



## A Cadaveric Study of Anatomical Variation of Fissures of Lung

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### Abstract

**Introduction:** Lungs are essential organs of respiration. Variations in lobes and fissures of lungs are clinically significant. Knowledge of the position of fissures of the lungs is necessary for the appreciation of lobar anatomy and thus locating the bronchopulmonary segments. This study is conducted to observe the completeness of fissures, presence of accessory fissures.

**Materials and Methods:** Present study was performed on 40 lungs (20 right and 20 left) from embalmed cadavers in department of anatomy, sms medical college, jaipur and lung specimens were examined for morphology of fissures and lobes, variations and find their clinical implications.

**Results:** In my study the right lung was normal with complete oblique fissure in 88.5% and complete horizontal fissure in 70%. The left lung was normal with complete oblique fissure 75%. In right lung, oblique fissure was incomplete in 10% and horizontal fissure was incomplete in 20% and absent in 10%. In left lung, oblique fissure was incomplete in 15% specimen.

Accessory fissures were present in 22.5% of right lungs and in 12.5% of left lung and accessory lobes were present in 2 specimens (5%) of right lungs.

**Conclusion:** There is a wide range of variation in occurrence of major, minor and accessory fissures in different populations. Knowledge of accessory fissure and variations in lobes and fissures of lung are important as such variations might explain variable presentation of certain clinical cases and also help the radiologist and clinician to make correct diagnosis, plan, execute and modify a surgical procedure. Knowledge of accessory fissure and variations in lobes and fissures of lung are important

**Keywords:** Accessory, Fissure, Lobes, Lung, Variation.

### Introduction

Lungs are one of the vital organs of human body.

The right lung is broader and heavier than the left lung.<sup>[1]</sup>

The **right lung is divided into three lobes:** superior, middle, and inferior by two fissures—(a) an oblique fissure and (b) a horizontal fissure.

The **left lung is divided into two lobes:** (a) superior and (b) inferior by an oblique fissure.

1. **Oblique fissure:** A long oblique fissure runs obliquely downwards and forwards crossing the posterior border about 6 cm (2 inches) below the apex and inferior border about 7.5 cm (3 inches) lateral to the midline. It separates the superior and middle lobes from the inferior lobe.

**2. Horizontal fissure:** A short horizontal fissure is present only in the right lung. It starts from oblique fissure at the midaxillary line and runs horizontally forward to the anterior border of the lung. It separates the superior and middle lobes.<sup>[2]</sup>

The visceral or pulmonary pleura adheres closely into pulmonary surface and its inter lobar fissure.

The fissure can be complete, incomplete or absent.

1. Complete fissure - lobes remain held together only at the hilum by bronchi and pulmonary vessels [Fig.1].

2. Incomplete fissures -the adjacent lobes are connected by a sizeable chunk of pulmonary tissue as the cleft fails to reach the hilum.

3. Absent fissure

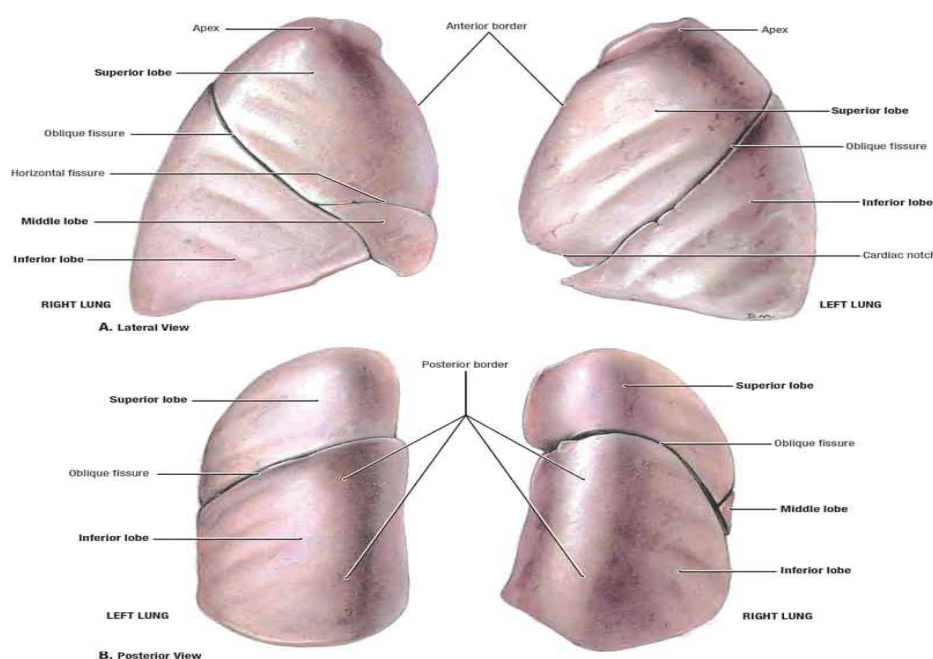
The commonly found accessory fissures are superior accessory fissure, inferior accessory fissure and left minor fissure.

