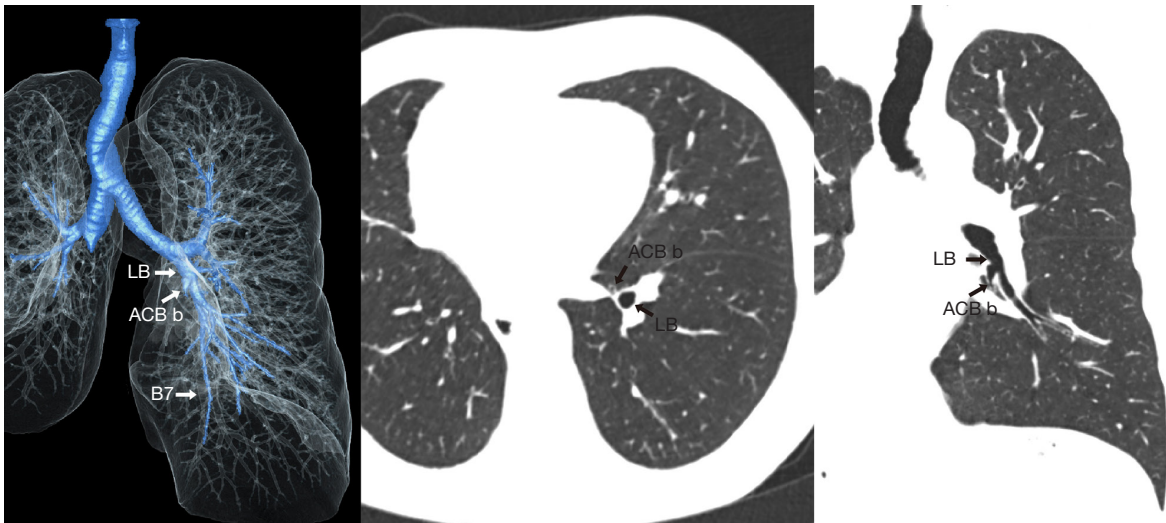


Figure 6 ACB arising from the LB in a 53-year-old man with carcinoma of the right lung. A 3D image of the tracheobronchial tree shows ACB arises from the medial wall of the LB. Coronal reformatted CT image reveals that the ACB is a long type ventilating a small undeveloped lobule with anomalous fissure, type (b). The largest diameter is shorter than length, and the ratio of largest diameter to length of type (b) is less than 1. The case displays the complete B7 arising from the medial wall of the left lower lobe bronchus besides the ACB. LB, left basal bronchus; ACB, accessory cardiac bronchus; B7, medial basal bronchus; 3D, three-dimensional; CT, computed tomography.

arising from the medial wall of the lower lobe bronchus besides the ACB.

We conducted the epidemiological studies of ACB and firstly reported the ACB originating from the basal bronchus, this may be a new variant. Our study also extends the definition and the original location of ACB. And we hope Surgeons could be aware of the ACB when performing bronchoscopic procedures to reduce the operation time and complications.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://qims.amegroups.com/article/view/10.21037/qims-22-68/coif>). The 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. The study was conducted in accordance with the Declaration of Helsinki

(as revised in 2013). This study was approved by Hebei General Hospital Ethics Committee (IRB No. 2022045). Written informed consent was not required because of the retrospective design.

Open Access Statement: This is an Open Access article distributed in accordance with the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

References

1. Brock RC. The anatomy of the bronchial tree. 2nd ed. London: Oxford University Press, 1946.
2. Evans JA. Aberrant bronchi and cardiovascular anomalies. *Am J Med Genet* 1990;35:46-54.
3. Mehta AC, Thaniyavarn T, Ghobrial M, Khemasuwan D. Common Congenital Anomalies of the Central Airways in Adults. *Chest* 2015;148:274-87.
4. Oshiro Y, Murayama S, Ohta M, Teruya T. CT findings of a displaced left upper division bronchus in adults: its

- importance for performing safe left pulmonary surgery. *Eur J Radiol* 2013;82:1347-52.
5. Chassagnon G, Morel B, Carpentier E, Ducou Le Pointe H, Sirinelli D. Tracheobronchial Branching Abnormalities: Lobe-based Classification Scheme. *Radiographics* 2016;36:358-73.
 6. Dogra N, Singla K, Kajal K, Mahajan S, Biswas I. Unusual "cardiac" cause of hemoptysis: Accessory cardiac bronchus. *Ann Card Anaesth* 2021;24:419-21.
 7. Leo F, Galetta D, Borri A, Spaggiari L. Segmentectomy for carcinoid arising from an accessory cardiac bronchus. *Eur J Cardiothorac Surg* 2009;35:537.
 8. Yildiz H, Ugurel S, Soylu K, Tasar M, Somuncu I. Accessory cardiac bronchus and tracheal bronchus anomalies: CT-bronchoscopy and CT-bronchography findings. *Surg Radiol Anat* 2006;28:646-9.
 9. McGuinness G, Naidich DP, Garay SM, Davis AL, Boyd AD, Mizrachi HH. Accessory cardiac bronchus: CT features and clinical significance. *Radiology* 1993;189:563-6.
 10. Mangiulea VG, Stinghe RV. The accessory cardiac bronchus. Bronchologic aspect and review of the literature. *Dis Chest* 1968;54:433-6.
 11. Ohnishi H, Mizuta J, Yokoyama A. Lobulated Accessory Cardiac Bronchus. *Intern Med* 2022. [Epub ahead of print]. doi: 10.2169/internalmedicine.9309-21.
 12. Trisolini R, Paioli D, Betti S, Livi V, Mehta AC. Carinal Bronchus: A Unique Variant of the Accessory Cardiac Bronchus. *Am J Respir Crit Care Med* 2020;202:e70-1.
 13. Ghaye B, Collard P, Pierard S, Sluysmans T. CT presentation of left-sided accessory cardiac bronchus. *Diagn Interv Imaging* 2018;99:827-8.
 14. Ghaye B, Kos X, Dondelinger RF. Accessory cardiac bronchus: 3D CT demonstration in nine cases. *Eur Radiol* 1999;9:45-8.

Cite this article as: Sun L, Dong L, Jia X, Chen Y, Zhang S, Zhang H. Epidemiological studies of accessory cardiac bronchus and a new variant. *Quant Imaging Med Surg* 2022;12(8):4296-4303. doi: 10.21037/qims-22-68