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CASE REPORT

The azygos lobe, an incidental finding in computer tomography

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ABSTRACT

The azygos lobe is an anatomical variant of the upper lobe, which occurs most often in the right lung. Atypical course of the azygos vein is formed during embryogenesis, while the precursor of this vein migrates through the lung and creates the azygos fissure. Despite its rare occurrence, this variation is well described. This article presents a case of 62-year-old male with the azygos lobe, which was found accidentally in the computer tomography. The knowledge about the azygos vein is significant for surgeons, because it might reduce iatrogenic damage and help them avoid unexpected bleeding during thoracic surgery. The azygos vein might be confused with pathological conditions. It might also be associated with lung cancers, pneumothorax and congenital abnormalities. Despite the fact that the azygos lobe is well known variant, dissemination of knowledge about it is still inadequate.

Key words: azygos lobe, azygos fissure, azygos vein, anatomical variation

INTRODUCTION

The azygos system has a significant number of anatomical variations and the knowledge about them is important for surgeons and radiologists. They are usually asymptomatic and detected in most cases during routine examinations. One of these variations is the azygos lobe, a rare anatomical variant of the upper lobe [12]. It is the most common in the right lung, but cases of the azygos lobe in the left lung are also reported [1, 10]. Prevalence of this lobe range from 0,4% to 1,54% and is higher among males. It is worth mentioning, that prevalence also depends on examination, and is described to be 0,4% on plain chest x-rays, 1% in cadaveric specimen and 1,54% on CT [13, 21]. It is presumed, that the cause of the azygos fissure is genetic and depends upon an autosomal dominant gene [10]. The azygos vein is formed between 4th and 6th week of embryonic development, as a result of the subcardinal vein's transformation [8, 11]. If there are no anatomical variations, the azygos vein arises from the right ascending lumbar vein, enters the thorax, arches over the root of the right lung, and drains towards the superior vena cava [14]. But sometimes, during embryogenesis, one of the precursors of the azygos vein, that is a right posterior cardinal vein migrates into the apex of the lung, and forms the azygos lobe [9]. This lobe is separated from the right upper lobe by the azygos fissure, which contains the azygos vein surrounded by the mesoazygos [16]. It is worth noting, that according to many authors, "azygos lobe" is a misnomer, because this part of the lung does not have its own bronchial or vascular [16, 21]. In the literature, there are three types of azygos fissures described- a, b and c [11]. Our case corresponds to type c, where the fissure is vertical, cuts of a tongue of the lobe from the mediastinal part and the pedicle is attached at the superior margin of the root of the lung. Whereas type a is a fissure more or less horizontal, which cuts lateral surface of the lung between the apex and a point located 2 inches below. In type b the fissure is practically vertical and divides the apex of the lung into two lateral halves [10, 11].

CASE REPORT

A 62-year-old male with adenocarcinoma of the oesophagus was admitted to the Thoracic Surgery Department of Warmia and Mazury Center of Pulmonary Diseases in Olsztyn for surgical treatment. In preparation for the procedure computer tomography was performed. The examination showed atypical course of the arch of the azygos vein. The arch of the azygos vein divides the upper lobe of the right lung, and forms the azygos lobe. The azygos fissure formed in this case, runs vertically and separates the part of lobe from the mediastinal surface, while the pedicle of this additional lobe is still attached to the root of the lung (Fig. 1).

DISCUSSION

Knowledge of the anatomical structures and their variations should be crucial for physicians, especially surgeons and radiologists. The azygos lobe is a well described, but rare anatomical variant of the upper lung lobe. In most cases, this structure is found incidentally during imaging examinations [7]. Proper description of this variability is important before any surgical interventions in the thorax. A different course of the azygos vein, including even the left azygos vein [19], and the existence of the azygos lobe make thoroscopic surgery more difficult. Probability of the bleeding is much higher in those cases, particularly during sympathectomies [2, 15].

This variation causes diagnostic difficulties for many clinicians, due to its similarity to various diseases. It can be confused with a lung abscess, a bulla, a pulmonary nodule, or a mass [1, 9]. Despite the fact that many cases of the azygos lobe are described, the knowledge about it among the clinicians is still insufficient. In a study among the physicians evaluating their knowledge about the azygos lobe, results were different depending on the medical specialty. None of the 173 intern doctors and the 26 surgery residents correctly identified this variation. However, 57,1% of the radiology residents chose the proper answer [2]. Other study, involving 50 children with azygos lobes, reports that 40% of them were not diagnosed by the first imaging examination [20].

