Uncommon Observation of a Trilobed Left Lung: A Cadaveric Case Report on Pulmonary Anatomical Variation and Its Embryological, And Clinical Perspectives

Promise Nwachinemerem Okpechi[1], Nkiruka Lilian Okwuanga[2*], Michael Obinna Onyewuchi[3], Augustine Alobu Ekoh[4], Onyinyechi Queen Promise[5]

Department of Anatomy, Nnamdi Azikiwe University, Nnewi Campus, Anambra. Nigeria

[*]Corresponding Authors

DOI: https://doi.org/10.51244/IJRSI.2025.120800366

Received: 06 September 2025; Accepted: 12 September 2025; Published: 15 October 2025

ABSTRACT

We present a rare case of a trilobed left lung, where the left lung possesses three distinct lobes separated by both horizontal and oblique fissures, mirroring the typical structure of the right lung. This anatomical variation was discovered during a routine cadaveric dissection at Nnamdi Azikiwe University. The study aims to document and describe this variation, compare it with classical lung anatomy, explore potential embryological causes, and highlight its clinical relevance. The discovery of this variation has significant implications for clinical practice, particularly in radiological diagnosis, thoracic surgery, and pulmonology. Recognizing such variations is crucial to avoid diagnostic errors, surgical complications, or misinterpretation in imaging. This case reinforces the importance of cadaveric dissection in anatomical education and highlights the need for region-specific anatomical documentation.

Keywords: Anatomical variation, Left lung, Trilobed lung, Cadaveric dissection, Clinical implications.

INTRODUCTION

Background of the Study

Human anatomy has long been established as a foundational pillar of medical science, yet it is also a field enriched by continual discoveries of anatomical variations. Traditionally, the human lungs are asymmetrical: the right lung comprises three lobes (superior, middle, and inferior), separated by the horizontal and oblique fissures, whereas the left lung typically has only two lobes (superior and inferior) separated by a single oblique fissure, accommodating the space taken by the heart (Drake *et al*, 2020).

However, during a routine cadaveric dissection in a medical anatomy lab, a rare and unusual finding was encountered: the left lung of the subject cadaver possessed three distinct lobes, clearly demarcated by both a horizontal and an oblique fissure, mirroring the typical structure of the right lung. This anomaly challenges the conventional understanding of pulmonary anatomy and demands deeper anatomical, embryological, and clinical evaluation.

Statement of the Problem

Despite numerous documented variations in human organs, bilateral trilobed lungs remain extremely rare, with only a few mentions in anatomical literature. The clinical implications of such a variation - especially in thoracic surgery, radiological imaging, and pathology - highlight the importance of accurate anatomical knowledge. Failure to recognize such variants can lead to diagnostic errors, surgical complications, or misinterpretation in imaging.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

Objectives of the Study

1. To document and describe an anatomical variation in the left lung having three lobes.
2. To compare the observed anatomical variant with classical lung anatomy.
3. To explore potential embryological causes for the lobation difference.
4. To highlight the clinical relevance of anatomical variations in pulmonary anatomy.

Significance of the Study

This study contributes to the growing body of literature on anatomical variability, particularly in thoracic anatomy. It serves as a teaching tool for medical educators and students and provides a reference point for clinicians, radiologists, and surgeons. Moreover, it underscores the importance of cadaveric dissection as a critical method for discovering and validating anatomical diversity.

Research Questions

1. How does the observed left lung structure differ from classical descriptions?
2. What embryological factors could explain such an anomaly?
3. What are the possible clinical implications of this variation?

Scope and Limitation of the Study

The study is limited to a single cadaveric case observed in a dissection lab. While it may not provide a statistically significant sample size, it raises important questions for future anatomical and embryological research.

MATERIALS AND METHODS

Dissection and Documentation

A formalin-embalmed adult male cadaver was dissected at the Gross Laboratory Department of Anatomy, Nnamdi Azikiwe University, following standard protocols (Carmine & Smith, 2019). The thoracic cavity was opened, and the lobar and fissural anatomy of both lungs was examined. The anomalous left lung structure was photographed and compared with standard anatomical references.

Materials Used

1. Preserved adult human cadaver (formalin-fixed, male adult, approximate age unknown)
2. Dissection instruments (scalpels, dissecting scissors, forceps, bone cutters, ribs spreader)
3. Personal protective equipment (PPE)
4. Photography equipment (digital camera or smartphone with high-resolution imaging)
5. Dissection table with drainage
6. Measurement tools (ruler or measuring tape, Vernier caliper for precise measurements)
7. Notebook and pen for in-situ notes and diagrams
8. Anatomy textbooks and atlases for real-time comparison and referencing

Procedure

The thoracic cavity was carefully opened, and observations were made regarding the number of lobes and fissures in both lungs. The left lung was found to have three clearly demarcated lobes, separated by a horizontal and an oblique fissure. Observations were compared with classical texts and documented photographically. The bronchial tree of the left lung was examined to assess corresponding bronchial division.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

Photographed (Promise Onyinyechi Queen)

Fig. 1. Thoracic cavity carefully opened during routine cadaveric dissection.

