Lungs Lobes and Fissures: A Morphological Study

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Research Article

Abstract: **Aim and Objective:** The lobe pattern and fissures of lungs and their variations have a great clinical study as compared to gross anatomy. During routine dissections we have come across many variations in the fissure and lobes of lungs. Hence, the present study is undertaken, to note such variations, compare them with the previous studies and identify their clinical implications. **Methods:** Twenty five pairs of lungs were taken for the study, obtained from 25 formalin fixed Indian cadavers. These specimens were thoroughly observed for the pattern of lobes and fissures. Variations were noted and the specimens were photographed. **Results:** Ten right sided lungs showed absence of horizontal fissure. Incomplete oblique fissure was observed in 05 right sides and 04 left side lungs. 01 left lung showed absence of fissures a single solid lung. Accessory or supernumerary lobes were seen in 06 right side lungs and 04 left side lungs. **Conclusion:** The present results when compared with the previous works showed a wide range of difference in the lobes and fissures between and among different populations. Knowledge of such variations might explain the bizarre of preservation of certain classical clinical cases pertaining to lung pathologies. Also knowing the frequency of occurrence of a variant fissure in a particular population might help the radiologist and the clinician to exactly diagnose, plan, execute and modify a surgical procedure depending on the merit of the case.

Keywords: Anatomical variation, Lung, Fissure, Anomaly, Lobes.

Introduction

Lung is a vital organ of respiration. Lobar anatomy and broncho pulmonary segments can be appreciated better with knowledge of variations in fissure of lungs. Anatomically, the right lung has two fissures, an oblique and a horizontal dividing it into three lobes namely the superior, middle and inferior (Shah P et al., 2005). The oblique fissure cuts the vertebral border of both lungs at the level of 4^{th} or 5^{th} 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 and upward on to the medial surface to end just below the lower end of hilum Godwin JD et al., (1985).The horizontal fissure is seen only in the right lung passes from the anterior margin into the oblique fissure to separate a wedge shaped middle lobe from the upper lobe Rosse C et al., (1997). The right lung is larger and heavier than the left lung. The fissures vary in the degree of completeness and tend to divide the lobe into smaller subdivisions. Complete fissure show continuity of lobes at their bottom only by parts of bronchial tree and blood vessels. In the region of incomplete fissures the adjacent lobes are connected to a sizeable chunk of pulmonary tissue as cleft fails to reach hilum. The fissures may be absent altogether. Certain radiological findings are specific enough to clinch the diagnosis as in case of azygos lobe. In the presence of azygos lobe, the CT scan shows a significant increase in the size of mediastinum in front and behind trachea. The most important finding is a significant chunk of lung tissue in front of superior vena cava Speck man JM et al., (1981).

Material and Methods

Twenty five pairs of lungs out of which 21 pairs belong to the right side and 14 pairs belong to the left side of embalmed with 10% Indian cadavers used for undergraduate dissection classes were taken for this study. Thoracic wall of the cadavers was dissected; the lungs were exposed to study the morphological features like number lobes fissures. The anatomical classification proposed by Craig and Walker (1997) was followed to determine for the presence and completeness of fissures.

Observations

All the 25 cadavers contained both the lungs. The observations regarding the incidence of major (Oblique) and minor (Horizontal) and accessory variant fissures was done.

Right lung specimens

The horizontal fissure was absent in Five right sided lungs (10%) and hence middle lobe was not appreciated. The horizontal fissure was incomplete in four right sided lungs (8%) and hence the lobation was imperfect. Incomplete oblique fissure was observed in five right sided lungs (10%). Accessory fissure was seen in two right sided lungs (4%). One lung showed lobe of azygos vein (2%). One lung showed separation of four bronchopulmonary segments (2%). Out of twenty five right lungs eighteen lungs of right side (36%) showed variations while seven lungs were normal (14%). **Left lung specimens**

Incomplete oblique fissure was seen in four left sided lungs (8%). The oblique fissure was absent in one left side lung (2%). Accessory fissure was seen in four left sided lungs (8%). Totally, out of 25 left lungs, 16 lungs

were normal (32%) and nine lungs showed variations (18%).

