

MORPHOMETRIC STUDY OF LUNG FISSURE AND ITS VARIATIONS; A CADAVERIC STUDY FROM MARATHWADA REGION

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ABSTRACT

Background: With the increase in air pollution; incidence of respiratory diseases varying from viral infections to lung cancers is increased and hence to know lung anatomy and its variation is important for physicians, cardiopulmonary surgeons and medical undergraduates.

Purpose of study: to study the morphological variation of the lung fissures. 46 formalin preserved cadaveric lungs allotted to undergraduate students in Anatomy Department of MGM medical college Aurangabad were studied for variations and morphometry of lung fissures.

Results: Out of 46 cadaveric lungs of unknown gender 22 were right sided and 24 were of left side. Amongst 22 right lungs; 17 (77.27%) lungs have well developed oblique fissure; while 5 (22.72%) lungs had incomplete oblique fissures. Only 5(22.72%) right lungs had complete horizontal fissure, 14(63.63%) right lungs had incomplete horizontal fissures 3(13.63%) lungs had absent horizontal fissure. Out of 24 left lungs 18(75%) specimens have well developed oblique fissure, 6 (25%) left lungs have incomplete oblique fissure while 1(4.16%) left lung had incomplete horizontal fissure. Present study had incomplete accessory fissure in 3 lung specimen of which 1 right lung had superior accessory fissure and 2 left lungs had inferior accessory fissure. There are very few studies on lung fissure for Marathwada population.

Conclusion: Present study gives idea about possible variations in lung fissures. Present study supports the frequent occurrence of variations of lungs fissures and lobes. Prior information of such variations is important for cardiothoracic surgeons and pulmonologists to avoid post operative complications of surgery or lung procedures.

KEY WORDS: lung, oblique fissures, accessory fissure.

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INTRODUCTION

During routine MBBS classes few of right lungs were found with two lobes and only one prominent oblique fissure with a small indentation of horizontal fissure practically dividing right lung

into two lobes; this raised the interest to find the incidence of morphological variation of the lung fissures.

The lungs are essential organs of respiration. Each lung is half conical in shape having apex,

base, costal and medial surfaces separated by its anterior, posterior, inferior border[1] Oblique (major) and horizontal(minor) fissures divide right lung into superior, middle and inferior lobes. The left lung is divided into superior and inferior lobes by its oblique fissure [2].

Absence of fissures that are normally present leads to a reduction in number of lobes. e.g. When transverse fissure is absent on right lung it has only two lobes [3].

“Accessory fissures may separate either the medial basal segment (Twining’s line) or the superior segment from the remainder of the inferior lobe” [2]. Prior to lobectomy identification of incomplete separation of lobes and incompleteness of the fissures are important as individuals with incomplete fissures are prone to develop postoperative air leaks. These post operative complication may require procedures like stapling and pericardial sleeves [2].

Keeping in mind the above clinical importance of lung fissure variation; an analytical study was carried out on 46 formalin preserved cadaveric lungs allotted to undergraduate students in Anatomy Department of MGM medical college Aurangabad.

Out of 46 lung specimen examined 24 were of left, 22 were of right sided lung specimen (laterality of lung was decided by considering hilar structure). Observation and readings were done for length and extent, completeness and variations of oblique and horizontal fissures. If present; type and extent of accessory fissures is noted. Present study had incomplete accessory fissure in 3 of the lung specimens.

The length of oblique and horizontal fissures were measured and statistically analyzed. The anatomical classification proposed by Craig and Walkar[4] was followed to classify oblique and horizontal fissures.

With the increase in air pollution incidence of respiratory diseases varying from viral infections to lung cancers is increased and hence knowledge of lung anatomy and its variation is important for physicians, cardiopulmonary surgeons as well as medical undergraduates.

Very few studies on lung fissures and its variations are conducted from Marathwada region. Present study and previous studies [5,6,7,8]

supports the frequent occurrence of variations of lungs fissures and lobes. Also as lung fissure and lobe variations are common; undergraduate students should be made aware regarding it.

MATERIALS AND METHODS

46 formalin preserved cadaveric lung allotted to MBBS students of Anatomy Department of MGM medical college Aurangabad, measuring thread, Vernier caliper, metric scale.

