

CASE REPORT

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A case of tuberculosis of the rare azygos lobe of the right lung

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Abstract

Background: The azygos lobe is a rare anatomical variant seen in the upper lobe of right lung. It occurs during embryological development due to the failure of posterior cardinal vein to migrate supero-medially. It is often an incidental finding on imaging and is asymptomatic in majority of cases. Tuberculosis involving the azygos lobe is extremely rare. Only a few cases of tuberculosis involving the azygos lobe have been reported in literature.

Case presentation: We present a rare case report of tuberculosis infection involving the azygos lobe in a 57-year-old male with history of chronic cough, fever, hemoptysis, and weight loss.

Conclusions: The azygos lobe is usually asymptomatic, but it may be misdiagnosed as bulla, lung cyst, or abscess. In rare cases it may be associated with certain pathology such as tuberculosis, other infections, and lung cancer. Hence, it is pertinent for a radiologist to be aware of this variant when reporting chest imaging cases.

Keywords: Azygos lobe, Azygos fissure, Anatomical variant, Tuberculosis, Case report

Background

The azygos lobe is a rare anatomical variant seen in the upper lobe of right lung [1, 2]. It is typically seen in the medial portion of the upper lobe of right lung [1–3]. It is separated from the rest of the right upper lobe by an accessory fissure, known as the azygos fissure [1, 2]. It occurs during embryological development due to the failure of posterior cardinal vein to migrate supero-medially [1, 2, 4]. Knowledge of this variant is vital, as it can potentially be misdiagnosed as a lung cyst, bulla, abscess, or even a neoplasm [2]. Azygos lobe is often an incidental finding on chest radiographs or computed tomography (CT) thorax, being asymptomatic in majority of cases [2]. In rare cases, it may be associated with certain pathology such as tuberculosis, other infections, and lung cancer [5–7].

We present a rare case report of tuberculosis infection involving the azygos lobe in a 57-year-old male. High-resolution computed tomography (HRCT) thorax was done using 32 slice Multidetector CT machine using thin

sections (1 mm slice thickness). Final diagnosis of pulmonary tuberculosis (TB) was made by demonstrating acid-fast bacilli (AFB) on sputum microscopy and QuantiFERON-TB Gold test (QFT), as per the current guidelines [8].

Case presentation

A 57-year-old male patient presented with chronic cough and fever for 5 weeks. There was history of loss of weight and appetite. He had three episodes of haemoptysis in the last 2 weeks. He was a known smoker with 15 pack years and an occasional drinker. There was no past history of significant lung disease. Clinical chest examination did not reveal any wheeze or rhonchi. Frontal chest radiograph revealed ill-defined nodular opacities in bilateral upper lung zones. A right paratracheal opacity suspicious for azygos lobe was also reported.

Subsequently, a high-resolution computed tomography (HRCT) scan of the thorax was performed. HRCT thorax revealed multiple patchy nodular opacities in peri-bronchovascular distribution involving the middle lobe of right lung, superior segment of right lower lobe, and bilateral upper lobes (Fig. 1a–d). Few associated

