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Original Research Paper

Anatomy

VARIANT LOBAR PATTERN OF LEFT LUNG: A CASE REPORT

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ABSTRACT The left lung classically presents two lobes (superior and inferior) divided by one oblique fissure. Anomalous lobar patterns and variant fissures in the left lung have been documented in existing literature. We report one such case detected during routine dissection of thorax region for undergraduate students in the department of Anatomy. The left lung presented with an incomplete accessory fissure separating the superior lingular and anterior bronchopulmonary segments. Knowledge of such abnormal fissures and lobes is extremely important for identification of bronchopulmonary segments. It provides vital information to radiologists and clinicians for accurate radiographic interpretation and diagnosis of various pulmonary lesions and aids the surgeons in successful planning and modification of pulmonary lobectomies and segmental resections.

KEYWORDS : Lung Fissure, Bronchopulmonary Segments, Lobectomies, Anatomical Variations.

Introduction:

Lungs (Pulmones) are paired vital respiratory organs situated in the thoracic cavity on either side of the mediastinum. Both the right and left lungs are anatomically divided into lobes by fissures. This organization facilitates movements of lobes in relation to one another; thereby resulting in uniform expansion of lungs for more air intake during inspiration.[1] The left lung is classically separated into superior and inferior lobes by the oblique fissure which cuts into the whole thickness of the lung, except at the hilum. This fissure passes obliquely downwards and forwards, commencing 6 cm below the apex (where it crosses the posterior border), 2 cm from the median plane at the level of spines of T3 and T4 vertebrae. It crosses the inferior border of the left lung almost at its apex, approximately 7.5 cm from the median plane.[2] Since the boundaries of lung lobes are formed by fissures, the anatomical understanding of their frequency, position and continuity is clinically indispensible for appreciation of the lobar anatomy and location of bronchopulmonary segments.[3]

The fissures can either be complete, incomplete or even absent. If the lobes are held together only at the hilum by the bronchi and pulmonary vessels, the fissures are considered as complete. Areas of parenchymal fusion between the lobes give rise to incomplete fissures, as the cleft fails to reach the hilum.[1] On the other hand, accessory fissures are extra clefts of variable depths lined by the visceral pleura, usually located at the boundaries of bronchopulmonary segments. These are found in upto 50% of the lung specimens.[4]

The knowledge of variant lung anatomy with respect to lobes and fissures is extremely important clinically, as it may lead to misinterpretations of radiographs (X-rays) or computed tomography (CT-scan).[3] It also proves equally beneficial for the cardiothoracic surgeons to plan and perform lobectomies and surgical resections involving individual bronchopulmonary segments.[5]

Therefore, this case report aims to present a unique variation involving the fissures and lobes of left lung observed during routine dissection.

Case Report:

During the routine dissection of thorax region for teaching of undergraduate students in the department of Anatomy, an anatomical variation in the pattern of fissures and lobes was observed in the left lung of a 50 year old male cadaver. No history of any pulmonary disease was documented for the deceased. The fissures, lobes, hilar pattern, etc. of the left lung were carefully examined and relevant measurements were recorded. The specimen was appropriately photographed [Figure 1 and Figure 2].

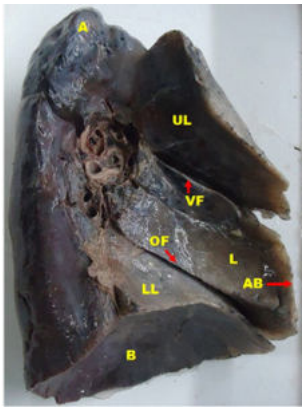

Figure 1: Photograph of the mediastinal surface of left lung showing a Variant Fissure (VF) separating anterior bronchopulmonary segment from Lingula (L). A- Apex, B- Base, AB- Anterior Border, OF- Oblique Fissure, UL- Upper Lobe, LL- Lower Lobe

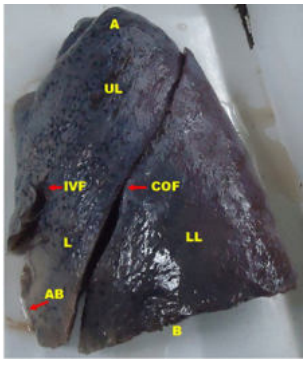

Figure 2: Photograph of the costal surface of left lung showing the Incomplete Variant Fissure (IVF) partially separating anterior bronchopulmonary segment from Lingula (L). A- Apex, B- Base, AB- Anterior Border, COF- Complete Oblique Fissure, UL- Upper Lobe, LL- Lower Lobe.

