



Morphological Variations of Fissures and Lobes of the Lung: A Cadaveric Study

KEYWORDS

lung fissures, variations, lobes, oblique, horizontal fissure, eparterial bronchus

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ABSTRACT Lung is a vital organ of respiration and is divided by fissures into lobes thereby facilitating movements of lobes in relation to one another. The fissures may be complete, incomplete or absent. Anatomical knowledge of variations of lobes of lung is important for accurate identification of broncho-pulmonary segments during lobectomies, surgical resection of individual segments of lungs. The precise anatomical knowledge of these variations is mandatory for proper radiological interpretation on X rays and CT scans. The present study is conducted on 60 lungs obtained from formalin fixed cadavers in our department of Anatomy. The variations in lobes and fissures and hilar structures were studied in each of the lung and incidence of anomalies noted.

INTRODUCTION

The knowledge of anatomical variation of lobes of lung is important for identifying broncho-pulmonary segments in diseases of the lung. Lungs are pair of respiratory organs situated in the thoracic cavity and are divided into lobes by horizontal and oblique fissures. Each lung is half conical in shape, presents an apex, base, three borders, two surfaces¹. Right lung is divided into three lobes by two fissures, oblique and horizontal. Left lung is divided into two lobes by oblique fissure.

The oblique fissure cuts the vertebral border of both lungs at the level of 4th or 5th thoracic spine. Traced downwards on the medial surface, it ends above the hilum just above the gap between the pulmonary artery and left principle bronchus. When traced downwards on the costal surface, it continues across the diaphragmatic surface and turn upwards on to the medial surface ends just below the lower end of the hilum.²The more vertical left oblique fissure is approximately indicated by the vertebral border of the scapula in fully abducted arm.³ Horizontal fissure passes from the anterior margin into the oblique fissure to separate a wedge shaped middle lobe from the upper lobe.

The fissures may be complete, when the lobes are held together only at the hilum by the bronchi and pulmonary vessels. The fissures may be incomplete when there are areas of parenchymal fusion between the lobes, or the fissures may be absent altogether.

Accessory fissures are not uncommon and cannot be appreciated by routine radiological scans. The commonly found accessory fissures are superior accessory fissure, inferior accessory fissure and left minor fissure⁴. The anatomical knowledge of fissures and the lobes of the lung are important for accurate interpretation on x rays and CT scan and is also important for identifying broncho-pulmonary segments during lung surgeries like lobectomies and resection of individual segments.

Behind the cardiac impression in mediastinal surface each lung shows a triangular depression named the hilum, where the structures which form the root of the lung enter and leave the organ. Both the lungs admit two pulmonary veins and one pulmonary artery through the hilum. The bronchi differ in their mode of subdivision between the left and right lungs. The right bronchus gives off a branch to the superior lobe about 2.5 cm from the bifurcation of the trachea. As this branch arises above the level of the pulmonary artery it is named as the eparterial bronchus. Other division come off below the artery and thus termed hyparterial bronchus. The left bronchus passes below the level of pulmonary artery before it divides and so all its branches are hyparterial.

Hence this study is conducted aiming to find variations in the morphology of lung fissures and lobes and also hilar structures.

Materials and methods

During routine dissection of thorax for the undergraduate students at our medical college over a period of three years, we studied 60 formalin fixed cadaveric lungs (30 right and 30 left sided lungs). Only those lungs which were covered by pleura were included in the study. We studied the variations of fissures, lobes and hilar structures of the lungs.

Observations

Observation A. Right lung variation-

1. Only oblique fissure is present. The horizontal fissure is absent (fig1). The oblique fissure started at mediastinal surface above and behind hilum, passed upwards and backwards and cut the posterior border of the lung. This fissure followed downwards and forwards along the costal surface meeting the anterior border, finally reached lower and anterior part of the hilum. The lung had only superior and inferior lobes. The hilum had only eparterial bronchus and the hyparterial bronchus could not be found (fig 2).

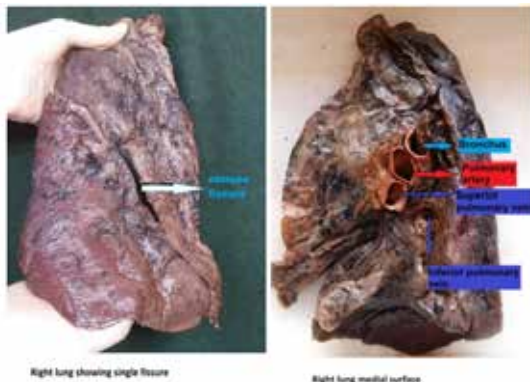


Fig1

Fig 2

Observation B

1.Right lung –Only oblique fissure is seen, horizontal fissure is absent (fig3). The oblique fissure began from the mediastinal surface above the hilum ,passed superiorly and posteriorly and cut the posterior border.It passed inferiorly along the costal surface upto the inferior border of the lung , dividing the base of the lung into approximately anterior one third and posterior two thirds. All the hilar structures are normal (fig 4).



