

Variations of Human Lung Fissures and its Clinical Significance - A Cadaveric Study

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Abstract: ***Introduction:** The lungs are the organs of respiration, the ease of respiratory movements is due to its divisions as lobes by fissures. These fissures may be complete, incomplete or absent. These fissures are formed during development by the surrounding mesenchyme. In addition to these fissures, lung might also have accessory fissures. Such fissures often mislead the clinicians in diagnosis of lung diseases. The aim of the present study was to study/investigate the morphology of lung fissures and its variations. **Materials & Methods:** A total of 50 lungs both right and left dissected from cadavers was studied for patterns of fissures and its variations. **Results:** Out of total 25 right lungs, 40% showed incomplete horizontal fissure and 44% showed incomplete oblique fissures and 2 lungs (8%) showed complete absence of both horizontal and oblique fissures. Out of total 25 left lungs, 40% showed incomplete oblique fissure and 3(12%) showed absence of oblique fissure. **Conclusions:** Increased incidence of absence fissures could primarily be a developmental defect or could result secondary to infections/ tumor or could be an evolutionary change due to genetic and environmental causes.*

Keywords: Lung fissures, Horizontal fissure, Oblique fissure, absent lung fissure

1. Introduction

The lungs are the vital organs of respiration located in the pleural cavities. Healthy lungs in living people are normally light, soft spongy and occupy the entire pleural cavities, while cadaveric lungs are hard to touch, and discolored in appearance. The right lung is larger and heavier than the left, but it is shorter and wider because the right dome of the diaphragm is higher and the heart and pericardium bulge more to the left. Each lung is divided by fissures into lobes, further each lobe has been divided into bronchopulmonary segments. The right lung has three lobes divided by oblique and horizontal fissure, and left lung has two lobes separated by a single oblique fissure. Oblique fissure of lung begins at T3 spine posteriorly runs obliquely along 6th rib upto 6th Costochondral junction anteriorly. The horizontal fissure is seen on right lung only. It extends from 4th costal cartilage to meet the oblique fissure at the midaxillary line [1]. The visceral or pulmonary pleura adheres closely into pulmonary surface and its interlobar fissure. Fissures can be complete or incomplete. In complete fissure the lobes are held together at the hilum by bronchi and pulmonary vessels. It is said to be incomplete when there are areas of parenchymal fusion between the lobes. In some it may be absent leading to formation of single lobe.[2] In case of lung disease, these fissures serve as a guide to know the exact location of disease within the lung. Hence, clinicians take lung fissures as a guide for interpreting images of the lung disease and for lung resection surgeries. Thus, the present study was done to know the regional variations in lung fissures and its significance.

2. Material and Methods

The study was done in Twenty five pairs of lungs collected from dissection of cadavers in the Department of Anatomy, Katuri medical college, Andhra Pradesh, India. Details of morphological variations of fissures such as complete or incomplete, any variant fissure was studied. The percentage

of Incidence was calculated using Microsoft excel. These fissures were also graded based on Craig and Walkers Anatomical grading of pulmonary fissures. [3]

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 fissureline.

3. Results

Right Lung: Totally, out of 25 right lungs, 50% of lungs exhibited normal pattern of fissures and lobes. Remaining lungs showed variations of fissures, horizontal fissure was incomplete in 10 lungs [Fig 1] and hence only two lobes upper and lower was seen. The oblique fissure was incomplete in 11 lungs (40%) [Fig 2]. In two of the specimens, both fissures were absent (8%) [Fig 3]. Accessory fissure was seen along the oblique fissure in one specimen. **Left Lungs:** Out of 25 left lung, 48% of lung showed normal pattern of fissures. Oblique fissure was incomplete in 10 (40%) [Fig 4] and absent in 3(12%) [Fig 5], and accessory fissure was not seen in any of the specimens.



Figure 1: Incomplete Horizontal fissure



Figure 2: Incomplete oblique fissure of right lung



Figure 3: Right lung showing absence of both oblique and Horizontal fissure



Figure 4: Left lungs showing Incomplete Oblique fissure



Figure 5: Left lungs showing absence of Oblique fissure

Table 1: Showing results of variations in fissures

| Right Lung(n=25) | Complete | Incomplete | Absent |
|--------------------|----------|------------|--------|
| Horizontal fissure | 13(52%) | 10(40%) | 2(8%) |
| Oblique fissure | 12(48%) | 11(44%) | 2(8%) |
| Accessory fissure | 1(4%) | | |
| Left lung(n=25) | Complete | Incomplete | Absent |
| Oblique fissure | 12(48%) | 10(40%) | 3(12%) |
| Accessory fissure | 0 | | |

Table 2: Grading according to Craig and Walker Classification

| Lung | Fissures | Grade I | Grade II | Grade III | Grade IV |
|------------|------------|---------|----------|-----------|----------|
| Right Lung | Horizontal | 44% | 8% | 40% | 8% |
| | Oblique | 40% | 8% | 44% | 8% |
| Left lung | Oblique | 40% | 8% | 40% | 12% |

