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Research Article

# MORPHOMETRIC STUDY OF LUNG AND ITS FISSURES AND THE PATTERN OF VARIATION WITH ITS CLINICAL IMPLICATIONS

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**ABSTRACT**

The lungs which are essential organs of respiration, due to their embryological basis can show a number of anatomical variations. The variations may be seen in the number of fissures, the dimension of fissures and hence the number of lobes. These variations gain importance in cardiothoracic surgeries where segmental resection of lungs is required.
Our study was to aimed to assess the various fissures and lobes in lungs and see the common variations in the fissures and lobes and to grade them. The study was done on 35 lungs (16 right and 19 left lungs).21% of left lung and 12.5% of right lungs showed incomplete oblique fissure. Out of the 16 right lungs 4 lungs (25%) showed incompletehorizontal fissure. Our data showed complete or Grade 1 horizontal fissures in 75 % of right lungs whereas Grade 1 oblique fissure was present in 87.5 % of right lungs and 78.9 % of the left lungs. Superior accessory Fissure was observed in 6.25% of right lung and in 5.2% left lung. Inferior accessory fissure was found in 10.5% left lung. Leftminor Fissure was observed in 5.2% of left lung. Azygous lobe was not documented in any lung.
The knowledge of such variations is helpful to the radiologist and the clinicians to make a correct diagnosis and plan the required surgical procedure.



## INTRODUCTION

The lungs are the essential organs of respiration which are located within the thoracic cavity on either side of the heart and other mediastinal structures. Each lung is approximately half a cone in shape having an apex, base, three borders and two surfaces. [1]

The lungs are divided into various lobes by a double layer of infolded reflections of visceral pleura called fissures.[2] Right lung is divided into superior, middle and inferior lobes by oblique and horizontal fissures whereas, the left lung being divided into two lobes namely upper and lower by an oblique fissure. The oblique fissure begins from the upper part of the hilum on the mediastinal surface. This fissure cuts the vertebral border at the level of 4th or 5th thoracic spine about 6cm below the apex, and cuts the inferior border of lung, at about 7.5cm behind the anterior end to reappear on the mediastinalsurface and ends at the lower end of hilum. The horizontal fissure seen only in the right lung, begins at the oblique fissure, courses along the costal surface, cuts the anterior border and appears on the mediastinal surface to end at the hilum. [3; 4]

These fissures may be complete or incomplete, as such dividing the lungs into complete and incomplete lobes.

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When the fissures are complete, the lobes are held together only at the hilum by the bronchi and pulmonary vessels, or they may be incomplete when there are areas of parenchymal fusion between the lobes, or, they may be absent. [5]

In addition to these fissures, accessory fissures may exist which are classified as superior accessory fissure, inferior accessory fissure, or left minor fissure and azygous lobe. [6]The most common accessory fissures are the inferior accessory fissure. [7]

The knowledge of anatomical variations in the lung fissures and lobes is of clinical importance for the cardiothoracic surgeons to prevent any complication during surgeries in order to avoid and reduce the mortality and morbidity associated with invasive procedures. While performing the segmental resection of the infected bronchopulmonary segments and lobectomies, prior identification of incomplete separation of lobes and incompleteness of the fissures is important as an incomplete major fissure may lead to disease spread and post-operative air leakage.

The knowledge of the anatomy and the variants of the major fissures is essential for recognizing their variable imaging appearances as well as related abnormalities, for appropriate radiological interpretation of medical imaging for proper evaluation of pulmonary diseases.

In this study, we aim to look at the most common morphological variation in lung and its fissures for its clinical and surgical importance.

## MATERIALS AND METHODS

A total of 35 (right 16, left 19) lung specimens, fixed in 10% Formalin, collected from the museum of the department of anatomy, skims medical college, Srinagar were studied for conducting the research. The age and gender differences were not determined in this study.

### *Exclusion criteria*

Specimens having any pathological lesions, marks of surgery, damaged in the course of removal or with gross abnormalities were not included in the study.

