

## STUDY OF MORPHOLOGICAL VARIATIONS OF FISSURES AND LOBES OF LUNG

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### ABSTRACT

**Background:** The lungs are the essential organs of respiration. Fissures are an integral part of human lung. The fissures in lung enhance uniform expansion. These fissures may be complete, incomplete or absent. A detailed knowledge of variations of classical and accessory fissures is necessary for proper radiological interpretation. It is a guide to cardiothoracic surgeons performing segmental lung resections, lobectomies to have an uncomplicated perioperative outcome. Considering the clinical and anatomical importance of this topic, the present study is undertaken.

**Aim of the study:** The cadaveric study was done to note the morphological variation of the fissures of lung and compared it with previous studies.

**Results:** In the present study among 40 adult human cadaveric lungs, the following observation was made; right sided lungs had incomplete oblique fissure in 3 lungs, incomplete horizontal fissure in 10 lungs. Left sided adult lungs had incomplete oblique fissure in 7, absent oblique fissure-1, accessory fissure-3 lungs.

**Conclusion:** Knowledge of normal and abnormal morphological variation is very important for the clinicians, radiologist and surgeons in order to avoid misinterpretation and misdiagnosing and preventing the untoward incidents.

**KEY WORDS:** Horizontal fissure, Oblique fissure, Lung, Accessory fissure.

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### INTRODUCTION

The fissures facilitate the movement of the lobes in relation to one another, which accommodates greater distention and movement of the lobes during respiration. The fissures may be complete, incomplete or absent. In case of complete fissure the lung lobes are held together only at the hilum by the bronchi and the pulmonary vessels. Parenchymal fusion of varied extent along the floor is found in case of incomplete fissure. In addition to those fissures

lung might also have accessory fissures, usually indicating junction between bronchopulmonary segments, they are superior accessory fissure, inferior accessory fissure or left minor fissure. An incomplete major fissure may lead to disease spread, collateral air drift, or the "incomplete fissure sign," a sign that may, however, also be present in cases of complete fissure. Knowledge of the anatomy and variations of the major fissures are essential for recognizing their variable imaging appearances as well as related abnormalities [1].

The oblique fissure cuts into the whole thickness of lung, except at the hilum. It passes obliquely downwards and forwards, crossing the posterior border about 6cm below the apex and the inferior border about 5cm from the median plane .due to the oblique plane of the fissure ,the lower lobe is more posterior and the upper and middle lobe more anterior .In the right lung the horizontal fissure passes from the anterior border up to the oblique fissure and separates a wedge-shaped middle lobe from the upper lobe .The fissure runs horizontally at the level of the fourth costal cartilage and meets the oblique fissure in the mid axillary line. The right lung is divided into superior, middle and inferior lobes by oblique and horizontal fissures. The left lung is divided into superior and inferior lobes by an oblique fissure [2].

The knowledge of variations in the morphology of fissures will be helpful for cardiothoracic surgeons while performing the segmental resection. It is also helpful for the radiologists and clinicians to make correct diagnosis, to plan and modify the surgical procedures. Thus morphological variations were noted and percentage calculated and reported.

**MATERIALS AND METHODS**

Twenty pairs of lungs are dissected out from the 20 embalmed cadavers available in Hassan Institute of Medical Sciences, Hassan .Thoracic walls of embalmed cadavers were dissected, the ribs are cut by rib cutter from the mid axillary line and the lungs were exposed to study morphological features like the number of fissures and lobes, percentage calculated and tabulated.

**RESULTS**

**Table 1:** showing the number and percentage of morphological fissure variation in the present study.

lungs	complete	Incomplete horizontal fissure	Incomplete oblique fissure	Absence of fissure	Accessory fissure
Right (20)	7 (35%)	10 (50%)	3(15%)	NIL	3 (15%)
Left (20)	12 (60%)	-	7 (35%)	1(5%)	NIL

Among 40 adult human lungs, 20 were right lungs and 20 left lungs.

Right adult lung: incomplete oblique fissure-3

lungs, incomplete horizontal fissure-10 lungs., accessory fissure-3 lungs.