Morphometric study of 46 formalin preserved lung fissures was carried out in Anatomy Department of MGM medical college Aurangabad. Out of 46 lung specimen examined 24 were of left, 22 were of right sided lung specimen (laterality of lung was decided by considering hilar structure). Observation and readings were done for length and extent, completeness and variations of oblique and horizontal fissures. Presence of accessory fissures is noted. The length of oblique and horizontal fissures were measured and statistically analyzed. (Figure 1,2,3,4) The anatomical classification proposed by Craig and Walkar [4] was followed to classify oblique and horizontal fissures.

RESULTS AND DISCUSSION

Amongst 22 right lungs; 17 (77.27%) lungs have well developed oblique fissure; while 5 (22.72%) lungs had incomplete oblique fissures. Only 5(22.72%) right lungs had complete horizontal fissure, 14(63.63%) right lungs had incomplete horizontal fissures 3(13.63%) lungs had absent horizontal fissure. Out of 24 left lungs 18(75%) specimens have well developed oblique fissure, 6(25%) left lungs have incomplete oblique fissure while 1(4.16%) left lung had incomplete horizontal fissure. Present study had incomplete accessory fissures in 3 lung specimens of which 1 right lung had superior accessory fissure and 2 left lungs had inferior accessory fissure.

In present study mean oblique fissure length in right lungs was-20.35 with range 14.5 to 26 cm, Average oblique fissure length on left side was 22.64cm with range 12 to 27 cm. Horizontal fissure length was mean 6.118 cm with range 1 to 12 cm.

Table 1: Incidence of variations in major and minor fissures of right and left lungs according to Craig and Walker[4] classification.

	Right oblique fissure	Right horizontal fissure	left oblique fissure
GRADE I	50%	18.18%	58.33%
GRADE II	36%	45.45%	33.33%
GRADE III	9%	22.70%	8.33%
GRADE IV	0%	13.60%	0%

Variation: Present study found variation of right lung fissure (Figure 7) showing fused oblique and horizontal fissure forming only one fissure which is reaching on anterior border as horizontal fissure dividing right lung into two lobes.

Accessory Fissures: (Figure 8 and 9) Present study had incomplete accessory fissure in 3; 1 specimen amongst of 22 right lungs (4.54%) had superior accessory fissure and 2 (8.33%) left lung amongst 24 specimens demonstrated inferior accessory fissure. However study by Enakshi Ghosh et al [6] had not found any accessory fissure. Dr Lakshmi Kumari^[10] noted accessory fissure in 1 (4%) right lung. Abhilasha Wahane et al ^[9] noted accessory fissure in 7 (24.13%) of right and 4 (19.04%) of left lung.

Study by Bincy M George et al[7] found 3 of 65 right and 2 of 73 left lung had accessory fissure.

Figure 1 and 2: Showing the Lung Specimens.



Fig. 3 and 4: Method to calculate length of fissure: Oblique fissure and horizontal fissure length was calculated by applying thread to fissure and then measuring length of the thread on metric scale.



Fig. 5: A small indentation of incomplete horizontal fissure of right lung practically dividing it into two lobes.



Fig. 6: (Specimen 2) Right Lung incomplete oblique fissure persistent in upper part only; fused in lower part near anterior border.



Fig. 7: Present study found variation of right lung fissure (Figure 2) showing fused oblique and horizontal fissure forming only one fissure which is reaching on anterior border as horizontal fissure dividing Right Lung into two lobes.



Fig. 8: Right superior accessory fissure. White arrow showing accessory fissure, black arrow showing horizontal fissure



Fig. 9: Left lung Inferior accessory fissure (specimen 12) White arrow showing accessory fissure, black arrow showing oblique fissure.



DISCUSSION

Respiratory system starts developing from median diverticulum of the foregut. The respiratory diverticulum divides into two primary divisions which form the right and left principal bronchi. Left division soon shows two subdivisions that represent the two lobar bronchi of the left lung. The right division divides into three lobar bronchi [3]. Mesoderm separates the parts of the lung parenchyma, developing from lobar bronchi. It forms the connective tissue basis of the lung and gives rise to the pleura. The lobes come to be separated by fissure as the pleura lines the surface of each lobe separately [3].

