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RESEARCH ARTICLE

ANATOMICAL STUDY OF PULMONARY FISSURES AND LOBES

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ABSTRACT

Background: The lungs are the essential organs of respiration which are divided into lobes by fissures. The fissures facilitate the movement of the lobes and help in a more uniform expansion of the whole lung. These fissures may be complete, incomplete or absent. In addition to these fissures, lung might also have accessory fissures, usually indicating the junction between bronchopulmonary segments. Knowledge of fissures is necessary for the appreciation of lobar anatomy and thus for locating the bronchopulmonary segments which are significant both anatomically and clinically.

Objective: To study the morphology of fissures and lobes of the lungs.

Materials & Methods: Morphological study of 55 lungs by dissection method of embalmed cadavers was performed in the Department of Anatomy of Sri Devaraj Urs Medical College.

Results: Out of total 28 right lungs,6 showed absence of horizontal fissure, 11 showed incomplete horizontal fissure and 3lungs showed incomplete both horizontal and oblique fissures. Out of total 27 left lungs, 2 showed absence of oblique fissure and 4 showed incomplete oblique fissure. Accessory fissure was seen in three left lungs.

Conclusions: Awareness of the variations in the lobes and fissures of the lungs is important for radiologists for proper radiological interpretation and to clinicians for performing segmental lung resections and lobectomies.

INTRODUCTION

The lungs are a pair of essential organs of respiration located within the thoracic cavity. Each lung is divided into lobes by fissures. Anatomically, left lung is divided into upper and lower lobes by oblique fissure whereas right lung is divided into upper, middle and lower lobes by oblique and horizontal fissures. In each lung, the oblique fissure begins from the mediastinal surface above and behind the hilum and cuts the posterior border of the lung about 2.5cms lateral to the junction of the T4 and T5 spine.

Then it runs along the costal surface, cuts the inferior border of the lung and reappears on the mediastinal surface and ends at the lower end of hilum. The horizontal fissure begins at the oblique fissure near midaxillary line, passes horizontally forward to anterior border of the lung, level with the sternal end of fourth costal cartilage and then passes backwards to the hilum on the mediastinal surface (Standring, 2005).The fissures of lung helps in the movement of lobes in relation to one another which accommodates the greater distension and movement of the lower lobes during respiration and hereby helps in uniform expansion of lung (Rosse C,1997). These fissures may be complete, incomplete or absent. When lung fissures are complete, lobes remain intact at hilum by bronchi and pulmonary vessels or when fissures are incomplete there is a parenchymal fusion between lobes. Other than usual fissures, the lungs may also have accessory fissure which may be single or multiple dividing the lungs into many lobes (Traver RD, 1995).

The position of lobes and fissures is useful in locating the bronchopulmonary segments which is significant both anatomically and clinically. Awareness of the variations in the lobes and fissures of the lungs is important for radiologists for proper radiological interpretation and is of great significance to cardio thoracic surgeon for planning segmental resections or pulmonary lobectomy (Nene AR, *et al*., 2011). Considering the clinical and anatomical importance of this topic, the present study is undertaken to determine the morphology of the lung in Indian population.

MATERIAL AND METHODS

55 lungs obtained from formalin fixed cadavers from the Department of Anatomy, Sri Devaraj Urs medical college, Kolar were included in the study. The morphological details of fissures and lobes of the lungs were recorded,presence of any variant fissure, accessory fissure were recorded.

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RESULTS

Out of 55 lungs, 28 were right lungs and 27 were left lungs.

Fig 1 Right lung showing absent horizontal fissure

Fig 2 Right lung showing incomplete horizontal fissure

Fig 3 Right lungs showing incomplete horizontal and oblique fissures

Fig 4 Left lung showing absent oblique fissure

Fig 5 Left lung showing accessory fissure on medial surface.

Right Lungs

Out of total 28 right lungs only 8lungs (28.5%) exhibited normal pattern of fissures and lobes.

Horizontal fissurewas absent in 6 lungs (21.4%), hence middle lobe was not appreciated. Horizontal fissure was incomplete in 11 lungs (39.2%). In 3 lungs (10.7%) both oblique and horizontal fissures were incomplete.

Left Lungs

Out of 27 left lungs, 18 lungs (66.6%) had normal pattern of fissure and lobes. Oblique fissure was absent in 2 lungs (7.4%). Oblique fissure was incomplete in 4 lungs (14.8%). 3 lungs (11%) showed accessory fissure.