The lungs were exposed, and observations were made regarding the number of lobes and fissures.
The left lung was found to have three clearly demarcated lobes, separated by a horizontal and an oblique fissure.

RESULTS

Observational Results

During routine anatomical dissection of a male adult cadaver in the Gross Anatomy Laboratory at Nnamdi Azikiwe University, an anatomical variation in the lobation of the left lung was observed.

Left Lung

External Features of the: The left lung exhibited three well-defined lobes, separated by two fissures:

Superior Lobe

- Located at the apex of the lung and anteriorly.
- Separated from the middle lobe by a clearly demarcated horizontal fissure.

Middle Lobe

- Situated between the superior and inferior lobes.
- This lobe is not normally present in the left lung.
- Bounded superiorly by the horizontal fissure and inferiorly by an oblique fissure.

Inferior Lobe

- Occupied the posteroinferior portion of the lung.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

- Extended anteriorly beneath the middle lobe, similar to the normal anatomical inferior lobe.

Fissures

- Horizontal Fissure: Extended horizontally from the anterior border of the lung, creating a separation between the superior and middle lobes.
- Oblique Fissure: Extended from the posterior surface obliquely downward and forward to separate the middle from the inferior lobe.

Right Lung

The right lung of the same cadaver was also examined and found to have the normal three-lobed structure separated by a horizontal and an oblique fissure.

Photographic Documentation

High-resolution images were taken from multiple angles showing:

- The complete left lung with three distinct lobes.
- Clear demarcation of the two fissures.
- A side-by-side comparison with the right lung.

Comparison with Anatomical Texts

- Reference to standard anatomical sources (e.g., Gray's Anatomy, Moore's Clinically Oriented Anatomy) confirmed that the typical human left lung contains only two lobes and one oblique fissure.
- No congenital malformation or external pathological evidence was noted in the cadaver.

This observation represents a rare anatomical variation not commonly documented in literature and raises considerations for clinical imaging, thoracic surgery, and pulmonary diagnostics.

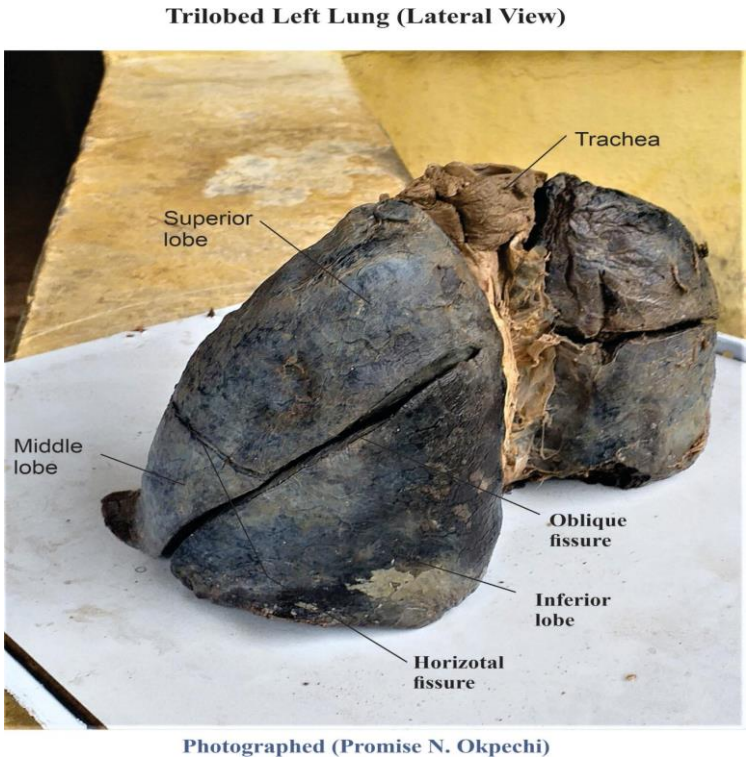

Fig. 2. The left lung presented with three lobes:

A horizontal fissure separating the superior and middle lobes.An oblique fissure separating the middle and inferior lobes.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