Anomalies of fissures are due to 1) absence of fissures that are normally present which leads to a reduction in number of lobes, e.g. absent transverse fissure of the right lung results in right lung with two lobes. 2) Presence of abnormal fissures this may present as a) A transverse fissure on the left side with the left lung having three lobes. b) The medial basal segment of the left lung may be separated by a fissure from the rest of the lower lobe. c) The superior segment of the lower lobe may be separated by accessory fissure. d) Azygous lobe may be present [3].

Early in the fifth week; the first round of branching of the primary bronchial buds occurs. This highly stereotypical round of branching yields three secondary bronchial buds on the right side and two on the left side. The secondary bronchial buds give rise to the three lobes in the right lung and two in the left lung [4-11].

“Many lung anomalies result from failure of the respiratory diverticulum or its branches to branch or differentiate correctly” [11]. During the embryonic or early fetal periods, errors in the pattern of pulmonary branching i.e. branching morphogenesis results in defects such as abnormal number of pulmonary lobes or bronchial segments or even complete absence of a lung [11].

A.K.Datta mentions the importance of Oblique fissure that “Oblique fissure acts as a plane of cleavage so that during inspiration upper part of the lung expands forwards and laterally by the elevation of ribs, whereas lower part of the lung moves downwards and backwards by piston movement of the diaphragm” [1].

Table 2: Showing comparison of fissure length of previous and present study.

	Right Oblique fissure length in cm		Right horizontal fissure length in cm		Left Oblique fissure length in cm	
	Mean	Range	Mean	Range	Mean	Range
Hina Sharma et al [8]	23.76 +/-7.34	-	10.73+/-4.46	-	22.06+/-3.43	-
K.Lakshmi Kumari et al [10]	-	13cm to 26 cm	-	4 to 18cm	-	8 to 28 cm
Abhilasha Wahane et al [9]	-	13 to 29 cm	-	10 to 18 cm	-	8 to 28 cm
Present study(2018)	20.35	14.5 to 26 cm	6.118cm	1 to 12cm	22.64	12 to 27cm

Table 3: Comparison of present and previous studies findings of major and minor fissures of lungs.

Study name	Right lung oblique fissure			Right lung horizontal fissure			Left lung oblique fissure		
	Complete	Incomplete	Absent	Complete	incomplete	Absent	Complete	incomplete	Absent
Medler EM [5]		25.60%	4.80%		17.10%	45.20%		10.60%	7.30%
Enakshi Ghosh et al [6]	-79%	19.56%	2.17%	26%	26.20%	47.80%	-79%	13.88%	5.55%
Bincy M George et al [7]	-	-	-	-	35.38%	3.07%	-	15.06%	-
Hina Sharma et al [8]	-	-	-	-	-	1 (7.69%)	-	-	14.28%
Abhilasha Wahane et al [9]	82.75%	17.24%	-	62.06%	31.30%	6.89	66.60%	28.50%	4.76%
Lakshmi kumari et al [10]	64%	12%	20%	59%	33%	4%	60%	28%	12%
Present study	17/22 (77.27%)	5/22 (22.72%)	0	5/22 (22.72%)	14/22 (63.63%)	3/22 (13.63%)	18/24 (75%)	6/24 (25%)	0

Present study measured oblique fissure lengths (Table 2) of right and left lungs these readings were comparable to previous studies by Dr. K Lakshmi Kumari et al [10] and Abhilasha Wahane et al. [9].

Craig and Walker's[4] fissural classification followed to classify lung fissures.(Table 1).Four Grades of Fissure described by them include 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 evidence of fissural line.

As mentioned in Grays Anatomy "Accessory fissures may separate either the medial basal segment (Twining's line) or the superior segment from the remainder of the inferior lobe." Prior to lobectomy Identification of incomplete separation of lobes and incompleteness of the fissures are important as individuals with incomplete fissures are prone to develop post-operative air leaks .These post operative complication may require procedures like stapling and pericardial sleeves [2].

Goldwin and Tarver found inferior accessory fissures, superior accessory fissure and left minor fissures as most commonly observed accessory fissures [12].