Table 3: Comparison of Variations of lung fissures of present study with other studies

| Authors | Right Lung Oblique Fissure | | Right Lung Horizontal fissure | | Left Lung Oblique fissure | |
|-------------------|----------------------------|--------|-------------------------------|--------|---------------------------|--------|
| | Incomplete | Absent | Incomplete | Absent | Incomplete | Absent |
| Meenakshi et al | 36.6% | 0 | 63.3% | 16.6% | 46.6 | 0 |
| Prakash et al | 39.3% | 7.1% | 50% | 7.1% | 35.7% | 10.7% |
| Magadam et al | 60% | 10% | 52.5% | 12.5% | 42.5% | 7.5% |
| Bhimai Devi et al | 9% | 9% | 18% | 9% | 36.3% | 9% |
| Present study | 44% | 8% | 40% | 8% | 40% | 12% |

4. Discussion

Fissures are double folds of pleura that divide the lung into lobes. Variations in the fissures of the lung are one of the common morphological variations. These variations could be due to developmental defect. [4]The developing lung bud bifurcates into three buds on right and two on left. These lung buds as they enlarge grows into the surrounding mesenchyme, this mesenchyme forms the pleura which forms the fissures or spaces separating the lobes of the lung. Finally two fissures on the right side and one fissure on the left lung is present. Fissures on the right lung were oblique and horizontal and only oblique in left lung. Incomplete formation of fissures leads to incomplete separation of lobes. Absence of formation of these fissures lead to failure of separation of lobes of lung leading to formation of Single lobe lung. [5] Sometimes accessory fissures are reported along the oblique and horizontal fissures. These fissures are used as an landmark for localizing lesions within the lungs [6].

In the present Study the following findings were observed and compared with various authors as shown in Table 3. In the right lung, incidence of Incomplete Oblique fissure was 44% which is more than Meenakshi et al (36.6%) and Prakash et al (39.3%) [7], Bhimaidevi et al (9%) [8] but less than Magadam et al(60%) [9] and Percentage of absence of Oblique fissure is 8% in the present study compared to 7.1% by Prakash et al ,10% by Magadam et al and (9%) by Bhimai Devi et al. Incidence of incomplete horizontal fissure of right lung in the present study is (40%) which is significantly more than Bhimaidevi et al (18%) less than Meenakshi et al (63.3%),Prakash et al (50%) and Magadam et al(52.5%) . Incidence of absence of horizontal fissure of right lung is 8% comparable to Bhimaidevi et al about 9%.

Left lung- Incidence of Incomplete oblique fissure is 40% which is higher than all other authors, and incidence of absent Oblique fissure is 12%. Earlier studies done by; Nene et al [10], Bhimai et al, also shows proportionately higher incidence of variations in left lung .

Grading of fissures based on Craig and walker is important for interpretation of Radiological images and prior to surgical intervention. [11] Based on the grading, the present study shows increase incidence of incomplete fissures in both right and left lungs. When these fissures are incomplete, diseases such as pneumonia may spread from one lobe to other lobes through pores present at the fissure. [12] Incomplete fissures gives additional space for accumulation of fluid. In case of pleural effusion, fluid tends to accumulate in the fissures and classical radiological appearance of incomplete fissure sign is demonstrated [13]. In pneumothorax, the portion of the collapsed lobe adjacent to and fused with the unobstructed lobe may be kept aerated by the airflow across the incomplete fissure through pores of Kohn and canals of Lambert showing Collateral air drift. Hence, knowledge of the completeness of fissures is necessary for precise localization of lung diseases and its management.

In the present study, incidence of absence fissures in right lung is 8% and in left lungs 12%. Such high incidence of absence fissures could be due to developmental defect or secondary to chronic lung diseases, in which there is obliteration of fissures secondary to parenchymal fusion. Such fusion of fissures leads to fusion of lobes of lung. In case of diseased lungs due to inflammations and infections involving the oblique fissure, the parenchyma of the lung fills these spaces or fissures giving a false appearance of absence of fissures. In addition, benign and malignant tumors of pleura also originate in the oblique fissure, which later obliterates the space leading to fusion of lobes. Hence, thorough clinical history should be taken into consideration before interpreting conventional chest x-ray and it is better to do higher imaging modalities such as CT and Bronchoscope/Bronchogram for precise localization of the diseased portion and for its surgical intervention.

5. Conclusion

Clinically, diseases of the lung are one of the commonest presentations secondary to infections or tumor. These lung disease are diagnosed primarily by conventional Chest X ray and CT scan. Lung fissures serve as an important landmark for diagnosing and defining lung lesions. The present study shows high incidence of Grade IV type of absent fissures. Such occurrence of variations differ in their incidences from region to region. From the present study we can conclude, absence of fissures could be primarily due to developmental defect or closure of space secondary to infection or tumor. Or it could be an evolutionary change due to various environmental and genetic factors. Knowledge of these fissure variation should be taken into consideration for precise interpretation of radiographs and other diagnostic images of the lungs. It is also essential for surgical resection of the diseased segments.

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