Observations:

The Left lung presented with a classical complete oblique fissure arising at a distance of 6.5 cm from apex of lung on the vertebral part of the medial surface and passing obliquely forwards and downwards to cross the inferior border at a distance of 3 cm from the anterior border. An accessory fissure was observed approximately 6 cm superior to lingula, separating the superior lingular and anterior bronchopulmonary segments. When viewed from the costal surface, this variant fissure was found to be incomplete, thereby partially dividing the left lung into three lobes. No variation was detected in the hilar structures of the left lung. The right lung of the

same cadaver did not exhibit aberrations of any kind.

Discussion:

Variations observed in the lobes and fissures of lungs are attributed to faults in the embryonic pulmonary development. The lung bud develops as a diverticulum from the ventral part of foregut during the 4th week of intrauterine life and grows caudally to bifurcate into right and left bronchial buds, which further divide respectively into three and two secondary bronchi. Lungs evolve by repeated dichotomous branching of secondary bronchi. Several generations of branching result in the formation of bronchopulmonary segments which are individually segregated by spaces called fissures during foetal life. These fissures get obliterated except along two planes (in line with the division of principal bronchi) manifesting as oblique (major) and horizontal (minor) fissures in adult lungs. Visceral pleura gets reflected along these fissures, covering individual lobes on all sides. Accessory fissures are a consequence of non-obliteration of these spaces. Whereas, incomplete or absent oblique and horizontal fissures result due to defective (either partial or complete) obliteration of these fissures. On the other hand, accessory bronchi and lobes are formed because of monopodial branching of stem bronchi.[3,5,6,7,8]

A fissural classification has been described by Craig and Walker based on the degree of completeness of fissures and the location of pulmonary artery at the base of oblique fissure:

- 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.
- Grade IV: Complete fusion of lobes with no evident fissural line.[9]

The variant fissure observed in the present case represents Grade-III type of the above mentioned classification. Fissural grading holds immense surgical importance as it is extremely beneficial while planning thoracoscopic resections. Post-operative air leak, haemorrhage and other complications often result in cases of incomplete fissures where parenchymal fusion is present, as extensive dissections are required in order to reach bronchi and pulmonary arteries.[10]

The most frequently observed accessory fissures are superior accessory fissure (SAF), inferior accessory fissure (IAF) and left minor fissure (LMF). SAF separates the superior segment of lower lobe (partially or completely) from the basal segments. IAF is typically found around the medial basal segment of lower lobe. Whereas, lingula is separated from the remaining left upper lobe by LMF.[11] Therefore, the accessory fissure presented in this case report can correctly be termed as a left minor fissure.

The left minor fissure has a reported incidence of 7.5 - 29.62 % in autopsy studies conducted across the globe,[10,12,13,14] when compared to 8 - 9 % incidence in high resolution CT-scans.[4,15] This incongruity highlights the significance of prior knowledge of variant fissural and lobar anatomy of lungs for correct radiological interpretations of X-rays and CT-scans. Incomplete fissures result in alterations of the usual patterns of collapse visualized in endobronchial lesions and also gives rise to atypical appearance of pleural effusion. A proper understanding of the accessory fissures helps both clinicians and surgeons to differentiate these from normal anatomical and pathological structures as well as in segmental localization of the lesions of lung and assessment of the pulmonary disease process. Accessory fissures act as barriers to infections spread, creating a sharply marginated pneumonia which might be misinterpreted as atelectasis, consolidation or a pleural scar. The spread of various lung diseases is altered by the presence of incomplete fissures- the typical examples being the spread of pneumonia to the adjacent lobes and odd lobar involvement with carcinoma of lung. Precise delineation of fissural anatomy and the meticulous localization of the pulmonary disease process are important steps in determining the optimal route for diagnosis (eg. fibreoptic endoscopy, transthoracic needle biopsy, etc.) as well as in planning the surgical approaches such as video-assisted or local pulmonary wedge resections and lobectomies, since incomplete fissures cause post-operative air leakage and haemorrhage.[3,16,17]

Conclusion:

Cadaveric studies are unparalled avenues to explore variant human anatomy. Prior knowledge of variant fissural and lobar anatomy of lungs is extremely beneficial in clarification of confounding radiographic findings and pre-operative planning of pulmonary lobectomies and segmental resections.

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