ORIGINAL ARTICLE

Variation in lobar morphology of the left lungs and clinical implications: A cadaveric case report from Uganda

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ABSTRACT

The lungs are vital organs of respiration occupying the thoracic cavity. The lungs are covered by a membrane called pleura and located in the pulmonary cavity. The lungs are attached to the mediastinum via pulmonary ligament. Anatomically the right lungs and left lungs have distinct uniqueness and structural differences. The right lungs have three lobes: superior, middle and inferior lobe divided by 2 fissures; namely horizontal and oblique fissure while the left lungs have two lobes with only one oblique fissure separating the lobes into superior and inferior lobes. Structural variations may exist in the lobar structure, with incomplete fissures, or absences of a particular fissure in either lung. A notable variation in the left lungs was observed during a gross anatomy dissection session in a middle age male cadaveric subject. We observed incomplete oblique fissure and lobes which are not completely separated. Distortion in the embryological development of the lungs has been reported to be associated with morphological variation of the lungs. Knowledge of these variations is of great anatomical and clinical importance and becomes handy during surgical procedures involving the lungs.

Keywords: Lungs Variation, Oblique Fissure, lobe, Left lungs

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INTRODUCTION

The lungs are pinkish gray in color and have a spongy texture. The lungs are paired structure, which are key component of the respiratory system (1). Anatomically the lungs consist of apex, base, three surfaces, and three borders. The cervical pleura covers the apex, which is located above the first rib. The lungs occupy the thoracic cavity and are covered by pleura. The right lung is wider than the left because of the heart's location excavating the greater portion of the left, even as the left lung is shorter and longer because the diaphragm's dome is higher on the right side (2).

Development of the lungs begins during the third week of embryonic life with the formation of a respiratory diverticulum (lung bud), which emerges as an outgrowth from the ventral wall of the foregut. This diverticulum rapidly expands in a ventral and caudal direction, pushing into the surrounding mesenchyme. As it grows, the lung bud bifurcates into two primary bronchial buds, which will eventually give rise to the right and left lungs (3). The development of the lung bud is guided by complex signaling interactions between the endoderm of the foregut and the surrounding mesoderm, setting the foundation for further branching and the formation of the bronchial tree (3).

The lungs are segmented into lobes by fissures, including the horizontal and oblique fissures, which are folds of the visceral pleura (2). These fissures divide the lobes nearly up to the hilum, facilitating smooth movement and even expansion of the lungs during breathing (1,2). The superior, middle, and inferior lobes which are separated by oblique and horizontal fissures make up the right lung. The superior and inferior lobes, which make up the left lung, are separated by an oblique fissure (4). Additionally, the lingula, a little tongue-like structure, is located on the inferior border of the left lung's superior lobe (2).

Lung fissures are highly variable between individuals, with incomplete fissures more commonly observed in the right lung, particularly within the horizontal fissure. Variations in the morphology of lungs fissures exist among individuals for both the left and right lungs, but the most reported of these variations is the incomplete horizontal fissure in the right lungs. Both pathogenic events, such as smoking-induced parenchymal damage, and embryologic factors like inadequate invagination of the visceral pleura, contribute to these variations (2,5). Any deviation from normal embryonic development will result in variations in the morphology of the lobes and fissures, as well as the hilum pattern (6). Understanding these variations which can include accessory, partial, and absence of fissures as well as differences in the quantity and configuration of structures at the hilum is essentially for surgical procedures, including pulmonary lobectomy and thoracoscopic pulmonary resection, where a variation could result to complications (7). Knowledge of these variations will help avoid confusion for clinicians, radiologists and anatomists in interpreting the morphological variations of the lungs.

CASE REPORT

During a dissection on the thoracic region, a case of variation on the morphology of the lungs was reported and recorded in the anatomy laboratory of Kampala International University, Uganda. The left lungs specimen was dissected from a male cadaver observed to be of the middle age. The medical history of the cadaver was unknown. In the morphological observation of the left lung, there was incomplete oblique fissure, with the lobes of the left lungs not completely separated as the two lobes were not clearly divided because of the incomplete obliques fissure. When we compared this to the normal left lungs, we also noticed that the lingula was not clearly visible. The normal morphology of the left lungs is made up two lobes clearly divided by a complete oblique fissure, with the pulmonary ligament that extends from the hilum, a tongue-like structure called the lingula. The left lungs have grooves for esophagus close to the pulmonary ligament, groove for aortic arch, descending aorta. The left lung has a cardiac notch, which is an indentation on the front of the lung to accommodate the heart. This notch makes the left lung slightly smaller than the right lung, as the heart slightly pushes into this space.