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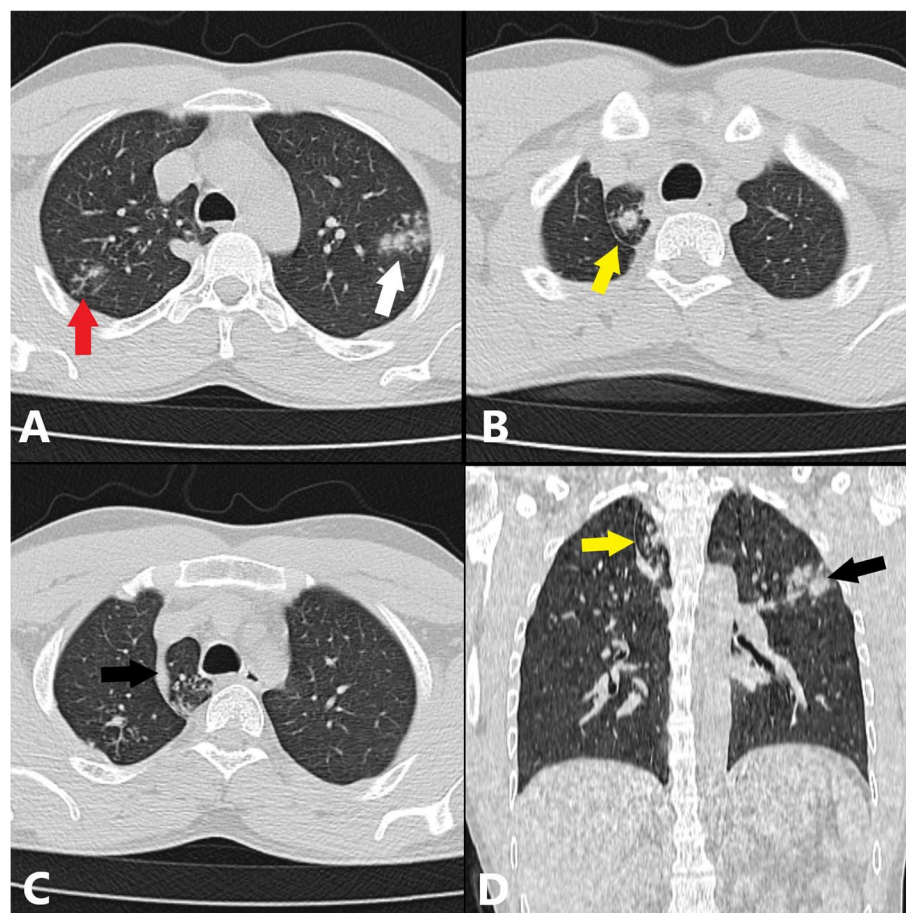


Fig. 1 a–d Axial HRCT thorax demonstrates. **a** Nodular opacities in bilateral upper lobes (white arrow) with tree-in-bud nodularity in right upper lobe. **b** Azygos fissure and lobe (yellow arrow) showing nodularity within. **c** Azygos vein (black arrow) seen as a thick curvilinear density caudal to the azygos fissure. Nodularity within azygos lobe and right upper lobe was also seen. **d** Coronal HRCT thorax demonstrates lung nodules within the azygos lobe (yellow arrow) and left upper lobe (black arrow)

tree-in-bud nodules were also seen (Fig. 1a). In addition, an azygos lobe was revealed. Nodularity of varying sizes was also revealed within the azygos lobe (Fig. 3b–d). No significant mediastinal or hilar lymphadenopathy was seen. Other mediastinal structures appeared normal.

Patient was prescribed levofloxacin for 1 week. Sputum for acid-fast bacilli (AFB) and QuantiFERON-TB Gold test (QFT) were performed which yielded a positive result for *Mycobacterium tuberculosis*. First line anti-tuberculous drugs were commenced as per the current protocol and advised to continue follow-up at the outpatient department and the Directly Observed Therapy, Short-Course (DOTS) centre.

Discussion

The azygos lobe is a rare anatomical variant of the lung, first recognized by Heinrich August Wrisberg in 1777 [9]. It is encountered in approximately 1% of anatomical specimens, 0.4% of chest radiographs and 1.2% of high-resolution CT (HRCT) thorax scans [1, 2].

The azygos vein is a unilateral vein, formed by the right ascending lumbar veins and right subcostal veins [10, 11]. It enters the thoracic cavity at the T12 vertebral level through the aortic hiatus [11]. It ascends anterolateral to the thoracic vertebral column and joins the superior vena cava at T4 vertebral level [10]. On chest radiograph, the normal azygos vein forms the right cardiomedial contour.

