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# An unusual case of upper airways obstruction: What if it's not asthma?

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**Abstract**
Tracheal stenosis poses a diagnostic challenge that can mimic other respiratory pathologies, particularly bronchial asthma. It is characterized by a narrowing of the tracheal lumen, leading to respiratory symptoms such as dyspnea, cough, and wheezing. However, these manifestations can overlap with those of bronchial asthma, making the differential diagnosis a challenging yet crucial task for an appropriate therapeutic approach. This study aimsed to underscore the importance of a comprehensive clinical approach, using bronchoscopy and global spirometry with bronchodilator reversibility testing, to differentiate tracheal stenosis from bronchial asthma, thereby contributing to accurate and timely surgical treatment. Bronchoscopy stands as a cornerstone in investigating tracheal stenosis, allowing for a direct assessment of the site, extent, and nature of the stenosis. Endoscopic observation of the morphological characteristics of the stenosis, such as concentric narrowing or mucosal irregularities, can guide precise diagnosis. Asthma, characterized by reversible bronchial obstruction, responds positively to bronchodilators, compared with a minimal response in the context of tracheal stenosis.

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**Keywords:** tracheal stenosis, asthma, bronchoscopy, endoscopic**,** observation

## Introduction

According to the GINA 2023 document, bronchial asthma is a heterogeneous disease characterized mainly by chronic inflammation of the airways. It is defined by a history of respiratory symptoms - such as wheezing, dyspnea, chest tightness and cough -, which vary in intensity over time. This is associated with variable limitation of airflow on exhalation, which may become persistent over time. It is usually associated with airway hyperresponsiveness and inflammation, but these features are neither necessary nor sufficient for the diagnosis. The diagnosis of asthma is based on the history of characteristic symptoms and the presence of variable airflow limitation during exhalation, which must be confirmed by bronchodilator reversibility testing or other tests [1]. In differential diagnosis of asthma, obstructions in the central airways, such as tracheal stenosis, are critical considerations. Tracheal sound frequency analysis is considered a valid method for detecting tracheal stenosis, especially in patients with malignant tumors compressing the trachea. However, among patients with intrathoracic stenosis, abnormalities in lung function and tracheal sound spectra have been observed, even in the presence of milder stenosis [2]. Tracheal stenosis diagnosis requires precise assessment and the expertise of clinicians skilled endoscopic and surgical interventions, supported by case series analyses in the literature. Comprehensive management includes sequential spirometry and endoscopic evaluations tailor treatment strategies to individual patient needs [3].

**Case report**

The clinical case described concerns a 74-year-old Caucasian woman who came to our attention in September 2023 during a recent flu episode, accompanied by a persistence of dry cough, nocturnal symptoms, dyspnea, wheezing and a sense of tightness in the chest, she had not experienced any of these symptoms previously.The clinical history included drug allergy to penicillin since childhood, arterial hypertension, and episodes of tachycardia treated with propanolol. Laboratory evaluations, including complete blood count and immunoglobulin E levels, revealed no abnormalities. During a comprehensive medical assessment which showed no significant pulmonary pathology upon physical examination and normal peripheral oxygen saturation 97%, we reviewed her computed tomography (CT) scans from October 2023 and July 2023. These scans revealed an enlarged thyroid gland which in my estimation, was causing extrinsic compression of the trachea (Fig. 1 panels A-B), along with the presence of high mediastinal lymphadenopathies. Spirometric assessment was conducted using the PulmOne MiniBox+. The results indicated a mild non-reversible obstructive deficit post-bronchodilation with 400 micrograms of salbutamol The characteristic plateau in the expiratory phase, of the flow-volume curve suggested an extrathoracic obstruction in the upper airways, as evidenced by an altered Motley Index (Fig. 2) Given patient's known history of nodular goiter, these findings warranted further evaluation by a medical endocrinologist. Initially, a tentative bronchial asthma was considered with the consideration of an extrathoracic anomaly potentially compressing the trachea and mimicking asthma symptoms. The management plan involved discontinuing popanolol in favor of bisoprolol, in addition to initiating a inhalation therapy regimen with dry powder inhaler (DPI) contining fluticasone furoate/vilanterol 92/22 micrograms and an antibiotic (azithromycin) for a few days, with a recommendation to return for follow-up clinical and spirometric evaluation during inhalation therapy. Further instrumental and clinical evaluations were conducted to monitor the response to therapy and delve deeper into the patient's endocrinological situation, especially in relation to tracheal closure. Despite adherence to prescribed treatment and additional clinical assessmentnegative, the lady at the clinical check-up one month in the course of regular therapy, presented the assesment yielding negative results, patient displayed persistent symptoms, without clinical or spirometric improvement. At the one-month follow-up during regular therapy she repeats the chest CT scan, corroborated the initial suspicion of upper airway pathology and a bronchoscopy was recommended. Bronchoscopic examination revealed a 90% occlusion in the upper third of the trachea (Fig. 3 Panel A), which proved challenging to navigate with the bronchoscope and mediastinal compression was evident on the tracheal tissue as seen in the image (Fig. 3 Panel B). The bronchoscopy was performed using an Olympus BF H190 bronchoscope, which features the capability of narrow band imaging for the assessment of tumors in the head,neck and gastroenterological tract. The exploratory examination was not conducted beyond the tracheal tissue(Panels A-B), as the patient had significant desaturations (dropping to 85%) under sedation with midazolam 2.5 milligrams.