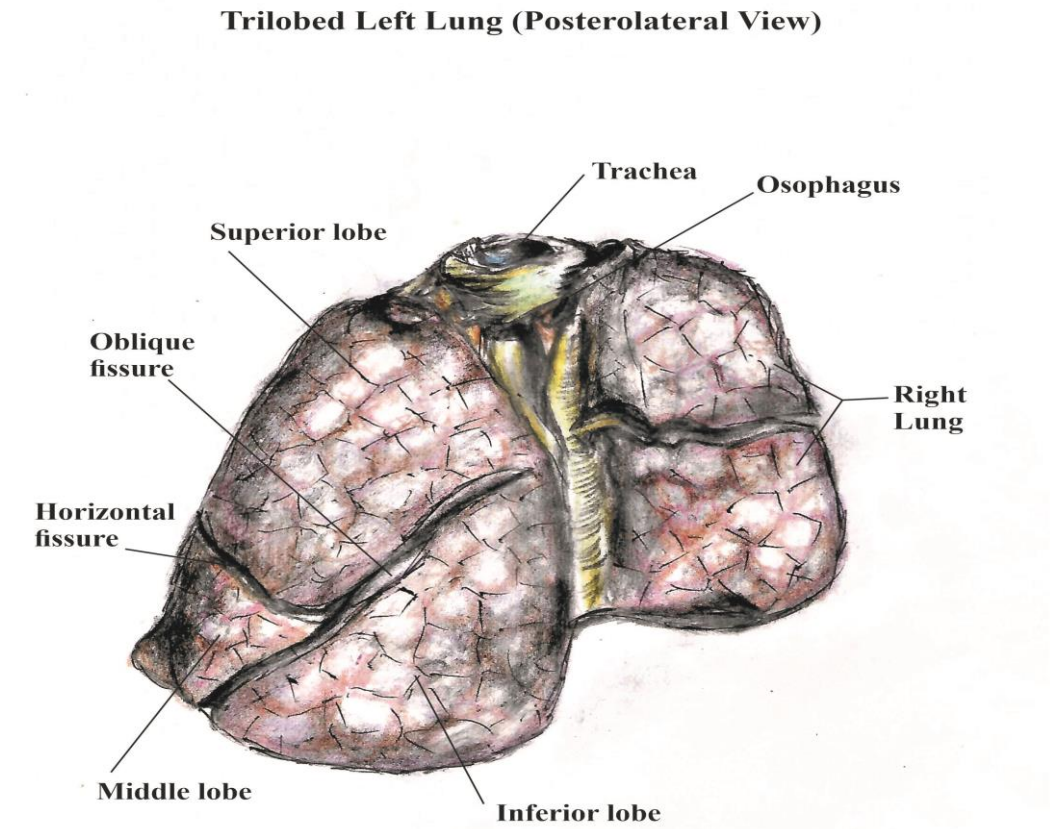

Fig 3: Anatomical illustration of a trilobed left lung,

Demonstrating a rare variation in lung morphology. This description provides a clear and concise overview of the diagram, highlighting the key features of the trilobed left lung © Promise N. Opkechi

