

## Original Article



## Morphometric Study of Human Cadavaric Lung Fissures with Different Variations: A Descriptive Observational Study from Eastern Odisha

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### ABSTRACT

**Introduction:** Both right and left lung of human being shows lot of variations in their dimensions like length, breadth, thickness and so also the disposition of fissures. In the present study we observed the variations of fissures, measured the length, depth of transverse and oblique fissures of both right and left lungs

**Aims and objectives:** To study the normal lung fissures, lobes, variations, and compare with the study of previous authors.

**Materials and Methods:** The present descriptive observational study was done with specimens of 33 Right and 33 left lungs obtained during dissection in the Anatomy department, S C B Medical Cuttack as a part of 1st year MBBS curriculum from 2018 to 2020.

**Observations:** The left lung shows maximum variations of fissures in that they show an extra transverse fissure which is normally absent in the right lung. Out of 33 left lungs 7(21.1%) and 33 left lungs 7(21.1%) showed complete fusion of oblique fissures. The entire lower lobe fissures of one left lung showed broncho-pulmonary segment wise separation having horizontal and vertical fissures. The right lung was found to be broader shorter and thicker than the left lung with significant p value <0.0001. The horizontal fissures of right lungs were predominantly fused showing various degrees of adhesions. There were one partially fused horizontal fissure in the left lung and two accessory fissures vertical and horizontal observed in the present study.

**Conclusion:** Fused and accessory horizontal fissures are most commonly seen. Incomplete and fused oblique fissures are almost same for both the lungs. Presence of horizontal fissure in left lung is an unusual finding of this study. The morphometry of lungs and its various normal, fused and accessory fissures will be helpful for cardiothoracic surgeons for removal of pathological lung tissue during lobectomy or segmentectomy.

**Keywords:** Lungs, Fissures, Variations, MBBS curriculum.

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### INTRODUCTION

Lungs and heart are two vital organs present in the thoracic cavity for respiration and circulation. Each lung is conical in shape and having apex base two surfaces and 3 borders. It is further divided into lobes by oblique and transverse fissures and anatomically and surgically important broncho-pulmonary segments.<sup>1</sup> Classically right lung has three lobes due to presence of two fissures oblique and transverse whereas left lung two lobes by one oblique fissure only.<sup>2</sup> The expression of WNT5A and HOXB gene cluster antisense RNA are regulators of embryonic development of lung fissures located in chromosome no 5 and 14.<sup>3</sup>

Broncho-pulmonary segments are independent pulmonary districts having own vasculature and aeration. There were

total 10 broncho-pulmonary segments in each lung the upper lobe 3 segments, middle/ lingular lobe 2 segments and lower lobe 5 segments one apical and four basal respectively. This knowledge however is very useful for surgeons to remove the pathological segments.<sup>4</sup>

Right and left lung of Human being shows lot of variations in their length, breadth and thickness from person to person. Even the fissures and lobes in both the lungs in the same person vary with each other.<sup>5</sup> The length, breadth and thickness of both right and left lungs were also measured to observe its dimension to compare with previous studies.<sup>6</sup>

The knowledge of normal measurement of lungs and its variations of lobes and fissures are useful in diagnostic procedures and surgeries involved in lobectomy especially removal of pathological segments of diseased lungs.

**Aims and Objectives:** Study of normal length, breadth and thickness of both, right and left lungs with special emphasis on normal fissures and their variations.

### MATERIALS AND METHODS

The present descriptive observational study was carried out in the PG Department of Anatomy S C B Medical



College Cuttack during the routine dissection procedure of formalin preserved cadavers from April 2019 to December 2021. The entire specimens studied were having intact lobes and fissures. There were 33 Right and 33 Left lungs obtained from 33 embalmed cadavers. The morphometry was done by simple measuring tape of the lungs, main fissures (complete or incomplete) with variations and presence of accessory fissures after being washed carefully by running tap water.

Inclusion criteria: complete intact lung parenchyma without any damage.

Exclusion criteria: damaged lung tissue distorting normal architecture.

Ethical issue: ethical clearance was not applicable to the present study as per National Health Act No. 61/2003.

