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Original Article

FISSURES AND LOBES OF LUNGS: A MORPHOLOGICAL AND ANATOMICAL STUDY

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ABSTRACT

Background and Aims: The fissures of the lungs serve as boundaries for the lobes of the lungs. They also acts as barriers to avoid the spread of pathologies .The proposed aim of the study was to study the fissures and lobes of the lungs and their variations and to compare them with previous studies and to find their clinical implications.

Methods: Thirty pairs of lungs were used for the study, obtained from formalin-fixed cadavers of south-indian origin. The lung specimens were observed for the patterns of lobes and fissures, variations were noted and specimens were photographed.

Results: Five right lungs showed absence of horizontal fissure. Out of thirty, twelve right sided lungs showed incomplete fissures.On the left side, seven specimens showed incomplete oblique fissure. In addition, two right-sided specimens and four left sided specimens showed presence accessory fissure.

Conclusion: The results and their comparison with the previous works show that there is a wide range of difference in occurrence of major, minor and accessory fissures between and among different populations. Knowledge of such variations is mandatory for surgeons in pre-operative planning for performing pulmonary lobectomies and for radiologists for interpreting X-rays and CT scans.

KEY WORDS: Accessory fissure, Horizontal fissure, Lung, Oblique fissure.

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INTRODUCTION

The lungs are the vital organs of respiration situated in the thoracic cavity. Each lung is approximately half conical in shape and presents an apex, base, three borders and two surfaces. The lungs are divided into lobes and the physical boundaries between the lobes are the lobar fissures [1]. The right lung classically has two fissures, an oblique and horizontal dividing it into three lobes namely superior, middle and lower. Left lung has only the oblique fissure which divides it into upper and lower lobes [2]. The lobes function relatively independently within the lungs. The lobes are further subdivided into segments [1]. In addition to major fissures lung might also have accessory fissures, usually indicating junction between bronchopulmonary segments [3]. Fissure serves as a physical boundry between two segments. The fissures may be complete, when the lobes remain 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 altogether [4].

As the fissures form the boundaries for the lobes of the lungs, 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.[5] Knowledge of anatomical variations of fissures alerts the surgeons to potential problems that might be encountered during surgical treatment. Since the cadavers are best methods to study all the domains of anatomy, the present study was undertaken to analyse the morphological variations of fissures and lobes of lungs.

MATERIALS AND METHODS

Thirty pairs of lungs procured from the formalin fixed cadavers that were used for undergraduate teaching at Karpaga Vinayaga Medical College, Madhuranthagam were used for this study. The lungs were studied for:

1. Presence of fissures and lobes.
2. Variations in fissures, complete or incomplete.
3. Accessory fissure, if any.

The anatomical classification proposed by Craig and Walker was followed to determine the presence of completeness of fissures.

RESULTS

The right lung showed incomplete horizontal fissure in 12 lungs (40%) and incomplete oblique fissure in 5 lungs (17%).The horizontal fissure was absent in 5 of the lung specimens. Two of the right lungs showed the presence of accessory fissure.

The left lungs showed incomplete oblique fissure in 7 lungs (23%). Four of the left lungs showed presence of accessory fissures.

Fig. 1: Right lung showing horizontal and oblique fissures.

Fig. 2: Right lung with only blique fissure.Absence of horizontal fissure.

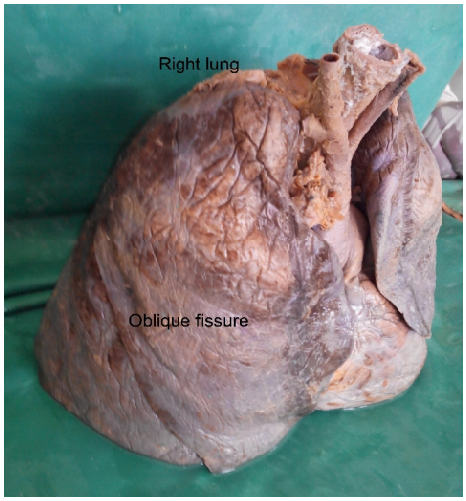

Fig. 3: Left lung with incomplete oblique fissure.

