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VARIATIONS OF OBLIQUE AND HORIZONTAL FISSURES OF HUMAN LUNGS- A CADAVERIC STUDY

Anatomy

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ABSTRACT

Background: Human lungs have two fissures, namely oblique fissure and horizontal fissure. These two fissures divide the right lung into superior, middle and inferior lobes, while the left lung is divided by oblique fissure into superior and inferior lobes. The fissures of lungs may be complete, incomplete or absent. Thus, they may vary in length and depth. The knowledge of variations of fissures is necessary during lobectomies, x-rays and CT-scans of lungs. Hence, the present work has been carried out to study the presence, completeness and morphological parameters [length and depth] of oblique and horizontal fissures of human lungs.

Methods: The study was carried out in 92 adult human lungs [46 right and 46 left] in the Department of Anatomy, Gauhati Medical College and Hospital, Guwahati. The lungs were collected from the Department of Anatomy and Department of Forensic and State Medicine, Gauhati Medical College and Hospital, and preserved in 10% formalin. Then, the lungs were examined for variations of oblique and horizontal fissures, and the morphological parameters were measured.

Results: In the present study, 45.65% lungs showed complete oblique fissure and 54.35% lungs showed incomplete oblique fissure. Also, 41.30% lungs had complete horizontal fissure, 52.17% lungs had incomplete horizontal fissure and 6.52% lungs had absent horizontal fissure.

Conclusion: A detailed knowledge of variations of oblique and horizontal fissures is required for correct radiological diagnosis of lung pathologies and to prevent postoperative complication following lobectomies of lungs.

KEYWORDS

oblique fissure, horizontal fissure, lungs, lobectomy

INTRODUCTION

Human lungs have two fissures namely, oblique fissure and horizontal fissure. Both these fissures are present in the right lung, thus dividing it into three lobes-superior, middle and inferior, while the left lung has only oblique fissure, which divides it into two lobes- superior and inferior[1]. The fissures of lungs are lined by visceral pleura[2] and they help in movement of the lung lobes over each other during respiration[3]. They develop as indentations in the lung mesenchyme, as the bronchial tree enlarges in size and extent in a growing fetus[4]. Usually, the oblique fissure starts on the medial surface near the upper end of the hilum, runs across the costal surface, diaphragmatic surface and medial surface to end below the lower end of the hilum. The horizontal fissure starts from the oblique fissure, runs across the costal surface and medial surface to end near the hilum. Thus, the fissures completely separate the lobes and the lobes are held together only at the lung root[5].

The oblique and horizontal fissures have many variations in human lungs. They may be complete, incomplete or absent[6]. The oblique fissure may be incomplete at the beginning of the course, at the end of the course or at both ends. Thus, they may vary in length along the course over the lung surface[7] and in depth towards the lung root[2].

The success of lobectomies of lungs depends on proper identification of completeness of fissures, as an incomplete fissure might lead to postoperative air leak following operation[8]. The knowledge of lung fissures is also important in diagnosis of lung pathologies in x-rays and CT-scans[9].

Hence, the proposed work has been carried out to study the presence, completeness and morphological parameters [length and depth] of oblique and horizontal fissures of human lungs.

MATERIALS AND METHODS

92 adult human lungs [46 right and 46 left] were collected from the Department of Anatomy and Department of Forensic and State Medicine, Gauhati Medical College and Hospital, Guwahati during 2015-16, after obtaining ethical clearance from the Institutional Ethical Committee, Gauhati Medical College and Hospital, Guwahati. The lungs were then washed in running tap water and preserved in 10% formalin. Lungs with previous pathologies, injuries and surgical resections were not included in the study. Lungs were then observed for variations of oblique and horizontal fissures in both [right and left] lungs. The incomplete oblique and horizontal fissures were also noted for their site of incompleteness. That is whether they are incomplete at the upper end [at the beginning of the course], at the lower end [at the end of the course], or at both ends. Then, the degree of completeness of fissures was determined following Craig and Walker's fissural classification[10] into four grades: 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; and grade IV- complete fusion of the lobes with no evident fissure line. The lengths of the fissures were then measured using thread and flexible measuring tape and maximum depths were measured using Vernier caliper, and the average lengths and depths were calculated in mean ± SD and the P values were calculated on comparing the numbers of variations between right and left sides, using statistical software package SPSS version 21.0.

