

Original Article**A Study on Morphological Variations of Fissures and Lobes of Human Lungs with its Clinical Significance****Dil Islam Mansur*, Nabin Bista, Pragma Shrestha and Sunima Maskey**Department of Anatomy, Kathmandu University School of Medical Sciences, Dhulikhel, Nepal
Article Received: 20th April, 2019; Accepted: 18th September, 2019; Published: 31st December, 2019**DOI: <http://dx.doi.org/10.3126/jonmc.v8i2.26737>****Abstract****Background**

Fissures of lungs facilitate the movement of lobes which helps in expansion of lungs during breathing. The fissures may be complete, incomplete or absent. Sometime the accessory fissures may also present. Awareness of variations is essential during segmental resections as well as during radiological interpretation of lungs. Hence, the present study was aimed to study the morphological variations in fissures and lobes.

Material and Methods

This study consisted of sixty nine human lungs with irrespective of sex which were available in the department of anatomy of various medical colleges. All lung specimens were carefully observed and recorded for the presence of any variations in fissures and lobes.

Results

The present study revealed that the absence of horizontal fissure was observed in 7.89% of right lungs, while no specimen showed absence of oblique fissure on both lungs. Incomplete oblique fissure was recorded 35.48% of left lungs and 28.95% of right lungs. In addition, 22.58% of right lungs and 23.68% of left lungs showed presence of accessory fissure and lobes. The incomplete and absence of horizontal fissures were more common abnormalities observed in this study. The accessory fissures were more common in lower lobe of right lungs whereas they were more common in upper lobe of left lungs.

Conclusion

The present study showed the wide range of variations in fissures and lobes of lungs. The knowledge of variations in morphology of lungs would be helpful for clinical diagnosis and pulmonary surgical procedures.

Key Words: *Anatomy, Bronchi, Lung*

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Introduction

A pair of lung is important organs of respiratory system, located in the thoracic cavity. There are presence of two fissures (oblique and horizontal) on the right lung which divide it into upper, middle and lower lobes. There is only one oblique fissure on left lung which divides it into upper and lower lobes [1]. The fissures may be complete when they are attached to each other at the hilum of lung or they may be incomplete when there is parenchymal tissue present between the lobes. The fissures allow the movement of lobes which also provide distension and uniform expansion of lung [2].

A study suggested that fissures are important landmarks for proper identification of normal morphology and diagnosis of disease [3]. In many clinical cases, localization of segment is essential. Presence of accessory fissures has to be considered for the pre-operative planning and strategy for pulmonary lobectomy and surgical resections involving individual segment [4]. The accessory fissures frequently fail to be detected on computed tomography scans, because of their incompleteness [5].

The knowledge of anatomical variations of the lobes and fissures of lung is important for identifying broncho-pulmonary segments and surgical resections involving individual segment [6]. Hence the present study was aimed to study variations in fissures and lobes of lung with their clinical importance which may help the clinicians during their clinical practices.

Materials and Methods

The cross-sectional and observational study was conducted on 69 formalin fixed human lungs (38 right and 31 left) with unknown sex. The sample size was calculated by using G-power formula with confidence level 95% and standard error 0.05. Lung specimens were collected from the department of anatomy, Kathmandu University School of Medical Sciences, Dhulikhel, Kathmandu Medical College, Duwakot and Nepal Medical College, Attarkhel during the period of April 2017-December 2017.

All specimens were carefully observed and recorded for the presence of any variations such as complete or incomplete oblique and horizontal fissures, absence of fissure, presence of accessory fissure or lobe. A good physical condition or without any damage of lungs were included in the study. The lungs having pathological lesions, marks of previous surgery, damaged during removal with gross abnormalities were excluded from the study. The ethical approval for the study was taken prior to the study.

