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Original Research Article

MORPHOLOGICAL STUDY OF LUNG LOBES AND FISSURES: ANATOMICAL BASIS OF SURGICAL AND IMAGING TECHNIQUES

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ABSTRACT

Background: A sound knowledge regarding anatomy of the lungs is must for the clinicians. Knowledge of anatomy and normal variants of the major fissures is essential for recognizing their variable imaging appearances as well as related abnormalities. The fissures may be complete or incomplete or it may be absent completely. . In addition to these fissures, lung might also have accessory fissures indicating junctions between bronchopulmonary segments. Sometimes radiologist may misinterpret an X-ray or CT scan. Anatomical knowledge of such variations is helpful for lobectomies and surgical resections involving individual segments.

Materials and Methods: 77 lungs from 40 cadavers were included in the study carried out in the dissection hall of our medical college. Morphological features of lung fissures and lobes were noted. Presence of any accessory fissures was also recorded.

Results: Incomplete oblique fissure was observed in 10.26% on right side and 5.26% on left side. Oblique fissure was found missing in 2.56% of right lungs. Absent horizontal fissure was observed in 23.08% of right lungs.

Conclusions: The knowledge of fissures and lobes of the lung is highly recommended for the clinicians and anatomists as well. CT and other radiological procedures showing fissures of the lung should be interpreted keeping in mind of possible variations of various fissures.

KEY WORDS: Variations, Interventions, Fissures, Accessory, Bronchopulmonary.

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INTRODUCTION

A sound knowledge regarding anatomy of the lungs is must for the clinicians. Aldur et al (1997) [1] quoted that the surgeon must always remember the anatomical variations of the location of the lungs especially in lobectomies and in segmental resection [2]. Hayashi et al (2001) [3] proposed that knowledge of anatomy and normal variants of the major fissures is essential for recognizing their variable imaging appearances as well as related abnormalities [2]. The knowledge of anatomical variations alerts the surgeons to potential problems that might be encountered during surgical interventions [4].

Anatomically, left lung has two lobes separated by oblique fissure. Oblique fissure cuts the vertebral border of both lungs at the level of fourth and fifth thoracic spine. Traced on

medial surface it ends above the hilum, traced downwards on costal surface it become continuous across the diaphragmatic surface and turn upwards on medial surface to end just below the lower end of hilum. Right lung is divided in three lobes (superior, middle and inferior) by two fissures (Oblique and horizontal). Horizontal fissure pass from oblique at the level of midaxillary line to the anterior border of right lung at the level of sternal end of fourth costal cartilage.

The fissures may be complete (where lobes are held together only at the hilum by bronchi and pulmonary vessels) or incomplete (where varied extent of parenchymal fusion between the lobes are present) or it may be absent completely [5,6]. In addition to these fissures, lung might also have accessory fissures indicating junctions between bronchopulmonary segments. Knowledge of anatomy and variations of major fissures are essential for recognizing their variable imaging appearances as well as related abnormalities [7]. Sometimes radiologist may misinterpret an X-ray or CT scan. Anatomical knowledge of such variations is helpful for lobectomies and surgical resections involving individual segments. Now a day Video assisted thorasic sursery (VATS) is gaining more attention. This knowledge is helpful for identifying broncho-pulmonary segments. This study might serve to generate some new data regarding lung lobes and fissures which will be helpful for surgeons and radiologists to plan a surgical procedure or reporting CT or X-ray.

MATERIALS AND METHODS

This study was conducted on 77 lungs obtained from 40 cadavers dissected in dissection hall for undergraduate teaching. Properly embalmed and formalin fixed cadavers were dissected and lungs were exposed to observe and study the morphological features of lung fissures and lobes. Presence of any accessory fissures was recorded. Lung specimens with pathological lesions, marks of previous surgeries or damaged during removal were excluded from the study. Specimens were serially numbered and photographs were taken.

RESULTS

Out of 80 lung specimens recovered from 40 cadavers, three lungs were excluded from the study because of damage or pathological lesions of the lungs. 39 specimens were of right side and 38 belonged to left side.

Fig. 1: Showing Accessory fissure on sternocostal surface of left lung.

Fig. 2: Showing Right lung with missing horizontal fissure.

Fig. 3: Showing Left lung with absence of fissure.

The important observations regarding absence or degree of completeness of oblique and horizontal fissures is presented below.

