

CT Imaging of the Azygos Lobe: Prevalence and Clinical Implications

Erdem Yuzuak¹, Serdar Aslan¹, Ismet Mirac Cakir², Uluhan Eryuruk¹, Alptekin Tosun¹, Hakan Yuzuak³

¹ Giresun University, Faculty of Medicine, Department of Radiology, Giresun, Türkiye

² Samsun University, Faculty of Medicine, Department of Radiology, Samsun, Türkiye

³ Giresun University, Faculty of Medicine, Department of Physiology, Giresun, Türkiye

Abstract

Introduction: Azygos lobe is a rare anatomical variation in the upper lobe of the right lung. It is visible on chest radiography or computed tomography (CT) scans. In this study, we aimed to investigate the prevalence and sex distribution of the right azygos lobe in patients undergoing thoracic CT in a local region of the Eastern Black Sea in 2020.

Materials and Methods: In this study, we retrospectively examined the images of 10,271 patients with thorax CT scans between 2020 and 2021. The ages and sex of the patients were recorded. The azygos fissure was identified as a convex line in the paramediastinal portion of the upper lobe of the right lung. The presence or absence of the right azygos lobe and fissure and the presence of a lung mass or nodule inside the azygos lobe were examined in patients undergoing thoracic CT.

Results: The azygos lobe was found in 51 (1%) females and 73 (1.4%) males out of 10,271 patients examined. Azygos lobe was found in 124 patients (1.2%). The study results indicated that males had a higher prevalence of azygos lobe variation than females. However, there was no statistically significant relationship between the presence of azygos lobe variation and sex. This study revealed no masses or nodules in the azygos lobe.

Conclusion: The present study reports on the prevalence and sex distribution of the azygos lobe in a large representative sample of the Eastern Black Sea region, highlighting the importance of accurately detecting the azygos lobe in imaging studies.

Key words: Azygos; prevalence; tomography; mass.

Introduction

The azygos lobe was first characterized by Wrisberg in 1877, followed by Jachies in radiology in 1923 (1). The azygos lobe is a rare anatomical variation in the upper lobe of the right lung (2). Although it is more commonly present in the right upper lobe, it can rarely be observed in the left upper lobe (3). Because the azygos lobe lacks its own bronchus or blood supply, it is not considered an actual accessory lobe. As far as is known, it serves no other physiological function beyond gas exchange (4). The azygos lobe develops during the embryologic process when the posterior cardinal vein passes through the upper lobe of the lung and travels over the pleural layers (5). The azygos lobe is an anatomical variant that appears in 1% of anatomical materials and 0.4% of chest radiographs (6). The azygos lobe plays a significant role in lung pathology. The appearance of the azygos lobe on chest radiographs or computed tomography (CT) scans may be misinterpreted as a pneumothorax, abscess, or

bullae (5). In addition, the presence of the azygos lobe may require the use of alternative surgical methods during thoracic surgeries. The azygos lobe complicates thoracic surgery and increases the risk of bleeding, particularly during sympathectomy (7,8,9). In this study, we aimed to investigate the prevalence and sex distribution of the right azygos lobe in patients undergoing thoracic CT in a local region of the Eastern Black Sea in 2020.

Materials and Methods

This retrospective study was approved by the Ethics Committee for Clinical Studies of Giresun University Faculty of Medicine (approval number: E-90139838-000-18904/26.04.2021) and followed the principles of the Helsinki Declaration. This study included patients who underwent thorax CT in a year between 2020 and 2021, beginning January 1, 2020. Images from thorax CT scans performed in the Faculty of Medicine, Department of Radiology in 2020, and registered

*Corresponding Author: Ismet Mirac Cakir, Department of Radiology, Samsun University Faculty of Medicine, Samsun, Turkey. E-mail: ismetcakir_55@hotmail.com Orcid: Erdem Yuzuak [0000-0003-2540-8881](https://orcid.org/0000-0003-2540-8881), Serdar Aslan [0000-0003-2950-8767](https://orcid.org/0000-0003-2950-8767), Ismet Mirac Cakir [0000-0002-4229-7493](https://orcid.org/0000-0002-4229-7493), Uluhan Eryuruk [0000-0001-6581-621X](https://orcid.org/0000-0001-6581-621X), Alptekin Tosun [0000-0003-1783-9171](https://orcid.org/0000-0003-1783-9171), Hakan Yuzuak [0000-0002-9783-0451](https://orcid.org/0000-0002-9783-0451)



in the PACS system were evaluated retrospectively.

