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ORIGINAL ARTICLE

Hidden lung findings in 10,000 patients presenting to anesthesia outpatient clinics for preoperative evaluation: Azygos Lobe

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Abstract

The azygos lobe is usually considered to be a continuation of the upper lobe of the right lung. The azygos vein passes over the right main bronchus and is characterized by its distinct passage. This variation is not typically considered part of the normal anatomy of the right lung and can result in various clinical conditions. The prevalence of the azygos lobe varies among different populations, but it is generally reported to be between 0.1% and 1%. From an anatomical perspective, the azygos lobe, formed by the separate continuation of the right upper lobe bronchus, is an important structure to consider in surgery and anesthesia. Diagnosis is usually made using imaging techniques, and the presence of the azygos lobe should be carefully considered when planning and performing endotracheal intubation during induction of anesthesia. In 73 out of 10,000 patients, the presence of the azygos lobe may affect the anatomical structure of the airway during anesthesia management; therefore, ventilation strategies should be adjusted accordingly. Our study aims to determine the prevalence of the azygos lobe in patients attending the anesthesia clinic for preoperative. It also aims to raise awareness of radiologically missed anatomical variants and avoid unnecessary surgical delays and consultations by differentiating the azygos lobe from bullae, masses, or abscesses.

Keywords: Azygos lobe, anesthesia, congenital anomaly

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Introduction

The azygos venous system, also known as the azygos system, refers to the H-shaped configuration formed by the azygos vein, the hemiazygos vein, the accessory hemiazygos vein, and the left superior intercostal vein. This system is responsible for draining the thoracic wall and the upper lumbar region via the lumbar and posterior intercostal veins. It also provides significant collateral circulation between the superior and inferior venae cavae in the event of obstruction [1]. The azygos lobe is a rare anatomical variation characterised by the extension of the right upper lobe of the lung over the right main bronchus and the passage of the azygos vein. This variation is not typically found among the normal anatomical structures of the right lung and may be associated with different clinical conditions [2]. The azygos lobe, formed by the separate continuation of the right upper lobe bronchus, is an important anatomical structure that must be considered in surgical and anaesthetic procedures. Although generally considered insignificant, this structure may have different clinical implications during the preoperative evaluation process. Therefore, the presence of the azygos lobe should be considered when evaluating patients in the anaesthesiology clinic [3,4].

The azygos lobe is a rare anatomical variant, observed radiologically in only 0.4% of the population and in 1% of cadavers during anatomical dissection [4]. During embryonic development, it forms when the posterior cardinal vein, the precursor of the upper thoracic segment of the azygos vein, passes through the upper lobe of the lung anomalously [5]. Typically, the posterior cardinal vein migrates from the apex of the right lung to its final position in the mediastinum. It is important for clinicians to be aware of this anatomical variant and its characteristic radiographic features because its presence may be confused with conditions such as a bulla, mass, or abscess [6,7]. Abnormal azygos migration results in a classic paratracheal shadow on X-ray, accompanied by several important radiographic findings. The laterally displaced azygos vein, or mesoazygus, is located between the folds of the parietal pleura and forms a teardrop shape. The mesoazygus invades the right upper lobe and forms an accessory azygos fissure with an inverted comma-like shape. The azygos lobe is bounded superiorly by the medial accessory azygos fissure, laterally by the pleural folds of the mesoazygos, and medially by the tracheobronchial angle, which appears empty on X-ray [8–10].

Understanding the anatomy of the azygos lobe is important for all clinicians, especially pulmonologists, radiologists, thoracic surgeons, and anaesthesiologists. The azygos lobe is a radiological feature created by the azygos vein as it passes in front of the lung tissue. It is not a true accessory lobe. It is asymptomatic and does not require treatment. Its clinical significance lies in the need to consider it in the differential diagnosis of other lung pathologies and exercising caution regarding potential complications during thoracic procedures [11].

Epidemiological studies suggest that the azygos lobe is more prevalent in women than in men. It has also been reported to increase in prevalence with age. This important anatomical feature should be considered when evaluating patients prior to surgery and when planning procedures. The Azygos lobe is typically diagnosed using imaging methods. These include radiographic examinations, as well as computed tomography (CT) and magnetic resonance imaging (MRI). These methods clearly reveal the lobe's presence in lung tissue and provide important information for evaluating the patient's condition [12].