Fig 3. Right lung with single fissure Fig 4. Right lung -mediastinal surface

Fig 3. Right lung with single fissure Fig 4. Right lung -mediastinal surface

2.Left lung-There is no obvious fissure(Fig 5) .There was only pleural thickening along the costal surface in line with the oblique fissure. The thickening extended from postero-superior part of the hilum along the line of oblique fissure upto the junction of anterior and inferior borders. Hilar structures appeared normal (fig 6)



Fig 5. Left lung with absent oblique fissure



Fig 6.left lung with normal hilar structures

Discussion

At around 28thday of fertilization ,the lung tissue grows as multiple broncho-pulmonary buds. Later the fissures that separate individual broncho-pulmonary buds become obliterated. The spaces remain along the interlobar planes to give rise to oblique and horizontal fissures in a fully developed lung⁵.Incomplete or absence of fissure could be due to obliteration of these fissures either completely or partially.

Craig and Walker (1997)⁶ have proposed a fissural classification based on both the degree of completeness of the fissures and the location of the pulmonary artery at the base of the oblique fissure. Four stages have been described. Grade I – complete fissure with entirely separate lobes; Grade II – complete visceral cleft but parenchymal fusion at the base of the fissure; Grade III – visceral cleft evident for a part of the fissure; and Grade IV – complete fusion of lobes with no evident fissural line.

The Present case falls under Grade IV classification.

The fissures facilitate the movement of the lobes in relation to one another, which accommodates greater distention and movement of the lobes during respiration⁷

According to medlar et al⁸,out of 1200 pairs of lungs, horizontal fissure was absent in 45.2%of the right sided lungs. They found that the oblique fissure was absent in 7.3% of left sided lungs .According to meenakshi et al⁹, among 30 right sided lungs, 16.6%had absent horizontal fissure. Berkman et al¹⁰ found by CT in 40 patients the incidence of absent horizontal fissure on right lung was 20%.

As per Godwin et al ⁴ , Horizontal fissure was completely absent in 34.6% and oblique fissure was absent in 8% of the left lungs. Sumita data et al ¹¹ found absent horizontal fissure among 7 out of 50 (13.5%) right sided lungs .

Suja mary Jacob et al ¹² reported absent horizontal fissure in right sided lungs in 6.6% cases. Bhimadevi et al ¹³ found absent oblique fissure in left lung in 2 out of 22 lungs. According to Muralimanju.et al¹⁴, out of 60 adult cadaver lungs, 6 right lungs (18.7%) had absent horizontal fissure and one left lung had (3.6%) absent oblique fissure. Bincy M Gorge et al¹⁵ studied the variations of fissures, lobes and hilar structures in 65 right isolated lungs. Out of all right lungs 2 lungs (3.07%) showed absence of horizontal fissure.

Aeby ¹⁶ first characterized the human lung as asymmetrical because of the presence of a right eparterial bronchus. Boyden ¹⁷ noted that in very rare instances, a left eparterial may also occur (five cases, with only one case in 100 consecutive dissections). Although this variation has an in-

idence of "no more" than 1%, it is of surgical importance that it be recognized when present .

In the present study, we found a single eparterial bronchus on right lung (fig 2)and absent hyparterial bronchus. The lung also had absent horizontal fissure(fig 1).The other right lung had the absent horizontal fissure and with normal hilar structures(fig3,4). we found one left sided lung with absent oblique fissure and normal hilar structures (fig5,6).

The overall incidence of absent horizontal fissureof right lung in our study is 6.6% and incidence of absent oblique fissure is 3.3%.The incidence of absent hyparterial bronchus of right lung is 3.3%.

Conclusion

Among the congenital lung abnormalities, the incidence of incomplete and accessory fissures is more than that of absent fissures. The knowledge of absent fissure of right and left lungs is important for various surgical procedures like lobar resection because there is a high chances of post operative air leak. Absent fissure may alter the usual patterns of collapse and consolidation seen in patients with endobronchial lesions and infections. It may also give rise to atypical type of pleural effusion. Lobar pneumonias usually confined to particular lobe may spread to entire lung in case of absent fissure.

The knowledge of anatomy of fissures and variations of lung may help to clarify confusing radiographic findings. It can also help to explain various radiological appearances of lobar anatomy of the lungs.

Variations in the number and pattern of hilar structures in both human lungs have not been studied in detail by earlier researchers, thus this study adds a database for the same. So, clinicians ,radiologists and, surgeons should keep in mind regarding absent fissure and absent hyparterial bronchus while diagnosing and treating various lung diseases.

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