### *Instruments used*

Magnifying lens, metal probe, scale, measuring tape and dissection instruments were used during the study.

### *Parameters measured*

a. Length, breadth and thickness of lungs.
b. Length and depth of fissures.
c. Presence of any variation (complete/incomplete fissure) or accessory fissure.

After numbering the specimens, the morphological parameters of the lung and its fissures were measured. The depth of oblique fissure was measured by using a metal probe and placing the probe perpendicular to the surface. The measurements were taken at the center, upper and lower end, and subsequently the maximum depth was recorded.

The anatomical classification proposed by Walker WS *et al*., was followed to categorize the fissures based on the degree of completeness of fissure and the location of pulmonary artery at the base of oblique fissure. [8]

### *Craig and walker classification*

| | |
|---|---|
| Grade I | Complete fissure with completely separate lobes and 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, however the fissure does not extend up to the hilum. |
| Grade IV | Complete fusion of lobes with no evident fissure line |

### *Statistical analysis*

All data were tabulated and statistically analysed by using Statistical Package for the Social Science (version 20) software (SPSS).

## RESULT

**Table 1** Mean length, breadth and thickness of right and left lungs

| | Mean length (cm) | Mean breadth(cm) | Mean thickness (cm) |
|---|---|---|---|
| Right lung | 22.0± 2.1 | 8.2±0.9 | 13.7±2.2 |
| Left lung | 22.8±2.4 | 7.7±1.1 | 14.6±3.7 |

**Table 2** Mean length and depth of oblique and horizontal fissures

| Side | Fissure | Mean Length (cm) ±SD | Mean Depth(cm)±SD |
|---|---|---|---|
| Right | Oblique | 23.7±4.8 | 4.2±0.8 |
| | horizontal | 10.9±2.6 | 3.6±0.6 |
| Left | Oblique | 22.1±4.6 | 3.9±0.9 |

**Table 3** Incidence and classification of fissures according to Craig and Walker criteria

| Grade | Right lung(n=16) | | Left lung(n=19) |
|---|---|---|---|
| | Horizontal fissure | Oblique fissure | Oblique fissure |
| Grade 1 | 12(75%) | 14(87.5%) | 15(78.9 %) |
| Grade 2 | 3(18.75%) | 2 (12.5% ) | 3(15.7%) |
| Grade 3 | 1(6.25%) | 0(0%) | 1(5.2%) |
| Grade 4 | 0(0%) | 0(0%) | 0(0%) |

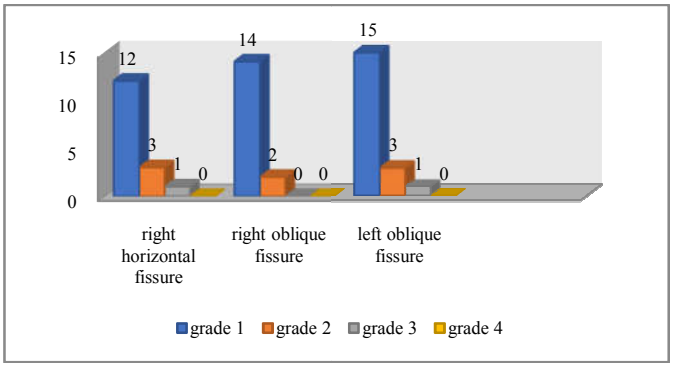


**Fig 1** Graph showing variations in fissure

**Table 4** Incidence of Accessory fissures

| Side | Fissure | Incidence |
|---|---|---|
| Right (n=16) | Superior accessory fissure | 1(6.25%) |
| | Inferior accessory fissure | 0 |
| | Azygous lobe | 0 |
| Left (n=19) | Superior accessory fissure | 1(5.2%) |
| | Inferior accessory fissure | 2(10.5%) |
| | Left minor fissure | 1(5.2%) |