Results

Right lungs

Out of 38 lungs, only 6 (15.79%) lungs were found anatomically normal with complete both oblique and horizontal fissures as shown in table 1. The right lung showed the oblique fissure was complete in 27 (71.05%) specimens as shown in figure 1 and incomplete in 11 (28.95%) specimens as illustrated in figure 2. Absence of oblique fissure was not recorded. The horizontal fissure was found complete in 11 (28.95%) as shown in figure 1, incomplete in 24 (63.16%) as shown in figure 3 and absent in 3 (7.89%) specimens as shown in figure 4. The presence of accessory fissures and lobes were also recorded in 9 (23.68%) specimens as shown in table 2. Out of these, 2 (5.26%) specimens had accessory fissures in upper lobe as shown in figure 1, 1 (2.08%) specimen had accessory fissure in middle lobe as shown in figure 6, 4 (10.53%) had accessory fissure in lower lobe as shown in figure 4 and 5; and 1 (2.08%) specimen had accessory fissure in diaphragmatic surface as shown in figure 6. Four lobes were also recorded in 1(2.08%) specimen as shown in figure 7.

Left lungs

Out of 31 lungs, it was found normal in 14 (45.16%) specimens as shown in table 1. The oblique fissure was found complete in 20 (64.52%) specimens as shown in figure 9 and incomplete in 11 (35.48%) specimens as shown in figure 8. As shown in table 2, 2 (6.45%) specimens showed accessory fissure in upper lobe as shown in figure 9. Accessory lobe was found in 3 (9.68%) specimens as shown in figure 10, incomplete two lobes were recorded in 1 (3.23%) specimen as shown in figure 11 and incomplete three lobes were also recorded in 1 (3.23%) specimen as shown in figure 12.

Table 1: Incidence of variations in fissures

Lungs	Fissures	Complete	Incomplete	Absence
Right	Oblique Fissure	27 71.05%	11 28.95%	0 0%
	Horizontal Fissure	11 28.95%	24 63.16%	3 7.89%
Left	Oblique Fissure	20 64.52%	11 35.48%	0 0%



Table 2: Incidence of accessory fissures and lobes

SN	Right lung		Left lung			
	Features	n	%	n	%	
1.	Accessory fissure in upper lobe	2	5.26	Accessory fissure	2	6.45
2.	Accessory fissure in middle lobe	1	2.08	Accessory lobe	3	9.68
3.	Accessory fissure in lower lobe	4	10.53	Incomplete two lobes	1	3.23
4.	Accessory fissure in diaphragm surface	1	2.08	Incomplete three lobes	1	3.23
5.	Complete four lobes	1	2.08	Total	7	22.58
6.	Total	9	23.68			



Figure 1: Right lung with complete oblique and horizontal fissures; and accessory fissure in upper lobe, Figure 2: Right lung with incomplete oblique fissure, Figure 3: Right lung with complete oblique and incomplete horizontal fissures, Figure 4: Right lung with absence of horizontal fissure and accessory fissures in inferior lobe, Figure 5: Right lung with accessory fissure in inferior lobe, Figure 6: Right lung accessory fissure in diaphragmatic surface, Figure 7: Right lung with and accessory fissure in middle lobe and accessory lobe, Figure 8: Left lung with incomplete oblique fissure, Figure 9: Left lung with complete oblique and accessory fissure in upper lobe, Figure 10: Left lung with accessory lobe, Figure 11: Left lung with incomplete two lobes and Figure 12: Left lung with incomplete three lobes.

Discussion

The lungs are developed from the respiratory diverticulum (lung bud), an outgrowth from the ventral wall of the foregut. First the right and left principal bronchi (bronchial bud) are developed which divides into three secondary bronchial buds on right side and two on left side. Later they develop bronchopulmonary segments [7]. The spaces between the individual bronchopulmonary segments are obliterated except along the line of division of principle bronchi where the deep complete fissures remain dividing the right lung into three lobes and left lung into two lobes. Fissures are obliquely and horizontally placed in right lungs; and only obliquely placed in left lungs [8].

The lungs are made up of bronchopulmonary segments which form lobes and they are separated from each other by fissures. Each segment has its own tertiary or segmental bronchus [1]. In case of any disease of lungs, initially it would be confined to its own bronchopulmonary segment and then extend to its lobe [9]. The defective development of lung brings about the variations which are incomplete fissure, absence of fissures; and presence of accessory fissures and lobes [2]. Incomplete fissure or absence of fissures could be due to obliteration of fissures either partially or completely. Accessory fissure would be the result of nonobliteration of spaces which are normally obliterated [9]. Due to monopodial branching of principal bronchi, the accessory bronchi and lobes are seen in lungs [10].