The fissures facilitate the movement of the lobes and provide greater distention and movement of the lower lobes during respiration.

The appearance of accessory lung fissure varies on X ray and CT scan.

The knowledge of anatomical variations of lobes of the lung is important for identifying precise location, extent and morphology of bronchopulmonary segments.

Many times the radiologists may misinterpret them on an X-ray or a CT scan. As the fissures form the boundaries for the lobes of the lungs. Hence, the knowledge of their variations is essential in making correct diagnosis and appropriate planning of surgery for performing lobectomies and in segmental resection. It would be helpful in interpreting radiological images.



**Figure 1.** Normal Oblique and horizontal fissures in the lung

## Materials and Methods

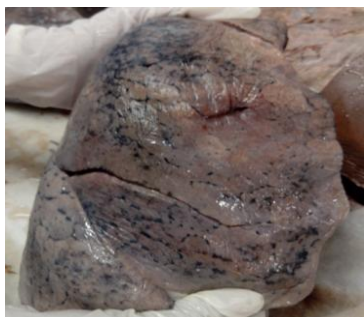
Forty pairs (32 male and 8 female) of lungs from embalmed cadavers used for routine undergraduate dissection classes were studied for the presence of normal fissures, its variations, number of lobes, accessory lobes and accessory fissures.

Completeness of a fissure is determined as per the grading given by Craig and Walker<sup>[4]</sup>.

## Results

In my study the right lung was normal with complete oblique fissure in 88.5% and complete horizontal fissure in 70%. The left lung was normal with complete oblique fissure 75 %. In right lung, oblique fissure was incomplete in 10 % [Fig: 2] and horizontal fissure was incomplete in 20 % and absent in 10% [Fig: 3]. In left lung, oblique fissure was incomplete in 15% specimen.

Accessory fissures were present in 22.5% of right lungs [Fig: 4 & 5] and in 12.5% of left lung and accessory lobes were present in 2 specimens (5%) of right lungs [Fig: 6 & 7].



**Fig.2:** Incomplete oblique fissure of right lung



**Fig . 3:** Absent oblique fissure of right lung



**Fig.4:** Absent horizontal fissure of left lung



**Fig 5:** Accessory fissure present in right lung along diaphragmatic surface (forceps indicating)



**Fig.6:** Multiple accessory fissure in right lung and accessory lobe.



**Fig.7:** Right lung showing four lobes

**Discussion**

During the developmental period, the lung tissue grows as multiple bronchopulmonary buds. Later these spaces or fissures that separate individual bronchopulmonary buds obliterated. The spaces remain along the inter lobar planes to give rise to major (oblique) and minor (horizontal) fissures in a fully developed lung.

Absence or incompleteness of a fissure due to obliteration of these fissures either completely or partially.



Completeness of a fissure is determined as per the grading given by Craig and Walker<sup>[4]</sup>. Grade

1- complete fissure with entirely separate lobes; grade 2- complete visceral cleft but parenchymal fusion at the base of the fissure; grade 3- visceral cleft evident for part of the fissure; grade 4-

**Table 1:** Incidence of grades of completeness of oblique and horizontal fissures of lungs observed (according to Craig and Walker criteria).

Side of the Lung	Fissures	Grade I	Grade II	Grade III	Grade IV
Right Lung	Oblique fissure	85%	5%	10%	0%
	Horizontal fissure	60%	25%	10%	5%
Left Lung	Oblique fissure	55%	28%	18%	0%

complete fusion of the lobes with no evident fissural line.

In the present study fissures were classified into four grades according to Craig and Walker’s criteria. [Table 1]

There is a huge variation observed in fissures of lung in present study which is compared by various authors [Table 2].

**Table 2:** Incidence of variations in fissures of lung reported by various authors are.

Author	Lung	Fissure	Incomplete	Absent
Lukose et al.1999[14]	Right Lung	Horizontal	-	10.5%
		Oblique	-	-
	Left Lung	Oblique	21%	-
IEHAV.2002[15]	Right Lung	Horizontal	67%	21%
		Oblique	30%	-
	Left Lung	Oblique	30%	-
Meenakshi et al.2004[8]	Right Lung	Horizontal	63.3%	16.6%
		Oblique	36.6%	-
	Left Lung	Oblique	46.6%	-
Prakash et al. 2010 [11]	Right Lung	Horizontal	50%	7.10
		Oblique	39.30% 7.10% Left Oblique 35.70% 10.70%	7.10
	Left Lung	Oblique	35.70%	10.70%
Ajay Ratnakarrao Nene et al.2011[12]	Right Lung	Horizontal	8%	14%
		Oblique	6%	2%
	Left Lung	Oblique	12%	0%
Muralimanju et al. 2012[13]	Right Lung	Horizontal	46.9%	18.70%
	Left Lung	Oblique	7.10%	3.60%
Radha K et al. 2015 [9]	Right Lung	Horizontal	43%	17
		Oblique	17%	0%
	Left Lung	Oblique	23%	0%
Dhanalakshmi V et al.2016[3]	Right Lung	Horizontal	52%	18%
		Oblique	32%	0%
	Left Lung	Oblique	38%	0%
Present study	Right Lung	Horizontal	20%	10%
		Oblique	10%	2.5%
	Left Lung	Oblique	15%	0%

IEHAV: Illustrated Encyclopedia of Human Anatomical Variations

Grading of fissures is surgically important for ligation of the vessels and bronchi which are approached through the depth of the fissures by the surgeons. Grade I fissure makes the easy approach while doing surgeries. In Grade IV lung

parenchyma has to be dissected leading to preoperative hemorrhage and postoperative complications<sup>[7]</sup>.