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

		complete	Incomplete	absence
Right lung	Horizontal fissure	13(43%)	12(40%)	5(17%)
	Oblique fissure	25(83%)	5(17%)	0
Left lung	Oblique fissure	23(77%)	7(23%)	0

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

		Grade I	Grade II	Grade III	Grade IV
Right lung	Horizontal fissure	43%	7%	33%	17%
	Oblique fissure	77%	17%	6%	0
Left lung	Oblique fissure	83%	14%	3%	0

Craig and Walker [6] proposed a criteria for classification of fissures for describing operative technique and also for comparing different surgical series. The criteria used to classify the lung fissures were based on the degree of completeness of fissure and the location of the pulmonary artery at the base of the oblique fissure.

Four grades of fissures have been described. Grade 1- complete fissure with entirely separate lobes. Grade-2- complete visceral cleft but parenchymal fusion at the base of the fissure. Grade3-visceral cleft evident for a part of the fissure.Grade4-complete fusion of lobes with no evident fissure line.

In the present study morphological variations involving the oblique fissure in left-sided lungs is of Grade-1 in 83%,Grade-2 in 14% and of Grade -3 in 3%. Variations involving the horizontal fissure in right-sided lungs is of Grade-1 is 43% , Grade-2 is 7% , Grade-3 is 33% and of grade-4 is 17%. and the variations involving the oblique fissure is of Grade -1 in 77% , Grade-2 is 17% and of Grade-3 is 6%.

DISCUSSION

During lung development, lung parenchyma developing from the lobar bronchi is separated from each other by mesoderm. This mesoderm forms the pleura, which lines the surface of each lobe separately giving rise to fissures. Many of these fissures get obliterated.[7] Based on this, the right lung of humans comprises two complete fissures with corresponding three lobes, while the left lung having only one complete fissure with corresponding two lobes leaving the main fissures in their complete form throughout adult life [4].

Any variation in the morphological pattern of the fissures indicates variations from the normal pattern of development of lung. Detection of any accessory fissure is indicative of persistence of those prenatal fissures [3].

The presence of incomplete horizontal fissure of right lung is in the frequency of 40% in the present study which was lower than the findings of meenakshi et al [8](63.3%) and IEHAV[9] (67%) and higher than lukose et a[10] l(21%) and ajay ratnakarro et al [11] (8%).

In the present study the presence of incomplete oblique fissure of right lung is 17% which was lower than the findings of meenakshi et al (36.6%) and IEHAV (30%) higher than lukose et al (10%) and ajay ratnakarro et al (6%).

The presence of incomplete oblique fissure of left lung is 23% in the present study which was lower than the findings of meenakshi et al (46.6%) and IEHAV (30%) higher than lukose et al(21%) and ajay ratnakarro et al (12%).

Compared with studies by Meenakshi et al, Lukose et al and Ajay ratnakarro et al ,the incidence of absence of horizontal fissure was very low in the present study.

The presence of fissures in normal lungs enhance uniform expansion of lobes and their position could be used as reliable landmark in specifying lesions within the thorax in general and within the lungs in particular [12]. In patients with incomplete fissures,pneumonia may spread to adjacent lobes through the parenchymal continuation. Odd lobar involvement with carcinoma of the lung may be explained on a similar basis [1]. Incomplete fissures always give an atypical appearance of pleural effusion in X-ray .It is also site of post-operative air leakage [13]. And incomplete fissures are also responsible for altering the spread of diseases.

Gradation of fissures is important surgically. The surgeon approaches to ligate the vessels and bronchi through the depth of the fissure. Grade I oblique fissure makes the approach easy while doing lobectomy and video assisted thoracoscopic surgery [14] Otherwise the lung parenchyma has to be dissected to reach those structures leading to peroperative hemorrhage and postoperative complications [15].

Accessory fissures of the lung are commonly observed in lung specimens, but are often unappreciated or misinterpreted on radiographs and CT scans. Accessory fissures can be mistakenly confused with areas of linear atelectasis, pleural scars, or walls of bullae.

In patients with endobronchial lesion, an accessory fissure might alter the usual pattern of lung collapse and pose difficulty in diagnosing a lesion and its extent.

CONCLUSION

Current study indicates the incomplete fissure predominates in right lungs. In few cases,the horizontal fissure is classically absent. Considering the clinical and surgical importance of such anomalies one can opine that prior anatomical knowledge and high index of suspicion for probable variations in the fissures,lobes and bronchopulmonary segments in the lung may be important for clinicians, surgeons and radiologists.

Conflicts of Interests: None

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