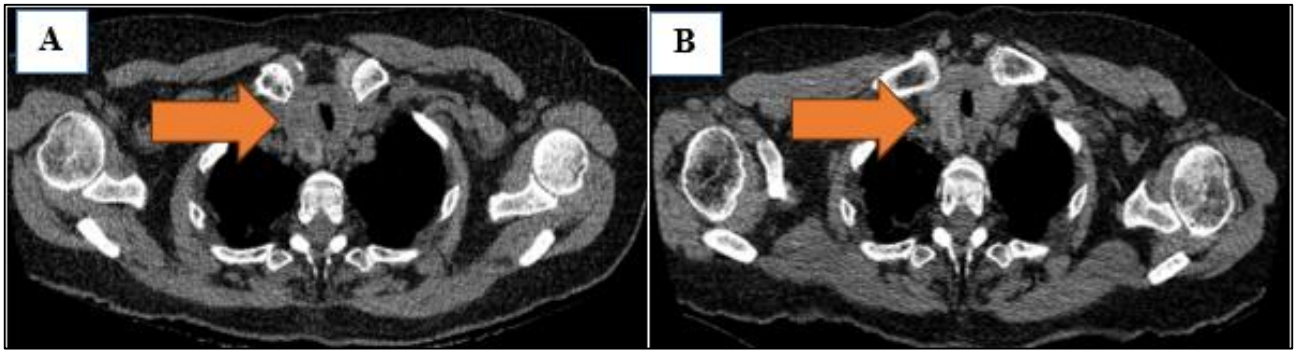
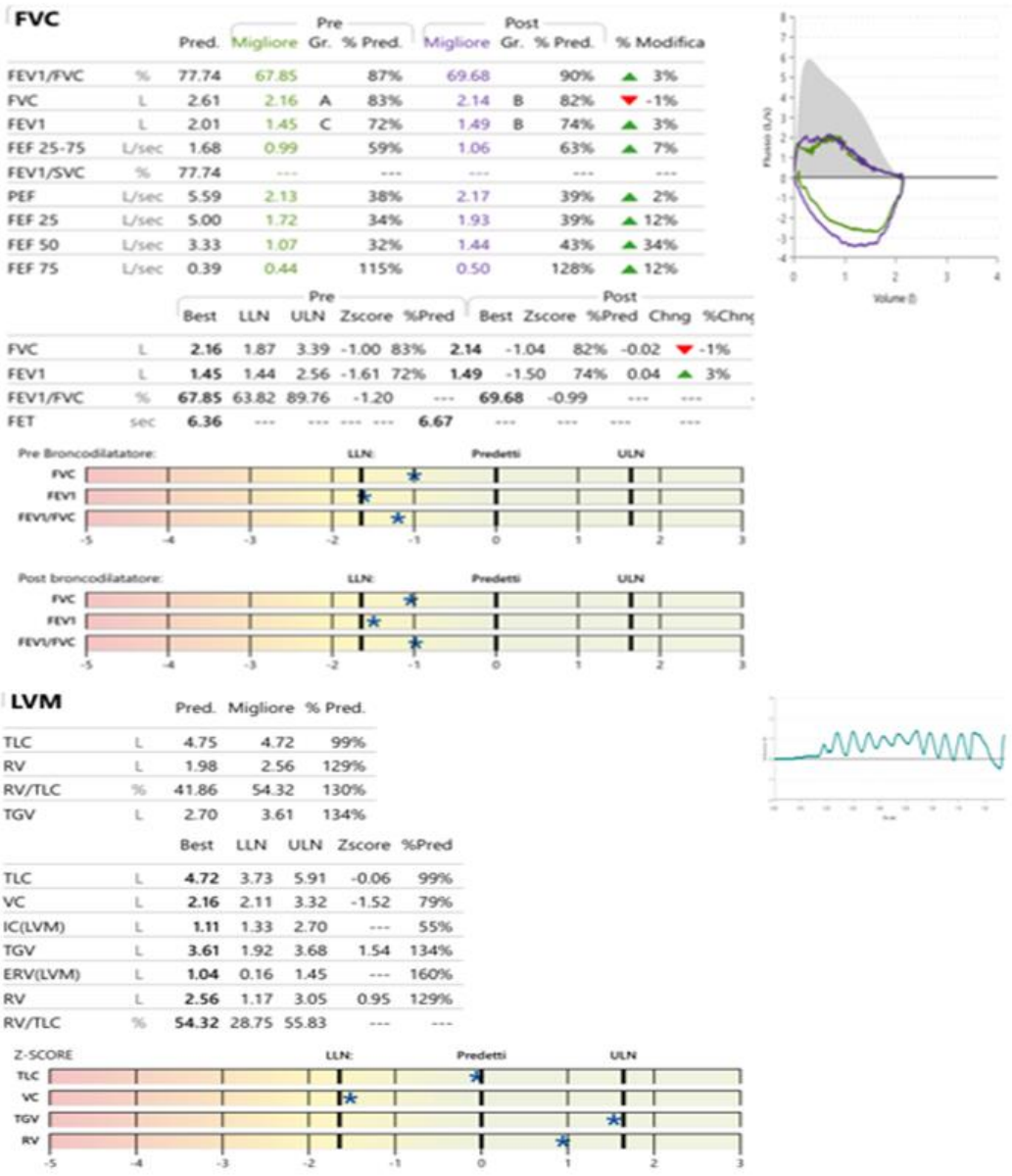