We note incomplete accessory fissure in 3 specimens of lung of which 1 right sided lung had

superior accessory fissure and 2 left lungs had inferior accessory fissure.(Figure 8 and 9)

Because of their incompleteness, thick sections and orientation in relation to a particular plane many a times the accessory fissure fails to be detected on CT scans. [13] Several authors[7,9] have reported varying percentage of incidence of the incompleteness and absence of the fissure. (Table: 4)

In study by Dr Lakshmi Kumari et al[10] 5 right and 3 left lung had absent oblique fissure, study by Abhilasha Wahane et al[9] observed 1left lung had absent oblique fissure, while all right lung had oblique fissure. Study by Prakash Bharadwaj^[14] had absent oblique fissure in 7.1% right lung and 10.7% left lung. Study by Heena Sharma et al showed absent oblique fissure in 2 out of 14 (3.6%) left lung. Study by Medler depicted 4.8% right lung had absent oblique fissure. 7.3% of left lung had absent oblique fissure.

In contrast to previous studies in present study; oblique fissure was present in all of the specimen.

CONCLUSION

Present study and earlier studies [5,6,7,8,9] supports frequent occurrence of absence or incomplete lung fissures as well as accessory fissures. Present study and previous studies suggests that undergraduate students should be

mentioned that hilar structures and borders are better guide for determining the side of the lung as variations of lung fissures and lobes are common. Due to their frequent occurrence prior to operative procedures knowledge of possible variations of lungs lobes and fissures is important for cardiopulmonary surgeons and physicians.

Conflicts of Interests: None

REFERENCES

- [1]. Essentials of Human Anatomy (Thorax and Abdomen) Part-1. A.K.Datta. 8th Edition Current Books International .60, Lenin Saranee, Kolkata-700 013 ,page 35.
- [2]. Susan Standring International Edition. Gray forty first edition Grays Anatomy The anatomical basis of clinical practice. page no 957.
- [3]. Human Embryology Eighth Edition Inderbir Singh , G P Pal. Macmillan Publishers India limited June 2007 Page 175- 178.
- [4]. Craig SR, and Walker's W S. A proposed Anatomical classification of the pulmonary fissures. J.R.Coll.Surg,Edinb.1997;42;233-234.
- [5]. Medlar E.M Variations in interlobar fissures. AM.J. Roentoenol. Radium Ther. 1947;57:723-25.
- [6]. Enakshi Ghosh , Rituparna Basu, Anjana Dhur, Anindya Roy, Hironmaya Roy, Amitwa Biswas. Variations of Fissures and lobes in Human lungs- A Multicentric cadaveric study From West Bengal, India. International journal of Anatomy, Radiology and Surgery,2013 April .Vol2(1):5-8.
- [7]. Bincy M.George, Satheesha B. Nayak, and Sapna Marpalli.Morphological variations of the lungs: a study conducted on Indian cadavers. Anat Cell Biol. 2014 December;47(4):253-258 Published online 2014 Dec 23. Doi: 10.5115/acb.2014.47.4.253
- [8]. Hina Sharma, K. Prabhakaran,L.K. Jain .Morphometric Analysis of Human Cadaveric Lungs.IJCRR. Int J Cur Res Rev. 2014;6(22):34-36.
- [9]. Dr Abhilasha Wahane , Dr Charulata Satpute . A Cadaveric Study of Morphological Variations of Lung in Vidarbha Region. International Journal of Science and Research(IJSR) 2015;4(1):1:2163-2166
- [10]. Dr. K. Lakshmi Kumari, Dr. K. Deena Usha Kumari,D Asha Latha . Morphological Variations of Fissures of Lungs.IOSR Journal of Dental and Medical Sciences (IOSR –JDMS) 2015;14(11):50-53.
- [11]. Larsen's Human Embryology Fifth Edition Schenwolf, Bleyl,Brauer, Francis –West.Elsevier Churchill Linving stone page no 254- 257.
- [12]. Goldwin JD,Tarver RD. Accessory fissures of the lung. American journal of Radiology 1985,144: p 39-47.
- [13]. Raasch BN, Carsky. EW, Lane EJO, Collaghan JF, Heitzman ER, Radiographic anatomy of the interlobar fissures. A study of 100 specimens AJR 1982:1043-49.
- [14]. Prakash, Bharadwaj 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.

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