Jurnal Biologi Tropis

Literature Review Paper

Central Airway Obstruction A Narrative Review of Etiology Clinical Manifestations and Diagnosis

Daanys Amiira Rusdhy[1], Nour Hatem Mohamed[1], Rifdatul Imtiyaz Anshari[1], Siti Qirani Annur[1], Warlia Mursida[1], Moulid Hidayat[1]

[1]Medical Study Program, Faculty of Medicine and Health Sciences, University of Mataram, Mataram, Indonesia;

[2]Department of Pulmonology and Respiratory Medicine, Faculty of Medicine and Health Sciences, University of Mataram, Mataram, Indonesia;

Article History

Received : October 01th, 2026

Revised : October 20th, 2026

Accepted : October 25th, 2026

*Corresponding Author: **Daanys Amiira Rusdhy**, Faculty of Medicine and Health Sciences, University of Mataram, Mataram, West Nusa Tenggara, Indonesia;

Email: daanysamiira08@gmail.com

Abstract: Central airway obstruction (CAO) is a potentially serious condition caused by malignant or nonmalignant processes narrowing the trachea or main bronchi. Its nonspecific manifestations may resemble common pulmonary diseases, delaying diagnosis. This narrative review summarizes the etiology, clinical manifestations, and diagnostic evaluation of CAO. Literature searches were conducted in PubMed/MEDLINE and Google Scholar using terms related to CAO, airway stenosis, tracheobronchomalacia, pulmonary function tests, computed tomography, and bronchoscopy. Publications from 2017 to 2025 were prioritized, alongside relevant foundational studies and clinical guidelines. Literature was selected based on relevance to CAO etiology, clinical presentation, and diagnostic methods. Malignant causes, particularly lung cancer, and nonmalignant conditions, including post-intubation stenosis, inflammatory disorders, benign airway lesions, and tracheobronchomalacia, contribute to CAO. Common manifestations include dyspnea, cough, wheezing, stridor, and reduced exercise tolerance. Pulmonary function tests may indicate airflow limitation but cannot reliably exclude CAO. Computed tomography characterizes the location and extent of obstruction, while bronchoscopy enables direct visualization and tissue sampling. These modalities provide complementary information. Accurate diagnosis requires integrating clinical findings, pulmonary function tests, computed tomography, and bronchoscopy. Further prospective research is needed to standardize diagnostic criteria and improve severity assessment.

Keywords: Bronchoscopy; Central airway obstruction; Computed tomography; Pulmonary function tests; Respiratory symptoms.

Introduction

Central airway obstruction (CAO) is a clinically important condition characterized by narrowing of the trachea, mainstem bronchi, bronchus intermedius, or other central conducting airways. Severe obstruction can compromise ventilation and lead to substantial morbidity, while malignant CAO may be associated with poor clinical outcomes (Murgu et al., 2016; Vakil & Wang, 2025). CAO can result from malignant lesions, including primary airway tumors and extrinsic compression by adjacent malignancies, or nonmalignant disorders such as post-intubation stenosis, post-tracheostomy injury, inflammatory disease, infection, benign tumors, and tracheobronchomalacia (Murgu et al., 2016). This diverse etiological spectrum makes CAO a diagnostic challenge because the underlying pathology, anatomical location, degree of narrowing, and rate of progression can vary substantially between patients (Hattab et al., 2024).

The clinical manifestations of CAO depend on the severity and location of the obstruction, its rate of development, and the patient's underlying cardiopulmonary reserve.

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Common symptoms include dyspnea, cough, wheezing, and reduced exercise tolerance, whereas stridor, hemoptysis, or respiratory distress may indicate more severe disease (Ampazis et al., 2024; Hattab et al., 2024). Because these manifestations overlap with more common respiratory disorders, CAO may be mistaken for asthma, chronic obstructive pulmonary disease, or persistent pneumonia, particularly when symptoms develop gradually. A case series by Le-Khac et al. (2024) described patients whose diagnoses were delayed or initially attributed to other respiratory conditions. Such diagnostic overlap is clinically relevant because a normal or nonspecific chest radiograph and the absence of distinctive symptoms do not reliably exclude central airway disease (Ampazis et al., 2024; Le-Khac et al., 2024).