This study aims to contribute to the literature by determining the incidence of the azygos lobe in patients presenting to the anesthesia clinic for surgery. This finding is often overlooked in routine chest X-rays and surgeries involving the lungs. This will help to prevent unnecessary delays to surgery and consultations by enabling differentiation from bullae, masses, or abscesses. It will also assist in the segmental and topographic localisation of pulmonary lesions and contribute to the literature.

Materials and Methods

Research type and data collection and processing methods

This retrospective study was conducted at a single centre. All patients undergoing surgery visited the anesthesia clinic for routine examinations. A preoperative examination is also performed to assess anesthesia risk. For this study, posteroanterior digital chest X-rays were evaluated for 5,000 male patients and 5,000 female patients aged 18 years and over who attended the anesthesia outpatient clinic for a preoperative examination between 1 January and 31 December 2024. Patients with a history of pleural disease, previous lung surgery or lobectomy, or pulmonary parenchymal distortion were excluded from the study. The obtained data were analysed using SPSS software. Percentage values were obtained using arithmetic means.

Population and sample

A pilot study was conducted, and the required sample size was calculated using the G*Power 3.1.9.4 program. The type I error rate was set at 0.05, the power at 0.80, and the effect size at 0.57. Based on these parameters, the required sample size was determined to be 82. To prevent potential data loss, the study included 10,000 patients.

Ethical considerations

Prior to implementing the study, the ethics committee approval was obtained from the Amasya University Non-Interventional Ethics Committee (decision no/date: 2025/16, 06.03.2025). Permission to conduct the archival study was obtained from the Amasya Provincial Health Directorate and the Amasya University Education and Research Hospital Chief Medical Officer. As the study was an archival review, informed consent forms were not obtained from patients. The principles of confidentiality and voluntariness were strictly adhered to throughout the study.

Statistical analysis

The study data were analysed using the SPSS 22.0 (SPSS Inc., Chicago, IL) software package. Descriptive statistics were presented as mean ± standard deviation and frequency distribution in percentages. Pearson's chi-square test was used to evaluate categorical variables. Statistical significance was set at $p<0.05$.

Results

In the study, it is evaluated posteroanterior digital chest X-rays of 5,000 male, and 5,000 female patients aged 18 years and over who attended the outpatient clinic for a preoperative assessment. The mean age of the patients was found to be 47.7 (±16.2) years, with a mean age of 48.9 (±16.1) years for women and 46.5 (±16.2) years for men. The azygos lobe was observed in 73 of the 10,000 patients included in the study (0.73%). Examining the distribution of the incidence rate according to gender revealed that the azygos lobe was present in 39 (0.78%) of the 5,000 male patients and 34 (0.68%) of the 5,000 female patients. The incidence of azygos lobe in males and females is compared in Table 1. No statistically significant difference was found between the sexes in the Pearson Chi-Square test analysis (Table 1).

Of the 73 patients with an azygos lobe, 38 (52%) required a consultation with a chest disease specialist for preoperative evaluation. Of these 38 patients, 8 (21.05%) were not approved for surgery by the chest disease specialists due to active infection, while 30 (78.95%) were approved for surgery. Of these 30 patients, 26 underwent surgery, and postoperative pulmonary complications developed in 2 (7.69%) of the patients who underwent surgery. Both patients who developed complications had undergone septorinoplasty surgery.

Table 1. Comparison of the incidence of Azygos lobe in males and female.

