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Morphological Variations of Fissures of Lungs in Indian Population

Manisha Nakhate[*1], Ruta Bapat[2], VG Sawant[3], Joy Ghoshal[4]

[*1]Associate Professor, Department of Anatomy, Dr D Y Patil Medical College, Nerul, Navi Mumbai
[2]Assistant Professor, Department of Anatomy, Dr D Y Patil Medical College, Nerul, Navi Mumbai
[3]Professor, Department of Anatomy, Dr D Y Patil Medical College, Nerul, Navi Mumbai
[4]Professor and Head, Department of Anatomy, Dr D Y Patil Medical College, Nerul, Navi Mumbai

Abstract:

Introduction: *The lungs are the pair of essential organs of respiration located within the thoracic cavity, on either side of heart. Pulmonary interlobar fissures are important landmarks for proper identification of normal pulmonary anatomy and evaluation of disease. A pulmonary fissure is a boundary between the lobes in the lings. Its segmentation is of clinical interest as it facilitates the assessment of lung disease.*

Objectives: *The purpose of this study was to define the morphological variations of fissures of lungs in Indian population.*

Material & Methods: *Morphological variations of fissures such as complete or incomplete; presence of any variant fissure and accessory fissure of 80 lungs (40 right and 40 left) were studied.*

Results: *Out of 40 right lungs, the horizontal fissure was absent in 5 lungs (12.5%) and incomplete in 4 lungs (10%). Oblique fissure was absent in one lung (2.5%) and incomplete in 3 lungs (7.5%). The complete absence of the horizontal and oblique fissures was reported in one lung (2.5%) and accessory fissures were present in 8 lungs (20%). Out of 40 left lungs, the incomplete oblique fissure was noted in one lung (2.5%) and accessory fissures were present in 5 lungs (12.5%).*

Conclusion*: These variations are of radiological and surgical importance for assessment of lung disease.*

Keywords: ***Lungs, Fissures, Variations, Morphology, Indian Population.***

Introduction:

The lungs are the pair of essential organs of respiration located within the thoracic cavity, on either side of heart.[1] Some symmetry exists between the right and the left lungs. Both lungs are divided into lobes. The gross functional subunits of each lung are called segments and have a close relation with the segmental bronchi. The right lung comprises 10 segments: 3 in the right upper lobe (apical, anterior and medial), 2 in the right middle lobe (medial and lateral), and 5 in the right lower lobe (superior, medial, anterior, lateral, and posterior). The left lung comprises 8 segments: 4 in the left upper lobe (apicoposterior, anterior, superior lingula, and inferior lingula) and 4 in the left lower lobe (superior, anteromedial, lateral, and posterior).[1-3]

Corresponding Author:

Dr. Manisha Nakhate
Associate Professor,
Department of Anatomy, Dr D Y Patil Medical College, Nerul, Navi Mumbai

The lungs are covered by the visceral pleura, which is contiguous with the parietal pleura as it reflects from the lateral surfaces of the mediastinum. The visceral pleura form invaginations into both lungs, which are called fissures. There are 2 complete fissures in the right lung and 1 complete fissure with an incomplete fissure in the left; these separate the different lung lobes. The pleura also form the pulmonary ligament, which is a double layer of pleura that extends caudad along the mediastinum from the inferior pulmonary vein to the diaphragm.[1,3]

A major organ of the respiratory system, each **lung** houses structures of both the conducting and respiratory zones. The main function of the lungs is to perform the exchange of oxygen and carbon dioxide with air from the atmosphere. To this end, the lungs exchange respiratory gases across a very large epithelial surface area-about 70 square meters-that is highly permeable to gases.

The lungs are pyramid-shaped, paired organs that are connected to the trachea by the right and left bronchi; on the inferior surface, the lungs are bordered by the diaphragm.

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The diaphragm is the flat, dome-shaped muscle located at the base of the lungs and thoracic cavity. The lungs are enclosed by the pleurae, which are attached to the mediastinum. The right lung is shorter and wider than the left lung, and the left lung occupies a smaller volume than the right. The **cardiac notch** is an indentation on the surface of the left lung, and it allows space for the heart. The apex of the lung is the superior region, whereas the base is the opposite region near the diaphragm. The costal surface of the lung borders the ribs. The mediastinal surface faces the midline.

At rest, the respiratory system performs its functions at a constant, rhythmic pace, as regulated by the respiratory centers of the brain. At this pace, ventilation provides sufficient oxygen to all the tissues of the body. However, there are times that the respiratory system must alter the pace of its functions in order to accommodate the oxygen demands of the body.

Development of the respiratory system begins early in the fetus. It is a complex process that includes many structures, most of which arise from the endoderm. Towards the end of development, the fetus can be observed making breathing movements. Until birth, however, the mother provides all of the oxygen to the fetus as well as removes all of the fetal carbon dioxide via the placenta.