During embryological development, the posterior cardinal veins regress completely except for a small proximal segment on the right side [10, 11]. This precursor of the

azygos vein normally migrates medially over the right lung apex [1, 10, 11]. If the right posterior cardinal vein fails to migrate medially and in turn penetrates through the upper lobe of right lung, it creates an azygos fissure [1, 2, 4]. The portion of the upper lobe superomedial to the azygos fissure is termed as the azygos lobe. It has 4 layers of pleura (2-folds of visceral pleura and 2-folds of parietal pleura) [1, 4, 11]. The azygos lobe is not considered a true accessory lobe as it does not have a separate bronchus or vascular supply [10, 12].

The azygos fissure can usually be identified on frontal chest radiographs [1]. On chest radiograph, the azygos fissure may be seen as a curvilinear opacity within the upper right lung zone with its concavity towards

the upper mediastinum (Fig. 2a, b). A tear drop-shaped structure representing the azygos vein can be seen at the inferior aspect of the azygos fissure (Fig. 2a, b) [1, 13]. However, it can be misdiagnosed as on chest radiograph as bullae or displaced fissures are possible mimics [12].

Computed tomography (CT) of the thorax has superior capability of characterizing the morphology as well as presence of any pathology within the azygos lobe [1, 2, 14]. Furthermore, it can differentiate between azygos lobe, bulla and lung cyst. The azygos fissure is distinctly visible as a curvilinear density in the right upper lobe (Fig. 3a). It is usually C-shaped, but its morphology depends on the size of the azygos lobe [1]. The azygos vein can be seen as

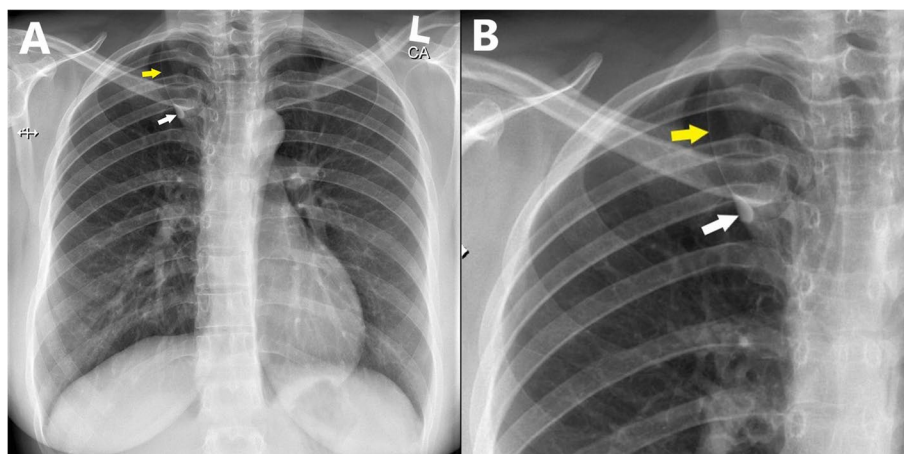


Fig. 2 a, b Chest radiograph of normal azygos lobe and fissure. **a** Frontal chest radiograph demonstrates the azygos fissure (yellow arrow) and azygos vein (white arrow). **b** Magnified image of the same radiograph demonstrates the azygos fissure (yellow arrow) and the tear drop shape of azygos vein (white arrow)

