

## Anatomical study on variations of fissures of lung

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### Abstract

**Aim:** This study is conducted to record the variations in fissures and lobes of lung which will be helpful for all clinicians and also of academic interest.

**Materials and Methods:** The study was undertaken in 25 pairs of cadaveric specimens. The lungs were exposed to study the morphological features like number, fissures and lobes. Presence of anatomical variations was observed and photographed.

**Results:** 11 right side lungs showed incomplete horizontal fissure. In 5 right lungs there was no horizontal fissure. Incomplete oblique fissure was found in 7 right lungs. 2 right lungs did not have any fissures. 8 left lungs exhibited incomplete oblique fissure.

**Conclusion:** A detailed knowledge of the anatomy of the fissures of lung is essential for the proper interpretation of radiological images like X- ray, CT scan and MRI for the radiologists, cardiothoracic surgeons performing lobectomies, and segmental resections. Furthermore, the knowledge of fissures and lobes of lungs is important for the surgeons to properly manage the potential problems which may be encountered during surgery.

**Keywords:** Lungs, Horizontal fissure, Oblique fissure, Variations.

### Introduction

Lungs are vital organs of respiration situated in the thoracic cavity, on either side of the heart. Each lung is divided by fissures into lobes. The right lung has 3 lobes separated by the oblique and horizontal fissures. The oblique fissure of the right lung separates the superior and middle lobe from the inferior lobe and the horizontal fissure separates the superior lobe from the middle lobe. The left lung has 2 lobes, superior and inferior, separated by a single oblique fissure. The oblique fissure begins at the postero-superior aspect of the hilum at level of the 5<sup>th</sup> thoracic spine, crosses the posterior border about 6cm from the apex of the lung at the level 4<sup>th</sup> thoracic spine. On the sternocostal surface the fissure follows the 6<sup>th</sup> rib and crosses the inferior border near its anterior end. It then passes backwards onto the mediastinal surface to end at the inferior aspect of the hilum. The horizontal fissure seen only on the right lung, starts at the oblique fissure at the mid-axillary line, it runs across the costal surface in level with the 4<sup>th</sup> costal cartilage and passes onto the hilar surface to end in front of the hilum<sup>1</sup>.

### Materials and Methods

During the routine dissection for undergraduate medical students the variation in fissures of lung have become a frequent entity, which prompted the authors to do this study. The study was undertaken in the department of anatomy, Government Mohan Kumaramangalam Medical College, Salem on 25 pairs of cadaveric lung specimens. 25 properly embalmed cadavers containing lungs were dissected. The lungs were exposed to study the morphological features like

number, fissures and lobes. Presence of anatomical variations was observed.

The anatomical classification proposed by craig and walker<sup>2</sup> was followed to determine the presence and completeness of fissures.

### Craig and walker classifications

Grade	Classification
Grade I	Complete fissure with entirely separate lobes, the lobes being held together only at the hilum by the bronchi and pulmonary vessels.
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, i.e. the fissure does not extend up to the hilum.
Grade IV	Complete fusion of lobes with no evident fissure

### Results

**Right lung:** Incomplete horizontal fissure was found in 11 specimens out of 25 right sided lungs (Fig. 1). There was absence of horizontal fissure in 5 specimens (Fig. 2).



**Fig. 1: Incomplete horizontal fissure right lung**



**Fig. 2: Absent horizontal fissure right lung**

7 specimens were exhibited incomplete oblique fissure (Fig. 3).



**Fig. 3: Incomplete oblique fissure right lung**

No fissure was found in 2 right sided lungs out of 25 specimens (Fig. 4).



**Fig. 4: No fissures right lung**

**Left lung:** The oblique fissure was incomplete in 8 specimens out of 25 left sided specimens (Fig. 5).



**Fig. 5: Incomplete oblique fissure left lung**

### Discussion

**Development of lung:** During the 4<sup>th</sup> week of embryonic period, the respiratory diverticulum appears as a ventral growth from the endodermal foregut. The diverticulum expands caudally into the surrounding mesenchyme and gives rise to two buds, right and left. At the beginning of the 5<sup>th</sup> week each of these buds enlarges to form right and left main bronchi. The right then forms three secondary bronchi and the left, two. Each lung then develops by a process of repeated dichotomous branching of the secondary bronchi. After several generations of branching, bronchopulmonary segments are formed<sup>3</sup>.