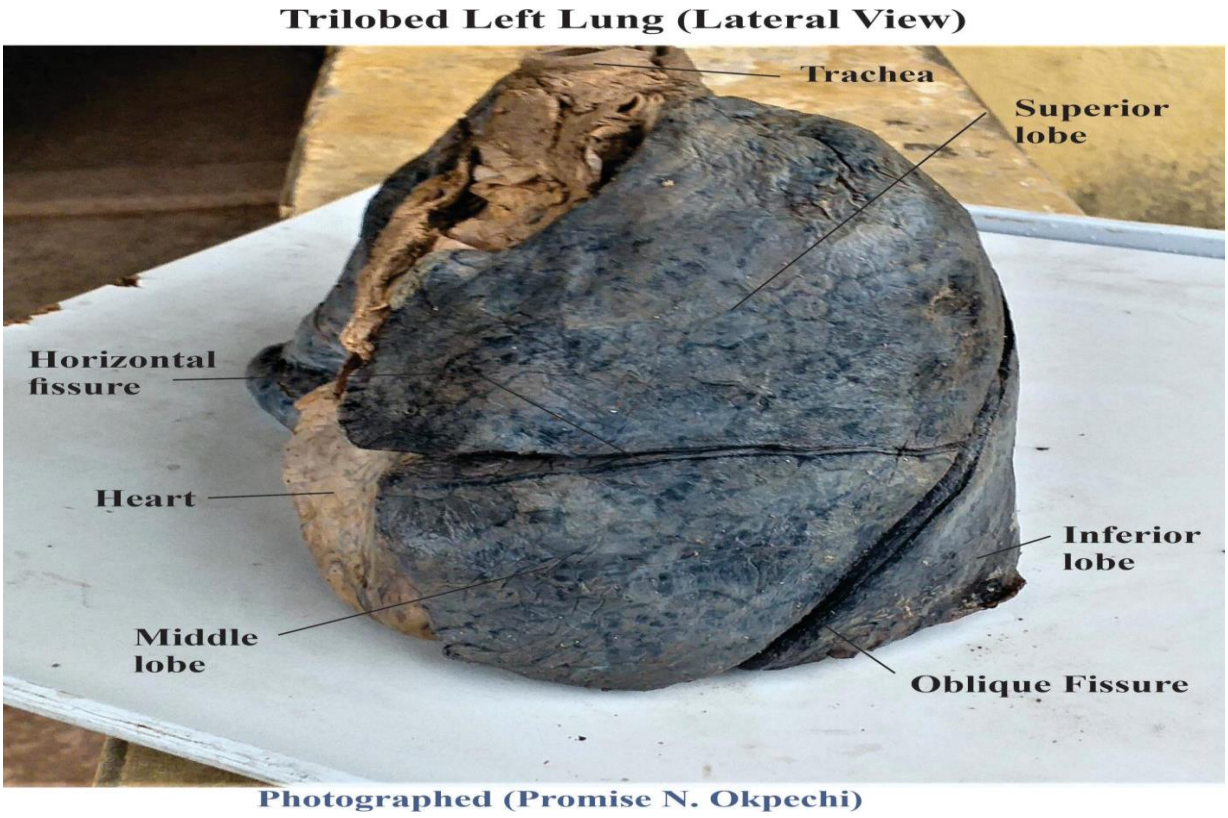

Fig. 4. This left lung mirrored the structure of the right lung.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

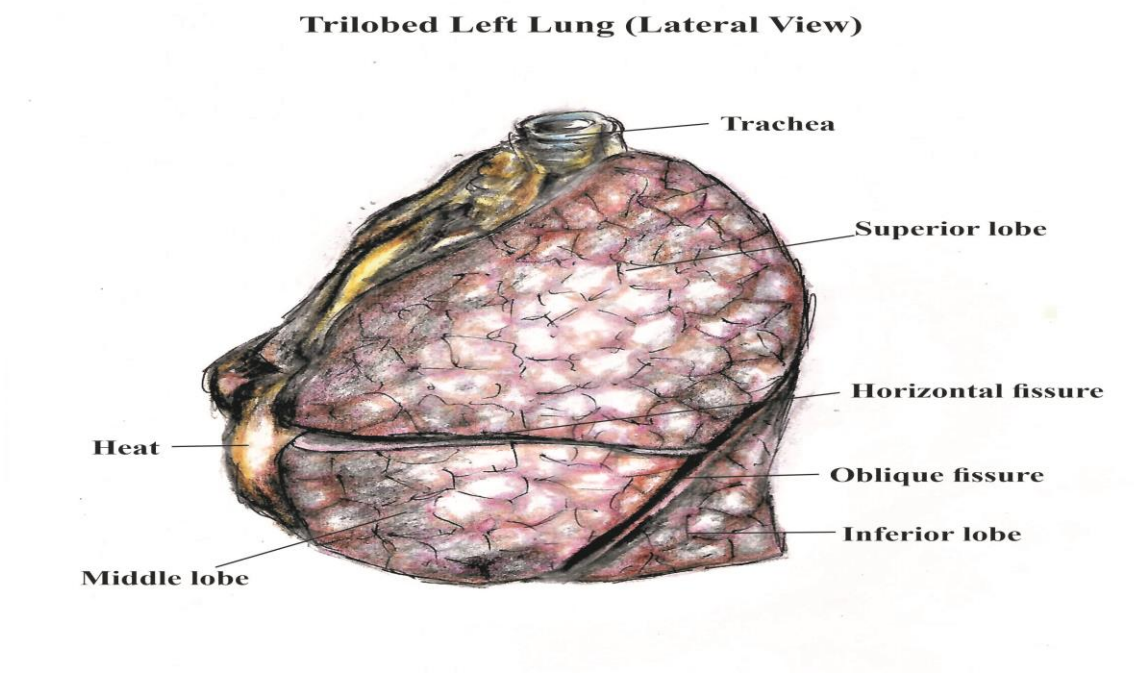

Fig 5: Anatomical illustration of the right lung,demonstrating typical trilobed morphology.

This description highlights the standard anatomy of the right lung,Providing a comparison to the rare trilobed left lung variation © Promise N. Okpechi

