CASE REPORT

Eur. J. Anat. 23(6): 465-468(2019)

An unusual arrangement of accessory fissures observed in left lung

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SUMMARY

Anatomical variation of pulmonary fissures and lobes is common, and may be a source of confusion in the interpretation of signs seen on chest imaging. We report a very rare case of three pulmonary fissures in a plastinated specimen of a left lung, producing a unique lobar pattern consisting of four lobes. To our knowledge, this is the first report of three complete fissures dividing the left lung into four distinct lobes. A left minor fissure courses obliquely across the upper lobe, distinguishing the lingula from the rest of the upper lobe while an inferior accessory fissure demarcates the antero-medial basal segment from the other bronchopulmonary segments of the lower lobe . Recognising the existence of such rare variants is crucial for surgeons performing lobectomies or surgical resection of the lungs. It is also of great clinical significance to radiologists interpreting chest radiographs and computerised tomography (CT) scans to identify and diagnose lung lesions.

Key words: Accessory fissures – Accessory lobes – Lobectomy – Lung variations – Bronchopulmonary abnormalities

INTRODUCTION

Pulmonary fissures are deep clefts separating the lungs into lobes and are usually lined by visceral pleura. Typically, a horizontal and oblique fissure divide the right lung into upper, middle and lower lobes while a single oblique fissure separates the left lung into upper and lower lobes. Interlobar fissures ease the movement of lobes against one another, allowing for uniform distension of the lungs (Meenakshi et al., 2004). The classical fissures may be categorised into complete, more than half complete or less than half complete, based on the depth of the fissure (Medlar, 1947). Each lobe consists of a series of bronchopulmonary segments, which are functionally independent units of the lung. The right lobe classically consists of 10 bronchopulmonary segments and the left lung has 8 to 10 segments (Snell and Mackay, 2008).

Accessory fissures are normal anatomical variants that divide the lung parenchyma, appearing between bronchopulmonary segments or sometimes even within a segment (Foster-Carter, 1946; Boyden, 1955). Variation in lobation patterns is one of the most common bronchopulmonary abnormalities and has been reported in post-mortem examinations as early as 1885 (Maylard, 1885). Since then, the various types of accessory fissures observed have been extensively described, providing appropriate nomenclature to identify such anomalies (Foster-Carter, 1946; Boyden, 1955; Watanabe, 2016).

Although defective embryonic lung development gives rise to these supernumerary fissures, they do not seem to have any pathological consequences. Yet, they have several important surgical and diagnostic implications. For example, the nature of the pulmonary fissures is an important consideration in surgery, as incomplete fissures can play a

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Submitted: 29 August, 2019. *Accepted:* 30 September, 2019.

part in post-operative air leakage (Craig and Walker, 1997). The most frequently occurring accessory fissures include the azygos fissure, left minor fissure, superior accessory fissure and inferior accessory fissure, among others (Cronin et al., 2010). In our case, the inferior accessory fissure (IAF) and left minor fissure (LMF) are of interest.

The IAF demarcates the medial basal segment from the rest of the lower lobe and may occur on either lung. Its relative incidence on the left lung in comparison to the right is arguable, with frequencies ranging from 0.17% to 18.3% on the left (Trapnell, 1973; Langlois and Henderson, 1980).

The LMF is analogous to the right horizontal fissure but rarely assumes a horizontal position. It is usually more craniad than the right horizontal fissure and its lateral edge usually extends superior to its medial edge (Austin, 1986). Its reported frequency also varies widely from 0.17% to 15% (Medlar, 1947; Boyden, 1949; Langlois and Henderson, 1980). While these accessory fissures have been reported individually, there have been no previous reports of both an IAF and LMF occurring together in a left lung to our knowledge.

Appreciating normal anatomical variation and novel lobar patterns in human specimens has important clinical implications for surgical planning as well as interpretation of radiographs and computerised tomography (CT) scans. It is thus imperative to create awareness about these variants among medical students during anatomy teaching.

CASE REPORT

We report here the case of two accessory fissures occurring in addition to a normal complete oblique fissure in a plastinated specimen of a left lung. The plastinated specimen was obtained from Gubener Plastinate (Guben, Germany) by Lee Kong Chian School of Medicine, Singapore for anatomy teaching purposes. Data pertaining to the donor to whom the lung specimen belongs was not made available. During routine teaching, this unique four- lobed left lung pattern was incidentally observed (Fig. 1a). The abnormal lobar pattern can be noted upon observation of the costal surface and base of the lung. Further examination of the specimen revealed the presence of two accessory fissures, namely a left minor fissure and an inferior accessory fissure.