Data analysis: Graph Pad software Prism version 9 was used for calculation of frequency, standard deviations and p value <0.05 was taken into consideration.

## RESULTS

The dimensions were analyzed in each side of 33 lungs. The mean and standard deviations of various parameters were length  $18.45 \pm 3.12$  (R)/  $22.05 \pm 3.34$  (L), breadth  $9.14 \pm 1.02$  (R)/  $7.50 \pm 1.22$  (L) and thickness  $14.3 \pm 2.58$  (R)/  $11.6 \pm 2.86$  (L) respectively. The two-tailed P value is less than 0.0001, which was statistically significant comparing right and left side of lungs. (Fig 1 and 2)

The measurements of length and depth were  $19.45 \pm 5.5/5.1 \pm 1.62$  centimetres for oblique fissures of right lung and  $22.33 \pm 4.23/3.21 \pm 2.01$  centimetres for left lung respectively. The length and depth horizontal fissures for right lung were  $11.01 \pm 2.21/3.3 \pm 1.22$  centimetres. The length and depth of two horizontal fissures and one accessory/ vertical fissure of left lung were  $4.42 \pm 0.80/0.40 \pm 0.21$  centimetres respectively. The statistically significant two-tailed P value less than 0.0001 were in all the measurements of the present study. (Fig 1 and 2).

**Table 1:** Mean and standard deviations of length, breadth and thickness of both right and left lung.

Measurements in centimetres	Right lung n=33	Left lung n=33	t= value	Std error	P value
Length $\pm$ SD	$18.45 \pm 3.12$	$22.05 \pm 3.34$	4.5247	0.796	<0.0001
Breadth $\pm$ SD	$9.14 \pm 1.02$	$7.50 \pm 1.22$	5.9244	0.277	<0.001
Thickness $\pm$ SD	$14.3 \pm 2.58$	$11.6 \pm 2.86$	4.0268	0.671	<0.0002

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

Measurements in centimetres	Right lung n=33		Left lung n=33		P value length	P value depth
Dimensions	Length $\pm$ SD	Depth $\pm$ SD	Length $\pm$ SD	Depth $\pm$ SD		
Oblique fissure	$19.45 \pm 5.5$	$5.1 \pm 1.62$	$22.33 \pm 4.23$	$3.21 \pm 2.01$	0.0201	0.0001
Horizontal fissures	$11.01 \pm 2.21$	$3.3 \pm 1.22$	$4.42 \pm 0.80$	$0.40 \pm 0.21$	0.0001	0.0001



**Figure 1:** Complete oblique and transverse fissures right lungs.





Figure 2: Complete oblique fissures left lungs.



Figure 3: A. fused right oblique fissure B. complete fused oblique fissure with horizontal fissure in left lung



Figure 4: Both A and B complete oblique fissure and two accessory fissures one horizontal and one vertical in lower lobe of left lungs.

**Table 3:** Incidence of variations of oblique and horizontal fissures of both the lung

Side of lung	Right lung fissures n=33		Left lung fissures n=33		
Type of fissure	Oblique	Horizontal	Oblique	Horizontal	Vertical
Complete	26(78.8%)	13(39.4%)	25(75.8%)	0	0
Fused	7(21.2%)	20 (60.6%)	7(21.1%)	1(0.03%)	0
Accessory	00	00	1 (0.03%)	1 (0.03%)	1 (0.03%)

The oblique fissures were complete in 26(78.8%)/ fused 7(21.2%) case of right lung and complete in 25(75.8%)/ fused 7(21.1%) specimens of left lung. The horizontal fissures were complete in 13(39.4%)/ fused in 20 (60.6%) of specimens of right lungs. One left lung showed complete fusion of oblique fissure with partially fused horizontal fissure1 (0.03%) Fig 1. Another specimen of left lung was showing one complete fissure 1 (0.03%) and two accessory fissures one horizontal 1 (0.03%) and one vertical 1 (0.03%) making the lower lobe of left lung segmented. (Fig 3 and 4)

## DISCUSSIONS

Embryologically the development of lungs was started from 6<sup>th</sup> week of intrauterine life and completed by 14<sup>th</sup> weeks of gestation with its architectural pattern and broncho-pulmonary segmentations. Later on most of the spaces fused to give typical 3 lobes with two fissures in right lung and 2 lobes with one fissure in left lung. Extra or accessory lobe or fissures appear due to non obliteration or partial fusion of the spaces.<sup>6</sup>

In the present study 66 lung specimens (33 for both right and left side) were examined for general morphometry, fissures and accessory fissures in detail and compared with previous authors.

