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Original article

Anatomy Section

Variations of Fissures and Lobes In Human Lungs-A Multicentric Cadaveric Study from West Bengal, India

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ABSTRACT

Rationale: Being a vital organ of respiration, the human lungs are divided by fissures into lobes, which facilitate movements of lobes in relation to one another. This knowledge of fissures & lobes is of academic interest to all medical professionals. Not only that, considering the fact that malignant lung neoplasms are on the rise all over the world and also in India, this case series would also be particularly useful to cardiothoracic surgeons during surgical resection of individual lung segments.

Objective: Keeping in mind the above clinical importance, a cadaveric study focussed on anatomical variations of fissures & lobes was done in 82 human cadaveric lungs, over a period of one year.

Result: Among the right lung specimens examined, one lung showed absence of oblique fissure & 22 right lungs had no horizontal fissure. None of the right lung specimens showed any accessory fissure. Among the left lung specimens studied, incomplete oblique fissure was seen in 29 lungs & absence of oblique fissure in two lung specimens.

Conclusion: Hence, awareness of anatomical variations of lungs with respect to its lobes & fissures is of great significance.

Key Words: Lungs, Fissures, Lobes, Variations

INTRODUCTION

The lungs are the essential organs of respiration which are situated within the thoracic cavity on either side of the heart & other mediastinal contents. Each lung is approximately half conical in shape & presents an apex, base, three borders & two surfaces. In addition, the right lung is divided into superior, middle & inferior lobes by an oblique fissure [1].

The oblique fissure cuts the vertebral border of both lungs at the level of 4th or 5th thoracic spine. Traced downwards on the medial surface it ends above the hilum; traced downwards on the costal surface, it will be found to continue across the diaphragmatic surface & turns upwards on to the medial surface to end just below the lower end of the hilum. Horizontal fissure, seen only in the right lung begins laterally at the oblique fissure & runs almost transversely across the costal surface to the anterior margin & around the margin back to the hilum [2]. The fissures facilitate the movement of the lobes in relation to one another, which accommodates the greater distension & movement of the lower lobes during respiration. Thus, they help in a more uniform expansion of the whole lung [2]. Other than the normal anatomy, different variations in the fissural patterns are observed in the form of incomplete fissures where there is fusion of lung parenchyma between the lobes & absent fissures or accessory fissures of varying depth, delimiting anomalous lobes corresponding to normal bronchopulmonary segments [3].

Since these fissures delimit the lobes & thus are needed for locating bronchopulmonary segments, knowledge of their position is necessary both anatomically as well as clinically for planning lobectomies & surgical resections & also in the interpretation of radiological images. Hence, this case series was carried out to gain further insight into the fissural pattern of human lungs.

OBJECTIVE

To find out the anomalous fissures and lobes along with their patterns, in human lungs; collected from cadavers, in different medical colleges of West Bengal, India.

MATERIALS & METHODS

With prior permission from concerned ethics committee and HOD(s) of the departments, this multi-centric cadaveric study was carried out in the Department(s) of Anatomy of different medical colleges of West Bengal, India over a period of one

year. Formalin fixed cadaveric lungs preserved in departmental museums as well as collected while doing undergraduate dissection classes; were studied meticulously irrespective of laterality and gender of the deceased. Total number of specimens examined were 82.

Specimens were studied on the basis of the following:

1. Whether there were any abnormalities of the fissures and lobes.
2. Whether there was any accessory lobes present or not.

Laterality of the specimens were confirmed by hilar structures of the lungs.

RESULT

Among the total 82 specimens, 46 were of right side and 36 were of left side (laterality judged based on the hilar structures). Incomplete oblique fissures were noted in 19.56% of right lungs and 13.88% of left lungs, where as it was found to be absent in more in left lungs proportionate to right lungs (5.55% of left lungs and 2.17% of right lungs). Almost in equal proportion (79%) it was complete in both the sides.

The horizontal fissure found to be complete only in 26% cases and it is surprising to note that almost half of the right lungs studied, had no horizontal fissure (47.8%); it is present partially in rest of them. One of the right lungs studied found to have neither any oblique nor any horizontal fissure [Table/Fig-1-11].

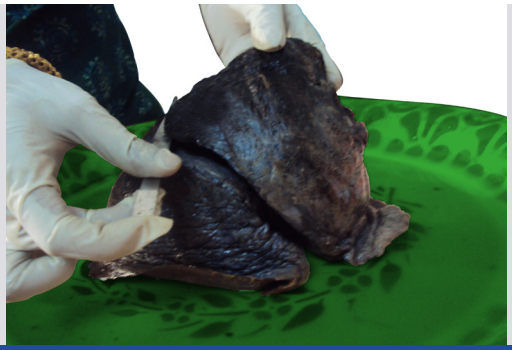
[Table/Fig-1]: Right lung with complete oblique and no horizontal fissure

[Table/Fig-2]: Right lung with almost complete oblique and incomplete horizontal fissure

[Table/Fig-3]: Left lung with no oblique fissure

[Table/Fig-4]: Right lung with partially complete oblique and incomplete horizontal fissure