Ideally, suspected CAO should be recognized early through careful clinical assessment and confirmed using appropriate investigations. Computed tomography (CT) provides information about the location, extent, and morphology of airway narrowing, while bronchoscopy enables direct visualization, assessment of the obstruction, and tissue sampling when indicated (Hattab et al., 2024; Mahmood et al., 2025). Pulmonary function tests and flow-volume loops may provide additional evidence of fixed or variable obstruction, but their sensitivity can be limited, particularly in mild-to-moderate disease (Ampazis et al., 2024). Furthermore, CT findings do not always correspond precisely with bronchoscopic assessment of obstruction severity or subtype, supporting the need to interpret imaging alongside clinical and endoscopic findings rather than relying on a single diagnostic modality (Kalvapudi et al., 2024). In practice, however, delayed recognition, overlapping symptoms, variable diagnostic expertise, and differences in access to specialized investigations may complicate timely and accurate diagnosis (Le-Khac et al., 2024; Mahmood et al., 2025).

Although previous publications have examined specific aspects of central airway obstruction (CAO), including benign airway disorders, pulmonary function testing, malignant obstruction, and diagnostic bronchoscopy, these topics are often discussed within distinct clinical contexts (Ampazis et al., 2024; Hattab et al., 2024). A remaining challenge is to integrate these domains into a clinically oriented diagnostic framework that connects the suspected etiology and presenting manifestations with the appropriate selection and interpretation of diagnostic modalities. In particular, the complementary roles of pulmonary function testing, computed tomography (CT), and bronchoscopy, as well as potential discrepancies between their findings, require consideration when evaluating obstruction characteristics and severity. Rather than focusing on individual diagnostic techniques in isolation, this review synthesizes their respective contributions and limitations in the context of the underlying causes and clinical presentation of CAO.

This narrative review aims to provide an integrated clinical synthesis of the etiology, manifestations, and diagnostic evaluation of CAO. Its specific contribution is to organize the available evidence around the relationship between suspected causes, clinical presentation, anatomical characterization, and the complementary diagnostic roles of pulmonary function testing, CT, and bronchoscopy. By highlighting the limitations of individual modalities and the implications of discordant findings, this review seeks to support a more systematic approach to diagnostic assessment, identify persistent evidence gaps, and inform priorities for future research on standardized diagnostic criteria and severity assessment.

Materials and Methods

This article was conducted as a narrative literature review of the etiology, clinical manifestations, and diagnostic evaluation of central airway obstruction (CAO). Literature searches were performed using PubMed/MEDLINE and Google Scholar, supplemented by relevant clinical practice guidelines and reference lists of selected publications. The search focused on publications from January 2017 to December 2025, while earlier studies were retained when they provided foundational evidence. Search terms included “central airway obstruction,” “tracheal obstruction,” “main bronchus obstruction,” “benign airway stenosis,” “malignant central airway obstruction,” “clinical manifestations,” “pulmonary function tests,” “computed tomography,” and “bronchoscopy.” These terms

were combined using Boolean operators, including: ("central airway obstruction" OR "tracheal obstruction" OR "main bronchus obstruction") AND ("diagnosis" OR "clinical manifestations" OR "pulmonary function tests" OR "computed tomography" OR "bronchoscopy").

Studies were considered eligible if they addressed the etiology, clinical presentation, diagnostic assessment, or diagnostic limitations of CAO. Eligible publications included original research, clinical studies, case series, narrative and systematic reviews, and clinical practice guidelines published in English and relevant to the review objectives. Publications were excluded if they did not substantially address CAO or its diagnostic evaluation, lacked relevant clinical information, or duplicated information already represented in the selected literature. Earlier foundational publications were retained when clinically relevant.

Titles and abstracts were screened for relevance, followed by full-text assessment when available. The number of records identified, screened, excluded, and included was not formally quantified; therefore, the selection process was not presented as a systematic review or meta-analysis. Findings were synthesized narratively and organized into three themes: (1) etiology and underlying mechanisms, (2) clinical manifestations and diagnostic challenges, and (3) diagnostic evaluation using clinical assessment, pulmonary function testing, computed tomography, and bronchoscopy. The synthesis compared the clinical contributions, limitations, and complementary roles of these modalities and identified areas of agreement, discrepancies in reported findings, and priorities for future research.