**Fig 1: Panel A:** CT scan from July 2023, **Panel B:** CT scan from October 2023 after treatment with ICS/LABA for 1 month



**FVC**

| | | Pred. | Pre Migliore | Pre Gr. | Pre % Pred. | Post Migliore | Post Gr. | Post % Pred. | % Modifica |
|---|---|---|---|---|---|---|---|---|---|
| FEV1/FVC | % | 77.74 | 67.85 | | 87% | 69.68 | | 90% | ▲ 3% |
| FVC | L | 2.61 | 2.16 | A | 83% | 2.14 | B | 82% | ▼ -1% |
| FEV1 | L | 2.01 | 1.45 | C | 72% | 1.49 | B | 74% | ▲ 3% |
| FEF 25-75 | L/sec | 1.68 | 0.99 | | 59% | 1.06 | | 63% | ▲ 7% |
| FEV1/SVC | % | 77.74 | --- | | --- | --- | | --- | --- |
| PEF | L/sec | 5.59 | 2.13 | | 38% | 2.17 | | 39% | ▲ 2% |
| FEF 25 | L/sec | 5.00 | 1.72 | | 34% | 1.93 | | 39% | ▲ 12% |
| FEF 50 | L/sec | 3.33 | 1.07 | | 32% | 1.44 | | 43% | ▲ 34% |
| FEF 75 | L/sec | 0.39 | 0.44 | | 115% | 0.50 | | 128% | ▲ 12% |

| | | Pre Best | LLN | ULN | Zscore | %Pred | Post Best | Zscore | %Pred | Chng | %Chng |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FVC | L | 2.16 | 1.87 | 3.39 | -1.00 | 83% | 2.14 | -1.04 | 82% | -0.02 | ▼ -1% |
| FEV1 | L | 1.45 | 1.44 | 2.56 | -1.61 | 72% | 1.49 | -1.50 | 74% | 0.04 | ▲ 3% |
| FEV1/FVC | % | 67.85 | 63.82 | 89.76 | -1.20 | --- | 69.68 | -0.99 | --- | --- | --- |
| FET | sec | 6.36 | --- | --- | --- | --- | 6.67 | --- | --- | --- | --- |