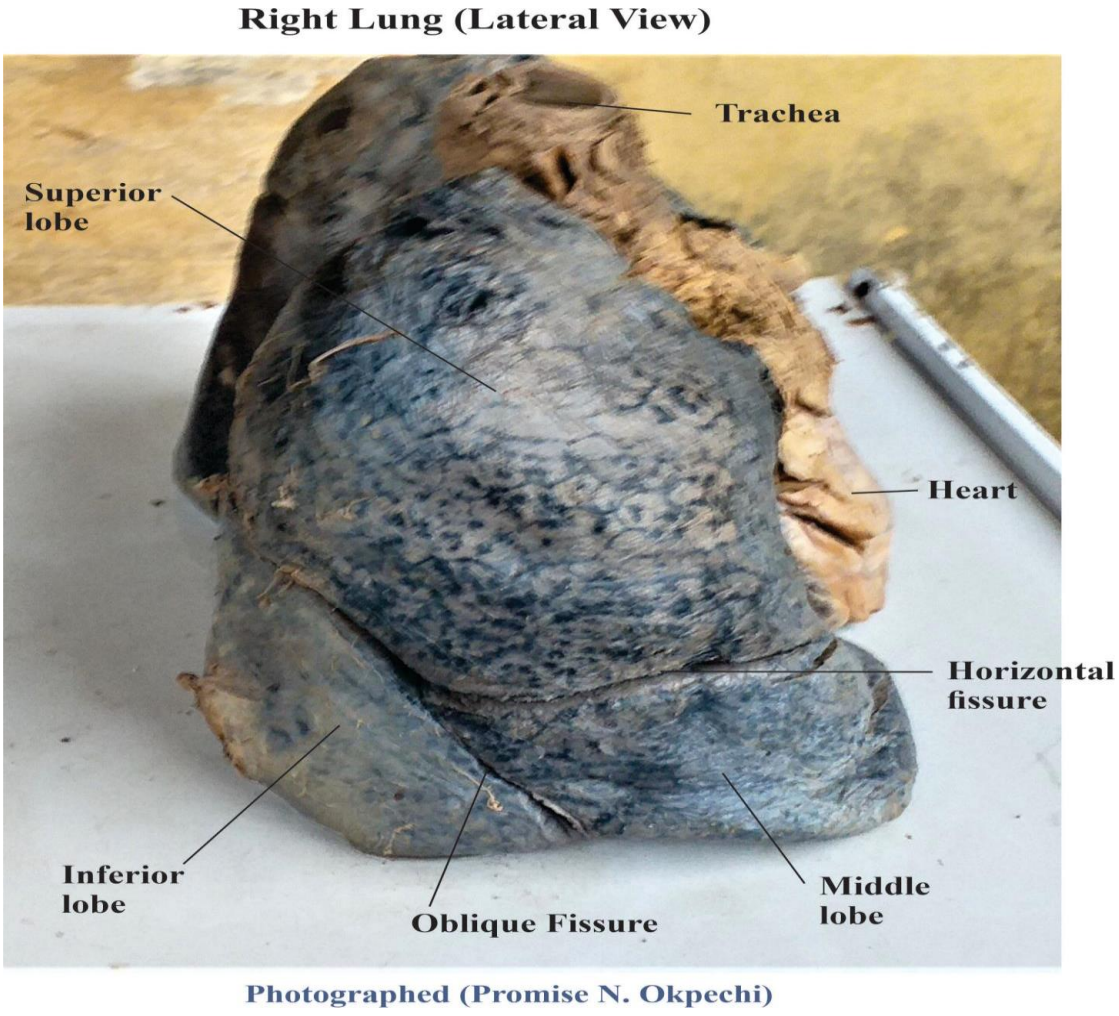

Fig.6: The right lung of the same cadaver with the normal three-lobed structure separated by a horizontal and an oblique fissure.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