Right lungs

In the present study, the oblique fissure was complete in 71.05% and horizontal fissure was complete in 28.95%. It seemed that the variation on completeness occurred frequently on horizontal fissure of right lungs than oblique fissure in a population. The similar findings were also reported by Thapa and Desai in which they found the incidence of complete oblique fissure in 70% and complete horizontal fissure in 30% [11]. Similarly, Dhanalakshmi et al noticed the incidence of complete oblique fissure in 68% and complete horizontal fissure was in 30% [12]. The knowledge of fissure may signify for identification of lesion within the lungs.

In the present study, oblique fissure was incomplete in 28.95% of specimens which is also supported by studies in which 30% [11] and 30.43% [13] were reported. While, Nene et al (6%) and Tallapaneni (6.66%) revealed lesser incidence of this fissure [4, 14] and in contrast Prakash et al (39.30%) found higher incidence of this fissure [15].

Meenakshi et al reported 63.30% [16] of incomplete horizontal fissure which is in accordance with the present study. In contrast, a study was done by Jacob and Pillay who reported 83.4% of this fissure [5] which is higher than the present study. While the researchers also reported very low incidence (8%) of this fissure [4].

Horizontal fissure was absent in 7.89% of specimens in the present study which is also supported by a study conducted by Prakash et al who found 7.10% [15]. In contrast, this fissure was absent in 45.20% [17] which is higher than the present study. While George et al recorded 3.07% [18] which is lower than the present study. But a study was done by Mamatha et al who could not find any lung with absence of this fissure [19].



In the present study, the accessory fissures and lobes were recorded in 23.68% of specimens. Among them, majority of these fissures were found in lower lobe (10.53%), followed by upper lobe (5.26%), middle lobe (2.08%) and diaphragmatic surface (2.08%). Similarly studies have also reported 4.34% of these fissures in upper lobe [13].

Nene et al [4] revealed 14% of accessory fissures in lower lobe which is almost similar with the findings (13.16%) of present study. However, KC et al recorded in 21.73% [13]. Few studies did not report any accessory fissures in lower lobe [15,16].

The right lungs usually present three lobes which are separated from each other by oblique and horizontal fissures. In the present study, it was found that 7.89% specimens had only two lobes due to absent or obliteration of horizontal fissure. Specimens with four lobes were also recorded in 2.08% due to presence of accessory fissures. Unver et al have reported the incidence of single lobe in 0.95%, two lobes in 1.90%, three lobes in 95.23% and four lobes in 1.90% [20].

Left lungs

In the present study, complete oblique fissure was recorded in 64.52% of specimens. Similarly, Thapa and Desai; and Dhanalakshmi et al reported the incidence of this fissure in 60% [11] and 62% [12] respectively. In a study, this fissure was found in 73.33% [14] which is higher than the present study.

In the present study, 35.48% of incomplete oblique fissure was obtained. Similar studies were conducted by Mamatha et al and Prakash et al; and they reported 35% [19] and 35.70% [15] respectively. The authors had also reported 46.60% [16] which is higher than the present study. While an author concluded very low (10.60%) [17].

In this study, absence of oblique fissure was not recorded in left lungs. Similarly absence of this fissure was also not reported by few authors [11]. Whereas Mamatha et al recorded in 5% [19] and Prakash et al found in 10.70% [15].

In the present study, accessory fissures were only observed in upper lobe (6.45%) which is in accordance with a study [15]. In the present study, an accessory lobe was found in 9.68%, incomplete two lobes were recorded in 3.23% and incomplete three lobes were also recorded in 3.23% specimens. Whereas variations in lobe were also reported in a study in which the incidence of single lobe in 0.95%, two lobes in 98.10% and three lobes in 0.95% were recorded [20].

The information on presence of accessory fissures would be helpful for medical personnel to differentiate anatomical and pathological changes. An accessory fissure prevents infection to spread and gives good interpretation for differentiating among atelectasis or consolidation [21]. Radiologically an accessory fissure is often mistaken as a lesion [22].

Conclusion

In the present study, the incomplete and absence of horizontal fissures were found more common variations. The accessory fissures were more common in lower lobe of right lungs and upper lobe of left lungs. The accurate knowledge of variations in fissures and lobes of lungs in a particular population might help the radiologist and clinician to make appropriate diagnosis. It might help the surgeon while performing segmental resection of lung.

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