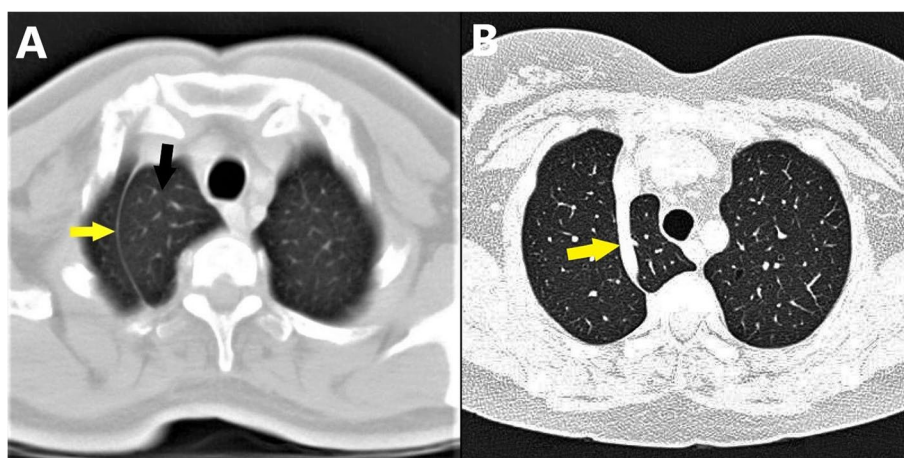


Fig. 3 a, b HRCT thorax of normal azygos lobe and fissure. **a** Axial HRCT thorax image demonstrates the azygos fissure as a C-shaped thin curvilinear density (yellow arrow) and the azygos lobe (black arrow) medial to it (courtesy of Dr. Ramesh Giti, MD, Mashhad University of Medical Sciences, Mashhad, Iran). **b** Axial HRCT thorax shows the azygos vein as a thicker band (yellow arrow) within the right upper lobe

a thick curved structure at the inferior aspect of the azygos fissure (Fig. 3b).

Tuberculosis of the azygos lobe is rare with only a few reports in literature [5]. The classical features of pulmonary TB on CT thorax are lung nodules, miliary opacities, mediastinal and/or hilar lymphadenopathy, pleural effusion and/or pleural thickening, cavities, and lung consolidation [8]. Chronic tuberculosis may show fibrotic changes along with bronchiectasis and may cause significant architectural distortion of the lung parenchyma [8]. Centrilobular nodules showing “tree-in-bud” appearance are a common occurrence in pulmonary TB [8, 15, 16].

Sputum smear microscopy for AFB is one of the most used investigations for detection of pulmonary TB in developing nations [17]. Culture & nucleic amplification methods for tuberculosis are further recommended owing to their superior sensitivity [18].

The azygos lobe can also have surgical implications as it hinders the extrapleural approach to the esophagus during thoracotomy procedure [19]. Hence, it is pertinent for a radiologist to be aware of this variant.

Conclusions

The azygos lobe is usually an incidental finding in chest radiograph or CT thorax scans. It is usually asymptomatic, but it may be misdiagnosed as bulla, lung cyst or abscess. Only a few cases of tuberculosis involving the azygos lobe have been reported in literature. We present such a rare case of tuberculosis involving the azygos lobe.

Abbreviations

CT: Computed tomography; HRCT: High-resolution computed tomography; TB: Tuberculosis; AFB: Acid-fast bacilli; QFT: QuantiFERON-TB Gold test; DOTS: Directly Observed Therapy, Short-Course.

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Authors' contributions

SSA analyzed and interpreted the radiological studies, and drafted the manuscript. SSB conceived of the study, analyzed, and interpreted the radiological studies. HG participated in manuscript design. SKA participated in manuscript design and coordination, analyzed and interpreted the microbiological studies. The authors read and approved the final manuscript.

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Availability of data and materials

The data and materials supporting the findings of this study are available on request from the corresponding author.

Declarations

Ethics approval and consent to participate

This study was approved from ethical committee of the institution. Written informed consent was obtained from the patients for publication of this case series and accompanying images.

Consent for publication

All authors read and approved the final manuscript. Patients included in this research gave written informed consent to publish the data & materials contained within this study.

Competing interests

The authors declare that they have no competing interests.