Table 1 Comparison of morphometry of lung fissures and lobes with other studies.

Lung	Fissure parameter		Medlar *et al* 1947	Lukose *et al* 1999	Bergman *et al* 2002	Meenakshi *et al* 2004	Prakash *et al* 2010	Lydia *et al* 2014	Present study 2015
RIGHT LUNG	Oblique fissure	Incomplete	25.6%	-	30%	36.6%	39.3%	5.5%	10.7%
		Absent	4.8%	-	-	-	7.1%	-	-
	Horizontal fissure	Incomplete	17.1%	21%	67%	63.3%	50%	25%	50%
		Absent	45.2%	10.5%	21%	16.6%	7.1%	11.1%	21.4%
LEFT LUNG	Oblique fissure	Incomplete	10.6%	21%	30%	46.6%	35.7%	2.5%	14.8%
		Absent	7.3%	-	-	-	10.7%	-	7.4%

DISCUSSION

Lung fissures help in a uniform expansion of the whole lung and they also form the boundaries for the lobes of the lungs. Knowledge of fissures is necessary for the appreciation of lobar anatomy and thus for locating the bronchopulmonary segments (Rosse C, 1997). Lung buds develop from the foregut and it divides into two primary bronchial buds at around 28 days after fertilization. Then they develop into the right and left lungs. As the development progresses, the formation of numerous bronchopulmonary buds take place, the spaces or fissures that separate individual bronchopulmonary buds/segments become obliterated except along two planes, evident in the fully developed lungs as oblique or horizontal fissures (Larsen WJ, 1993). Absence or incomplete oblique or horizontal fissures could be due to obliteration of these fissures either completely or partially. Accessory fissure could be the result of non-obliteration of spaces which normally are obliterated (Sadler TW, 2004).

Craig and Walker have proposed a fissural classification based on both the degree of completeness of the fissures and the location of the pulmonary artery at the base of the oblique fissure. (Craig SR, *et al*., 1997).

Four stages have been described

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 evident fissural line.

Several studies have been reported regarding the varying percentage of presence of incomplete fissures. Current study indicates that incompleteness of the fissures predominate in the right lung. The position of the lung fissure could be used as reliable landmarks in specifying lesions within the lung (Kent EM, 1942). The identification of the completeness of the fissures is important prior to lobectomy, because individuals with incomplete fissures are more prone to develop postoperative air leaks, and may require further procedures such as stapling and pericardial sleeves (Venuta F, *et al*., 1998). Incomplete fissure may give rise to atypical appearance of pleural effusions and causes the odd appearance of fluid tracking within the fissure. An incomplete fissure may also alter the spread of disease within the lung. Pneumonia in particular lobe is often limited to that lobe alone by the fissures.

In patients with incomplete fissures, pneumonia may spread to adjacent lobes through the incomplete fissures. Similarly carcinoma of the lung may involve odd lobes via incomplete fissure (Traver RD, 1995).

In this study, three left-sided lungs showed accessory fissures. Accessory fissures of the lung are commonly observed in lung specimens, but are often unappreciated or misinterpreted on radiographs and CT scans. On CT scans accessory fissures are seen as high attenuation curvilinear band and are confused with areas of linear atelectasis, pleural scars, or walls of bullae (Butler P, *et al*., 1999). 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. Often these accessory fissures act as a barrier to spread of infection, creating a sharply marginated pneumonia, which can wrongly be interpreted as atelectasis or consolidation (Godwin JD, *et al*., 1985). The knowledge of the anatomy and variations of the lung fissures is essential for proper identification of normal lung anatomy, evaluation of disease, for identification and interpretation of their variable imaging appearance and related abnormalities (Hayashi K, *et al*., 2001).

The results of present study and their comparison with the previous works show that there is a wide range of difference in occurrence of classical and accessory fissures between and among different populations. This implies that a variety of genetic and environmental factors might affect development of these fissures.

Knowing the frequency of occurrence of a variant fissure in a particular population is important for making correct radiological diagnosis and for proper surgical management of lung pathology.

CONCLUSION

The knowledge of variations in the morphology of fissures will be helpful for cardiothoracic surgeons while performing the segmental resection. It is also helpful for the radiologists and clinicians to make correct diagnosis, to plan and modify the surgical procedures. Recognition of lung anomalies improves understanding of pneumonia, pleural effusion and collateral air drift along with disease spreading through lung as seen by imaging techniques.

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