RESULTS

In the present study, 45.65% lungs had complete oblique fissure and 54.35% lungs had incomplete oblique fissure. Absent oblique fissure was not found in any lung. Among lungs with incomplete oblique fissure, 36% had incomplete oblique fissure at the upper end [at the beginning of the course], 46% had incomplete oblique fissure at the lower end [at the end of the course] and 18% had incomplete oblique fissure at both ends. Also, 41.30% lungs showed complete horizontal fissure, 52.17% lungs showed incomplete horizontal fissure and 6.52% lungs showed absent horizontal fissure. Among lungs with incomplete horizontal fissure, all showed incomplete horizontal fissure at the lower end [at the end of the course].

On studying the grades of completeness of oblique fissures and horizontal fissures, according to Craig and Walker's fissural classification[10], it was found that, 33.67% lungs have grade I, 11.96% lungs have grade II, 54.35% lungs have grade III and none of the lungs have grade IV oblique fissure, and 30.44% lungs have grade I, 10.87%

lungs have grade II, 52.17% lungs have grade III and 6.52% lungs have grade IV horizontal fissure.

On studying morphological parameters [length and depth], the lengths of oblique fissures in right and left lungs were found to be 29.51 ± 7.10 cm and 27.30 ± 2.36 cm [in mean ± SD] respectively, and maximum depths of oblique fissures in right and left lungs were 5.55 ± 1.79 cm and 4.92 ± 1.34 cm respectively. The length of horizontal fissures of lungs was 10.82 ± 3.67 cm and maximum depth of horizontal fissures was 3.36 ± 1.34 cm.

Table 1: Variations of oblique fissures and horizontal fissures of lungs

Lung	Oblique fissure						Horizontal fissure					
	Complete		Incomplete		Absent		Complete		Incomplete		Absent	
	No. of specimen	%	No. of specimen	%	No. of specimen	%	No. of specimen	%	No. of specimen	%	No. of specimen	%
Right (n=46)	18	39.13	28	60.87	0	0	19	41.30	24	52.17	3	6.52
Left (n=46)	24	52.17	22	47.83	0	0	–	–	–	–	–	–

n= Total no. of specimens on each side; P value of oblique fissure= 0.209; P= Non significant (>0.05)

Table 2: Site of incompleteness of oblique fissures of lungs

Lung	Incomplete at upper end		Incomplete at lower end		Incomplete at both ends		P value
	No. of specimen	%	No. of specimen	%	No. of specimen	%	
Right (n=28)	12	42.86	10	35.71	6	21.43	0.258
Left (n=22)	6	27.27	13	59.09	3	13.64	

n= Total no. of specimens with incomplete oblique fissures on each side; P= Non significant (>0.05)

Table 3: Grades of completeness of oblique fissures of lungs

Lung	Grade I		Grade II		Grade III		Grade IV		P value
	No. of specimen	%	No. of specimen	%	No. of specimen	%	No. of specimen	%	
Right (n=46)	16	34.78	2	4.35	28	60.87	0	0	0.074
Left (n=46)	15	32.61	9	19.57	22	47.82	0	0	

n= Total no. of specimens on each side; P= Non significant (>0.05)

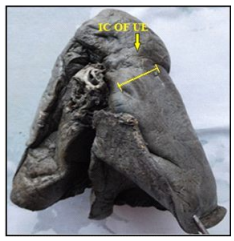

Figure 1: Showing incomplete oblique fissure at upper end [right lung-medial surface]

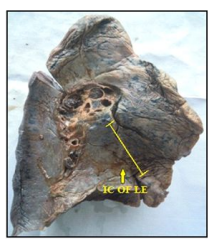

Figure 2: Showing incomplete oblique fissure at lower end [left lung-medial surface]

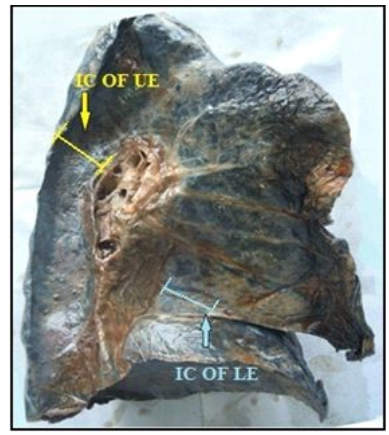

Figure 3: Showing incomplete oblique fissure both at upper and lower ends [left lung- medial surface]

Figure 4: Showing incomplete horizontal fissure at lower end [right lung-lateral surface]

Figure 5: Showing absent horizontal fissure [right lung-lateral surface].

