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AUTHORS: Enes GÜRÜN,İsmail AKDULUM

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A rare anatomical variation detected incidentally on computed tomography of the thorax: the azygos lobe

Toraks Bilgisayarlı Tomografisinde Tesadüfen Saptanan Nadir Bir Anatomik Varyasyon: Azigos Lobu

Enes Gürün^{1*}, İsmail Akdulum²

1.Department of Radiology, İskilip Atıf Hoca State Hospital, 19400, Çorum, Turkey

2.Department of Pediatric Radiology, Gazi University Medical Faculty Hospital, 06560, Ankara, Turkey

ABSTRACT

Aim: An azygos lobe is an unusual anatomical variation of the upper lobe of the right lung. During the formation of the lungs, the right azygos lobe develops as the precursor of the azygos vein, moving along the pleural surface rather than arcing forward above the origin of the lung to reach the upper vena cava, enters the apex of the right lung in the upper thoracic region. The purpose of this study was to assess the prevalence of the right azygos lobe in a sample of the Turkish population.

Methods: This study was conducted from February to October 2020. Each computed tomography (CT) scan was checked for the presence of a right azygos lobe and a fissure on the axial plane. The azygos lobe was described as the convex line in the paramediastinal portion of the upper right lung on the CT scan. Our exclusion criteria were previous thoracic surgery in the right lung or parenchymal distortion on CT examinations.

Results: One thousand nine hundred and sixty-five thorax CT scans were evaluated retrospectively. Nine hundred and forty-five of them were from men and the remainder were from women. A total of 15 right azygos lobe variations were detected (six females, nine males). The mean age of the patients was 52.87 ± 14.604 years (30–77). The azygos lobe frequency was 0.76%.

Conclusion: The azygos lobe is typically an uncommon variation of the right lung and is not really a distinct lobe. It is a very important variation that should be known about as it can mimic pathological conditions such as cysts, abscesses, or lung lesions. Since the azygos lobe is usually an incidental finding, radiologists and surgeons should be aware of this potential anomaly during the imaging and interventional procedures.

Keywords: Azygos vein, prevalence, computed tomography

ÖZ

Amaç: Azigos lob, sağ üst lobun nadir bir anatomik varyasyonudur .Akciğerlerin oluşumu sırasında, sağ azigos lob, prekürsör sağ akciğerin apeksinden azigos venin üst torasik kısmına girerek akciğerin orjin noktasının üzerinde ileriye doğru kıvrılarak vena kavaya ulaşmak yerine plevral yüzey boyunca hareket ederken gelişir.Bu çalışmanın amacı, bir Türk popülasyonu örnekleminde sağ azigos lobunun prevalansını değerlendirmektir.

Yöntem: Bu çalışma Şubat 2020'den Ekim 2020 tarihleri arasında gerçekleştirildi. Bilgisayarlı tomografi (BT) görüntüleri, aksiyel düzlemde sağ azigos lob ve fissür varlığı açısından kontrol edildi. Azigos lob, BT taramasında sağ akciğerin üst paramediastinal kısmındaki konveks çizgi olarak tanımlandı. Dışlama kriterlerimiz, sağ akciğerden daha önce göğüs cerrahisi geçirmiş olan ya da BT incelemelerinde parankimal distorsiyonu bulunan vakalardır.

Bulgular: 1965 toraks BT taraması retrospektif olarak değerlendirildi. Vakaların 945'i erkek, kalanı kadındı. Toplam 15 sağ azigos lob varyasyonu tespit edildi (6 kadın, 9 erkek). Hastaların yaş ortalaması 52.87 ± 14.604 (30-77) idi. Azigos lob frekansı% 0.76 olarak bulundu.

