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A Study on Fissural Anatomy of lungs in Adult Human Cadavers – Its Clinical Importance

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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.*

Methods*: 62 adult lungs available in the department were studied and the fissures with respect to the borders were noted.*

Results*: Out of total 62 lungs studied, 30 were from left side and 32 were from right side. Out of 32 right lungs examined, the horizontal fissure was absent in 11 lungs and incomplete in 11 lungs. Complete horizontal fissure was seen in 10 lungs. Oblique fissure was incomplete in 20 lungs. The complete oblique fissures were reported in 12 lungs. Out of 30 left lungs, the incomplete oblique fissure was noted in 12 lungs and complete oblique fissures were present in 17 lungs. The oblique fissure was absent in 1 lung. Horizontal fissure is present in one left lung having three lobes. Studies have recorded the importance of fissural anatomy in explaining various radiological appearances of inter-lobar 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.*

Keywords: *Fissure, Lobe, Accessory Fissure, Accessory Lobe.*

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I. 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.

II. Material and methods

The study was under taken by observing 62 lungs from adult human cadavers obtained by using conventional dissection procedure. 62 lungs were studied and the fissures with respect to the borders were noted and no other anomalies were considered for study. The specimens were photographed and the data obtained was tabulated, analyzed and compared with previous reported studies in literature.

III. Observations

Out of total 62 lungs studied, 30 were from left side and 32 were from right side. Out of 32 right lungs examined, the horizontal fissure was absent in 11 lungs and incomplete in 11 lungs. Complete horizontal fissure was seen in 10 lungs. Oblique fissure was incomplete in 20 lungs. The complete oblique fissures were reported in 12 lungs. Out of 30 left lungs, the incomplete oblique fissure was noted in 12 lungs and complete oblique fissures were present in 17 lungs. The oblique fissure was absent in 1 lung. Horizontal fissure is present in one left lung having three lobes.

Fig 1: Right Incomplete Oblique & Incomplete Horizontal Fissure

Fig 2: Absent Oblique Fissure Left Lung

Fig 3: Left Lungs with Incomplete Oblique Fissure

Fig 4: Left Lung with Horizontal Fissure & Incomplete Oblique Fissure

Fig 5: Right lungs without Horizontal fissures

III. Discussion

During the development, as the lung grows, the spaces or fissures that separate individual broncho-pulmonary buds/segments become obliterated except along two planes, evident in the fully developed lungs as oblique or horizontal fissures. Absence or incomplete oblique or horizontal fissures could be due to obliteration of these fissures either completely or partially. Accessory fissure could be the result of non-obliteration of spaces which normally are obliterated. Incomplete pulmonary fissures indicating partial fusion between lobes are common and more than half of the pulmonary fissures are incomplete. Several authors (9-13) have reported varying percentages of incidence of the incompleteness of the fissures. Medlar(9)in his examination of 1200 pairs of lungs found incomplete oblique fissure in 10.6% and 25.6%of the left- and right-sided lungs, respectively and incomplete horizontal fissure in 17.1% of the right-sided lungs. Oblique fissures were absent in 7.3% of the left-sided and 4.8% of the right-sided lungs; horizontal fissure was absent in 45.2% of the right-sided lungs. In another study of 100 fixed and inflated lung specimens (50 of each side), fusion was observed across the upper right major (oblique)fissure in 70%, across the lower right major fissure in 47%, across the upper left major fissure in 40%, across the lower left major fissure in 46% and across the minor (horizontal) fissure in 94%. In the only available Indian study (14), incomplete and absent horizontal fissure was reported in 21%, and 10.5%, respectively. Incomplete oblique fissure with absent horizontal fissure was described in 5.3% of the right-sided lungs. Incomplete oblique fissure was present in 21% of left-sided lungs. When compared with the study by Lukose *et al*, a higher incidence of variations was observed in the present study whereas nearly similar incidence was observed when compared to the figures quoted in the IEHAV. When compared with the study reported by Medlar(9), the incidence of incomplete fissure was higher and the incidence of absence of horizontal fissure was lower in the present study. 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. In order to provide a frame work for description of operative technique and to allow meaningful comparison between different surgical series, Craig and Walker (15) 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 presence of fissures in normal lungs enhances uniform expansion, and their position could be used as reliable landmarks in specifying lesions within the thorax, in general and within the lungs in particular.

Sometimes, especially in the infant, accessory fissures of varying depth can be seen in abnormal locations of the lung, delimiting anomalous lobes which correspond to the normal broncho-pulmonary segments (17). From a radiological point of view, an accessory fissure is important as it can be mistaken for a lung lesion (16). In this study, one right-sided lung and three left-sided lungs showed accessory fissures. Incomplete fissure may alter the usual patterns of collapse seen in patient with endo-bronchial lesions and may also give rise to atypical appearance of pleural effusions. An incomplete major fissure causes the odd appearance of fluid tracking within the fissure. Incomplete fissures may also alter the spread of disease within the lung. Pneumonia in particular lobe is often limited to that lobe alone by the fissures. In patients with incomplete fissures, pneumonia may spread to adjacent lobes through the incomplete fissures. Odd lobar involvement with carcinoma of the lung, may be explained on a similar basis (18).

IV. Conclusion

Studies have recorded the importance of fissural anatomy in explaining various radiological appearances of inter-lobar 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.

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