**Fig 2** left lung with left minor fissure


**Fig 3** left lung with superior accessory fissure

## DISCUSSION

The respiratory system starts developing as early as 4th week of gestation from a median endodermal diverticulm of foregut. This divertculum divides into 2 primary divisions which forms right and left principal bronchi. [9] Further division of these principal bronchi forms lobar bronchi, two lobar bronchi in left and 3 lobar bronchi in right. Subsequently, these lobar bronchi subdivide and give rise to the various bronchopulmonary segments. The individual bronchopulmonary segments fuse completely except along the lines of division of principal bronchi, which in the adults is the site of oblique or horizontal fissures and resulting in the formation of lobes and fissures. [10] The presence of fissures allows the movement of the lobes against each other and enhances uniform expansion of the lung during breathing. Moreover, their position could be used as reliable landmarks in specifying lesions within the thorax. [11] Developmental defects result in variations in fissures and hence of the lobes. The fissures may undergo partial or complete obliteration, which results in an incomplete fissure or absence fissure, respectively. Non-fusion of spaces between the bronchopulmonary buds could result in an accessory fissure.

Some of the common variants of accessory fissures include: azygous lobe, inferior accessory fissures, superior accessory fissure and left minor fissure.[13]Inferior Accessory fissure (Twining's line) divides the medial basal segment from the rest of lower lobe ,whereas, the Superior accessory fissure separates the superior segment from the remainder of the inferior lobe. Whenever present, the superior segment is called the posterior or dorsal lobe .The left minor (or horizontal) fissure separates the lingual from the rest of left upper lobe. [1; 7]

Inthe present study 21% of left lung and 12.5% of right lungs showed incomplete oblique fissure. The increased incidence of incomplete oblique fissure on left side may be attributed to early commencement of fusion of the prenatal fissures [12]. Similar variations in oblique fissure were reported by Amin M [3]. While equal incidence of incomplete oblique fissure in both lungs (30%) was reported by Bergmann *et al*. [13]

In contrast to the previous studies horizontal fissure was reported in all specimen of right lung. Out of the 16 right lungs 4 lungs (25%) showed incomplete fissure. The same rate of incomplete horizontal fissure was reported by Amin M[16] (24%) and lukose R *et al* (21%).[14]

Knowledge about the incompleteness of fissures i.eGradation of fissure is surgically important to the surgeons performing lobectomy as the chances of post operative air leak are more common in patients with incomplete fissure [8]. Our data showed complete or Grade 1 horizontal fissures in 75 % of right lungs whereas Grade 1 oblique fissure was present in 87.5 % of right lungs and 78.9 % of the left lungs.

It has been reported that grade 1oblique fissure facilitates the approach while doing lobectomy and thoracoscopicsurgeries [15], thus decreasing the rate of intra-operative haemorrhage and postoperative complications.[16] While performing right upper lobectomy preventive fixation of the middle lobe is essential as middle lobe has the chance of undergoing torsion if the oblique fissure is of grade 1 variety[17].

Accessory fissures were noted in both lungs. Superior Accessory Fissure was observed in 6.25% of right lung and in 5.2% left lung. Inferior accessory fissure was found in 10.5% left lung. Left Minor Fissure was observed in 5.2% of left lung. Azygous lobe was not documented in any lung.

The anatomy of accessory fissures is important to be kept in mind by the doctors, as it may influence the radiological interpretation of CT scans and radiographs. The incompleteness of fissureand there orientation in relation to a particular plane can be mistakenly confused with areas of linear atelectasis, pleural scars, or walls of bullae. In patients with incomplete fissures, pneumonia may spread to adjacent lobes through the parenchymal continuation. It may also alter the usual pattern of lung collapse causing difficulty in diagnosing a lesion and its extent. [18]

## CONCLUSION

The knowledge about the frequency of variations in the pattern of fissures and lobes in the lung gains its importance in clinical practice. The idea about the various anatomical variations is important to avoid mortality and morbidity associated with misinterpretation of CT's and radiographs and with complications like air leaks associated with invasive procedures.