Results and Discussion

Results

The reviewed literature addressed three major domains of central airway obstruction (CAO): etiology, clinical manifestations, and diagnostic evaluation. Malignant causes, particularly lung cancer, were frequently discussed alongside nonmalignant conditions, including benign airway stenosis, tracheobronchomalacia, and post-intubation or post-tracheostomy injury (Mudambi *et al*., 2017; Hattab *et al*., 2024). A retrospective cohort study by Daneshvar *et al*. (2019) identified CAO in 13% of patients with newly diagnosed lung cancer, while an additional 5% developed obstruction during follow-up. Clinical manifestations included dyspnea, cough, wheezing, and stridor, although their severity varied according to the location, extent, and progression of obstruction (Mudambi *et al*., 2017; Ho *et al*., 2023).

Diagnostic evaluation involved clinical assessment, pulmonary function testing, computed tomography (CT), and bronchoscopy. Pulmonary function tests may support the detection and characterization of airflow limitation, whereas CT provides anatomical information for evaluating the location and extent of obstruction (Ampazis et al., 2024; Rosell & Stratakos, 2020). In a retrospective study of 108 patients with malignant CAO, Kalvapudi et al. (2024) reported 80.8% agreement between CT and bronchoscopy for obstruction subtype and 65% agreement for severity. Recent publications also examined the outcomes of therapeutic bronchoscopy, including symptom improvement, repeat-procedure requirements, and procedure-related complications (Ho et al., 2023; Karambelkar et al., 2025). The 2025 American College of Chest Physicians guideline emphasized that diagnostic findings, underlying etiology, procedural expertise, and patient characteristics should inform subsequent management decisions (Mahmood et al., 2025).

The selected literature indicates that CAO has diverse causes and nonspecific clinical manifestations, making accurate characterization important. CT is useful for anatomical assessment, while bronchoscopy provides direct visualization and can support intervention. Recent studies have also expanded the evidence on procedural outcomes and the differences between benign and malignant obstruction. These findings provide the basis for further interpretation in the Discussion section.

Table 1. Summary of key literature on central airway obstruction etiology, diagnostics, and outcomes

Author, year	Study design and population/source	Main findings	Limitations
Mudambi et al. (2017)	Narrative review of malignant CAO literature	Malignant CAO may present with nonspecific symptoms. CT and bronchoscopy provide complementary information for diagnosis and procedural planning.	Review focused on malignant CAO; findings depend on the underlying studies and their methodological quality.
Daneshvar et al. (2019)	Retrospective clinical audit of 342 patients with newly diagnosed lung cancer	CAO was present in 13% at diagnosis, and another 5% developed CAO during follow-up. Some cases were missed on initial CT interpretation.	Single-center observational data; findings may not represent all patients with CAO, particularly those with nonmalignant causes.
Giovacchini et al. (2019)	Retrospective study comparing 94 selected cases of therapeutic bronchoscopy for malignant CAO	A patent distal airway on CT and bronchoscopy was associated with procedural success. Longer delay from radiological identification to intervention was associated with lower odds of success.	Retrospective, single-center study; selected successful and unsuccessful procedures may limit generalizability.
Rosell and Stratakos (2020)	Narrative review of therapeutic bronchoscopy for central airway diseases	Mechanical debulking, thermal ablation, cryotherapy, dilation, and stenting can restore airway patency; technique selection depends on lesion characteristics.	Not a primary comparative study; differences in techniques and clinical indications limit direct comparisons of outcomes.
Ho et al. (2023)	Review of clinical outcomes following therapeutic bronchoscopy	Therapeutic bronchoscopy can relieve obstruction and improve symptoms, but outcomes vary with patient and disease characteristics.	Review findings depend on the quality and heterogeneity of the included studies.
Ampazis et al. (2024)	Narrative review of pulmonary function tests for CAO	Spirometry, flow-volume loops, and other pulmonary function tests may support diagnosis, but their diagnostic utility varies with obstruction characteristics.	Narrative review; diagnostic performance may vary across tests, obstruction types, and disease severity.
Hattab et al. (2024)	Clinical practice review of benign airway obstruction	Benign obstruction has diverse causes, including iatrogenic injury, inflammatory disorders, infections, and benign tumors, requiring individualized evaluation and management.	Focused on benign obstruction; conclusions may not apply directly to malignant CAO.
Kalvapudi et al. (2024)	Retrospective study of 108 patients with malignant CAO assessed by CT and bronchoscopy	CT detected CAO in 107/108 patients. Agreement with bronchoscopy was 80.8% for obstruction subtype and 65% for severity.	Single-center retrospective study limited to malignant CAO; CT and bronchoscopy agreement may differ in other populations and settings.
Mahmood et al. (2025)	American College of Chest Physicians clinical practice guideline based on evidence review	Recommends comprehensive clinical assessment and chest CT for suspected CAO; therapeutic bronchoscopy may be used for symptomatic malignant and nonmalignant obstruction.	Some recommendations rely on evidence of low or very low certainty, limiting confidence in comparative conclusions.
Karambelkar et al. (2025)	Retrospective cohort of 96 patients undergoing therapeutic bronchoscopy; 66% had malignant and 34% benign CAO	Median procedure-free survival was 175 days for benign CAO and 49 days for malignant CAO. Airway prostheses were associated with shorter procedure-free survival.	Single-center retrospective cohort; differences in underlying disease and treatment selection may affect outcomes.