Sonuç: Azigos lob, tipik olarak sağ akciğerin nadir görülen bir varyasyonu olup gerçek bir lob değildir. Kistler, apseler veya akciğer lezyonları gibi patolojik durumları taklit edebileceği için bilinmesi gereken oldukça önemli bir varyasyondur. Azigos lob genellikle insidental bir bulgu olduğundan, görüntüleme ve girişimsel işlemler sırasında radyologlar ve cerrahlar bu anomalinin varlığı açısından dikkatli olmalıdır.

Anahtar Kelimeler: Azigos veni, prevalans, bilgisayarlı tomografi

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*Corresponding Author: Enes Gürün. İskilip Atıf Hoca State Hospital, Çorum, Türkiye. +905535352575, e.grn06@gmail.com

ORCID: 0000-0002-5321-8439

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INTRODUCTION

An azygos lobe, first defined by Heinrich Wrisberg in 1778, is an unusual anatomical variation of the upper lobe in the right lung [1]. Via the azygos fissure, containing the azygos vein and a four-folded pleura, the azygos lobe is split from other lung areas. During the formation of the lungs, the right azygos lobe is developed as the precursor enters the apex of the right lung into the upper thoracic portion of the azygos vein, termed the right posterior cardinal vein, moving along the pleural surfaces, rather than arcing forward above the origin of the lung to access the superior vena cava [2, 3]. A good understanding of the entity is essential, as it can be mistaken for some disease processes such as cysts, abscesses or pulmonary lesions. It is also essential in planning for medical interventions. An understanding of the imaging characteristics of the azygos lobe is critical to avoid misdiagnosis and unwarranted interventions [4]. Its prevalence ranges from 0.4% on chest x-rays to 1.2% on computed tomography (CT) and is generally incidentally identified by imaging [4, 5]. The purpose of this study is to assess the prevalence of the right azygos lobe in a sample of the Turkish population.

MATERIAL AND METHODS

This study was approved by the Hitit University Ethics Committee and complies with the Helsinki Declaration (2020–353). Informed consent was waived due to the retrospective nature of the study as well as the fact that the assessment utilized anonymous research findings. The study included 1965 thorax CT scans, of which 945 subjects were men and the remainder were women. Many had respiratory symptoms, such as chest pain, shortness of breath and cough, while others were asymptomatic for respiratory problems but were routinely screened for several diseases, such as malignancies and lung nodules. This study was conducted over nine months, from February 2020 to October 2020.

CT studies were performed using a multidetector 16 row helical CT scanner (Alexion, Toshiba Medical Systems, Nasu, Japan). CT imaging was performed during a breath-hold at deep inspiration. Spirometric gating was not applied. The scans were obtained from the base of the neck down to

the diaphragm. A supine or prone position was chosen. Parameters were 100–120 Kv, the field of view was 350 mm, beam collimation was 1 × 16 mm, gantry rotation time was 0.5 seconds and scan time was 11–13 seconds. Thin-section CT data was reconstructed at a slice thickness of 1 mm with 0.8-mm intervals. Image matrix size was 512 × 512. We used automatic tube-current modulation at a maximum of 225 mAs for exposure dose reduction. Intravenous contrast medium was not administered unless vascular pathologies, such as pulmonary embolism, were suspected. CT images were analyzed using a Vitrea workstation (Canon Medical Systems Corporation; Otawara, Japan) by a single radiologist, EG, who has seven years of CT experience.

Each CT scan was checked for the presence or absence of the right azygos lobe and fissure on the axial plane. The azygos lobe was described as the convex line in the paramediastinal portion of the upper-right lung, on the CT scan. Our exclusion criteria were participants who had previous thoracic surgery in the right lung or parenchymal distortion on CT examinations.

Statistical analysis was performed via the SPSS v.22 package program (IBM SPSS Statistics, Chicago, IL, USA). Participant age, gender, diagnosis and radiological features were recorded. Descriptive statistics were expressed as a mean, ± standard deviation (SD). Continuous variables were analyzed using the Mann-Whitney U test. A P-value of less than 0.05 was considered statistically significant.