Knowledge of the azygos lobe is also significant because of the variety of lung cancers associated with this structure. In the literature, there are described cases of an azygos lobe lung cancer- a small cell carcinoma and a non small cell carcinoma, and their

surgical treatment [3, 17]. It is worth noting, that in the previous studies, authors reported that the azygos lobe carcinoma is not associated with regional lymph node involvement [7], which has been repeatedly confirmed [5, 18]. Although lung cancers occur in the azygos lobe, they are not very common. Fukuhara et al. drew attention to one hypothesis, concerning a relatively rare cancers in the azygos lobe. It is possible that worse ventilation of this lobe, related to constriction by the azygos vein leads to limited oxygenation, carcinogens deposition and thus restricting carcinogenesis [6]. Variations among lungs might result in bronchial changes. Ndiaye et al. suggest, that the azygos vein passing through the azygos fissure, leads to deformation of the anterior apical subsegmental bronchus (B1b). Hence, atelectasis and bronchiectasis may be noticed more often rather in other parts of the right upper lobe, than in the azygos lobe [11], contrary to previous opinion, that deformation of the bronchus, caused by the azygos fissure, may predispose the azygos lobe to air trapping and further consequences [4]. It also means, that the azygos lobe plays significant role in the ventilation of the right upper lobe. This fact should always be considered before surgical intervention in the thorax [11]. Other authors noticed, that the azygos lobe associated with spontaneous pneumothorax has been reported rarely, thereby this variation might have a protective effect against the formation of bullae or blebs [4]. Furthermore, the azygos fissure, or pleural folds, might limit the spreading of infection to the azygos lobe from another parts of the lung [1].

The azygos lobe seems to be clinically significant for one more reason. In a research about prevalence of the azygos lobe, attention was drawn to the results suggesting an association between the azygos lobe and cardiopulmonary malformation and/or genetic factors. This anatomical variation appears more frequently in individuals with Turner's syndrome, bronchogenic cysts, and congenital heart diseases [21]. That is not the only study which reports that probably association. Wang et al. described that azygos lobe among children might be complicated with other congenital abnormalities, like tracheal bronchus, tracheal stenosis, congenital heart disease, cystic adenomatoid malformation, and Down syndrome [20].

CONCLUSIONS

Even though the azygos lobe is rare variation, the knowledge about it is unusually precious for all physicians, but especially for surgeons and radiologists. Dissemination of knowledge about the azygos lobe is still insufficient. Correct recognition of this structure might prevent iatrogenic damage of the azygos vein and reduce the risk of bleeding. Further research is needed to explain possible association between the azygos lobe and the other abnormalities, and thereby increase the knowledge about pathophysiology and anatomy.

Conflict of interest: Non declared

REFERENCES

1. Akhtar J, Lal A, Martin KB, et al. Azygos lobe: A rare cause of right paratracheal opacity. *Respir Med Case Reports*. 2018; 23(February): 136–137, doi: 10.1016/j.rmcr.2018.02.001.
2. Al-Mnayyis A, Al-Alami Z, Altamimi N, et al. Azygos lobe: Prevalence of an anatomical variant and its recognition among postgraduate physicians. *Diagnostics*. 2020; 10(7): 1–8, doi: 10.3390/diagnostics10070470.
3. Arai H, Inui K, Kano K, et al. Lung cancer associated with an azygos lobe successfully treated with video-assisted thoracoscopic surgery. *Asian J Endosc Surg*. 2012; 5(2): 96–99, doi: 10.1111/j.1758-5910.2011.00125.x.
4. Azoury FM, Sayad P. Thoracoscopic management of spontaneous pneumothorax due to azygos lobe bullae. *Asian Cardiovasc Thorac Ann*. 2011; 19(6): 427–429, doi: 10.1177/0218492311420542.
5. Darlong LM, Ram D, Sharma A, et al. The Azygous Lobe of the Lung: in the Case of Lung Cancer. *Indian J Surg Oncol*. 2017; 8(2): 195–197, doi: 10.1007/s13193-016-0617-y.
6. Fukuhara S, Montgomery M, Reyes A. Robot-assisted azygos lobectomy for adenocarcinoma arising in an azygos lobe. *Interact Cardiovasc Thorac Surg*. 2013; 16(5): 715–717, doi: 10.1093/icvts/ivt021.
7. Kotov G, Dimitrova IN, Iliev A, et al. A Rare Case of an Azygos Lobe in the Right Lung of a 40-year-old Male. *Cureus*. 2018; 10(6): 6–10, doi: 10.7759/cureus.2780.
8. Krakowiak-Sarnowska E, Wiśniewski M, Szpinda M, et al. Variability of the azygos vein system in human fetuses. *Folia Morphol (Warsz)*. 2003; 62(4): 427–430.
9. Moawad CM, Griep DW, Moawad KA, et al. The azygos lobe of the lung. *Pulmonology*. 2022; 28(3): 241–242, doi: 10.1016/j.pulmoe.2021.12.012.

