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Morphological Variations of Fissures of Lungs

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Abstract:
Background: *The lungs are paired organs which are essential for respiration and are situated in thoracic cavity. Each lung is divided into lobes by fissures. Knowledge of variations in fissures and lobes is important for cardiothoracic surgeon, radiologists and physicians.*
Objective of study: *To study the morphological variations of fissures and lobes of Lung. Materials and* ***Methods:*** *Fifty formalin fixed lungs from The Department of Anatomy, Andhra Medical College, Visakhapatnam were studied.*
Results: *In total of 25 right lungs only one lung showed absent horizontal fissure., 8lungs showed incomplete horizontal fissure. Out of total 25 lungs of left side 3 lungs showed complete absent oblique fissure, incomplete oblique fissures shown in 7 lungs. Accessory fissures of left lung are seen in 4% of left lungs.*
Conclusion: *Proper knowledge of variations in fissures are helpful for surgeons to resection of segments and Radiologist for proper radiological interpretation.*
Keywords: *Lung, fissures , lobes.*

I. Introduction

Lungs are a pair of respiratory organs situated in the thoracic cavity. Amongst the pair of lungs, the right lung is broader and heavier than the left lung. Lungs are divided into lobes by fissures. These fissures are double folded pleura that section the lungs. The fissures helps in expansion of lung [1]. Two fissures oblique and horizontal, divides right lung into three lobes namely, upper, middle and lower. The oblique fissure separates the lower lobe from the remaining two lobes. It runs obliquely and crosses the inferior border of the lung about 7.5 cm behind its anterior end. The horizontal fissure separates the upper and middle lobe. It begins from the oblique fissure, runs horizontally and cuts the anterior border at inner end of fourth costal cartilage. The longer and lighter left lung is divided into a superior and an inferior lobe by an oblique fissure which extends from costal to medial surfaces of the lung both above and below the hilum. It begins on the medial surface posterosuperior to the hilum, runs obliquely upwards and backward to cut the posterior border of the lung about 6 cm below the apex and then passes downward and forward across the costal surface. The more vertical left oblique fissure is approximately indicated by vertebral border of scapula in fully abducted arm. Anatomical knowledge of variations is required to alert surgeons to potential problems encountered during operation [2].

Anatomical variations of lungs including number, fissures, and lobes are important for clinicians. Hayashi et al. (2001) concluded that the knowledge of the anatomy and normal variants of the major fissures is essential for recognizing their variable imaging appearances as well as related abnormalities [3]. Aziz et al. (2004) suggested that interlobar fissures are important landmarks for proper identification of normal pulmonary anatomy and evaluation of disease. Accurate knowledge of anatomy is recommended for appropriate interpretation .Various researchers in different studies of lung reported their findings and again since cadavers are still the best means of study all the domains of anatomy[4,5,6,7]. In many diseases, segmental localization is a must and the knowledge of accessory fissure is of much clinical importance to the clinician. Pre operative planning and strategy for pulmonary lobectomy and segmental resection may also change during presence of such accessory fissures. An incomplete fissure is also a cause for post operative air leakage [8]. Many times, the accessory fissures fail to be detected on CT scans, because of their incompleteness, thick sections and orientation in relation to a particular plane . As the fissures form the boundaries for the lobes of lungs, the knowledge of the anatomy and normal variant of the the major fissures is essential for recognizing their variable imaging appearances as well as related abnormalities(9)

II. Materials And Methods

A descriptive study was employed to assess the variations in presence and completeness of fissures and lobes of the lung in human cadavers . Fifty Lungs of formalin fixed cadavers which were collected during routine dissection for the medical undergraduates and postgraduates in The Department of Anatomy, Andhra Medical College, Visakhapatnam were used for this study. The study was conducted from December 2013 to march 2015.

III. Observations And Results

This study had been done in the Department of Anatomy, Andhra Medical College,Visakhapatnam. We procured 50 formalin fixed lungs belonging to both sex for a period of 3 years out of which 25 are right and 25 are left lungs.

The right lung showed incomplete horizontal fissure in 8 lungs (33%)Fig 1, incomplete oblique fissures in 3 lungs (12%) Fig .2, complete horizontal fissures in 14 lungs (59%) and complete oblique fissures in 16 lungs (64%) Fig 3.The oblique fissure was absent in 5 lungs (20%) and transverse fissure was absent in 1 lung (4%).Accessory fissures were noted in one right lung

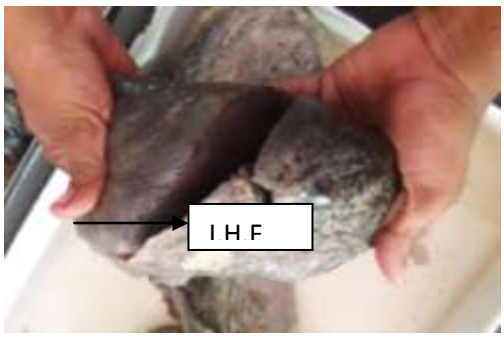
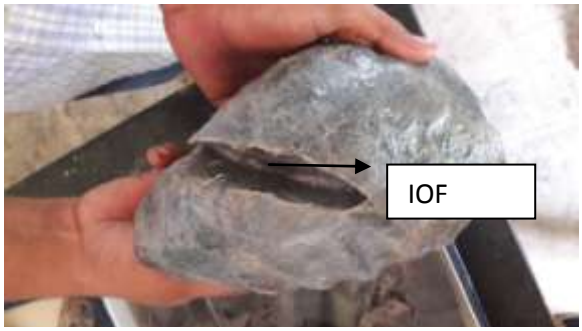


Fig:1. Showing IHF- incomplete Horizontal fissure. Fig2. Showing IOF-Incomplete oblique fissure

Fig:3. Showing complete fissures

The left lung showed incomplete oblique fissures in 7 lungs (28%)Fig.4 and complete oblique fissures in 11 lungs (44%)fig 5. The oblique fissure was absent 3 lungs (12%).Fig.6.