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References

- Caceres J, Mata J, Andreu J (1998) The azygos lobe: normal variants that may simulate disease. *Eur J Radiol* 27(1):15–20. [https://doi.org/10.1016/S0720-048X\(97\)00146-0](https://doi.org/10.1016/S0720-048X(97)00146-0)
- Al-Mnayyis A, Al-Alami Z, Altamimi N, Alawneh KZ, Aleshawi A (2020) Azygos lobe: prevalence of an anatomical variant and its recognition among postgraduate physicians. *Diagnostics* 10(7):470. <https://doi.org/10.3390/diagnostics10070470>
- Brown S, Braverman M (1931) Azygos lobe of the right lung. *Radiology* 17(3):575–575. <https://doi.org/10.1148/17.3.575>
- Felson B (1989) The azygos lobe: its variation in health and disease. *Semin Roentgenol* 24(1):56–66. [https://doi.org/10.1016/0037-198X\(89\)90054-0](https://doi.org/10.1016/0037-198X(89)90054-0)
- Abo-Zed A, Yassin M, Phan T (2021) Tuberculosis of the rare azygos lobe of the right lung. *Respir Med Case Rep* 33:101424, ISSN 2213-0071. <https://doi.org/10.1016/j.rmcr.2021.101424>
- Arai H, Inui K, Kano K, Nishii T, Kaneko T, Mano H et al (2012) Lung cancer associated with an azygos lobe successfully treated with video-assisted thoracoscopic surgery. *Asian J Endosc Surg* 5(2):96–99. <https://doi.org/10.1111/j.1758-5910.2011.00125.x>
- Wang L, Zhao F, Liu H et al (2021) Clinical characteristics of 50 children with azygos lobe: a retrospective study. *Eur J Pediatr* 180:2687–2691. <https://doi.org/10.1007/s00431-021-04133-9>
- Bhalla AS, Goyal A, Guleria R, Gupta AK (2015) Chest tuberculosis: Radiological review and imaging recommendations. *Indian J Radiol Imaging* 25(3):213–225. <https://doi.org/10.4103/0971-3026.161431>
- Boyden EA (1952) The distribution of bronchi in gross anomalies of the right upper lobe, particularly lobes subdivided by the azygos vein and those containing pre-eparterial bronchi. *Radiology* 58(6):797–807. <https://doi.org/10.1148/58.6.797>
- Donohue JR, Daly DT (2021) Anatomy, thorax, azygos veins. [Updated 2020 Jul 31]. In: StatPearls. StatPearls Publishing, Treasure Island Available from: <https://www.ncbi.nlm.nih.gov/books/NBK554430/>
- Demos TC, Posniak HV, Pierce KL, Olson MC, Muscato M (2004) Venous anomalies of the thorax. *Am J Roentgenol* 182(5):1139–1150. <https://doi.org/10.2214/ajr.182.5.1821139>
- Akhtar J, Lal A, Martin KB, Popkin J (2018) Azygos lobe: a rare cause of right paratracheal opacity. *Respir Med Case Rep* 23:136–137. <https://doi.org/10.1016/j.rmcr.2018.02.001>

13. Lenoir V, Kohler R, Montet X (2013) The empty azygos fissure. *J Radiol Case Rep* 7(4):10–15. <https://doi.org/10.3941/jrcr.v7i4.1323>
14. Karre PR, Cooper GB (2011) The azygos lobe and vein: interesting and typical clinical image. *Case Rep* 2011(sep28 1):bcr0520114266. <https://doi.org/10.1136/bcr.05.2011.4266>
15. Rossi SE, Franquet T, Volpacchio M, Giménez A, Aguilar G (2005) Tree-in-bud pattern at thin-section CT of the lungs: radiologic-pathologic overview. *RadioGraphics* 25(3):789–801. <https://doi.org/10.1148/rg.253045115>
16. Im J-G, Itoh H (2018) Tree-in-bud pattern of pulmonary tuberculosis on thin-section CT: pathological implications. *Korean J Radiol* 19(5):859. <https://doi.org/10.3348/kjr.2018.19.5.859>
17. Rao S (2009) Sputum smear microscopy in DOTS: are three samples necessary? An analysis and its implications in tuberculosis control. *Lung India* 26(1):3–4. <https://doi.org/10.4103/0970-2113.45196>
18. Afsar I, Gunes M, Er H, Gamze Sener A (2018) Comparison of culture, microscopic smear and molecular methods in diagnosis of tuberculosis. *Rev Esp Quimioter* 31(5):435–438
19. Ndiaye A, Ndiaye NB, Ndiaye A, Diop M, Ndoye JM, Dia A (2011) The azygos lobe: an unusual anatomical observation with pathological and surgical implications. *Anat Sci Int* 87(3):174–178. <https://doi.org/10.1007/s12565-011-0119-5>

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