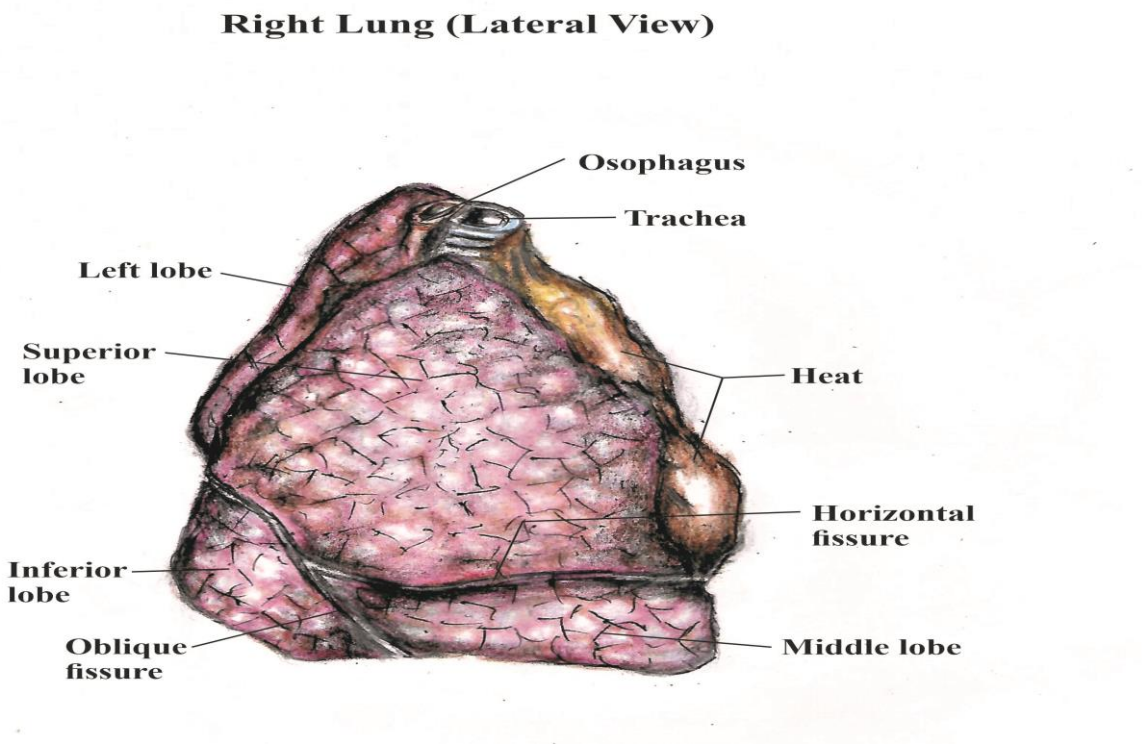

Fig 7: Anatomical illustration of a trilobed left lung,Demonstrating a rare variation in lung morphology.

This description provides a clear and concise overview of the diagram,Highlighting the key features of the trilobed left lung © Promise N. Opkechi

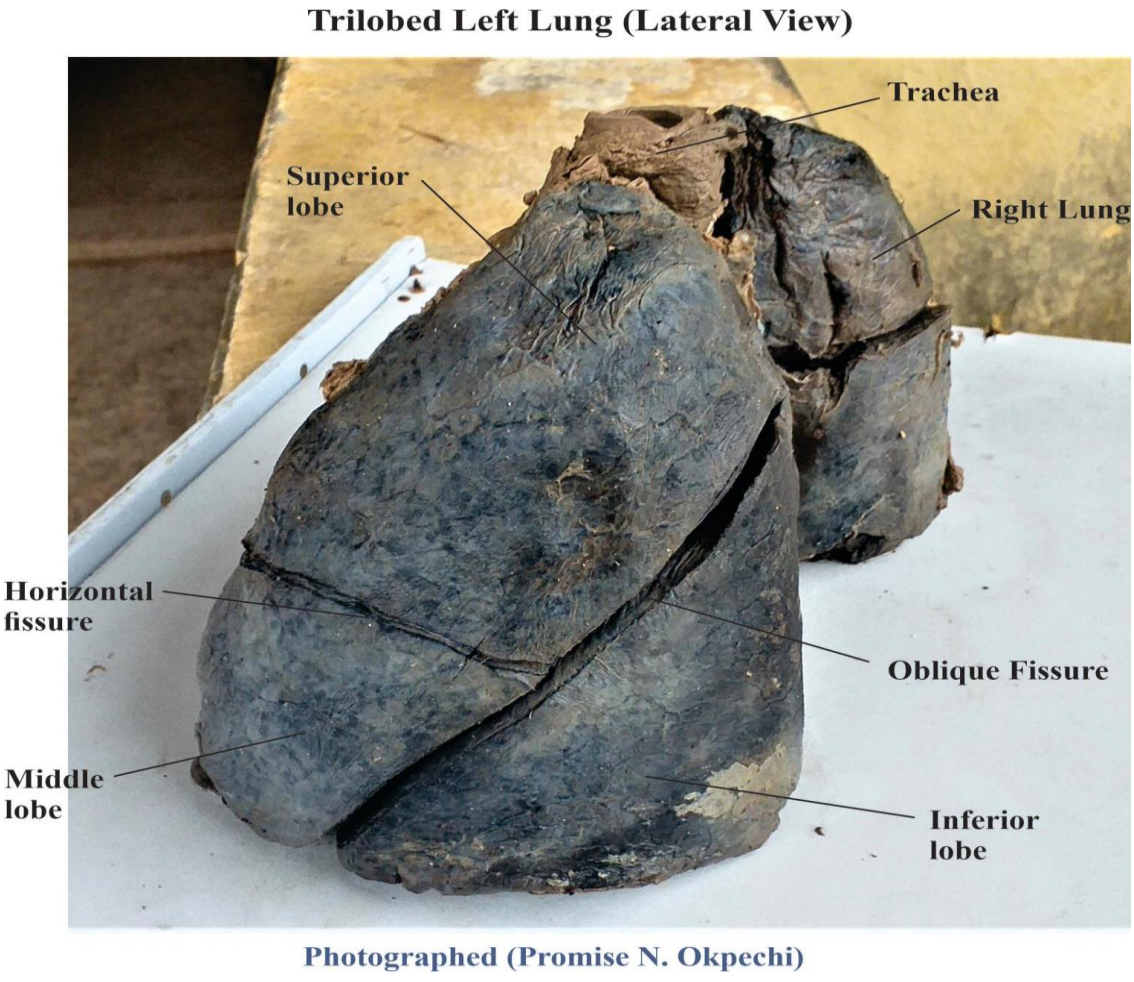

Fig. 8. The left lung presented with three lobes:

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

A horizontal fissure separating the superior and middle lobes.An oblique fissure separating the middle and inferior lobes.