RESULTS

From February 2020 to October 2020, 1,965 chest CT scans were evaluated retrospectively. Nine hundred and forty-five of them were from men and the remainder were from women. A total of 15 right azygos lobe variations were detected (6 females, 9 males). The mean age of the patients was 52.87 ± 14.604 (30–77). There was no statistically significant difference between the ages of men and women ($p = 0.906$). None of the patients had known congenital heart anomalies. The azygos lobe frequency was found to be 0.76% in the sample of 1,965 thorax CT. The prevalence of the right azygos lobe in males and females was 0.95% and 0.58%, respectively (Table 1). The most common

symptoms and other accompanying imaging findings were cough (8/15) and pneumonia (6/15). Symptoms and other accompanying CT findings of all cases are given in Table 2. Examples of the right azygos lobe from two different patients are shown in Figures 1 and 2.

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

	Male	Female	Total
Number of patients (n)	945	1020	1965
Patients with an azygos lobe (n)	9	6	15
Prevalence (%)	0.95	0.58	0.76

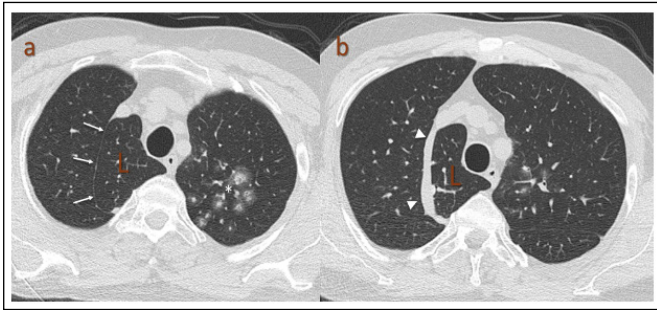


Figure 1: Parenchymal window images of consecutive axial non-contrast thoracic CT images of a 47-year-old female (a) shows pleural fold of azygos fissure at the arrow. Besides, nodular ground-glass opacities in the neighborhood of ‘*’ in the left lung apicoposterior were found to be compatible with COVID pneumonia. (b) At the inferior sections, the view of the azygos vein is observed at the arrowhead. The azygos lobe (L) is located medial to the azygos vein and fissure.

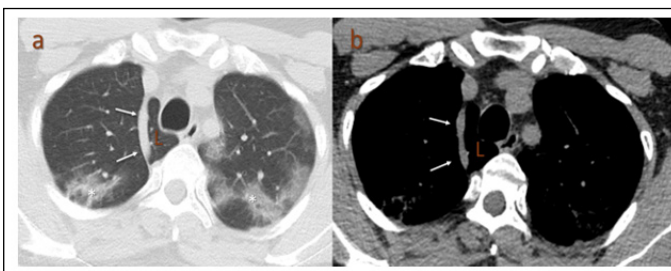


Figure 2: In a 48-year-old male patient who presented with shortness of breath, the azygos vein at the arrow and azygos lobe (L) are observed in the parenchyma (a) and mediastinum (b) window images of the non-contrast thoracic CT. Also, in the parenchymal window images, patchy ground-glass densities of both lungs are observed (*).

Table 2: Clinical symptoms and other CT findings in 15 adults accompanying the azygos lobe.

No	Age	Gender	Symptoms	Other CT findings
1	39	M	Cough and weakness	Emphysema
2	30	F	Cough, fever, and joint pain	Pneumonia
3	47	F	Cough and shortness of breath	Pneumonia
4	71	M	Cough and diarrhea	Atelectasis
5	77	F	Weakness and fever	Pneumonia
6	62	M	Sore throat, cough, and weakness	Pneumonia
7	54	M	Cough	Atelectasis
8	48	M	Shortness of breath	Pneumonia
9	37	M	Fever and joint pain	None
10	60	M	Headache, sore throat, and cough	Pneumonia
11	73	M	Shortness of breath and cough	Signs of heart failure
12	51	F	Cough	Atelectasis
13	64	F	Weakness and joint pain	None
14	35	M	Sore throat and weakness	None
15	45	F	Cough, weakness, and shortness of breath	Aortic aneurysm