	Total (n=10000)	Male (n=5000)	Female (n=5000)	*p*
Incidence of the azygos lobe	73(73)	39(36,5)	34(36,6)	0,557*

Discussion

The results of the archive review are consistent with those reported in the literature. In this study, the azygos lobe was detected in 73 out of 10,000 patients, which is slightly higher than the rates reported in previous studies [13]. Studies on the distribution of the azygos lobe began in Sweden in 1899, using cadavers and have continued to the present day. A comprehensive meta-analysis included 1,033,083 subjects from 88 studies, of whom 584,919 (56.6%) were from North America, 210,298 (20.4%) from Asia, 186,209 (18%) from Europe, 30,943 (3%) from Africa, and 17,214 (1.7%) from South America. The incidence rate of the azygos lobe was reported as 0.475% (4,908 individuals). When analysed by region, the incidence rate was found to be highest in North America (0.58%), followed by South America (0.4%), Europe (0.26%), Africa (0.16%), and lowest in Asia (0.05%) [13]. Although the value found in the current study is higher than that given in the meta-analysis, it is like values found in studies conducted in Türkiye [14].

A study conducted in Türkiye in 2019, by Perinçek et al. reported 67 cases (1.09%) of the azygos lobe in 5,854 subjects [14]. These results are consistent with our research and the existing literature. However, the differences are thought to be due to regional factors and the fact that the study used computed tomography. This highlights the need for broader regional studies in Türkiye.

A study conducted by Gürün and Aktulum in 2021 examined 1,965 subjects and detected 15 (0.076%) azygos lobes [15]. These results are like those of study. Similarly, Tosun and Ölmez, in their study involving 1,623 participants, detected an azygos lobe in 29 (1.8%) individuals in a patient group with an average age of 25.6 ± 2.4 [16]. This study is consistent with our research and the literature. However, it is thought that the differences stem from regional variations and the use of computed tomography.

In study, a chest disease consultation was requested for 38 (52%) of the 73 patients with an identified azygos lobe due to a lung mass. However, the chest disease clinic granted surgical permission for 30 (78.95%) of these patients. Considering this rate, unnecessary consultations were requested due to masses and infections appearing similar in asymptomatic patients, and that this rate is quite high. It was determined that eight (21.05%) of the patients who did not receive surgical approval had an active infection.

Of the 26 patients who underwent surgery, two (7.69%) developed postoperative pulmonary complications; these patients were treated in the operating room and transferred to the postoperative observation unit. The occurrence of complications after septorinoplasty in these patients, combined with normal preoperative chest X-rays, suggests that the complications may have originated in the upper airways. It was noted that the asymptomatic infection was undetectable as the patients were admitted for surgery just a few days after the preoperative evaluation. However, it should be borne in mind that the azygos lobe is occasionally associated with malignancies, pneumothorax, hemothorax, extrapulmonary sequestration, vascular malformations or infection [16]. The fact that 24 (92.31%) of the patients who underwent surgery experienced uncomplicated anesthesia is consistent with literature indicating that most of the azygos lobe is asymptomatic [11].

Conclusion

It is important for anaesthetists to identify the azygos lobe when examining patients presenting for preoperative evaluation. This is because anaesthetic interventions are necessary for patients with associated pulmonary lesions. If the azygos lobe is identified, patients with pulmonary infiltrative lesions near the azygos lobe can be referred to a pulmonary specialist. This enables them to receive an earlier diagnosis and undergo necessary follow-up and treatment before requiring urgent surgery.

The most significant limitation of this study is its small sample size. Furthermore, the study data were obtained from a single centre, which prevented a multicentre study from being conducted. However, as the study was strictly controlled by the researchers and conducted on a unique population of surgical patients, definitive cut-off values with high sensitivity and specificity could still be formulated based on the obtained data.

The azygos lobe is a rare anatomical lung variant. In addition to morphological lung abnormalities, rare anatomical variations may also be present incidentally. Future studies examining hidden lung findings, pulmonary infiltrative lesions and lobar bronchial variations associated with intraoperative complications would help address these limitations.

Additionally, advanced training and education, in identifying the azygos lobe, could help with the rotation of the left double-lumen tube during a left upper lobectomy. Furthermore, the potential for complications related to the azygos lobe should be considered during right-sided surgeries. The azygos lobe should be given greater emphasis in anesthesia specialty training and future educational programmes. Furthermore, interns in the anesthesia clinic could be assessed on their knowledge. Radiologists could be given a first-breath protocol to ensure the lung is visualised in all sections during preoperative imaging. Radiology reports containing hidden-lung findings could also be kept on file for closer attention by the patient or surgeon.

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Conflict of interest

There is no conflict of interest among the authors in this study.

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