The left minor fissure begins at the hilum of the lung and runs almost parallel to the oblique fissure, joining the oblique fissure approximately 2/3 along the course of the oblique fissure (Fig. 1a, b). Thus, the fissure likely separates the lingula from the anterior and apico-posterior bronchopulmonary

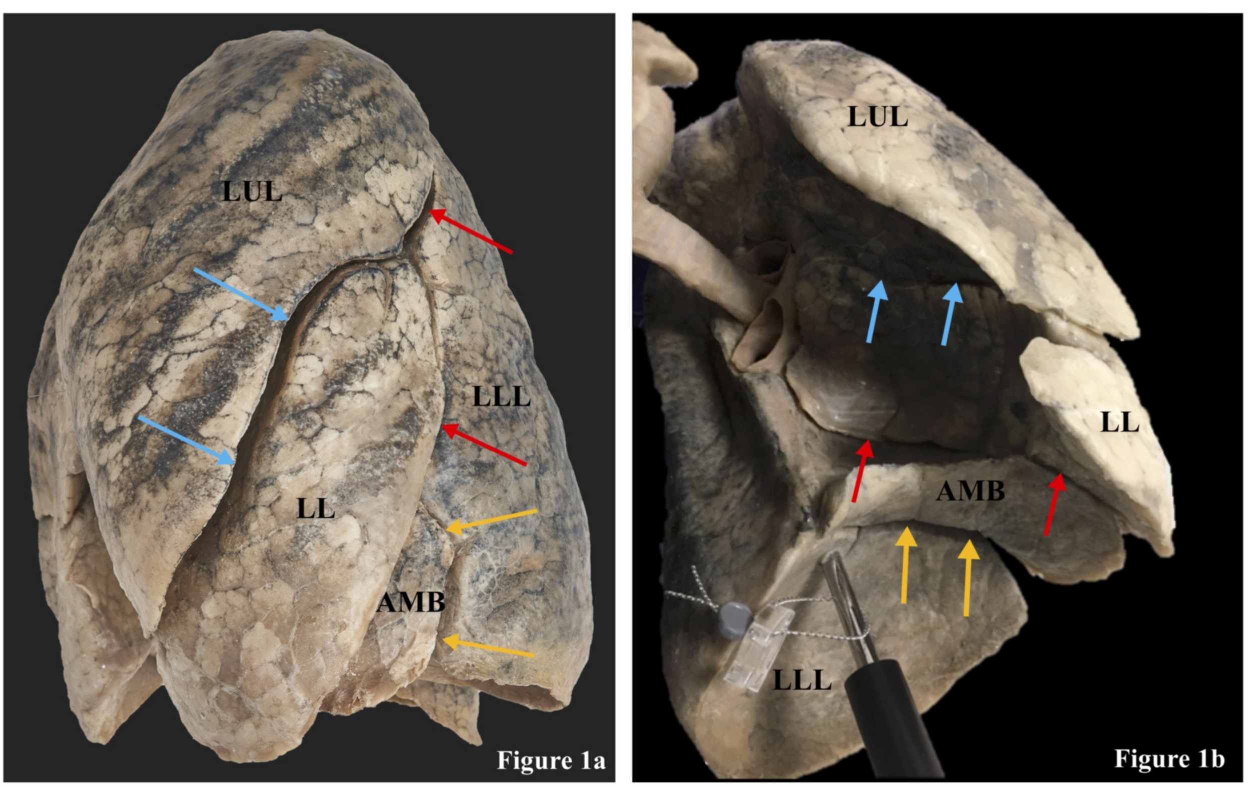

Fig 1a. Photograph of the costal surface of a plastinated left lung showing the oblique fissure (red arrows), left minor fissure (blue arrows) and inferior accessory fissure (yellow arrows). (LUL – left upper lobe, LL – lingular lobe, LLL – left lower lobe, AMB – antero-medial basal segment).

Fig 1b Photograph of the base of the left lung showing the inferior accessory fissure (yellow arrows) extending antero-medially to meet the inferior edge of the pulmonary ligament. (LUL – left upper lobe, LL – lingular lobe, LLL – left lower lobe, AMB – antero-medial basal segment).

segments of the upper lobe. The inferior accessory fissure observed also joins the oblique fissure on the costal aspect of the lung and extends to the inferior edge of the pulmonary ligament (Fig. 1b), possibly delineating the antero-medial basal segment from the remaining left lower lobe.

COMMENTS

Anatomical variants in lung fissures and lobes arise due to defective obliteration of fissures during embryonic lung development. Early in embryonic development, at approximately 5 weeks, the primary lung bud divides into 3 secondary bronchi on the right and 2 secondary bronchi on the left. This is the precursor of the final typical arrangement consisting of 3 lobes on the right and 2 on the left. Condensation of mesenchyme around the bronchial buds produces the lung lobes, separated by clefts that may eventually persist as fissures. As continued branching of the bronchial buds progresses, tertiary segmental bronchi form and each of these, together with the surrounding mesenchyme, make up a bronchopulmonary segment (Pansky, 1982).

The clefts separating bronchopulmonary segments are usually obliterated by fusion except along the planes of the oblique and horizontal fissures seen in the mature lung, which are invested by visceral pleura. Although a causative factor has not been established, it has been suggested that the development of fissures may partly be attributed to the level of protuberance of the bronchial bud at that particular point in time (Boyden, 1955).