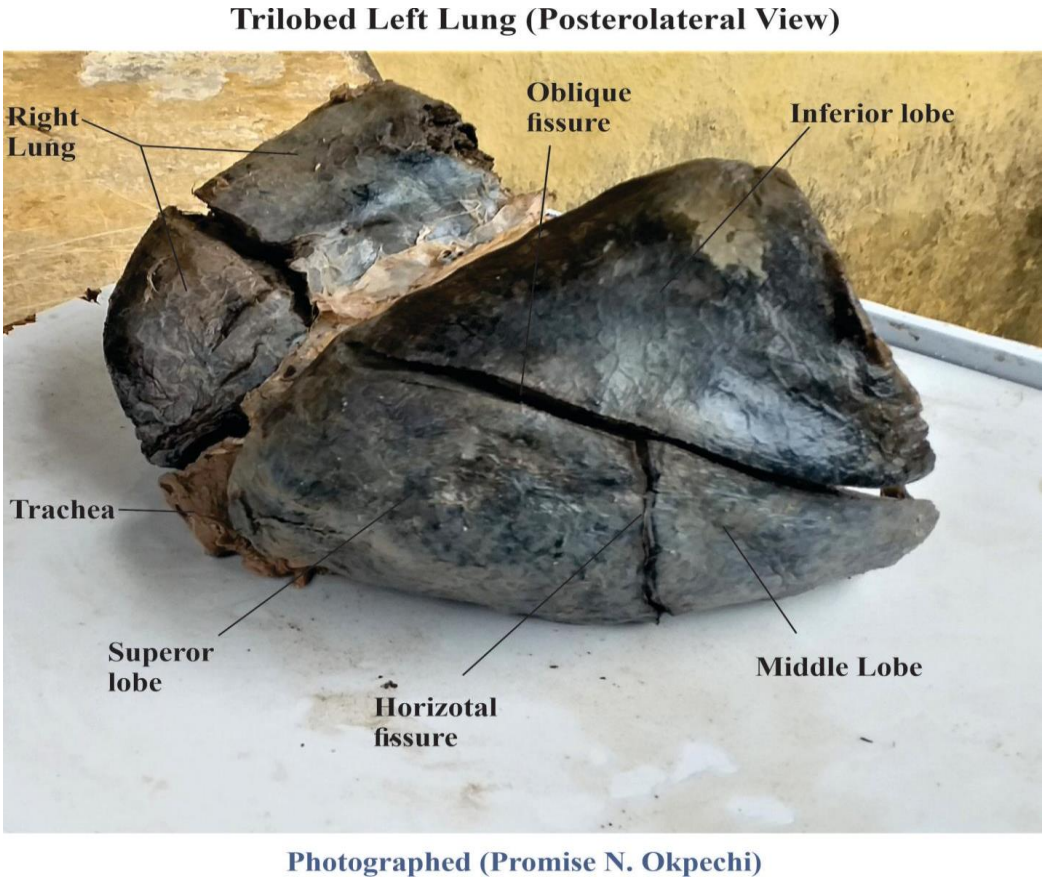

Fig.9. The left lung presented with three lobes:

A horizontal fissure separating the superior and middle lobes. An oblique fissure separating the middle and inferior lobes.

DISCUSSION

The discovery of a trilobed left lung separated by a horizontal and an oblique fissure in an adult Nigerian cadaver represents a rare but clinically significant anatomical variation. This anomaly deviates from the traditional description of the left lung having two lobes and has important implications for clinical practice.

Clinical Implications

Recognizing this variation is crucial for:

1. **Radiologists**: Misinterpretation of additional fissures or lobes as pathological findings can lead to diagnostic errors. For instance, a trilobed left lung may be mistaken for atelectasis or scarring, resulting in unnecessary interventions.
2. **Thoracic Surgeons**: Precise anatomical knowledge is essential for procedures like lobectomy, segmentectomy, or lung transplantation. Failure to recognize atypical lobation may lead to surgical complications, such as incomplete resection or damage to adjacent structures.
3. **Anesthetists and Pulmonologists**: Accurate understanding of lung anatomy is vital for bronchoscopy and segmental lung ventilation. Misinterpretation of anatomical variations can lead to inadequate ventilation or complications during procedures.

Impact on Clinical Decision-Making

This anatomical variation highlights the importance of considering individual differences in lung anatomy when making clinical decisions. For example:

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

- **Preoperative Planning**: Thoracic surgeons should be aware of potential anatomical variations when planning lobectomies or other thoracic procedures.
- **Radiological Interpretation**: Radiologists should consider the possibility of anatomical variations when interpreting imaging studies, particularly in patients with atypical lung anatomy.

The identification of a trilobed left lung in a routine cadaveric dissection emphasizes the importance of anatomical awareness and documentation in clinical practice. By recognizing and understanding anatomical variations, healthcare professionals can provide more accurate diagnoses and effective treatment, ultimately improving patient outcomes.