Pre Broncodilatatore: LLN: Predetti ULN — FVC, FEV1, FEV1/FVC

Post broncodilatatore: LLN: Predetti ULN — FVC, FEV1, FEV1/FVC

**LVM**

| | | Pred. | Migliore | % Pred. |
|---|---|---|---|---|
| TLC | L | 4.75 | 4.72 | 99% |
| RV | L | 1.98 | 2.56 | 129% |
| RV/TLC | % | 41.86 | 54.32 | 130% |
| TGV | L | 2.70 | 3.61 | 134% |

| | | Best | LLN | ULN | Zscore | %Pred |
|---|---|---|---|---|---|---|
| TLC | L | 4.72 | 3.73 | 5.91 | -0.06 | 99% |
| VC | L | 2.16 | 2.11 | 3.32 | -1.52 | 79% |
| IC(LVM) | L | 1.11 | 1.33 | 2.70 | --- | 55% |
| TGV | L | 3.61 | 1.92 | 3.68 | 1.54 | 134% |
| ERV(LVM) | L | 1.04 | 0.16 | 1.45 | --- | 160% |
| RV | L | 2.56 | 1.17 | 3.05 | 0.95 | 129% |
| RV/TLC | % | 54.32 | 28.75 | 55.83 | --- | --- |

Z-SCORE: LLN: Predetti ULN — TLC, VC, TGV, RV

**Fig 2:** Global spirometry findings with PulmOne MiniBox+: mild non-reversible obstructive deficit (FEV1: 72%→74% FVC: 83%→82% FEV1/FVC: 87%→90% PEF: 38%→39%, RV: 129% RV/TLC: 130%) after bronchodilation testing with salbutamol. The flow–volume curve was characterized by a plateau in the expiratory phase, caused by an extrathoracic obstruction affecting the upper airways and altered Motley index.

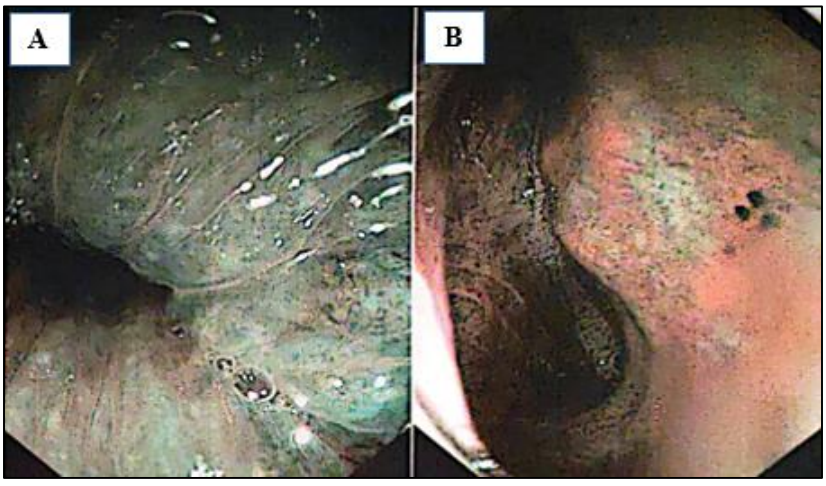



**Fig 3:** Images captured from an Olympus BF H190 bronchoscope, which has NBI (narrow band imaging) capabilities to evaluate head and neck and gastroenterological tumors**. Panel A** shows evidence of a 90% occlusion of the upper third of the trachea, which was difficult to navigate with the instrument. **Panel B** focuses on the mediastinal compression of the tracheal tissue.