Discussion

Etiology and Clinical Characteristics of Central Airway Obstruction

Central airway obstruction (CAO) comprises a heterogeneous group of conditions that narrow the trachea or main bronchi and differ in etiology, clinical presentation, progression, and management requirements. Malignant CAO may arise from intraluminal tumor growth, extrinsic compression, or a combination of both mechanisms, whereas nonmalignant CAO includes post-intubation stenosis, inflammatory disorders, infections, benign tumors, and other structural airway abnormalities. Mudambi et al. (2017) highlighted the diagnostic challenges associated with malignant CAO, particularly its nonspecific respiratory manifestations. In contrast, Hattab et al. (2024) emphasized the diversity of causes underlying benign airway obstruction and the need for individualized assessment. These findings indicate that identifying airway narrowing is only the initial step; subsequent evaluation should establish its anatomical characteristics and probable underlying cause.

The clinical burden of malignant CAO is illustrated by Daneshvar et al. (2019), who reported that CAO was present in 13% of 342 patients with newly diagnosed lung cancer, while an additional 5% developed obstruction during follow-up. Some cases were not recognized during initial CT interpretation, highlighting the importance of considering CAO when respiratory symptoms persist or progress despite initial evaluation. However, these estimates apply to the study population of patients with lung cancer and should not be interpreted as prevalence estimates for all patients with CAO. Differences in patient selection, diagnostic definitions, and follow-up may influence the reported frequency of obstruction. Together, the findings from Mudambi et al. (2017), Daneshvar et al. (2019), and Hattab et al. (2024) demonstrate that clinical suspicion should be informed by both the presenting symptoms and the possibility of malignant or nonmalignant airway disease.

Clinical Manifestations and Diagnostic Challenges

The recognition of CAO is complicated by the overlap between its clinical manifestations and those of common respiratory disorders. Dyspnea, cough, wheezing, and reduced exercise tolerance may occur in several pulmonary conditions, while stridor or progressive respiratory distress may raise concern for substantial central airway narrowing. Consequently, symptom-based assessment alone cannot reliably establish or exclude CAO. A history of malignancy may increase suspicion of tumor-related obstruction, whereas previous endotracheal intubation, tracheostomy, or airway procedures may indicate a possible acquired stenosis. These clinical features help guide subsequent investigations but do not independently determine the anatomical severity or exact cause of obstruction.

The findings reported by Daneshvar et al. (2019), including cases that were not initially recognized on CT, further illustrate that CAO may remain undetected during routine evaluation. Accordingly, persistent or progressive symptoms warrant reassessment when the clinical course is inconsistent with the initial diagnosis. Mahmood et al. (2025) recommend comprehensive clinical assessment and CT in the evaluation of suspected CAO. This approach supports integrating clinical history and examination with appropriate diagnostic investigations rather than relying on isolated symptoms or preliminary findings.

