

Background

The Eustachian tube (ET) is a highly specialized anatomical conduit whose optimal function depends on the finely tuned interplay between its cartilaginous framework and surrounding musculature. In chronic obstructive Eustachian tube dysfunction (COETD), abnormal biomechanics—including alterations in the structural properties of the posterior cushion cartilage—disrupt its valvular mechanism, leading to impaired middle ear pressure regulation.

Cross-hatching Eustachian tuboplasty (ChEt), introduced over a decade ago as a laser-assisted intervention, was designed to reshape the posterior cushion cartilage (**Yanez 2010**). By strategically modifying its curvature, ChEt expands the ETs medial luminal area and re-establishes physiologic valvular competence. However, its long-term outcomes have not been elucidated.

Objectives

To evaluate the long-term outcomes of cross-hatching Eustachian tuboplasty (ChEt) in patients with COETD.

Study Design

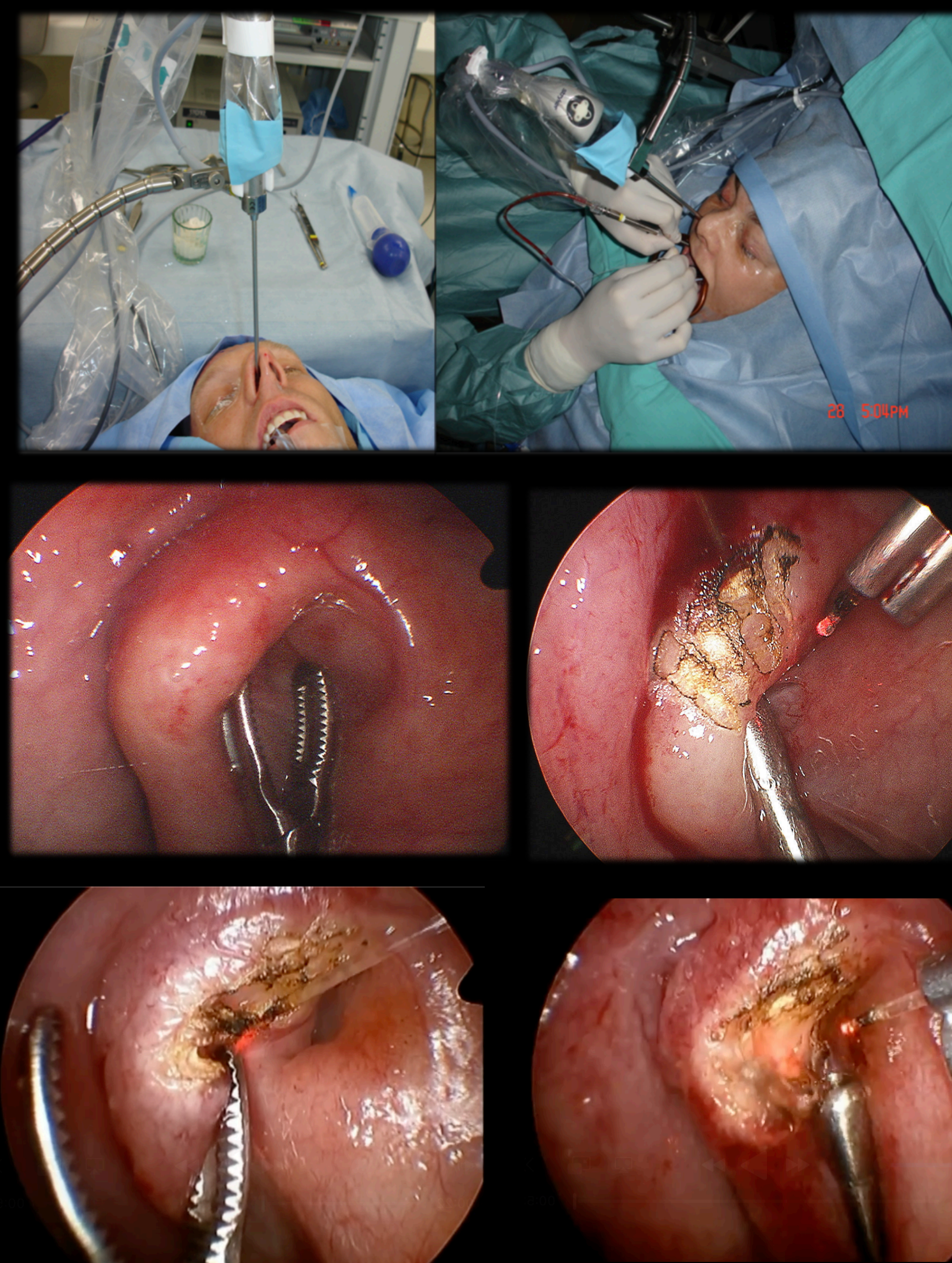
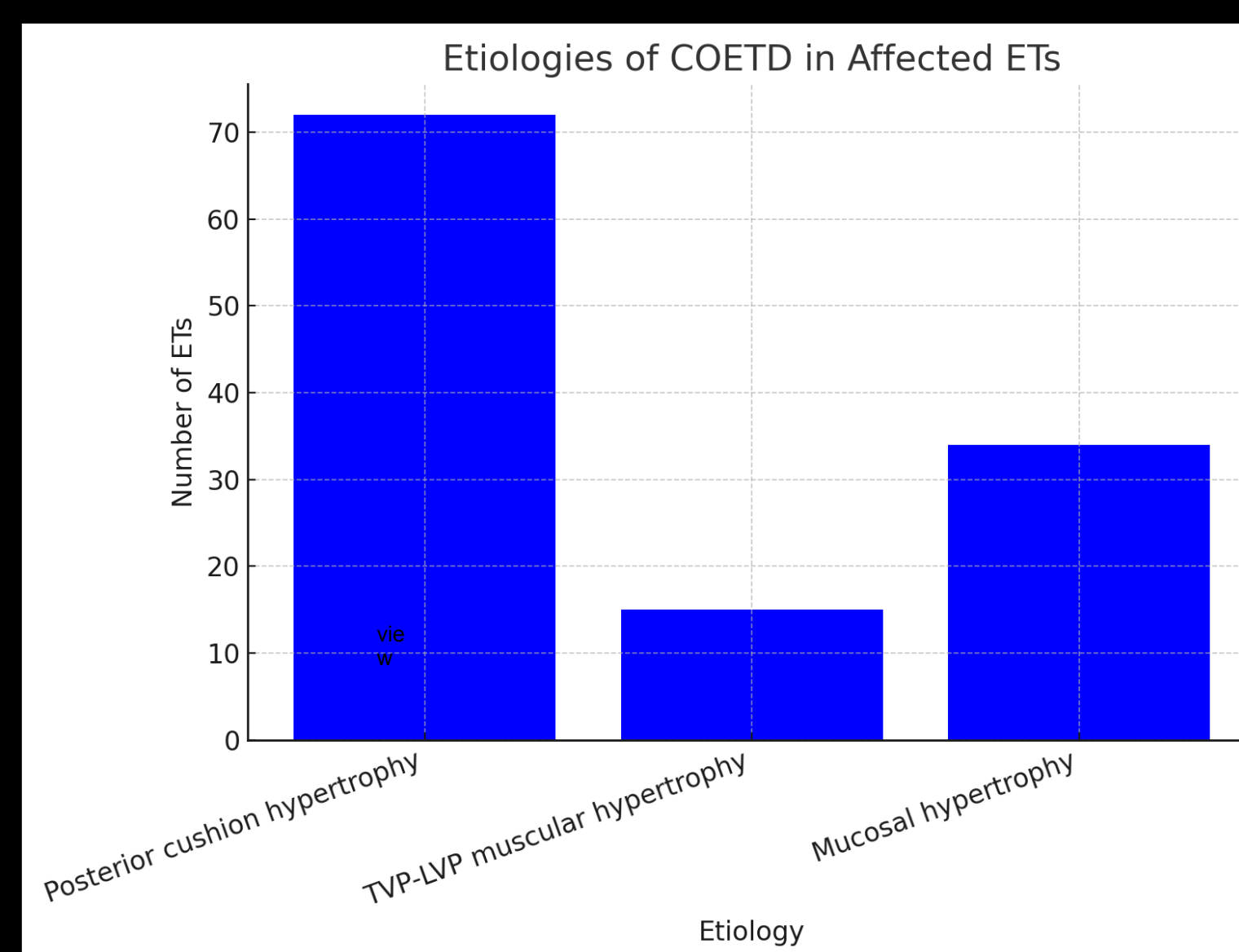
Retrospective case series