The variations in the morphology of the left lung observed provide insight into the anatomical diversity of human lungs and research has shown that various anatomical variations exist in the morphology of the lungs(8–12). The key morphological variation in this case was the incomplete oblique fissure in the left lung, resulting in the partial separation of the lung into its two lobes.

Lung development begins with several bronchopulmonary buds. The cracks that divide each individual bronchopulmonary bud eventually disappear. In a fully grown lung, the residual space along the interlobar planes results in major (oblique) and minor (horizontal) fissures (9,12). Embryological defects in the development of the lungs are linked to variations in fissures and lobes. The respiratory diverticulum's development into the lung lobes may have resulted in inadequate folding or incorrect separation, which might have caused the incomplete fissure(10,13). An in-depth comprehension of morphology of lung fissures is crucial for developing an operational plan for a variety of treatments, such as pulmonary lobectomy or thoracoscopic pulmonary resection, when an incomplete fissure may result in post-operative air leakage. When fissures are present, the lungs expand uniformly, and their location may serve as a useful reference for identifying abnormalities in the lungs or thorax (12,14).

The incomplete oblique fissure in this instance prevented the clear division of the lobes and also resulted in the absence of the visible lingula; this has also been reported by Schittny (2017). In normal morphology of the lungs, the left lung is normally divided into two lobes (superior and inferior) by a complete oblique fissure. The lingula is a small tongue-like projection of the superior lobe that is visible on the inferior border of the left lung. The presence of the cardiac notch, a characteristic of the left lung, was noted; this is consistent with the left lung's typical structural features. Because of this heart-accommodating indentation, the left lung is smaller than the right. Other typical features of the anatomy of the left lung were also visible, such as the pulmonary ligament that extends from the hilum and the grooves for the oesophagus, aortic arch, and descending aorta. The absence of a well-defined lingula, undivided lobe and the incomplete fissure are significant variations reported overtime. Variations in lung fissure morphology are somewhat common, especially with partial horizontal and obliques fissures. (14–16). Environmental factors, such smoking or pathological lung injury, and embryological ones, like inadequate pleural invagination, can cause such variations in the structure of the lungs.

Understanding the lungs' lobes and fissures is important for planning different surgical interventions and preventing issues like air leaks after surgery. It may also aid in understanding the significance of the location of the interlobar fluid and different radiological representations of the lungs' lobar structure (4,16,17). The variation observed in this specimen holds clinical significance for both diagnostic and surgical procedures. For example, during pulmonary lobectomy or thoracoscopic pulmonary resection, the surgeon's awareness of such variations is very important. The incomplete fissure may alter the approach to resecting the lung or affect the interpretation of radiological images, which could otherwise appear as a pathologic condition or complicate clinical procedures. During surgical procedure the presence of this incomplete fissure can lead to complications, if it is not properly interpreted. As such knowledge of the variations that might exist in the lungs is essential for radiologists, clinicians, and anatomists, as misinterpretation of normal anatomical variants as pathological conditions could lead to unnecessary clinical concerns(15,18).

Finally, this case report on the variant morphology of the left lungs emphasizes the need for further research into the diversity of lung morphology and the factors that contribute to variations in lung development. A deeper understanding of these variations can help healthcare professionals make better-informed decisions during diagnosis, treatment, and surgical interventions.

CONCLUSION

In conclusion, the incomplete oblique fissure, inseparable lobes observed in the left lung represents a significant variation in lung morphology. This highlights the inherent anatomical variability of the human body, which must be considered in clinical practice, particularly in surgical procedure and radiological assessment. Knowledge of the variations in lung's morphology can contribute to better, improved medical care and surgical outcome.

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Fig 1: showing incomplete oblique fissure on the left lungs and incomplete separation of the lobes (red arrow)

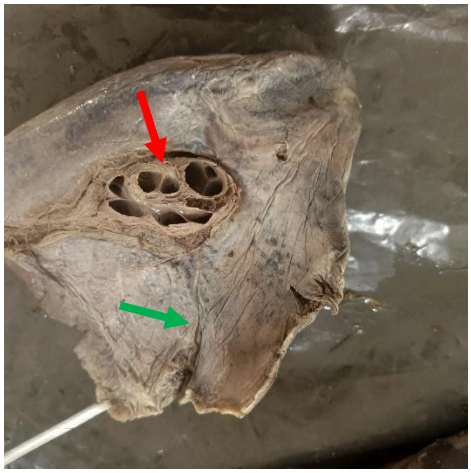

Fig 2: Showing the mediastinal surface of the left lung, the root of the lungs clearly seen in the hilum (red arrow) and incomplete fissure (green arrow)

Fig 3: Normal morphology of the left lungs showing complete oblique fissure on the left lungs and two lobes (blue arrows)

Fig 4: showing the mediastinal surface of the normal morphology of the left lungs