Discussion

Lung develops as an endodermal diverticulum at about 28 days after fertilization. The lung bud bifurcates into 2 primary bronchi left and right which ultimately develop into left and right lungs [20]. During development, in prenatal life, fissures separate individual broncho-pulmonary segments as the lungs grow. The spaces remain along the interlobar planes to give rise to major (oblique) and minor (horizontal) fissures in a fully developed lung [22]. Absence or incompleteness of a fissure could be due to obliteration of these fissures either completely or partially. With defective pulmonary development, there can be variations in the lobes and fissures of lung (22). These fissures, oblique or horizontal may be incomplete or absent due to partial or complete obliteration. In a study conducted on 1200 pairs of lungs [23], incomplete oblique fissure was noted in 10.6% and 25.6% of the left and right-sided lungs, respectively and incomplete horizontal fissure was noted in 17.1% of the right-sided lungs. Oblique fissures were absent in 7.3% and 4.8% of the left-sided and right-sided lungs respectively. Horizontal fissure was absent in 45.2% of the right-sided lungs. In 1999, Lukose et al. [8], conducted a study on morphology of the lungs, wherein it was observed that 21% of left lungs showed incomplete oblique fissure. It was also observed that the horizontal fissure was absent and incomplete in 10.5% and 21% of left lung and right lung respectively. In 1999, Bergman et al. [10], studied variations in peripheral segmentation of right lung and the base of the right and left lungs ,in this study they reported that the horizontal fissure was absent in 21% and incomplete in 67% of right lung. They also reported that 30% of right lung had incomplete oblique fissure. Meenakshi et al. (2004) [9] reported that the horizontal fissure was absent in 16.6% and was incomplete in 63.3% of right lung while 46.6% of the left lung showed incomplete oblique fissure. From these studies, it can be concluded that absence of fissure is a common form of lung variation so; the variation of fissure should be considered when operative strategy for thoracoscopic pulmonary resection is planned where an incomplete fissure may contribute to post-operative air leakage (8). In the present study (2014) the horizontal fissure was absent in Five right sided lungs (10%) and hence middle lobe was not appreciated. The horizontal fissure was incomplete in four right sided lungs (8%) and hence the lobation was imperfect. Incomplete oblique fissure was observed in five right sided lungs (10%). Accessory fissure was seen in two right sided lungs (4%). One lung showed lobe of azygos vein (2%). One lung showed separation of four bronchopulmonary segments (2%). Out of twenty five right lungs eighteen lungs of right side (36%) showed variations while seven lungs were normal (14%). Incomplete oblique fissure was seen in four left sided lungs (8%). The oblique fissure was absent in one left side lung (2%). Accessory fissure was seen in four left sided lungs (8%). Totally, out of 25 left lungs, 16 lungs were normal (32%) and nine lungs showed variations (18%). Knowledge of an accessory fissure is helpful for clinicians in order to differentiate it from other normal anatomical and pathological structures. Interpretation of various radiographic appearances of inter lobar fluid is important for clinicians. In X -ray, incomplete fissures always give an atypical appearance of pleural effusion. Many a times, the accessory fissures fail to be detected on CT scans, because of their incompleteness, thick sections and orientation in relation to a particular plane (24). In many diseases, segmental localization is a must and the knowledge of accessory fissure is of much clinical importance to the clinician. Pre operative planning and strategy for pulmonary lobectomy and segmental resection may also change during presence of such accessory fissures. An incomplete fissure is also a cause for post operative air leakage (6). Often this accessory fissure acts as a barrier to infection spread, creating a sharply marginated pneumonia which can wrongly be interpreted as atelectasis or consolidation (25). Incomplete fissures are also responsible for altering the spread of any lung disease (9).