In the fetal period, spaces of fissures separate the individual bronchopulmonary segment. During development these fissures are obliterated except along 2 planes in case of right lung and one plane in case of the left lung as the oblique and the horizontal fissures<sup>4</sup>.

Absence or incomplete oblique or horizontal fissures could be due to obliteration of these fissures either completely or partially.

Several authors have reported the anomalous fissures and lobes.

**Table 1** compares the work of previous authors regarding the prevalence of fissures of lung with our present study.

Prevalence of incomplete horizontal fissure of right lung in our study was 44% which was higher than in previous works by Bincy et al<sup>9</sup> 2014 (35.38%), Medlar<sup>5</sup> 1947 (17.1%) and Lydia et al<sup>10</sup> 2014 (25%). On the other hand it was less prevalent than in earlier reports by various authors. [Meenakshi et al<sup>7</sup> 2004 (67%), Jacob et al<sup>8</sup> 2013 (83.4%), and Amit magadam<sup>11</sup> 2015 (52.5%)].

Present study reported greater prevalence of absence of horizontal fissure of right lung (20%) than the reports published by Meenakshi et al<sup>7</sup> 2004 (16.6%), Jacob et al<sup>8</sup> 2013 (6.6%), Lydia et al<sup>10</sup> 2014 (11.11%) and Bincy et al<sup>9</sup> 2014 (3.07%) whereas it provided a lower prevalence than works by other authors Medlar<sup>5</sup> 1947 (45.2%) and Bergman<sup>6</sup> et al 2008 (21%).

The presence of incomplete oblique fissure of right lung was in the frequency of 28% in our study which was lower than the findings of Meenakshi et al<sup>7</sup> 2004 (36.6%), Bergman et al<sup>6</sup> 2008 (30%), and Jacob et al<sup>8</sup> 2013 (50%). The present study result was higher than Lydia et al<sup>10</sup> 2014 (5.55%) and Bincy et al<sup>9</sup> 2014 (3.07%).

32% of left lung in the current study showed incomplete oblique fissure whereas the previous studies reported the incidence of this variations as 7.5% to 46.6%. [Amit magadam<sup>11</sup> 2015, Lydia et al<sup>10</sup> 2014, Bergman et al<sup>6</sup> 2008 and Meenakshi et al<sup>7</sup> 2004].

There were no fissures in 8% of right lung in our study. But it was 4.8% in a study by Medlar<sup>5</sup> 1947.

We did not find even a single case of absence of fissures in left lung which was reported by Medlar<sup>5</sup> in 1947 as 7.3%.

Author	Right Lung				Left Lung		No Fissures	
	Horizontal Fissure		Oblique Fissure		Oblique Fissure		Right Lung	Left Lung
	Incomplete	Absent	Incomplete	Absent	Incomplete	Absent		
Medlar et al 1947	17.1%	45.2%	25.6% -30%	-	10.6%-18%	7.3%	4.8%	7.3%
Meenakshi et al 2004	63.3%	16.6%	36.6%	-	46.6%	-	-	-
Bergman et al 2008	67%	21%	30%	-	30%	-	-	-
Jacob et al 2013	83.4%	6.6%	50%	3.4%	38.9%	-	-	-
Lydia et al 2014	25%	11.11%	5.55%	-	2.5%	-	-	-
Bincy et al 2014	35.38%	3.07%	3.07%	-	15.06%	-	-	-
Amit magadam 2015	52.5%	-	-	10%	7.5%	-	-	-
Present study	44%(11)	20%(5)	28%(7)	-	32%(8)	-	8%(2)	-

The presence of fissures facilitates movement of the lung lobes with respect to one another and allows distension of the lobes and uniform expansion of the whole lung during respiration 12. They serve as reliable landmarks while locating and evaluating the extent of lung lesions 13. They play a major role in planning operative surgeries such as lobectomies and pulmonary resections.

### Conclusion

Current study indicates that incomplete horizontal fissure in right lung was more and there was no fissures in few right lungs.

To avoid and minimize the mortality and morbidity associated with the invasive procedures of lungs the radiologists and the surgeons must be aware of variations of fissures and lobes of lungs. Anatomical knowledge of fissures of lung is helpful for explaining the various radiological appearances of interlobar fluid. An incomplete fissure is also a cause of post-operative air leakage. Hope this study will be helpful for all above mentioned practitioners.

**Conflict of interest:** None

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