Role and Limitations of Pulmonary Function Testing

Pulmonary function testing provides physiological information that can support the evaluation of suspected CAO. Spirometry and flow-volume loops may demonstrate airflow limitation patterns associated with central airway narrowing, but their diagnostic performance varies according to obstruction characteristics and disease severity. Ampazis et al. (2024) reviewed the clinical utility of pulmonary function tests and highlighted variability in the diagnostic performance of spirometric criteria. Therefore, the absence of a characteristic flow-volume loop should not be interpreted as definitive evidence against CAO.

Pulmonary function testing and anatomical investigations address different diagnostic questions. Whereas spirometry helps characterize physiological impairment, it does not directly delineate the location, morphology, or surrounding anatomical relationships of an obstructing lesion. Coexisting peripheral airway disease may also complicate interpretation.

Ampazis et al. (2024) discussed oscillometry and body plethysmography as additional techniques that may provide complementary physiological information. Nevertheless, their clinical utility in CAO requires further evaluation, particularly regarding diagnostic thresholds and their incremental value over conventional spirometry. Pulmonary function testing should therefore be interpreted alongside clinical findings and anatomical assessment when indicated, rather than used as a stand-alone method to exclude central airway obstruction.

Computed Tomography and Anatomical Assessment

Computed tomography (CT) provides anatomical information about the location and extent of airway narrowing, the relationship between an obstructing lesion and surrounding structures, and the patency of the distal airway. These features are relevant to identifying possible mechanisms of obstruction and planning subsequent diagnostic or therapeutic procedures. However, CT findings may not fully represent the airway lumen under all clinical circumstances, and their interpretation depends on image quality, acquisition protocols, and recognition of airway abnormalities. CT should therefore be considered an important anatomical investigation rather than a complete substitute for direct airway assessment.

The complementary roles of CT and bronchoscopy are illustrated by Kalvapudi et al. (2024), who retrospectively evaluated 108 patients with malignant CAO. CT identified CAO in 107 patients, with agreement between CT and bronchoscopy of 80.8% for obstruction subtype and 65% for severity. The lower agreement for severity suggests that classification of obstruction extent may differ between imaging and direct endoscopic assessment. Nevertheless, agreement between two modalities does not establish diagnostic accuracy against an independent reference standard, nor does it demonstrate the superiority of either method. Furthermore, because the study involved patients with malignant CAO, its findings cannot automatically be generalized to benign obstruction or other populations.

These findings support using CT and bronchoscopy according to their respective diagnostic contributions. CT provides information about airway anatomy and surrounding structures, whereas bronchoscopy enables direct visualization of the airway lumen. When both anatomical characterization and direct examination are clinically necessary, the findings may be interpreted together to provide a more comprehensive assessment. The choice of investigations should nevertheless reflect the suspected etiology, clinical stability, and specific diagnostic question.

Bronchoscopy and Integrated Diagnostic Evaluation

Bronchoscopy permits direct visualization of the airway and assessment of the location and morphology of an obstructing lesion. It may also enable tissue sampling when histopathological confirmation is needed. The findings summarized by Mudambi et al. (2017) and Kalvapudi et al. (2024) support the complementary relationship between bronchoscopy and CT, particularly when anatomical imaging does not provide all the information required for clinical decision-making. However, the need for bronchoscopy should be determined by the expected diagnostic or therapeutic benefit and the patient's clinical condition.

The American College of Chest Physicians guideline by Mahmood et al. (2025) supports comprehensive assessment and individualized management of suspected CAO. This is particularly relevant when obstruction is severe or respiratory stability is compromised, because diagnostic procedures may require specialist planning and appropriate procedural expertise. Thus, the diagnostic pathway should not be regarded as a fixed sequence that must be completed identically for every patient. Rather, clinical assessment, pulmonary function testing, CT, and bronchoscopy should be selected and interpreted according to their respective purposes and the patient's circumstances.