**Legend**
FEV1%: Percentage of predicted value of FEV1
FVC%: Percentage of predicted value of FVC
FEV1: Maximum Expiratory Volume at first second
FEV1/FVC%: Index of Tiffeneau
FVC: Forced vital capacity.
PEF%: Percentage of Peak of expiratory flow
FEF25-75%: Forced expiratory flow between 25 and 75 percent of FVC.
FET: Forced expiratory time.
RV: residual volume
RV/TLC%: Motley Index
ICS: inhaled corticosteroids
LABA: long-acting beta-2-agonist

**Discussion**
The investigation into the patient's symptoms included an evaluation by an endocrinologist for an extensive intrathoracic goiter, which is known to compress the trachea and typically necessitates surgical intervention for removal, ensuring that critical nerves and blood vessels are preserved [4]. However, in this case, consulting endocrinology specialist conducted a thyroid ultrasound and based on the findings, excluded the need for surgical intervention. Despite radiological indications from CT that revealed considerable enlargement of both thyroid lobes and evidence of endobronchial tissue, a retrograde bronchoscopy, as performed in a similar case reported in the literature, was not feasible to conclusively confirm stenosis [5]. However, a strong suspicion of stenosis persisted, allowing the pulmonologist to recommend the patient for a surgical assessment. Endoscopic management of suchsignificant tracheal stenosis would typically involve procedures like balloon dilation, which are increasingly preferred for treating lesions previously deemed only amenable to open surgery. Additional treatment modalitites under consideration include the use of stents, regenerative therapies and adjunctive pharmacological tretments such as aerosolized topical steroids. Unfortunately, in this particular case, facility lacked the necessary equipment administer these treatments [6].
There is literature describing a case wherein intravenous anesthesia was utilized alongside airway management employing a narrowendotracheal tube (Tritube) and a high oxygen flow rate ventilation technique (STRIVE-Hi) in the treatment of tracheal masses. Post-tumor removal, the Tritube exchanged for a conventional endotracheal tube to ensure adequate ventilation and oxygenation of the patient, as was done for out-patient [7]. Thyroid cancer is often asymptomatic until tumor invasion reaches the mucosal surface. When this happens, bloody expectoration and shortness of breath may occur. Treatment is based on the site, depth, and extent of the invasion. Unlike tracheal mucosa, originating tumors, in thyroid cancer begin its invasion externally and advances inward, complicating the precise diagnosis of invasion extent via bronchoscopy, partially demonstrated in this case [8]. Bronchoscopy can be informative, occasionally revealing right vocal cord paralysis, yet it may not detect any tumors or inflammatory lesions in the larynx or pharynx; in this specific case, the bronchoscopic passage showed no abnormalities [9]. The thoracic surgeon's subsequent differential diagnosis, includes conditions such as Sarcoidosis, Amyloidosis, idiopathic subglottic and tracheal stenosis in multifocal fibrosclerosis and Wegener's granulomatosis, though Wegener's granulomatotis is less commonly presented in the trachea [10-11]. A clinical study assessed the efficacy of interventional bronchoscopic techniques in treating severe tracheal obstructions due to thyroid diseases, encompassing both benign and malignant forms. The retrospective study evaluated a cohort of patients treated at a university hospital center. Analyzing the outcomes of bronchoscopy procedures in terms of subjective improvement, pulmonary function tests, early and late complications, and survival. Procedures included dilation, stent placement, and/or Nd-YAG laser treatment. Post-treatment relief was immediate sustained for 88% of patients with benign conditions and 92% with malignantconditions. Complications were controllable and the median survival for patients with malignancies was 540 days [12].

**Conclusions**
This article addresses the diagnostic challenges posed by tracheal stenosis, which is frequently obscured by the symptoms of bronchial asthma, underscoring the necessity of differential diagnosis via bronchoscopy and spirometry. It details the presentation of a patient with asthma-like symptoms and suspected tracheal stenosis, where symptom persistence post-therapy was associated with a complex and uncertain diagnosis. The discussion elaborates on the intricacies of diagnosing tracheal stenosis, emphasizing that effective management requires endoscopic procedures and sophisticated treatments. The article concludes by stressing the critical role of comprehensive specialist evaluations and cutting-edge diagnostic methodologies to achieve accurate diagnoses and implement optimal treatments. We have highlighted difficulties encountered in the diagnosis and treatment of tracheal stenosis, and we advocate for more extensive research to enhance the management of similar clinical scenarios.

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