DISCUSSION

The azygos lobe is an unusual anatomical variation of the upper lobe in the right lung, which ranges in frequency from 0.4% on chest x-rays, to 1.2% on CT scans; it is generally identified incidentally via imaging [6-8]. The azygos lobe is located in the medial part of the upper lobe of the right lung and is separated from the other parts of the upper lobe of the right lung through the azygos fissure. The fissure contains the azygos vein and a double layer of the pleural leaf. Since it does not have its bronchus and does not represent a unique bronchopulmonary segment, the azygos lobe is not a specific lobe [4, 9].

The azygos vein is typically formed by the union of the right subcostal vein and the right lumbar ascending vein. It continues to the thorax from the diaphragmatic aortic cavity, ascends through the thoracic vertebra, at T4, takes an anterior curve and joins the superior vena cava. In normal conditions, the posterior cardinal vein moves through the apex of the right lung to its usual position in the mediastinum. The azygos lobe is formed due to the penetration of the right posterior cardinal vein to the apex of the right lung

rather than normal migration during embryonic development. The azygos lobe is the outcome of a medial movement defect of the azygos vein to the right tracheobronchial junction, above the lung apex [10, 11].

In our study, the frequency of azygos lobes in thorax CT images was found to be 0.76%. The incidence in men was 0.95%, while the frequency in women was 0.58%. There are few studies in the literature on the azygos lobe and fissure, and these are mostly case reports. In the study performed by Özdemir et al., the frequency of the azygos lobe was found to be 1.54% [12]. In this study, the prevalence was found to be 1.39% in women and 1.64% in men. In the study conducted by Al-Mnayyis et al. with 1709 CT scans, the prevalence of the azygos lobe was found to be 1.01%, 0.62%, and 0.88% in men, women, and all cases, respectively [13]. In the study conducted by Perincek et al., the frequency of azygos lobes was found to be 1.09%, and the incidence was found to be higher in men than in women (approximately 56% and 44%, respectively) [8]. Our findings are consistent with these studies.

Despite the uncommon frequency of the azygos lobe, there may be a relationship with pathologies such as accessory fissures, extrapulmonary sequestration, masses, pneumothoraces, bullae, and vascular anomalies [7, 9, 14, 15]. Additionally, a consolidated azygos lobe can be misinterpreted as a mass [12, 16]. In our study, we did not identify any of the azygos-lobe-accompanying pathological conditions mentioned above; however, pneumonia was the most common accompanying imaging finding. Although the azygos lobe is a coincidental finding, all physicians should be aware of azygos lobe variation and anatomy to avoid misinterpretations; thoracic surgeons should also be aware of it as it may affect surgical approaches [6].

Limitations of Study:

Our study has two major limitations. First, since there was no contrast in our CT examinations, accompanying vascular anomalies could not be clearly evaluated. Second, our study includes only a limited number of patients and is single-centered. Future multi-center studies with higher patient numbers will provide more accurate

information.

Conclusion: The azygos lobe is an uncommon variation of the right lung and is not a distinct lobe. It is necessary to have clear knowledge about the azygos lobe, as it can resemble pathological disorders such as cysts, abscesses or lung lesions. Since the azygos lobe is usually an incidental finding, radiologists and surgeons should be aware of this potential anomaly during the imaging and interventional procedures. Our study is important in terms of demonstrating the successful detectability of this variation on CT without contrast.

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Author / ORCID	Authorship Contrubition
Enes Gürün 0000-0002-5321-8439	Consept and/or Design, Materials,Practices, Data collection,Analysis, Literatüre Search, Manuscript Writing,Critical Review, Final approval.
İsmail Akdulum 0000-0001-6109-5240	Consept and/or Design, Analysis and/or Interpretation, Literatüre Search, Manuscript Writing, Critical Review, Final approval.