Therapeutic Bronchoscopy and Clinical Outcomes

The evidence on therapeutic bronchoscopy demonstrates that treatment selection depends on lesion characteristics, the underlying disease, and the intended clinical outcome. Rosell and Stratakos (2020) described interventions including mechanical debulking, thermal

ablation, cryotherapy, dilation, and stenting as options for managing central airway diseases. These approaches serve different procedural purposes and should not be considered interchangeable. The selection of a technique requires consideration of airway anatomy, obstruction characteristics, and clinical indications. As a narrative review, this publication provides an overview of therapeutic approaches rather than direct comparative evidence establishing the superiority of one technique across all patients.

Ho et al. (2023) reviewed clinical outcomes following therapeutic bronchoscopy, including symptom-related and other patient outcomes. Their review complements the procedural overview by emphasizing that treatment outcomes vary according to patient and disease characteristics. More specific observational evidence was reported by Giovacchini et al. (2019), whose retrospective study found that a patent distal airway on CT and bronchoscopy was associated with procedural success in malignant CAO. A longer interval between radiological identification and intervention was also associated with lower odds of success. Although these findings may help inform procedural assessment, the retrospective design does not establish that intervention delay directly caused reduced success.

Karambelkar et al. (2025) further demonstrated differences in outcomes between etiological groups in a retrospective cohort of 96 patients undergoing therapeutic bronchoscopy. Median procedure-free survival was 175 days in patients with benign CAO and 49 days in those with malignant CAO. Procedure-free survival reflects the interval without a subsequent procedure and should not be equated with overall survival or permanent resolution of obstruction. The authors also reported an association between airway prostheses and shorter procedure-free survival. This association should be interpreted cautiously because patients receiving airway prostheses may have had more complex obstruction or more advanced underlying disease.

Taken together, Rosell and Stratakos (2020), Ho et al. (2023), Giovacchini et al. (2019), and Karambelkar et al. (2025) address different but related aspects of therapeutic bronchoscopy: available interventions, clinical outcomes, predictors of procedural success, and differences in the subsequent need for procedures. However, differences in study design, patient populations, and outcome measures limit direct comparisons. These findings support individualized treatment planning rather than assuming that the same intervention will produce equivalent outcomes across malignant and nonmalignant CAO.

Evidence Limitations and Future Research Directions

The literature summarized in Table 1 includes narrative reviews, retrospective observational studies, and a clinical practice guideline. These sources address different populations and clinical questions, so their findings cannot be interpreted as equivalent forms of evidence. For example, Daneshvar et al. (2019) examined CAO among patients with lung cancer, whereas Hattab et al. (2024) focused on benign airway obstruction. Similarly, Kalvapudi et al. (2024) evaluated agreement between CT and bronchoscopy in malignant CAO, while Giovacchini et al. (2019) and Karambelkar et al. (2025) investigated outcomes associated with therapeutic bronchoscopy. Differences in population selection, diagnostic definitions, and outcome measures restrict direct comparisons and may limit the generalizability of findings across etiological groups.

The diagnostic literature also indicates that the available modalities provide complementary rather than interchangeable information. Pulmonary function testing characterizes physiological impairment, CT delineates airway anatomy and surrounding structures, and bronchoscopy provides direct visualization and tissue sampling when indicated. The lower agreement between CT and bronchoscopy for obstruction severity than for subtype in Kalvapudi et al. (2024) illustrates the importance of interpreting diagnostic results in context. However, the available evidence does not establish a single diagnostic modality or algorithm as optimal for every patient.

The present narrative review did not employ a systematic-review protocol, formal risk-of-bias assessment, or quantitative synthesis. Its findings should therefore be interpreted as a descriptive integration of selected literature rather than an exhaustive

evaluation of diagnostic accuracy or comparative treatment effectiveness. Future research should prioritize prospective studies with standardized definitions of CAO, reproducible severity-grading criteria, and clearly specified diagnostic reference standards. Direct comparisons of pulmonary function testing, CT, and bronchoscopy across malignant and nonmalignant populations could clarify their relative contributions under different clinical circumstances. Further research should also determine whether emerging physiological techniques, including oscillometry, provide clinically meaningful information beyond conventional spirometry and anatomical imaging.