Image acquisition: All CT scans were performed with a 16-slice spiral CT scanner (Emotion 16, Siemens Healthineers) from the apex to the base of the lung during deep inspiration and breath-hold, with or without contrast. We used the following parameters: tube voltage (80 kV), tube current (35–50 mA), rotation time (0.75 s), pitch (1.5), slice thickness (2.5 and 4 mm), and detector width (1.5 mm). Axial images were evaluated, with sagittal and coronal reformations performed as needed. Images were examined by two radiologists with over 10 years of experience in body imaging. Of the 10,448 patients, 177 were excluded for a variety of reasons. The exclusion criteria included missing or inaccurate images, severe parenchymal

lung distortion (previous lung laceration, advanced interstitial lung disease, or bronchiectasis), and thoracic surgery. The ages and sex of the patients were recorded. The azygos fissure was characterized as a convex line in the paramediastinal section of the upper lobe of the right lung, and the presence or absence of the right azygos lobe and fissure was seen in patients undergoing CT scan (Figure 1). A lung mass or nodule in the azygos lobe was also evaluated.

Statistical analyses: Statistical analyses were performed using IBM SPSS v23. Chi-square test was performed to determine the relationship between categorical variables. Data are presented as *n* (%) and mean \pm *SD*. The statistical significance level was set at $p < 0.05$.

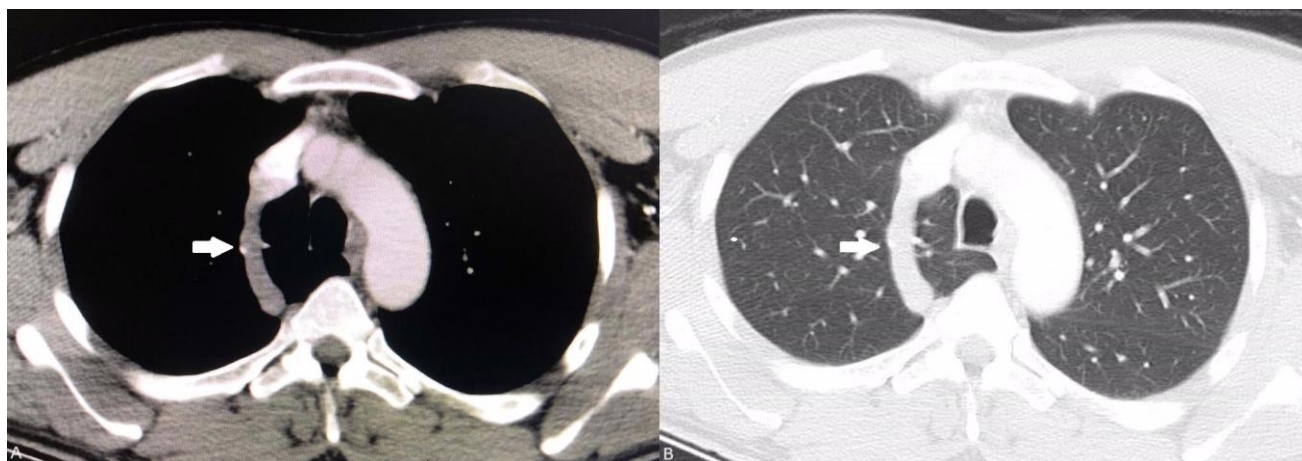


Figure 1: Azygos lobe and fissure (white arrows): (A) chest tomography axial section mediastinum window, and (B) chest tomography axial section parenchyma window.

Table 1: Prevalence of the right azygos lobe in patients.

		Female n (%)	Male n (%)	Total n (%)	<i>p</i>
Azygos Lobe Presence	None	4867 (99)	5280 (98.6)	10.147 (98.8)	0.130
	Exist	51 (1)	73 (1.4)	124 (1.2)	

Results

This study included 10,271 patients who had thoracic CT between 2020 and 2021. Azygos lobe was seen in 51 (1%) females and 73 (1.4%) males, for a total prevalence of 1.2% (124 patients). The mean age of our patients was 56.60 ± 20.1 years. Of the patients studied, 52.1% were males, and 47.9% were females. The presence of the azygos lobe was detected in 51 (1%) females and 73 (1.4%) males ($p = 0.130$). Azygos lobes were seen in 124 patients (Tables 1). Our study found that

males had a higher prevalence of azygos lobe variation than females. However, there was no statistically significant relationship between the presence of azygos lobe variation and sex ($p = 0.13$). A lung mass or nodule in the azygos lobe was also evaluated. The study revealed no masses or nodules in the azygos lobe in our study.