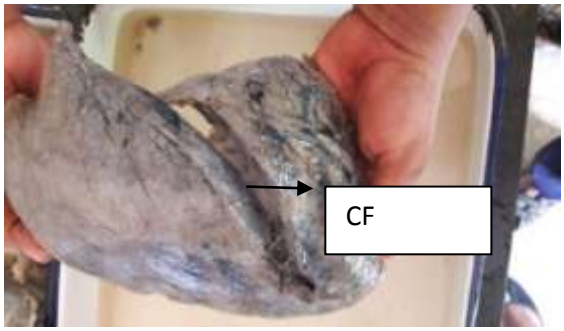


Fig:4. Showing Incomplete oblique fissure Fig.5:Showing complete fissure

Fig:6. Showing absent fissure

The length of oblique fissure ranged from26 cm(max) to 13 cm(min) on the right side .The length of fissures on the left side was ranging from 28 cm(max) to 8 cm (min).The length of transverse fissure on the right side was ranging from18 cm to 4 cm. The accessory fissures are about 3 cm to 1 cm in length. The right lobe showed 3 lobes and left lobe showed 2 lobes.

Table 1: Incidence of variations in major and minor fissures of right and left lungs.

Lung	Fissures	Complete	Incomplete	Absent	Accessory
Right Lung	Horizontal fissure	59%	33%	4%	4%
	Oblique fissure	64%	12%	20%	
Left Lung	Oblique fissure	60%	28%	12%	–

Table 2: Incidence of major and minor fissures of lungs according to Craig and Walker criteria

Lung	Fissures	Grade I	Grade II	Grade III	Grade IV
Right Lung	Horizontal fissure	53%	12%	26%	9%
	Oblique fissure	74%	21%	5%	0%
Left Lung	Oblique fissure	88%	9%	3%	0%

IV. Discussion

The anatomical classification proposed by (Craig and walker)[10] was followed to determine for the presence and completeness of fissures. It includes 4 grades. Grade I: complete fissure with entirely separate lobes; Grade II: complete visceral cleft but parenchymal fusion at the base of fissure; Grade III: visceral cleft evident for a part of fissure; Grade IV: complete fusion of lobes with no evident fissural line. In the present study variations involving the horizontal fissure in right lung is of Grade 1 is 53%, Grade 2 is 12%, Grade III is 26% and Grade IV is 9%. Left lung of Grade I is 88%, GradeII is 9% and Grade III is 3%. Gradation of fissures is important surgically. The surgeon approaches to ligate the vessels and bronchi through the depth of the fissures. Grade I oblique fissure makes the approach easy while doing lobectomy and video assisted Thoracoscopic surgery(11). Otherwise the lung parenchyma has to be dissected to reach those structures leading to preoperative hemorrhage and postoperative complications.(12) Embryologically, The respiratory diverticulum or lung bud develops from the foregut. During subsequent development, at around 28 days after fertilization, this diverticulum divides into two primary bronchial buds, the right and left ones, which will ultimately develop into the right and left lungs [13]. An embryological insult around 4 weeks post fertilization might have resulted in developmental anomaly of lungs. The lung bud bifurcates into 2 primary bronchii left and right which ultimately develop into left and right lungs. The right endodermal bud gives origin to a monopodial diverticulum which later becomes upper lobe bronchus .At this stage the right lung bud posses 3 bronchial tubes where as the left has only 2 bronchial tubes. These endodermal tubes together with lung buds give origin to definitive lobes of adult lung. In subsequent development 10 bronchii divide dichotomously until 18 generations of sub divisions are produced. The monopodial branching of stem bronchii account for accessory bronchii and lobes often found in an adult lung. In prenatal life fissures separate individual bronchopulmonary segments. All fissures get obliterated except along two planes which are developed fully as oblique and transverse fissures. Defective pulmonary development will give raise to variations as encountered in fissures and lobes . Prevalence of absent or incomplete horizontal fissure of the right lung was greater in our work than in the study by Lukose et al[14], whereas it was less prevalent (57.1%) than in the reports published by various other authors (Medlar; Raasch et al) [15]; (Bergman et al) [16]. Prevalence of incomplete oblique fissure of the right lung was higher in our study (39.3%) than in previous works by Medlar (1947), Meenakshi et al [15] and Bergman et

al. (2008); on the other hand it was less prevalent than in earlier reports by different authors (Raasch et al., 1982; Frija et al., 1988; Glazer et al., 1991; Otsuji et al., 1993; Aziz et al., 2004). The presence of incomplete oblique fissures of left lung is 28% in this study. This is lower than the findings of IEHAV(30%) and Meenakshi et al (46.6%) . this is higher than Lukose et al (21%). The incidence of absent fissures in this study were very low in comparision with other studies by Meenakshi et al and Ajay Ratnakar Rao et al. Accurate recognition of incomplete major and minor interlobar fissure in different populations may lead to improve the understanding of lesions like pneumonia, pleural effusion, and collateral air drift along with disease spreading through the lung. Any variations in the morphological pattern of the fissures indicates variations in normal pattern of lung development.

IV. Conclusion

The knowledge of morphological variations in fissures and lobes of lungs is helpful to cardiothoracic surgeons and surgeons while performing segmental resection of Lung. It is also helpful to the Radiologists and physician to appreciate the spread of disease and to plan the treatment.

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