Incomplete fissures may also alter the spread of disease within the lung. Because lymphatics of

lung drain centripetally from pleura towards the hilum. Altered course of oblique fissure lead to altered course of visceral pleura, so the arrangement of lymphatic drainage become change.<sup>[11]</sup>

Incomplete fissure may alter the patterns of collapse seen in patient with endobronchial lesions. An incomplete major fissure can cause the odd appearance of fluid tracking within the fissure [8].

On radiological assessment an accessory fissures mistakenly confused with areas of linear atelectasis, pleural scars, or walls of bullae or any other lung lesion<sup>[9]</sup>. In X-ray, incomplete fissure always give an atypical appearance of pleural effusion. Sometimes the accessory fissures are failed to be detected on CT scans, because of their incompleteness, thick sections and orientation in relation to a particular plane.

An incomplete fissure is also a cause for postoperative air leakage.<sup>[10]</sup>

The fissures in normal lungs enhance uniform expansion of lobes. Absence of fissures can affect or reduce the expansion of the lungs.

### Conclusion

Knowledge of anatomical variations is essential for performing lobectomies, segmental resection and interpreting radiological images. it is important to interpret radiological images to make correct diagnosis and correlating the variations to the disease for further treatment. As the fissures form the boundaries for the lobes of the lungs, knowledge of their position is necessary for the appreciation of lobar anatomy and thus for locating the bronchopulmonary segments which is significant both anatomically and clinically.

### References

1. Susan Standring: Gray's Anatomy.40th edition. Elsevier Limited: churchill Livingstone; 2008.1068-70.
2. Textbook of Anatomy: Upper Limb and Thorax, Volume I, Vishram Singh 2nd edition , Reed Elsevier 2014.237-238.
3. Dhanalakshmi V, Manoharan C,Rajesh R, Suba Ananthi K. Morphological study of fissures and lobes of lungs. int j anat res 2016;4(1):1892-1895.
4. Craig SR, Walker WS. A proposed anatomical classification of the pulmonary fissures: J R Coll Surg Edinb. 1997, Aug; 42(4):233-4.
5. W. Henry Hollinshead: Anatomy for Surgeons. The Thorax, Abdomen and Pelvis. volume.2: 2nd edition. Harper & Row publishers; p-72.1971.
6. Hamilton W.J: Mossman H.W.Human Embryology prenatal development of form and function. 4<sup>th</sup> edition. MacMillan press Ltd: London; 328-330.1976
7. K. Lakshmi Kumari, K. Deena Usha Kumari, D: Asha Latha Morphological Variations of Fissures of Lungs. IOSR Journal of Dental and Medical Sciences Nov. 2015;14 (11) Ver. IV:50-53.
8. Meenakshi S, Manjunath KY, Balasubramanyam V. Morphological variations of the lung fissures and lobes. Indian J Chest Dis Allied Sci. 2004 Jul-Sep; 46(3):179-82.
9. Radha K, Durai Pandian K. Fissures and lobes of lungs. a morphological and anatomical study. International Journal of Anatomy and Research 2015;3(2):995-98.
10. Zareena.SK. A study of morphology and variations of lungs in adults and foetus. International Journal of Advancements in Research & Technology. April- 2014;3(4).
11. Prakash, Bhardwaj AK, Shashirekha M, Suma HY, Krishna GG, Singh G. Lung morphology: a cadaver study in Indian population. Ital J Anat Embryol. 2010; 115(3):235-40.
12. Nene AR, Gajendra KS, Sarma MVR, Lung lobes and fissures: a morphological Study,international journal of clinical and experimental anatomy 2011;5:30-38.
13. Muralimanju B V, Prabhu LV, Shilpa K, Pai MM, Kumar CG, Rai A, Prashanth

KU. Pulmonary fissures and lobes: a cadaveric study with emphasis on surgical and radiological implications. Clin Ter. 2012; 163(1):9-13.

14. Lukose R, Paul S, Sunitha DM, et al. Morphology of the lungs: variations in the lobes and fissures. Biomedicine 1999;19: 227-32.
15. Bergman RA, Afifi AK, Miyauchi R. Variations in peripheral segmentation of right lung and the base of the right and left lungs. In: Illustrated Encyclopedia of Human Anatomic Variation. <http://www.anatomyatlases.org/AnatomicVariants/OrganSystem/Text/LungsTrachea.shtml> (28th of November, 2010).