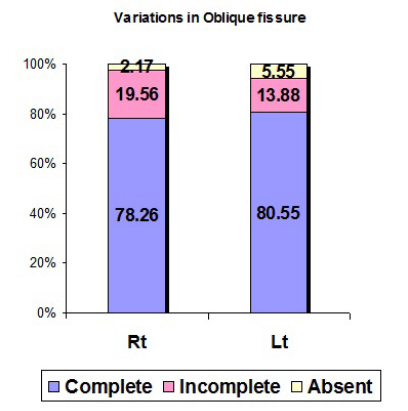
[Table/Fig-5]: Right lung with complete oblique and incomplete horizontal fissure



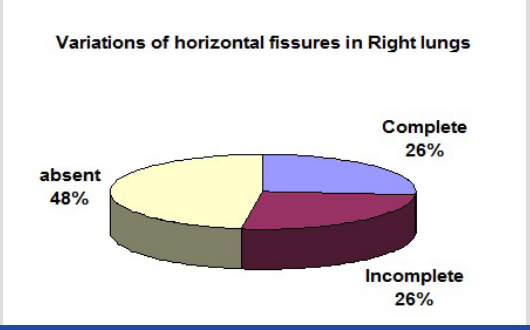
[Table/Fig-6]: Right lung with incomplete oblique and no horizontal fissure

[Table/Fig-7]: Left lung with incomplete oblique fissure

[Table/Fig-8]: Right lung with no fissure (Single Lobe)



[Table/Fig-9]: Graph showing the variations of oblique fissures in left (Lt) and right (Rt) lungs. Values in the graph to depict the percentage



[Table/Fig-10]: Figure showing the variant horizontal fissures in the right lungs

Description	No. of specimens (%)
Complete oblique fissure with complete horizontal fissure	12 (5.52)
Complete oblique fissure with Incomplete horizontal fissure	9 (4.14)
Complete oblique fissure with no horizontal fissure	15 (6.9)
Incomplete oblique fissure with Incomplete horizontal fissure	3 (1.38)
Incomplete oblique fissure with no horizontal fissure	6 (2.74)
Absent oblique fissure and absent horizontal fissure	1 (0.46)

[Table/Fig-11]: Variant relationships between oblique and horizontal fissures of right lungs

DISCUSSION

Ontogenetically the lung is a composite of endodermal and mesodermal tissues. The endoderm of the lung bud gives rise to the mucosal lining of the bronchi and to the epithelial cells of the alveoli. The vasculature of the lung & the muscles & cartilage supporting the bronchi are derived from the foregut splanchnopleuric mesoderm, which covers the bronchi as they grow out from the mediastinum into the pleural space [4]. When the embryo is approximately 4 weeks old, the respiratory diverticulum (lung bud) appears as an outgrowth from the ventral wall of the foregut. On day 22 it bifurcates into two primary bronchial buds between day 26 and day 28 [5]. Early in the 5th week the right bronchial bud branches into three secondary bronchial buds while the left one branches into two. By 6th week secondary bronchial buds branch into tertiary bronchial buds (ten on the right and eight on the left) to form the bronchopulmonary segments.

All the spaces between individual bronchopulmpnary segments get obliterated except along the line of division of principal bronchi where deep complete fissures remain dividing the right lung into 3 lobes and left lung into 2 lobes. These fissures are oblique and horizontal in position in right lung where as only in oblique position in left lung [4]. Along these fissures the visceral pleura is reflected and covers individual lobes on all sides. The monopodial branching of stem bronchi accounts for accessory bronchi and lobes often found in adult lung [6]. Defective pulmonary development will give rise to variations as encountered in fissures and lobes [7]. Incomplete or absence of oblique and horizontal fissures could be due to a defect in the obliteration of these fissures either completely or in completely [8].

From the present study, it was seen that the prevalence of incomplete or absent horizontal fissure of right lungs were higher (73.9%) than the previous studies. However, prevalence of incomplete oblique fissures of left lungs (13.88%) were com-

parable with the study of Medlar et al., [8]. Absent oblique and horizontal fissures were seen in 2.17% of the total right lung specimens and no oblique fissure was seen in 5.55% of the total left lung specimens.

David & Tarver [7] reported the presence of accessory fissures of varying depths occurring at the boundaries between bronchopulmonary segments. The most commonly observed accessory fissures are inferior accessory fissure, superior accessory fissure and left minor fissure [9]. However, no accessory fissures were found in any of the lung specimens.

From studies of different authors, knowledge of fissural anatomy explains various radiological appearances of interlobar fluid [3]. Post-operative air leakage is due to an incomplete fissure [10]. The accessory fissure might act as a barrier to spread in the tissue creating a sharply demarcated pneumonia, which could be misinterpreted as atelectasis or consolidation [11, 12]. Segmental localisation is a must for a thoracic surgeon and knowledge of accessory fissures is of great significance to cardiothoracic surgeons for planning segmental resections or pulmonary lobectomies.

CONCLUSION

From present multi-centric case series as well as from earlier studies it can be deduced that absence or incomplete fissure is a common form of lung variation. Hence the nature of fissures should be taken into consideration while planning operative strategy for thoracoscopic pulmonary resection where an incomplete fissure may contribute to post-operative air leakage. Furthermore, knowledge of fissure comes to bear when interpreting radiographic appearance of the lungs and during routine dissection of cadaver by undergraduate and postgraduate students.

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