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Original Research Article

A STUDY OF ANATOMICAL VARIATIONS IN PATTERNS OF FISSURES AND LOBES IN HUMAN LUNGS: A CADAVERIC STUDY WITH CLINICAL SIGNIFICANCE

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ABSTRACT

The lungs are essential organs of respiration and are situated in the thoracic cavity on either side of the mediastinum. The arrangement of lung tissue into lobes by fissures facilitates the movements of the lobes in relation to one another thus helping in uniform expansion of the whole lung in inspiration. The fissure may be complete, incomplete, or absent altogether. In the presence of these major variations, the left lung may have three lobes and the right lung may have four or only two lobes. The identification of the completeness of the fissure is important before lobectomy, individuals with incomplete fissure are more prone to develop postoperative air leaks. Out of total 84 lungs studied, 46 (55%) were from left side and 38 (45%) were from right side. Out of 38 right lungs examined, the horizontal fissure was absent in 10 lungs (26%) and incomplete in 24 lungs (63%). Complete horizontal fissure was seen in 4 lungs (10%). Oblique fissure was absent in 2 lungs (1%) and incomplete in 24 lungs (63%). The complete oblique fissures was reported in 12 lungs (32%). Out of 46 left lungs, the incomplete oblique fissure was noted in 32 lungs (70%) and complete oblique fissures were present in 10 lungs (22%). The oblique fissure was absent in 4 lungs (9%) Studies have recorded the importance of fissural anatomy in explaining various radiological appearances of interlobar fluid, extension of fluid into an incomplete fissure, or spread of diseases through them. Recognition of laterality of fissure in the lung improves understanding of pneumonia, pleural effusion, collateral air drift along with disease, carcinoma spreading within lung, postoperative air leakage in incomplete fissure and misinterpretation of accessory fissure as atelectasis or consolidation, and segmental localization of the lung for thoracic, cardiothoracic surgeons for planning segmental resections or pulmonary lobectomy.

KEY WORDS: Fissure, Lobe, Accessory Fissure, Accessory Lobe.

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INTRODUCTION

The lungs are essential organs of respiration and are situated in the thoracic cavity on either side of the mediastinum. Being vital organs of respiration, the lungs are divided by fissures into lobes which facilitate movements of lobes in relation to one another. Amongst the pair, the right lung is divided into three lobes namely upper, middle and lower by oblique and horizontal fissures. The left lung is divided into two lobes namely upper and lower by oblique fissure [1].

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) [2-4].

The arrangement of lung tissue into lobes by fissures facilitates the movements of the lobes in relation to one another thus helping in uniform expansion of the whole lung in inspiration [5]. 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 [1]. 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.

The fissures facilitate the movement of lobes in relation to one other which accommodate the greater distention and movements of lower lobes during respiration [6]. The fissure may be complete, incomplete, or absent altogether [7]. Accessory fissures are sometimes present which divide the lungs into smaller subdivision. In the presence of these major variations, the left lung may have three lobes and the right lung may have four or only two lobes. The identification of the completeness of the fissure is important before lobectomy, individuals with incomplete fissure are more prone to develop postoperative air leaks [8]. Considering anatomical and clinical importance, an attempt has been made to study the morphology of lung fissures and lobes from specimens obtained from cadavers in South Karnataka, India.

MATERIALS AND METHODS

The present study was conducted in department of Anatomy, Sri Siddhartha Medical College, Tumkur, Karnataka, India. A total of 84 lungs from dissection room were examined and studied. All 84 lungs were from cadavers dissected in the dissection hall of department of anatomy of Sri Siddhartha Medical College. Details of morphological variations of fissures such as complete or incomplete; presence of any variant fissure and accessory fissure were studied and data was analysed.

RESULTS

Out of total 84 lungs studied, 46 (55%) were from left side and 38 (45%) were from right side. Out of 38 right lungs examined, the horizontal fissure was absent in 10 lungs (26%) and incomplete in 24 lungs (63%). Complete horizontal fissure was seen in 4 lungs.(10%). Oblique fissure was absent in 2 lungs (1%) and incomplete in 24 lungs (63%). The complete oblique fissures was reported in 12 lungs (32%). Out of 46 left lungs, the incomplete oblique fissure was noted in 32 lungs (70%) and complete oblique fissures were present in 10 lungs (22%). The oblique fissure was absent in 4 lungs (9%)

Table 1: Showing variations in the oblique fissure of lungs.