The measurements of right lungs were comparatively broader shorter and thicker than left lung, which is clearly evident in the present study. The length breadth and

thickness were (18.45±3.12, 9.14±1.02 & 14.3±2.58) for right lung and (22.05± 3.34, 7.50± 1.22 & 11.6±2.86) for left lung with significant p value <0.0001.<sup>5</sup> (Table 1)

The mean lengths of oblique fissures were observed to be more in left lung 22.33±4.23 than that of right lung 19.45±5.5 centimetres. The depth of left lung was found to be shallower 3.21±2.01 than that of right 5.1±1.62 centimetres showing varying degrees of adhesions. The accessory fissures were observed in left lung showing one shallow horizontal fissure and two segmental fissures. The fissures observed in the present study for right and left lungs were statistically significant (two-tailed P value less than 0.0001) [Table 2, Fig 1 and Fig 2].<sup>7,9</sup>

The incidence of complete oblique fissures was almost similar in both the lungs 26(78.8%) and 25(75.8%) respectively. Similar studies were observed for fused oblique fissures 7(21.2%) for each lung. The horizontal fissures of right lungs were predominantly fused 20 (60.6%) showing various degree of adhesions. There were one partially fused horizontal fissure in the left lung 1(0.03%) and two accessory fissures vertical and horizontal observed in the present study which was similar to the studies done by Mamatha et al.<sup>11</sup>, Sudhikshya KC et al. Nepal and Mutua V et al. Kenya<sup>8,10</sup> and the accessory fissures were seen more in number by Gopalkrishna et al.<sup>12</sup> India and Mpolokeng K.S et al South Africa.<sup>9</sup> (Table 4)

**Table 4:** Comparison of different studies indicating the variations of oblique and transverse fissures in percentage.

Authors	Sample/ year	Right lung						Left lung		
Fissures	O/T	Oblique			Transverse			Oblique		
Types	C/I/A	C %	I %	A %	C %	I %	A %	C%	I %	A %
Mamatha et al. <sup>11</sup>	2016/40	85	15	00	50	50	00	65	35	00
Gopalkrishna et. al. <sup>12</sup>	2017/100	82	16	6	74	20	6	78	18	4
Sudhikshya KC Nepal <sup>8</sup>	2018/50	69.7	30.4	00	52.2	34.9	00	48.2	51.8	00
Mutua, V Kenya <sup>10</sup>	2021/70	63.2	36.8	00	47.4	42.1	10.5	65.3	34.4	00
Mpolokeng K.S South Africa <sup>9</sup>	2022/82	90.7	7	2.3	72	15.6	11.6	45.5	45.5	09
Present study	2022/66	78.8	21.2	00	39.4	60.6	00	75.8	21.1	0.03

O/T-oblique or transverse C/I/A -complete, incomplete absent or accessory

## CONCLUSION

Overall normal architecture of right lung as broader thicker and shorter in relation to lung slender left lung was observed. Rare variations like four lobed left lung is seen in one specimen. There is complete absence of transverse

fissure making the right lung bi-lobed.in stead of normal tri-lobar features. Fused and accessory horizontal fissures are most commonly seen. Incomplete and fused oblique fissures are almost same for both the lungs. Presence of horizontal fissure in left lung is an unusual finding of our





study. The morphometry of lungs and various normal, fused and accessory fissures will be helpful for cardiothoracic surgeons for removal pathological lung tissue during lobectomy or segmentectomy.

**Limitation of study:** Less number of specimen and adverse climatic conditions resulting shrinkage of lung parenchyma is the major limitation of the study. Age and sex are not determined as most of the cadavers are adult males.

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