Embryological Basis

The development of the lungs begins around the 4th week of gestation, with branching morphogenesis shaping the bronchial tree and lobation. During this process, the embryonic lung undergoes a series of complex cellular and molecular interactions that ultimately give rise to the mature lung structure.

Branching Morphogenesis

Branching morphogenesis is a critical process in lung development, where the bronchial buds undergo a series of branching events to form the bronchial tree. This process is regulated by a complex interplay of genetic and environmental factors, including:

- Fibroblast growth factors (FGFs): FGFs play a crucial role in regulating branching morphogenesis, promoting the growth and differentiation of bronchial epithelial cells.
- Sonic hedgehog (SHH) signaling: SHH signaling is essential for the proper formation of the bronchial tree, regulating the expression of target genes involved in lung development.

Lobation and Fissure Formation

The formation of lobes and fissures in the lung is a complex process that involves the coordinated action of multiple cellular and molecular mechanisms. Variations in fissure formation, such as the presence of a trilobed left lung, can result from incomplete or excessive branching of the bronchial buds during embryogenesis.

Aberrant division of secondary bronchial buds: A trilobed left lung may be explained by aberrant division of the secondary bronchial buds during embryogenesis, resulting in an additional lobe and fissure.

Implications for Anatomical Variation

Understanding the embryological basis of lung development provides valuable insights into the origins of anatomical variations, such as the trilobed left lung. By recognizing the complex cellular and molecular mechanisms involved in lung development, clinicians can better appreciate the importance of anatomical awareness and documentation in clinical practice.

CONCLUSION

The identification of a trilobed left lung in a routine cadaveric dissection highlights the presence of rare anatomical variations in pulmonary structure that deviate from classical descriptions. This case reinforces the educational value of cadaveric dissection and underscores the importance of anatomical awareness in clinical practice. To further investigate similar anomalies, future research could focus on:

1. Radiological studies: Utilizing imaging techniques like CT scans or MRI to identify and analyze similar variations in living patients.
2. Comparative anatomical studies: Examining the prevalence of such variations across different populations to better understand their distribution and significance.
3. Embryological studies: Investigating the developmental mechanisms underlying such variations to gain insights into their etiology.

By exploring these areas, researchers can deepen our understanding of anatomical variations and their implications for clinical practice, ultimately improving patient outcomes.

Finally, this case reinforces the educational value of cadaveric dissection as a tool not only for teaching standard anatomy but also for revealing deviations that may shape clinical understanding and improve patient outcomes.

REFERENCES

1. Bergman RA, Thompson SA, Afifi AK, Saadeh FA. Compendium of Human Anatomic Variation: Text, Atlas, and World Literature. Baltimore: Urban & Schwarzenberg; 1988.
2. Carmine, J., & Smith, H. (2019). Cadaver Dissection Manual for Medical Students (3rd ed.). Academic Press.
3. Cronin P, Gross BH, Kelly AM, Patel S, Kazerooni EA. Normal and accessory fissures of the lung: evaluation with multi-detector CT. Radiographics. 2003;23 (6):e11.
4. Drake, R. L., Vogl, A. W., & Mitchell, A. W. M. (2020). Gray's Anatomy for Students (4th ed.). Elsevier Health Sciences.
5. Ghosh SK. Variations in the lobes and fissures of the lungs: a study conducted on cadavers. Anat Physiol. 2015;5 (3):1000187.
6. Godwin, J. D., & Tarver, R. D. (1985). Accessory fissures of the lung. AJR American Journal of Roentgenology, 144(1), 39–47.
7. Kocabiyik N, Yalcin B, Yazar F, Ozan H. Fissures and lobes of the lungs: evaluation of cadavers. Turk J Med Sci. 2002; 32:17–20.
8. Kumar, M., Rath, G., Saha, S., & Wadhwa, S. (2020). Significance of anatomical variations encountered during cadaveric dissection. Journal of Clinical and Diagnostic Research, 14 (4), AE01–AE03. https://doi.org/10.7860/JCDR/2020/43786.13640
9. McMinn RMH. Last's Anatomy: Regional and Applied. 9th ed. Edinburgh: Churchill Livingstone; 1994.
10. Meenakshi, S., Manjunath, K. Y., & Balasubramanyam, V. (2004). Morphological variations of the lung fissures and lobes. Indian Journal of Chest Diseases and Allied Sciences, 46 (3), 179–182.
11. Moore, K. L., Dalley, A. F., & Agur, A. M. R. (2018). Clinically Oriented Anatomy (8th ed.). Wolters Kluwer.
12. Nayak, B. S., Rao, K. G., & Bhat, K. M. R. (2006). A rare case of tracheal bronchus associated with bilateral three-lobed lungs. Surgical and Radiologic Anatomy, 28(1), 89–91. https://doi.org/10.1007/s00276-005-0052-z
13. Standring S, ed. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 42nd ed. London: Elsevier; 2020