Side of lung	Complete Oblique Fissure	Incomplete Oblique Fissure	Absent Oblique Fissure	Total (percentage)
Right	12 (32%)	24 (63%)	2 (1%)	38 (45%)
Left	10 (22%)	32 (70%)	4 (9%)	46 (55%)

Table 2: Showing variations in the horizontal fissure of lungs.

Side of lung	Complete Horizontal Fissure	Incomplete Horizontal Fissure	Absent Horizontal Fissure	Total
Right Lung	4 (10%)	24 (63%)	10 (26%)	38

Table 3: Showing complex variations in fissures of lungs.

S. no	Complex variations of fissures	Number with percentage.
1	Complete oblique fissure with complete horizontal fissure	4 (10.52%)
2	Complete oblique fissure with Incomplete horizontal fissure	8 (21.05%)
3	Complete oblique fissure with no horizontal fissure	0 (0%)
4	Incomplete oblique fissure with Incomplete horizontal fissure	16 (42.10%)
5	Incomplete oblique fissure with no horizontal fissure	8 (21.05%)
6	Absent oblique fissure and absent horizontal fissure	2 (0.05%)

Fig. 1: Complete horizontal fissure of right lung.

Fig. 2: Complete oblique fissure.

Fig. 3: Incomplete oblique fissure

Fig. 4: Accessory fissure and absent horizontal fissure of right lung.

Fig. 5: complete oblique and complete horizontal fissure with accessory fissure of right lung.

Fig. 6: Absent oblique fissure in left lung

Fig. 7: Complete oblique with incomplete horizontal fissure of right lung.

DISCUSSION

The lungs develop from respiratory diverticulum of cranial foregut which subsequently differentiates into various components of respiratory tree and parenchyma. With progressive development, all the spaces between individual bronchopulmonary segments get obliterated except along the lines of division of principal bronchi, where deep complete fissure remains patent dividing the right lung into three lobes and left lung into two lobes. The fissures are oblique and horizontal in position in the right lung and only one fissure is placed obliquely in the left lung [9]. Absence or incompleteness of fissures could be due to obliteration of these fissures either completely or partially. With defect in pulmonary development, there can be variation in the lobes and fissures of lungs.

Several authors have reported varying percentage of incidence of absence of oblique fissure in the right lung, but in the present study, there was one percent incidence of absence of oblique fissure. There was higher percentage of incidence of incomplete oblique fissure in the right lung as compared to the left lung. When compared with other studies, the incidence of the percentage of incomplete oblique fissure of the right lung is more than the previous studies [Table 4]. The incidence of the percentage of incomplete horizontal fissure was more than the previous studies and similar to the values obtained by Divya *et al*. [10] and the study conducted by Thapa and Desai [11].

Study by Nisha et al [9] showed that incidence of absent right oblique fissure high when compared to present study. The incidence of absent left oblique fissure was 4.76% in a study done by Abhilasha and Charulatha [12] while the present study showed an incidence of 9%. The incidence of incomplete left oblique fissure was 10.6% in a study conducted by Varlakshmi et al [13] which is less than all other previous studies and in the present study showed incidence of 70%.

Table 4: Comparative incidence of variations of oblique and horizontal fissures.

Variations in fissures of lungs		Varalakshmi et al. [13] 2014	Divya et al.[10] 2015	Nisha et al. [9] 2014	Abhilasha and Charulata [12] (2015)	Thapa and Desai [11] 2016	Present study 2017
Right oblique fissure	Incomplete (%)	21	10.7	24	17.25	30	63
	Absent (%)	4.8	-	8	0	0	1
Right horizontal Fissure	Incomplete (%)	30	50	32	31.03	50	63
	Absent (%)	10	21.4	40	6.89	20	26
Left oblique Fissure	Incomplete (%)	10.6	14.8	40	28.8	25	70
	Absent (%)	7.3	7.4	0	4.76	15	9

CONCLUSION

Studies have recorded the importance of fissural anatomy in explaining various radiological appearances of interlobar fluid, extension of fluid into an incomplete fissure, or spread of diseases through them. Recognition of laterality of fissure in the lung improves understanding of pneumonia, pleural effusion, collateral air drift along with disease, carcinoma spreading within lung, postoperative air leakage in incomplete fissure and misinterpretation of accessory fissure as atelectasis or consolidation, and segmental localization of the lung for thoracic, cardiothoracic surgeons for planning segmental resections or pulmonary lobectomy. From a radiological point of view, an accessory fissure may commonly be misinterpreted as a lung lesion. On computed tomography scans, accessory fissures are seen as high attenuation curvilinear band.

Conflicts of Interests: None

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