Pulmonary interlobar fissures are important landmarks for proper identification of normal pulmonary anatomy and evaluation of disease.[1,2] A pulmonary fissure is a boundary between the lobes in the lings. Its segmentation is of clinical interest as it facilitates the assessment of lung disease.[2,3] The left lung is divided into upper and lower lobes by oblique fissure whereas right lung is divided into upper, middle and lower lobes by oblique and horizontal fissure.[1,3] Lung fissures help in a uniform expansion of the lung and they form the boundaries for the lobes of the lungs. Therefore, precise knowledge of their normal position is mandatory for proper understanding of lobar anatomy and locating bronchopulmonary segments.[2,3] The knowledge of morphological variations of fissures is important to clinicians to correctly locate bronchopulmonary segment during pulmonary lobectomy and for radiologists to correctly interpret X-rays and CT scans.[1-3]

Objectives:

The purpose of this study was to define the morphological variations of fissures of lungs in Indian population.

Material and Methods:

Present study was conducted in anatomy department of Dr D Y Patil Medical College, Navi Mumbai-Maharashtra located in western region of India. A total of 80 lungs from dissection room were examined and studied. All 80 lungs were from cadavers dissected in the dissection hall of department of anatomy of Dr D Y Patil Medical College. Out of 80 lungs studied, 40 were right and 40 were of left side. Details of morphological variations of fissures such as complete or incomplete; presence of any variant fissure and accessory fissure were studied. Data was entered and analysed by using Microsoft excel.

Results:

Out of total 80 lungs studied, 40 (50%) were from left side and 40 (50%) were from right side. Out of 40 right lungs examined, the horizontal fissure was absent in 5 lungs (12.5%) and incomplete in 4 lungs (10%) (Figure 1). Oblique fissure was absent in one lung (2.5%) and incomplete in 3 lungs (7.5%). The complete absence of the horizontal and oblique fissures was reported in one lung (2.5%) (Figure 2 & 3). Accessory fissures were present in 8 lungs (20%) (Figure 4). Out of 40 left lungs, the incomplete oblique fissure was noted in one lung (2.5%) and accessory fissures were present in 5 lungs (12.5%) (Table 1).

Table 1: Incidence of variations of fissures in right and left lungs

Interlobar Fissures	Status	Right Lungs (n=40)	Left Lungs (n=40)
Horizontal	Absent	5 (12.5%)	
	Incomplete	4 (10%)	
Oblique	Absent	1 (2.5%)	
	Incomplete	3 (7.5%)	1 (2.5%)
Both Fissures	Absent	1 (2.5%)	
	Incomplete		
Accessory Fissures	Present	8 (20%)	5 (12.5%)

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Fig 1: Absence of horizontal fissure in right lung

Fig 2: Complete absence of both fissures in right lung

Fig 3: Incomplete horizontal fissure lung

Fig 4: Accessary fissure in right and left lung

Discussion:

Variations of fissures of lungs are most commonly encountered. These are mainly due to defective pulmonary development. During the development, as the lung grows the spaces or fissures that separate individual bronchopulmonary buds, segments become obliterated except along two planes evident in the fully developed lungs as oblique or horizontal fissure. Obliteration of these fissures either completely or partially may lead to absence or incomplete fissures. Accessory fissure could be due to non-obliteration of spaces which normally are obliterated.[4] These more frequently encountered in fetal and neonatal lungs compared to the adult lungs.[5]

Incidence of absence of horizontal fissure of right lung in present study (12.5%) is more than Ambali et al study (8%) whereas our values are less than the reports obtained by Meenakshi et al (16.6%) and Prakash et al (57.1%). Incidence of incomplete horizontal fissure of right lung in present study (10%) is less than Ambali et al study (28%), Prakash et al (39.3%) and Meenakshi et al (63.3%). Meenakshi and Prakash et al did not observe absence of oblique fissure in right lung whereas Ambali et al reported (4%) cases and present study showed (2.5%) incidence.

In right lungs, incomplete oblique fissure was observed in 7.5% which is lesser than studies of Meenakshi, Prakash and Ambali (36.3%, 39.3% and 14%). Absence of both fissures in right lungs was noted in present study (2.5%), Meenakshi (3%), Ambali (4%). Incidence of absence of left oblique fissure was noted in 4% of cases by Ambali et al whereas none of the case was reported in rest three study groups.

Incidence of presence of incomplete oblique fissure in the left lungs in the present study is (2.5%) which was comparatively less than Meenakshi et la (46.6%), Prakash (35.7%) and Ambali (18%). Prevalence of accessory fissures in the present study (right-20%, left-12.5%) is less than Ambali et.al (right-38%, left-32%). Study of Prakash & Meenakshi et al did not report accessory fissures.[6] Veeralakshmi K L studied 64 left lungs, 30 lungs showed incomplete and 1 lung with absent oblique fissure. On the right side, out of 30 lungs, 5 lungs had incomplete oblique fissure and 9 lungs had incomplete and 2 lungs with absent horizontal fissure accessory fissure was seen in 6 right and 5 left lungs.[7,8]

A K Singh observed that different studies performed on radiological images reported greater prevalence of incomplete and or absence of pulmonary fissures as compared to their cadaveric study[9]. The wide range of difference in occurrence of major, minor and accessory fissures among different populations might be due to genetic and environmental factors during its development.

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Applied Anatomy: The nature of fissure is of great importance in planning operative strategy for thoracoscopic pulmonary resection where an incomplete fissure may contribute to post-operative air leakage[6]. Knowledge of variations is important for radiologist for proper interpretation. From a radiology point of view an accessory fissure can be mistaken for a lung lesion.[10,11]

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