Discussion

The azygos lobe is a rare anatomical variation in the upper lobe of the right lung (2,3). In this

study, we investigated the prevalence of the right azygos lobe in a population sample from the Eastern Black Sea. The literature consists primarily of case reports, with only a few studies on the azygos lobe. To the best of our knowledge, this is the largest study investigating the prevalence of the azygos lobe. According to Zdemir et al. (10), the prevalence of the azygos lobe was 1.54%. The prevalence rates in this study were higher than those in the literature. Gürün et al. found that the prevalence of the azygos lobe was 0.76% in 1965 thorax CT scans. The prevalence of the right azygos lobe was found to be 0.95% in males and 0.58% in females (11). In a study of 1,709 CT scans, Al-Mnayyis et al. (12) found that the prevalence of the azygos lobe was 1.01% in males and 0.62% in women, with an overall prevalence of 0.88%. Perincek et al. (13) found that the prevalence of the azygos lobe was 1.09%, with females having (13) a higher prevalence than women. In our study, the prevalence of the azygos lobe was 1% in females, 1.4% in males, and 1.2% in all patients. The prevalence of azygos lobe variation in our study may be higher than in other studies. This may be due to demographic variations or an increased number of patients. In our study, as in the literature, we found that the prevalence of azygos lobe variation was higher in males than females. However, there was no statistically significant relationship between the presence of azygos lobe variation and sex. The slight variations in prevalence across studies may be attributed to differences in population demographics, imaging technology resolution, and interpretation criteria. Furthermore, the higher male prevalence observed in multiple studies, including ours, might reflect anatomical or developmental differences, though the exact cause remains uncertain. These findings highlight the need for further multicentric studies to better understand the underlying factors contributing to the presence of an azygos lobe. The appearance of the azygos lobe on chest radiographs or CT scans may lead to misinterpretation, potentially being confused with pneumothorax, abscess, or bullae (5). Moreover, a consolidated azygos lobe may be mistakenly diagnosed as a mass (10,14). Therefore, thoracic surgeons should possess comprehensive knowledge of the variation and anatomy of the azygos lobe, as misdiagnosis may occur, prompting the need for alterations in surgical approaches (15). From a clinical perspective, recognizing the azygos lobe is crucial to avoid misdiagnoses and prevent complications during thoracic interventions. For example, during video-assisted thoracoscopic surgery (VATS) or

sympathectomy, the azygos lobe can obscure the operative field and cause unexpected bleeding due to vascular variations. In addition, a consolidated azygos lobe might be mistaken for a pathological lesion, potentially leading to unnecessary invasive diagnostic procedures. Therefore, accurate preoperative imaging recognition of this anatomical variant is vital to reduce perioperative risk and surgical complications (7-9, 15). Primary lung cancer originating from the azygos lobe is extremely rare. One theory posits that the rarity of azygos lobe-related cancer growth stems from reduced ventilation of the azygos lobe. Although controversial, this hypothesis suggests that ventilation of the azygos lobe may be reduced due to its constriction by the azygos vein, leading to decreased oxygen delivery and potential accumulation of carcinogenic particles, thereby limiting the development of carcinogenesis in the azygos lobe (16). No other studies have investigated the presence of a lung mass associated with the azygos lobe. The study found no mass or nodule in the azygos lobe of 124 patients. However, the sample size was insufficient to evaluate the likelihood of lung mass formation in the azygos lobe.

Study limitations: Our study has several limitations. Due to the high volume of COVID-19-related chest CT referrals during the period of this retrospective study, the number of patients included exceeded the usual levels. This may have enhanced the representativeness of the study cohort in reflecting the community-dwelling adult population. However, being a single-center study conducted in a specific geographical region limits the generalizability of the findings.

Conclusion

In conclusion, our study indicates that the prevalence of azygos lobe variation may be higher than reported in other studies, potentially influenced by demographic differences or a higher number of patients. We found a higher prevalence of azygos lobe variation in males than females. However, there was no statistically significant relationship between the presence of azygos lobe variation and sex distribution. Our study sheds light on the prevalence and sex distribution of the azygos lobe in a large representative sample from the Eastern Black Sea region, highlighting the importance of accurately identifying the azygos lobe in imaging studies.

Ethical approval: The study was approved by the Clinical Research Ethics Committee of Giresun University Faculty of Medicine (protocol number: E-90139838-000-18904/26.04.2021).

Conflict of interest: The authors have no conflict of interest regarding this study.

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