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Anatomical and Morphological Aspects of Lung Fissures and Lobes - Cadaveric Study in South India

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Abstract

Background

The fissures facilitate the movement of the lobes in relation to one another, which accommodates greater distention and movement of the lobes during respiration. The fissures may be complete, incomplete or absent altogether.

Aims

To study the morphology of fissures and lobes, to note the variations, to compare them with previous studies and to find their clinical significances. These lungs were carefully observed for the patterns of lobes, fissures and variations if any were noted.

Methods

Morphological study of 51 lungs by dissection method of embalmed cadavers was done in the Department of Anatomy.

Results

The present study showed oblique fissure was present in 33% of right lungs and 38 % of left lungs. Incomplete horizontal fissure was seen in 33.2% of right sided lungs. 19% of right lung and 9.5% of left lung had accessory lung fissures.

Conclusions

Awareness of the variations in the lobes and fissures of the lungs is important forradiologists for proper radiological interpretation and to clinicians for performing segmental lung resections and lobectomies. This implies that a variety of genetic and environmental factors might affect development of these fissures.

Keywords

Cadavers, Lobectomy, Fissure.

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[1,2.]

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. 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. 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 lobe [3-5].

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 as stated by Nene AR, et al., in 2011 [6]. Considering the clinical importance of this topic, the present study is undertaken to determine the morphology of the lung with respect to lobes and fissures.

Methods

Fifty one pairs of lungs obtained from formalin-fixed adult cadavers removed during routine dissection at were studied. This study was conducted in Department of Anatomy, from December 2021 to march 2022. The specimens having pathological lesions, marks of previous surgery, and those that were damaged during removal were excluded from the study. of the lung specimens, 25 were of the right side and 26 were of the left. These lungs were examined for the patterns of lobes and fissures. Later, variations in these lungs were observed and photographed.

The anatomical classification based on the degree of completeness of the fissures proposed by Craig and Walker6 was followed to determine the presence and completeness of fissure (table 1)[7].

Table 1: Grading of completeness of a fissure

Grades	Craig and Walker criteria of completeness of a fissure
Grade 1	Complete fissure with entirely separate lobes
Grade 2	Complete visceral cleft but parenchymal fusion at the base of the fissure
Grade 3	Visceral cleft evident for part of the fissure
Grade 4	Complete fusion of the lobes with no evidentfissural line

Results

The observations regarding prevalence of oblique and horizontal fissures are shown in table 2. Results showed oblique fissure was present in 33% of right lungs and 38 % of left lungs. Incomplete horizontal fissure was seen in 33.2% of right sided lungs. Figure 3 displaying the Superior accessory fissure of left lung and Figure 1 -2 showing , right lung with oblique and horizontal fissures.

Accessory fissures of lung are shown in table 2 .19% of right lung and 9.5% of left lung had accessory lung fissures Results of the study are expressed in percentage (%).

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) [3]. 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)[8]. 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)[9].

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[7].

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 [10]. 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)[11]. 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)[12].

In this study, four right -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)[13]. 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)[4]. 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 by Priya P Wattamwar et al.,2017[14].

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

Current study indicates the incomplete fissure prevails in right lungs. In some cases, the horizontal fissure is characteristically absent. Seeing the clinical and surgical importance of anomalies one can pronounce that prior anatomical knowledge and high directory of suspicion for probable variations in the fissures, lobes and bronchopulmonary segments in the lung may be important for clinicians, surgeons and radiologists.

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Table 2: Prevalence of Oblique and Horizontal fissures

Lung	Fissure	Grade 1	Grade 2	Grade 3	Grade 4
Right	Oblique	33% (7 lungs)	28.5% (6 lungs)	23.8% (5 lungs)	14.2% (3 lungs)
	Horizontal	38%(8 lungs)	19% (4 lungs)	19% (4lungs)	23.5% (5lungs)
Lung	**Fissure**	**Grade 1**	**Grade 2**	**Grade3**	**Grade 4**
Left	Oblique	33% (7 lungs)	38% (8 lungs)	14.20% (3 lungs)	14.20% (3 lungs)

Table 3: Prevalence of accessory fissures in right and left lungs

Lung	Accessory fissure	Number	Percentage
Right lung	Superior accessory Fissure	3	14%
	Inferior Accessory fissure	1	5%
Left lung	Superior accessory fissure	2	9.5%
	Inferior Accessory fissure	NIL	NIL

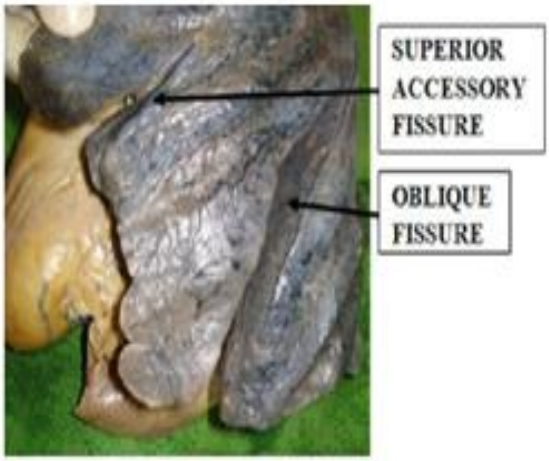

Figure 1: Left lung showing accessory fissure

Figure 2: Right lung showing horizontal fissure &oblique fissure

Figure 3: Right lung showing presence of oblique fissure