Methods

A retrospective review was conducted of patients who underwent ChEt for COETD between January 2009 and February 2017, with all patients followed for a minimum of six years. The etiology of COETD was determined preoperatively using slow-motion video-endoscopy. The surgical technique consisted of argon laser cartilage modification of the posterior cushion, designed to adjust the spring tension of the cartilaginous framework, enlarge the narrowed valve aperture, and restore dynamic function. All procedures were performed according to the standard technique described in the literature. Postoperative evaluations included video-endoscopic assessment of ET valve patency and opening, tympanometry, audiometry, and documentation of symptom resolution. Outcomes were recorded at predefined follow-up intervals.

Results

Seventy-two patients with COETD (58 males, 14 females; mean age, 42.0; 144 ETs) underwent video-endoscopic evaluation. All patients had at least one affected ET, with a total of 121 ETs affected and 23 were normal. Among the affected ETs (n=121), the most common etiologies were posterior cushion hypertrophy (n = 72; 59.5%), tensor veli palatini–levator veli palatini (TVP-LVP) muscular hypertrophy (n = 15; 12.4%), and mucosal hypertrophy (n = 34; 28.1%). All affected ETs were surgically managed with ChET. Postoperative slow-motion video-endoscopy demonstrated improved valve opening in 118 of 121 treated ETs (97.5%). Audiometric testing revealed improvement with a mean pure-tone average of 20–25 dB ($p = 0.015$), while tympanometric compliance improved in 91.9% of cases ($p = 0.010$). At a minimum follow-up of six years (mean 6.7 years), 91% of patients were free of COETD-related symptoms (aural fullness, muffled hearing, popping, crackling). Fourteen patients were lost to follow-up after the 6 year minimum, and treatment failure (i.e, no symptom resolution and/or lack of tympanogram normalization) was observed in 10 patients (9%).



Discussion

Our findings demonstrate that ChET provides durable, long-term improvement in patients with COETD. All patients had at least one affected ET. Postoperative video-endoscopy showed improved valve opening in 97.5% of treated tubes, while audiometric and tympanometric outcomes improved in most patients, with 91% free of COETD-related symptoms at a mean follow-up of six years.

The predominant etiologies—posterior cushion hypertrophy, TVP-LVP muscular hypertrophy, and mucosal hypertrophy—reaffirm that mechanical obstruction at the posterior cushion is a major driver of COETD. ChET addresses this by modifying cartilage spring tension to expand the medial lumen, restoring dynamic valve function.

While short-term benefits of ChET have been reported previously (**Yanez 2010**), long-term outcomes extending beyond several years had not been presented. Our findings show sustained audiometric and tympanometric improvement, supporting ChET as a durable intervention. Treatment failure occurred in 10 patients (9%), underscoring the importance of careful patient selection.

These results suggest that ChET should be considered in appropriately selected cases, particularly when posterior cushion obstruction is the primary pathology. They also raise the question of whether ChET could serve as an alternative or adjunct to balloon dilation in refractory COETD. Prospective studies directly comparing ChET and balloon dilation are warranted to clarify optimal indications, efficacy, and long-term durability.

ChET is a safe, effective, and durable procedure for COETD, providing sustained improvements in valve function, hearing, and symptom relief, and should be considered in selected patients. These findings lay the groundwork for further comparative studies with balloon dilation.

Conclusions

ChEt achieves durable long-term success in COETD, with 97.5% of treated Eustachian tubes demonstrating improved valve opening and 91% of patients reporting complete symptom resolution over a minimum follow-up of 6 years. These findings support ChEt as an effective and reliable surgical option for appropriately selected patients.

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References

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