Abbreviations: Key: IC OF UE= Incomplete oblique fissure at upper end; IC OF LE= Incomplete oblique fissure at lower end; IC HF LE= Incomplete horizontal fissure at lower end; AB HF= Absent horizontal fissure.

DISCUSSION

Several authors have reported about variations of oblique and horizontal fissures of human lungs. The findings of present study are compared with those of previous studies and are presented in the tabulated form below.

Table 4: Comparison of variations of oblique fissures and horizontal fissures with other studies

S/No	Authors & Years	Right Lung						Left Lung		
		Oblique fissure			Horizontal fissure			Oblique fissure		
		Complete (%)	Incomplete (%)	Absent (%)	Complete (%)	Incomplete (%)	Absent (%)	Complete (%)	Incomplete (%)	Absent (%)
1.	Meenakshi et al[11]	_	36.6	_	_	63.3	16.6	_	46.6	_
2.	Prakash et al[12]	_	39.3	7.1	_	50	7.1	_	_	_
3.	Nene et al[13]	_	6	2	_	8	14	_	12	0
4.	Arora et al[14]	_	20.0	0	_	27.2	9	_	11	7.3
5.	Dutta et al[7]	26.92	61.54	11.54	_	38.89	34.62	44	48	8
6.	Ghosh et al[15]	79	19.56	2.17	26	26	48	79	13.88	5.55
7.	Quadros et al[16]	94.44	5.55	0	63.88	25	11.11	97.5	2.5	0
8.	Gopalkrishna et al[17]	84	14	2	74	22	4	82	16	2
9.	Present study	39.13	60.87	0	41.30	52.17	6.52	52.17	47.83	0

Table 5: Comparison of grades of oblique fissures with other studies

Authors & Years	Lung	Grade I (%)	Grade II (%)	Grade III (%)	Grade IV (%)
Nene et al[13]	Right	70	22	6	2
	Left	58	30	12	0
Dutta et a[17]	Right	23.07	3.85	61.54	11.54
	Left	28	16	48	8
Present study	Right	34.78	4.35	60.87	0
	Left	32.61	19.57	47.82	0

Table 6: Comparison of lengths and depths of oblique fissures with other studies

		Length		Depth	
Authors & Years	Lung	Mean (cm)	SD (cm)	Mean (cm)	SD (cm)
Dutta et al[7]	Right	30.15	± 6.26	5.73	± 1.41
	Left	27.32	± 7.29	4.75	± 1.44
Sharma et al[18]	Right	23.76	± 7.34	4.94	± 1.52
	Left	22.06	± 3.43	3.07	± 0.70
Present study	Right	29.51	± 7.10	5.55	± 1.79
	Left	27.30	± 2.36	4.92	± 1.34

Nene et al[13] observed 68% lungs with grade I, 12% lungs with grade II, 6% lungs with grade III and 14% lungs with grade IV horizontal fissures. Also, Sharma et al[18] found the length and depth of horizontal fissures as 10.73 ± 4.46 cm and 3.10 ± 1.15 cm respectively.

In the present study, the incidences of incomplete oblique fissures in both right and left lungs correlate with those of Dutta et al[7], while the incidences of incomplete and absent horizontal fissures match with Prakash et al[12]. Also, the incidences of grade II and grade III oblique fissures correlate with those of Dutta et al[7], while the incidence of grade II horizontal fissures matches with Nene et al[13]. Moreover, the length and depth of oblique fissures correlate with those of Dutta et al[7], while the length and depth of horizontal fissures match with Sharma et al[18].

CONCLUSION

From the present study it can be concluded that, the incidences of oblique and horizontal fissures of lungs vary among populations. Moreover, there are limited studies on relationship of incomplete and absent lung fissures with bronchial tree branching pattern. Thus, more studies have to be conducted in this regard for correct radiological diagnosis of lung pathologies and to prevent postoperative complication following lobectomies of lungs.

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