Left adult lung: incomplete oblique fissure-7 lungs, absent oblique fissure-1 lung,

**Fig. 1:** incomplete horizontal fissure- In right lung.



**Fig. 2:** Incomplete oblique fissure-left lung.



**Fig. 3:** Accessory fissure cuts the oblique fissure-Right lung.



**Fig. 4:** Absence of fissure-left lung.



## DISCUSSION

Lung fissures help in a uniform expansion of the whole lung and they also form the boundaries for the lobes of the lungs. Knowledge of fissures is necessary for the appreciation of lobar anatomy and thus for locating the bronchopulmonary segments. Lung buds develop from the foregut and it divides into two primary bronchial buds at around 28 days after fertilization. Then they develop into the right and left lungs. As the development progresses, the formation of numerous broncho-pulmonary buds take place, 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 [3].

Craig and Walker 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, Grade IV- complete fusion of lobes with no evident fissural line. An incomplete fissure is also a cause for postoperative air leakage during lobectomies [4].

In the present study, it was observed the incomplete fissure is more common variant more on right side than the left (table 1) and comparison result with other researchers in (Table 2).

In present study horizontal fissure was incomplete in 10 right lungs (50%) which matched almost with sumitha data et.al [1].

Lymphatics of lung drain centripetally from pleura towards the hilum. Altered course of oblique fissure would mean altered course of visceral pleura, thereby changing the arrangement of lymphatic drainage [10]. In the present study incomplete left oblique fissure was in 7 (35%) lungs and absent in 1(5%) lung, on right lung incomplete oblique fissure was in 3(15%) lungs which matched with almost with Bhimadevi et al. [7].

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

**Table 2:** Comparison of percentage of occurrence of variant fissures with the other references.

Fissure	parameter	Present study	A. K. Singh et al. (2014) [5]	Sumitha dutta et al. (2013) [11]	Nene et al. (2011) [6]	Bhimai devi et al. (2011) [7]	Meenakshi et al. (2004) [8]	Lukose et al. (1999) [9]
Right oblique fissure	incomplete	3(15%)	6.67%	61.54%	6%	9%	36.60%	-
Right horizontal fissure	incomplete	10(50%)	26.67%	75.80%	14%	-	16.60%	21%
Accessory fissure on right lung		3(15%)						
Left oblique fissure	incomplete	7(35%)	30%	48%	12%	36%	46.60%	21%
Absent left oblique fissure		1(5%)	-	-	-	-	-	-

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 [11].

The results of present study and their comparison with the previous works show that there is a wide range of difference in occurrence of classical and accessory fissures between and among different populations. This implies that a variety of genetic and environmental factors might affect development of these fissures. Knowledge of such variations might explain bizarre presentation of certain clinical cases pertaining to lung pathologies. Also knowing the frequency of occurrence of a variant fissure in a particular population might help the radiologist and clinician to make correct diagnosis. Similarly, it might help the surgeon to plan, execute and modify a surgical procedure depending on the merit of the case. This will help to reduce the morbidity and mortality associated with lung surgeries. The knowledge of anatomy of fissures of lung may help clarifying initially confusing radiographic findings like extension of fluid into an incomplete major fissure or spread of various diseases through different pathways [12].

## CONCLUSION

In the present study the commonest variation is being the incomplete fissure both on right and left lung, the reason could be defective persistence or obliteration of embryological fissures that initially separates individual bronchopulmonary buds/segments as observed by other authors also in various studies done on different population supporting for the fact of involvement of genetic and environmental factors in abnormal persistence of fissures. In cases of endobronchial lesions an accessory fissure may alter the diagnosis of the diseases like pneumonia may spread to adjacent lobes

by parenchymal fusion. Hence the knowledge of lobes and fissure is important for the radiologists, clinicians to make correct diagnosis and to the surgeons to plan, execute and modify their surgical procedures. Recognition of lung anomalies improves understanding of pneumonia, pleural effusion and collateral air drift along with disease spreading through lung as seen by imaging techniques.

**Conflicts of Interests: None**

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