Clinical Implications and Conclusion

The evidence summarized in Table 1 supports an integrated, etiology-oriented approach to CAO evaluation. Clinical history and physical examination establish initial suspicion and help identify potential causes. Pulmonary function testing may characterize physiological impairment, whereas CT provides anatomical information about the location and extent of obstruction. Bronchoscopy enables direct airway assessment and tissue sampling when indicated. These methods address different diagnostic questions and should be selected according to the clinical presentation, suspected etiology, respiratory stability, and information required for management.

The literature also demonstrates that malignant and nonmalignant CAO differ in their underlying causes and may have different treatment objectives and subsequent procedural outcomes. Therapeutic bronchoscopy can be considered in appropriately selected patients, but procedural techniques and anticipated outcomes should be evaluated in relation to airway characteristics and the underlying disease. Observational associations, including those involving procedural success and procedure-free survival, should not be interpreted as proof of causality.

Overall, the reviewed evidence supports coordinated clinical assessment and individualized use of physiological testing, anatomical imaging, and bronchoscopy. Nevertheless, prospective studies with standardized diagnostic criteria and clinically relevant outcomes are needed to clarify the comparative contributions of these modalities and improve the consistency of CAO assessment and management (Ampazis et al., 2024; Mahmood et al., 2025).

Conclusion

Central airway obstruction (CAO) is a heterogeneous condition with malignant and nonmalignant causes that may present with nonspecific respiratory symptoms, making recognition and diagnosis challenging. Its evaluation requires consideration of clinical findings and the complementary information provided by pulmonary function testing, computed tomography, and bronchoscopy. Pulmonary function testing characterizes physiological impairment, CT delineates airway anatomy, and bronchoscopy enables direct visualization and tissue sampling when indicated. No single modality is sufficient to characterize all aspects of CAO in every patient. Therefore, the selection and interpretation of diagnostic investigations should be individualized according to the suspected etiology, obstruction characteristics, and clinical stability. Further prospective research is needed to establish standardized diagnostic criteria, improve the assessment of obstruction severity, and evaluate the diagnostic performance of individual modalities and integrated diagnostic approaches.

Acknowledgments

The authors would like to thank all individuals who provided support and guidance during the preparation of this narrative review. The authors also acknowledge the contributions of researchers whose published work provided the scientific basis for this article.

References

Ampazis, D., Vlachakos, V., Anagnostopoulos, N., Tzouvelekis, A., & Sampsonas, F. (2024). The clinical utility of pulmonary function tests in the diagnosis and characterization of central airway obstruction: A narrative review. *Journal of*

Clinical Medicine, 13(21), 6299. https://doi.org/10.3390/jcm13216299

Chaddha, U., Agrawal, A., Kurman, J., Ortiz-Comino, R., Dutau, H., Freitag, L., Trisolini, R., Dooms, C., Zuccatosta, L., Gasparini, S., Herth, F., Saka, H., Lee, P., Fielding, D., Oki, M., Rosell, A., & Murgu, S. (2024). World Association for Bronchology and Interventional Pulmonology (WABIP) guidelines on airway stenting for malignant central airway obstruction. *Respirology, 29*(7), 563–573. https://doi.org/10.1111/resp.14764

Chaddha, U., Agrawal, A., Murgu, S., Ghori, U., Trias-Sabria, P., Ortiz-Comino, R., Dutau, H., Freitag, L., Gasparini, S., Lee, P., Dooms, C., Trisolini, R., Madariaga, M. L. L., Li, S., Zuccatosta, L., Herth, F., Saka, H., Fielding, D., Oki, M., … Rosell, A. (2025). World Association for Bronchology and Interventional Pulmonology (WABIP) guidelines on airway stenting for benign central airway obstruction. *Respirology, 30*(7), 587–604. https://doi.org/10.1111/resp.70068

Daneshvar, C., Falconer, W. E., Ahmed, M., Sibly, A., Hindle, M., Nicholson, T. W., Aldik, G., Telisinghe, L. A., Riordan, R. D., Marchbank, A., & Breen, D. (2019). Prevalence and outcome of central airway obstruction in patients with lung cancer. *BMJ Open Respiratory Research, 6*(1), e000429. https://doi.org/10.1136/bmjresp-2019-000429