Knowledge of anatomical variants and their appearance on X-ray and CT scans has significant clinical value from a diagnostic and surgical point of view. The presence of accessory fissures is especially pertinent for preoperative planning in thoracoscopic segmentectomy or pulmonary lobectomy (Arıyürek et al., 2001). With advancements allowing for more accurate localisation of lung segments and malignancies, sublobar resection is beneficial for patients with diminished pulmonary reserve requiring surgical resection for lung cancer (Congleton et al., 2001). As such, incidental identification of accessory lobes during surgery can pose challenges, highlighting the need for cardiothoracic surgeons to recognise variants early prior to the surgery.

Incongruency between the frequency of accessory fissures identified on chest X-rays or CT scans and the true frequency of these fissures in anatomical specimens can be attributed to several factors including reduced visibility of the fissures due to their subtlety and the orientation of the fissures (Godwin and Tarver, 1985). However, the better resolution offered by high-resolution computed tomography (HRCT) can be used to convey finer anatomical detail. A study using HRCT found an IAF in 21% of subjects, which was consistent with the frequency of the fissure reported from autopsy (30-50%) (Arıyürek et al., 2001).

Radiographic manifestations of accessory fissures may be misinterpreted as the wall of a bulla, a pulmonary scar or as a thin pleural line created by a pneumothorax. Accessory fissures can also produce a sharply demarcated pneumonia that could be wrongly diagnosed as atelectasis, pulmonary consolidation or a mediastinal mass (Godwin and Tarver, 1985). Distinguishing the appearance of these pathological conditions from that of an accessory fissure is vital in avoiding misdiagnosis. Furthermore, accurate characterisation of fissures on CT scans is useful in the diagnosis of pleural tumours that could be mistaken for parenchymal lesions (Cronin et al., 2010).

Considering the vast clinical implications that anatomical variation of the lung lobes and fissures can have, it is crucial to create awareness among medical students and emphasise the frequency of occurrence of these variants during anatomy education.

In conclusion, the case reported here presents a unique combination of accessory fissures observed in a left lung specimen. Awareness of such variants and identification of these fissures through imaging is valuable in the preoperative planning of lobectomies and segmental resections as well as in the interpretation of radiological images and CT scans for accurate diagnosis of pulmonary lesions.

REFERENCES

ARIYÜREK OM, GÜLSÜN M, DEMIRKAZIK FB (2001) Accessory fissures of the lung: evaluation by high-resolution computed tomography. Eur Radiol, 11: 2449 -2453.

ARMSTRONG P, CONGLETON J, FOUNTAIN SW, JAGOE T, MCAULEY DF, MACMAHON J, MUERS MF, PAGE RD, PLANT PK, ROLANF M, RUDD RM, WALKER WS, WILLIAMS TJ, SAUNDERS MI, NICHOLSON AG (2001) Guidelines on the selection of patients with lung cancer for surgery. Thorax, 56: 89-108.

AUSTIN JH (1986) The left minor fissure. Radiology, 161(2): 433-436.

BOYDEN EA (1949) Cleft left upper lobes and the split anterior bronchus. Surgery, 26(2): 167-180.

BOYDEN EA (1955) Developmental anomalies of the lungs. Am J Surg, 89(1): 79-89.

CRAIG SR, WALKER WS (1997) A proposed anatomical classification of the pulmonary fissures. J R Coll Surg Edinb, 42(4): 233-234.

CRONIN P, GROSS BH, KELLY AM, PATEL S, KAZEROONI EA, CARLOS RC (2010) Normal and accessory fissures of the lung: evaluation with contiguous volumetric thin section multidetector CT. Eur J Radiol, 75(2): e1-e8.

FOSTER-CARTER AF (1946) Bronchopulmonary abnormalities. Brit J Tuberc, 40: 111-124.

GODWIN JD, TARVER RD (1985) Accessory fissures of the lung. Am J Roentgenol, 144: 39-47.

LANGLOIS SLP, HENDERSON DW (1980) Variant pulmonary location. Australas Radiol, 24(3): 255-261.

MAYLARD AE (1885) Abnormalities of the lobes of the human lung. J Anat Physiol, 20: 34-38.

MEDLAR EM (1947) Variations in interlobar fissures. Am J Roentgenol Rad Ther, 57(6): 723.

MEENAKSHI S, MANJUNATH KY, BALASUBRAMANYAM V (2004) Morphological variations of the lung fissures and lobes. Indian J Chest Dis Allied Sci, 46: 179-182.

PANSKY B (1982) Review of Medical Embryology. Prentice Hall, Upper Saddle River.

TRAPNELL DH (1973) The differential diagnosis of linear shadows in chest radiographs. Radiol Clin North Am, 11: 77-92.

SNELL A, MACKAY J (2008) Bronchoscopic anatomy. Anaesth Inten Care Med, 9: 542-544.

WATANABE K (2016) Lungs. In: Tubbs SH, Shoja M, Loukas M (eds). Bergman's Comprehensive Encyclopedia of Human Anatomic Variation. Wiley Blackwell, Hoboken.

WINESKI LE (2019) Snell's Clinical Anatomy by Regions. 10th ed. Wolters Kluwer, Philadelphia.