## References


1. Standring, S. (2015). *Gray's Anatomy: The Anatomical Basis of Clinical Practice (*41st Ed.). Elsevier.
2. UnverDogan, N., IlknurUysal, I., Demirci, S., HakanDogan, K., & Kolcu, G. (2015). Major anatomic variations of pulmonary fissures and lobes on postmortem examination. *ActaClinicaCroatica*, *54*(2.), 201-206.
3. Amin, M. A. S. (2020). Morphological Variations Of The Egyptian Human Lungs And Its Clinical APPLICATIONS. *Int J Anat Res*, *8*(3.2), 7674-79.
4. Halagatti, M. (2020). Types of pulmonary fissures and its surgical implications: A cadaveric study. *Indian Journal of Clinical Anatomy and Physiology*, *7*(1), 72-76.
5. Rosse, C.; Gaddum and Rosse, P(1997). Textbook of Anatomy(5th ed.). Lipincott-Raven.
6. Gopalakrishna, K., Deepalaxmi, S., Somashekara, S. C., &Rathna, B. S. (2017). A cadaveric study on morphological variations of fissures and lobes in the human lungs and its clinical significance. *Journal of Experimental and Clinical Anatomy*, *16*(1), 7.
7. Godwin, J. D., & Tarver, R. D. (1985). Accessory fissures of the lung. *American journal of roentgenology*, *144*(1), 39-47.
8. Craig, S. R., & Walker, W. S. (1997). A proposed anatomical classification of the pulmonary fissures. *Journal of the Royal College of Surgeons of Edinburgh*, *42*(4), 233-234.
9. Sadler, T. W. (2018). *Langman's Medical Embryology* (Fourteenoth, International ed.). Wolters Kluwer Health.
10. Larsen, W. J. (1997). *Human Embryology* (2nd ed.). W.B. Saunders Company.
11. Quadros, L. S., Palanichamy, R., &D'souza, A. S. (2014). Variations in the lobes and fissures of lungs-a study in South Indian lung specimens. *Eur J Anat*, *18*(1), 16-20.
12. Dutta, S., Mandal, L., Mandal, S. K., Biswas, J., Ray, A., &Bandopadhyay, M. (2013). Natural fissures of

lung: anatomical basis of surgical techniques and imaging. *Natl J Med Res*, *3*, 117-121.

13. Bergman, R. A., Afifi, A. K., &Miyauchi, R. (n.d.). *Illustrated Encyclopedia of HumanAnatomic Variation: Opus IV: Organ Systems: Respiratory System*. Www.Anatomyatlases.Org. Retrieved March03, 2021, from https://www.anatomyatlases.org/AnatomicVariants/OrganSystem/Text/LungsTrachea.shtml
14. Lukose, R., Paul, S., Daniel, M., Abraham, S. M., Alex, M. E., Thomas, R., & Nair, V. (1999). Morphology of the lungs: variations in the lobes and fissures. *Biomedicine-Trivandrum Then Taramani*, *19*(3), 227-232.
15. Richards, J. M., Dunning, J., Oparka, J., Carnochan, F. M., & Walker, W. S. (2012). Video-assisted thoracoscopic lobectomy: the Edinburgh posterior approach. *Annals of Cardiothoracic Surgery*, *1*(1), 61.
16. John A.Waldhausen, WilliamS. Pierce, David B.Campbell (1996) Thoracic Surgery. In: Surgery of the Chest ( 6th ed.).Mosby.
17. Le Pimpec-Barthes, F., Arame, A., Pricopi, C., &Riquet, M. (2011). Prevention of middle lobe torsion or bronchial plication using anti-adhesive membrane: a simple, safe and uncomplicated technique!. *European journal of cardio-thoracic surgery*, *39*(6), 1059-1069.
18. George, B. M., Nayak, S. B., &Marpalli, S. (2014). Morphological variations of the lungs: a study conducted on Indian cadavers. *Anatomy & cell biology*, *47*(4), 253.

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