Gan, E. M., Lim, H., Leong, C. K. L., Chow, S. Y., Hwang, K. W., & Hwang, N. C. (2025). Clinical approach to central airway obstruction in adult patients: Perioperative focus on causes and management including tracheobronchial stenting. *Journal of Cardiothoracic and Vascular Anesthesia, 39*(9), 2480–2497. https://doi.org/10.1053/j.jvca.2025.03.032

Giovacchini, C. X., Kessler, E. R., Merrick, C. M., Gao, J., Wang, X., Wahidi, M. M., Shofer, S. L., Cheng, G. Z., & Mahmood, K. (2019). Clinical and radiographic predictors of successful therapeutic bronchoscopy for the relief of malignant central airway obstruction. *BMC Pulmonary Medicine, 19*, Article 219. https://doi.org/10.1186/s12890-019-0987-3

Hattab, Y., de Salmeron, S. P., & Malsin, E. (2024). Benign airway obstruction: A clinical practice review of causes and managements principles. *AME Medical Journal, 9*, Article 4. https://doi.org/10.21037/amj-23-103

Ho, A. T. N., Shah, A., & Sagar, A. E. S. (2023). Review of the clinical outcomes of therapeutic bronchoscopy for central airway obstruction. *Mediastinum, 7*, Article 17. https://doi.org/10.21037/med-22-39

Kalvapudi, S., Zubair, H. M., Kunadharaju, R., Bhura, S., Mengiste, H., Saeed, M., Saradna, A., Grover, H., Shafirstein, G., Yendamuri, S., & Ivanick, N. M. (2024). Correlation of bronchoscopy and CT in characterizing malignant central airway obstruction. *Cancers, 16*(7), 1258. https://doi.org/10.3390/cancers16071258

Karambelkar, A., Lara, J., Beattie, J. A., Parikh, M. S., Swenson, K. E., Majid, A., & Zhang, C. (2025). Procedure-free survival after therapeutic bronchoscopy in patients with central airway obstruction. *Respiratory Medicine, 244*, Article 108156. https://doi.org/10.1016/j.rmed.2025.108156

Le-Khac, B., Nguyen-Dang, K., Vu-Hoai, N., Nguyen-Thanh, N., Duong-Minh, N., Tran-Ngoc, T.-H., & Nguyen-Ho, L. (2024). Challenges in diagnosis and management of central airway obstruction: Case series. *SAGE Open Medical Case Reports, 12*. https://doi.org/10.1177/2050313X231225327

Mahmood, K., Frazer-Green, L., Gonzalez, A. V., Shofer, S. L., Argento, A. C., Welsby, I., Hales, R., Shojaee, S., Gardner, D. D., Chang, J. Y., Herth, F. J. F., & Yarmus, L. (2025). Management of central airway obstruction: An American College of Chest Physicians clinical practice guideline. *Chest, 167*(1), 283–295. https://doi.org/10.1016/j.chest.2024.06.3804

Mudambi, L., Miller, R., & Eapen, G. A. (2017). Malignant central airway obstruction.

Journal of Thoracic Disease, 9(Suppl. 10), S1087–S1110. https://doi.org/10.21037/jtd.2017.07.27

Murgu, S. D., Egressy, K., Laxmanan, B., Doblare, G., Ortiz-Comino, R., & Hogarth, D. K. (2016). Central airway obstruction: Benign strictures, tracheobronchomalacia, and malignancy-related obstruction. *Chest, 150*(2), 426–441. https://doi.org/10.1016/j.chest.2016.02.001

Murgu, S., Urrutia-Royo, B., Ntiamoah, P., & Dutau, H. (2025). Multidisciplinary care in nonmalignant central airway obstruction. *Current Opinion in Pulmonary Medicine, 31*(1), 11–18. https://doi.org/10.1097/MCP.0000000000001133

Rosell, A., & Stratakos, G. (2020). Therapeutic bronchoscopy for central airway diseases. *European Respiratory Review, 29*(158), 190178. https://doi.org/10.1183/16000617.0178-2019

Vakil, E., & Wang, M. (2025). Malignant central airway obstruction. *Clinics in Chest Medicine, 46*(2), 301–315. https://doi.org/10.1016/j.ccm.2025.02.008