Results

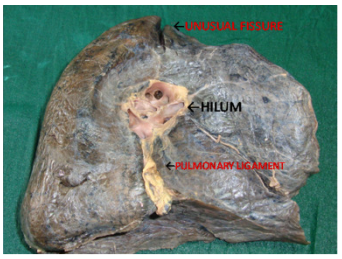

Table 1:

	Fissure Parameter		Present Study	Meenakshi et al.	IHEAV	Lukose et al.
Right Lung	Oblique Fissure	Absent	00%	--	--	--
		Incomplete	10%	36.6%	30%	--
	Horizontal fissure	Absent	10%	16.6%	21%	10.5
		Incomplete	08%	63.6%	67%	21
Left Lung	Oblique fissure Fissure	Absent	02%	--	--	--
		Incomplete	08%	46.6%	30%	21

Table 2: Comparative prevalence of anatomical variations of fissures of lung

Author(s) and Year	Method of Study	Prevalence of absent or incomplete horizontal fissure of right lung (%)	Prevalence of incomplete oblique fissure of right lung (%)	Prevalence of incomplete oblique fissure of left lung (%)
Medlar, 1947	Cadaverand specimen	62.3	25.6--30	10.6---18
Raasch et al.,1982	Fixed inflated specimen and radiograph	94	47--70	40--46
Frija et al.,1988	High resolution CT	96.7	87	77
Glazer et al.,1991	Thin section CT	----	64	52
Otsuji et al., 1993	Thin section CT and cadaver	96	83.1	50
Lukose et al., 1999	Cadaver and specimen	31.5	---	21
Aziz et al., 2004	High resoloution CT	63	48	43
Meenakshi et al.,2004	Cadaver and specimen	63.3	36.6	46.6
Bergman et al., 2008	Cadaver and specimen	67	30	30
Prakash et al., 2010	Cadaver and specimen	57.1	39.3	35.7
Narasing rao et al.,2010	Cadaver and specimen	18	09	36
Nene AR et ai., 2011	Cadaver and specimen	68	70	30
Present study 2014	Cadaver and specimen	18	10	08

Table 3: Incidence of major and minor fissures according to craig and walke'rs criteria

Lung	Fissure	Grade I	Grade II	Grade III	Grade IV
Right Lung	Horizontal	16%	08%	06%	---------
	Oblique	26%	10%	06%	--------
Left Lung	Oblique	32%	08%	12%	02%

Table4: Showing the length of oblique fissures of both lungs

Sr. No.	Length of oblique fissure of left lung	Length of oblique fissure of right lung
01	23cms	24cms
02	09cms	26cms
03	22cms	28cms
04	18cms	16cms
05	20cms	28cms

06	16cms	25cms
07	22cms	22cms
08	Absent	21cms
09	26cms	18cms
10	15cms	17cms
11	13cms	16cms
12	13cms	13cms
13	26cms	22cms
14	10cms	21cms
15	05cms	25cms
17	26cms	23cms
18	22cms	21cms
19	11cms	24cms
20	15cms	25cms
21	22cms	18cms
22	24cms	19cms
23	10cms	17cns
24	21.5cms	16cms
25	19cms	20cms
26	23cms	22cms
27	16.5cms	23cms
28	15.5cms	25cms
29	22cms	26cms
30	24cms	21cms
31	20cms	20cms
32	15cms	13cms
33	14cms	13cms
34	13cms	16cms
35	18cms	08cms
36	16cms	21cms
37	14cms	24cms
38	25cms	14cms
39	21cms	25cms
40	23cms	23cms
41	20cms	23cms
42	22cms	28cms
43	15cms	25cms
44	16cms	16cms
45	56cms	27cms
46	04cms	26cms
47	12cms	25cms
48	15cms	21cms
49	07cms	20cms
50	10cms	18cms

Conclusion

The results of the present study and their comparison with the previous works show that there is a wide range of difference in occurrence of major, minor and accessory fissures between and among different populations. This implies that a variety of genetic and environmental factors might affect development of these fissures. Knowledge of such variations might explain bizarre presentation of certain clinical cases pertaining to lung pathologies. Also knowing the frequency of occurrence of a variant fissure in a particular population might help the radiologist and clinician to make correct diagnosis. Similarly, it might help the surgeon to plan, execute and modify a surgical procedure depending on the merit of the case. This will help to reduce the morbidity and mortality associated with lung surgeries. The knowledge of anatomy of fissures of lung may help clarifying initially confusing radiographic findings like extension of fluid into an incomplete major fissure or spread of various diseases through different pathways (26). Considering the clinical importance of such anomalies, we as anatomists opine that prior awareness and anatomical knowledge of the presence of accessory fissures and lobes in the lung may be important for clinicians and radiologists.(anomalous rt lung lobar pattern paper).