10. Mpolokeng KS, Louw GJ, Gunston G, et al. Anatomical variations in lung fissures leading to supernumerary lobes in the lungs. *Transl Res Anat.* 2022; 28: 100209, doi: 10.1016/j.tria.2022.100209.
11. Ndiaye A, Ndiaye NB, Ndiaye A, et al. The azygos lobe: An unusual anatomical observation with pathological and surgical implications. *Anat Sci Int.* 2012; 87(3): 174–178, doi: 10.1007/s12565-011-0119-5.
12. de Oliveira Gomes M, Nobeschi L, Dias DV, et al. Analysis of the territorial pattern of the azygos venous system and its variations in fixed cadavers. *Transl Res Anat.* 2020; 21(May): 100077, doi: 10.1016/j.tria.2020.100077.
13. Ozdemir L, Ozdemir B, Duman T. Prevalence of an Azygos Lobe using Thoracic Computed Tomography. *Cyprus J Med Sci.* 2017; 1(3): 55–57, doi: 10.5152/cjms.2016.97.
14. Pyrzowski J, Spodnik JH, Lewicka A, et al. A case of multiple abnormalities of the azygos venous system: A preaortic interazygos vein. *Folia Morphol (Warsz).* 2007; 66(4): 353–355.
15. Reisfeld R. Azygos lobe in endoscopic thoracic sympathectomy for hyperhidrosis. *Surg Endosc Other Interv Tech.* 2005; 19(7): 964–966, doi: 10.1007/s00464-004-8212-7.
16. Rivaud Y, Maldjian PD. The Azygos Vein from A to Z. *J Thorac Imaging.* 2019; 34(5): W100–W108, doi: 10.1097/RTI.0000000000000420.
17. Sezer HF, Abdullayev G, Avci A, et al. Segmentectomy for primer lung cancer, which arise from azygos lobe: Azygos lobectomy. *Tuberk Toraks.* 2019; 67(3): 231–233, doi: 10.5578/tt.68622.
18. Su X, Huang Q, Luo Z, et al. A rare case of right upper lung cancer with azygos lobe and partial anomalous pulmonary venous return. *J Cardiothorac Surg.* 2022; 17(1): 1–4, doi: 10.1186/s13019-022-01823-9.
19. Tang Z, Teng Y, Li J, et al. Left upper lung cancer with persistent left superior vena cava and left azygos vein: a case report. *J Cardiothorac Surg.* 2020; 15(1): 4–7, doi: 10.1186/s13019-020-01278-w.
20. Wang L, Zhao F, Liu H, et al. Clinical characteristics of 50 children with azygos lobe: a retrospective study. *Eur J Pediatr.* 2021; 180(8): 2687–2691, doi: 10.1007/s00431-021-04133-9.
21. Yurasakpong L, Yammine K, Limpanuparb T, et al. The prevalence of the azygos lobe: A meta-analysis of 1,033,083 subjects. *Clin Anat.* 2021; 34(6): 872–883, doi: 10.1002/ca.23737.

Figure 1. Computer tomography. A-C: coronal view D-E: axial view. Red arrow-azygos lobe, orange arrow-azygos vein, white arrow-azygos fissure, blue arrow-trachea, green arrow-oesophagus