Right Lung: Total 39 specimens of right side were observed (n=39). Oblique fissure was absent in 2.56% cases and incomplete oblique fissure was observed in 10.26% cases. Incomplete horizontal fissure was noted in 20.51% and its absence was found in 23.08% lungs.

Left lung: Total 38 lung specimens belonged to left side. Incomplete oblique fissure was observed in 5.26% lungs. None of the lungs showed absence of oblique fissure (Table 1).

Table 1: Comparison of oblique and horizontal fissures of right and left lungs.

Fissure	Parameter studied	Number of specimens	Percentage
Right lung (n=39)			
Oblique fissure	Absent	1	2.56%
	incomplete	4	10.26%
Horizontal fissure	Absent	9	23.08%
	incomplete	8	20.51%
Left Lung (n=38)			
Oblique fissure	Absent	0	0%
	incomplete	2	5.26%

Accessory fissures: Interesting fact about the accessory fissures was observed that their number is more on left side as compared to right side (table 2).

Table 2: Distribution of accessory fissures according to the surfaces of the lungs.

	Right Lung (n=39)	Left Lung (n=38)
Mediastinal surface	14	19
Sternocostal surface	16	23
Inferior surface	**4**	**4**

DISCUSSION

The lung tissue develops as multiple bronchopulmonary buds. Later on the spaces or fissures that separate individual bronchopulmonary buds/segments become obliterated. The spaces remain along the interlobar planes to give rise to major (oblique) and minor (horizontal) fissure in a fully developed lung [8,9]. Defective pulmonary development will give rise to variations as encountered in fissures and lobes [4,10]. Incomplete or absence of oblique and transverse fissures could be due to defect in obliteration of these fissures completely or incompletely [4,5]. On the other hand, accessory fissure could be the result of non-obliteration of spaces which are normally obliterated. Incomplete pulmonary fissures indicating partial fusion between lobes are common and more than half of the pulmonary fissures are incomplete [9].

The detailed knowledge regarding the anatomy of fissures is of great significance for planning operative strategy for various procedures like thoracoscopic pulmonary resection or pulmonary lobectomy where incomplete fissure may be the cause of post-operative air leakage. Presence of fissures in lung enhances uniform expansion of lungs and their position might be used as a reliable landmark in specifying lesions within the lungs or thorax as well [11]. Incomplete fissures usually change the pattern of collapse which is normally seen in the patients of endobronchial lesions and also contribute to the atypical appearance of pleural effusion. An incomplete major fissure causes the pseudo appearance of fluid within the fissure [5]. Incomplete fissure may alter the spread of disease within lung. Pneumonia may spread to adjacent lobes via parenchymal continuation in case of incomplete fissures. Accessory fissures often are not detected on CT scans, because of incompleteness, thick sections and orientation in relation to particular plane [15] (Table 3).

Table 3: Comparison of present study with other previous studies.

		Present Study (2015)	Singh & Niranjan (2014) [12]	Nene et al (2011) [9]	Bhimadevi et al (2011) [4]	Prakash et al (2010) [2]	Aziz et al (2004) [16]
Type of study		Cadaveric	Cadaveric	Cadaveric	Cadaveric	Cadaveric	HRCT
Right Oblique	Absent	2.56%	-	2%	--	--	--
	Incomplete	10.26%	6.67%	6%	9	9%	48%
Right Horizontal	Absent	23.08%	-	14%	--	--	--
	Incomplete	20.51%	26.67%	8%	18	57.10%	--
Left Oblique	Absent	0%	-	-	9	--	--
	Incomplete	**5.26%**	**30%**	**12%**	**36.3**	**35.70%**	**43%**

Prevalence of variations in the fissures of lungs is much more in CT scan and radiological studies as compared to cadaveric lung studies [12]. Knowledge of fissure anatomy also explains various radiological appearances of interlobar fluid [12,13]. Radiologically one may confuse accessory fissures with lung lesions. Accessory fissures also acts as a barrier for spreading infection producing sharply demarcated pneumonia, which could be misinterpreted as

atelectasis, consolidation, pleural scar or walls of bullae [14].

CONCLUSION

The knowledge of fissures and lobes of the lung is highly recommended for the clinicians and anatomists as well. CT and other radiological procedures showing fissures of the lung should be interpreted keeping in mind of possible variations of various fissures.

Conflicts of Interests: None

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