References

1. Shah P, Johnson D, Standring S. Thorax. In: Gray's Anatomy.39th ed. Edinburgh: Churchill Livingstone; 2005. p. 1068-9.
2. Godwin JD, Tarver RD. Accessory fissures of the lung. AJR Am JRoentgenol 1985; 144:39-47.
3. Rosse C, Gaddum-Rosse P. Hollinshead's Textbook of Anatomy. Philadelphia: Lipincott-Raven; 1997. p. 441-61.
4. Berkmen T, Berkmen YM, Austin JH. Accessory fissures of the upper lobe of the left lung: CT and plain film appearance. AJR AmJ Roentgenol 1994; 162:1287-93.
5. Speckman JM, Gamsu G, Webb WR. Alterations in CT mediasti-nal anatomy produced by an azygos lobe. AJR Am J Roentgenol 1981; 137:47-50.
6. Craig SR, Walker WS. A proposed anatomical classification of the pulmonary fissures. J R Coll Surg Edinb 1997; 42:233-4.
7. Larsen WJ. Human Embryology. New York: Churchill Livingstone; 1993. p. 111-30.
8. Lukose R, Paul S, Sunitha DM, et al. Morphology of the lungs: variations in the lobes and fissures. Biomedicine 1999; 19:227-32.
9. Meenakshi S, Manjunath KY, Balasubramanyam V. Morphological variations of the lung fissures and lobes. Indian J Chest Dis Allied Sci 2004; 46:179-82.
10. Bergman RA, Afifi AK, Miyauchi R. Variations in peripheral seg-mentation of right lung and the base of the right and left lungs. In: Illustrated Encyclopedia of Human Anatomic Variation. http://www.anatomyatlases.org/AnatomicVariants/OrganSystem/ Text/LungsTrachea.shtml (28th of November, 2010).
11. Butler P, Mitchell AWM, Ellis H. Applied Radiological Anatomy. Cambridge (UK): Cambridge University Press; 1999. p. 136-8.
12. Muller NL, Fraser RS, Colman NC, Pare PD. The normal chest. In: Radiologic Diagnosis of Diseases of Chest. Philadelphia: WB Saunders Company; 2001. p. 25-6.
13. Gesase AP. The morphological features of major and accessory fis-sures observed in different lung specimens. Morphologie 2006;90: 26-32.
14. Cronin P, Gross BH, Kelly AM, Kazerooni EA, Carlos RC. Normal and accessory fissures of the lung: evaluation with con-tiguous volumetric thin-section multi detector CT. Eur J Radiol 2010; 75:e1-8.
15. Aziz A, Ashizawa K, Nagaoki K, Hayashi K. High resolution CT anatomy of the pulmonary fissures. J Thorac Imaging 2004; 19: 186-91.
16. Austin JHM. The left minor fissure. Radiology 1986; 161:433-6.
17. Aldur MM, Denk CC, Çelik HH, Taflç›o¤lu AB. An accessory fis-sure in the lower lobe of the right lung. Morphologie 1997; 81:5-7.
18. Tarver RD. How common are incomplete pulmonary fissures, and what is their clinical significance? AJR Am J Roentgenol 1995; 164: 761.
19. Dandy WE. Incomplete pulmonary inter lobar fissure sign. Radiology 1978; 128:21-5.
20. Sadler TW. Langman's medical embryology, eithed lippincott Williams and Wilkins, Baltimox Maryland. 2004; Pp223-284.
21. Human embryology, Hamilton, Boy H.W. Moss 1971 p: 326-330.and lobes. Indian J Chest Dis Allied Sci. 2004;46:179-82
22. Modgil V, Das S, and Suri R. Anomalous lobar pattern of right lung: A case report. Int. J Morphol. 2006; 24:5-6.
23. Medlar EM. Variations in interlobar fissures. AJR .1947; 57:723-25.
24. Ariyurek, O. M.: Gulsun, M. and Demirkazik, F. B. Accessory fissures of the lung: evaluation by high-resolution computed tomography. Eur. Radiol., 11:2449-53, 2001.
25. Godwin, J. D. and Tarver, R. D. Accessory Fissures of the Lung. A. J.R., 144:39-47, 1984.
26. Dandy, W. E. Incomplete pulmonary interlobar fissure sign. Radiology, 128:21-5, 1978.