



Balloon Eustachian Tuboplasty and CO2 Myringoplasty for Tympanic Membrane Atelectasis



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Introduction

In this case report, we describe a surgical technique addressing tympanic membrane atelectasis using a combination of balloon eustachian tuboplasty (BET), and CO2 laser myringoplasty.

Methods and Materials

This case report presents the management of a 44-year-old female patient with a history of chronic eustachian tube dysfunction. Otomicroscopy revealed severe right pars tensa retraction pockets in the posterior and anterior-superior regions. Additionally, a CT scan of the temporal bone revealed soft tissue in the right Prussak space, raising concerns for cholesteatoma. Pre-operative audiometry indicated a mild conductive hearing loss.

Intervention

The primary interventions performed in this case included a right canaloplasty with tympanomeatal flap elevation, CO2 laser myringoplasty, and transcanal tympanoplasty with a tragal cartilage graft.

Main Outcome Measure

The main outcome measures evaluated in this study included post-operative audiometry results and assessment of tympanic membrane morphology. These measures were used to determine the effectiveness of the surgical interventions in terms of hearing improvement and the successful reconstruction of the tympanic membrane.

Case

The patient underwent a bilateral eustachian tube balloon dilation procedure, applying a pressure of 12 atm for 2 minutes to address eustachian tube dysfunction and facilitate middle ear insufflation. To further enhance middle ear insufflation, inhaled nitrous oxide was administered. A CO2 laser with a continuous pulse of 2W was utilized to resurface the tympanic membrane. The laser fiber tip was positioned approximately 1cm from the membrane to defocus the beam and induce contraction of the retraction pockets. Subsequently, a tympanomeatal flap was elevated, and thorough examination revealed no evidence of cholesteatoma. A tragal cartilage graft was placed beneath the posterior retraction pocket. Post-operative follow-up confirmed complete healing of the tympanic membrane, with no perforations or recurrence of retraction pockets. Audiometric assessment demonstrated improvement in hearing function.

Discussion

Tympanic membrane atelectasis, a condition commonly associated with eustachian tube dysfunction, is characterized by the retraction of the tympanic membrane leading to symptoms such as conductive hearing loss, aural pressure and can eventually result in the formation of a cholesteatoma. Treatment, however, is controversial as there is no way to predict progression towards a cholesteatoma and hearing is often normal until late in the disease course.¹ Interventions described in the past involve elevation of the ear drum followed by cartilage reconstruction of the tympanic membrane to prevent reformation of the retraction pocket.

One potential treatment approach involves the use of a CO2 laser, which has been described in previous studies as a means to stimulate collagen growth on epithelial surfaces without causing perforation or damage to the outer layer. This laser therapy aims to promote contraction and tightening of the ear drum, preventing the formation of retraction pockets.²

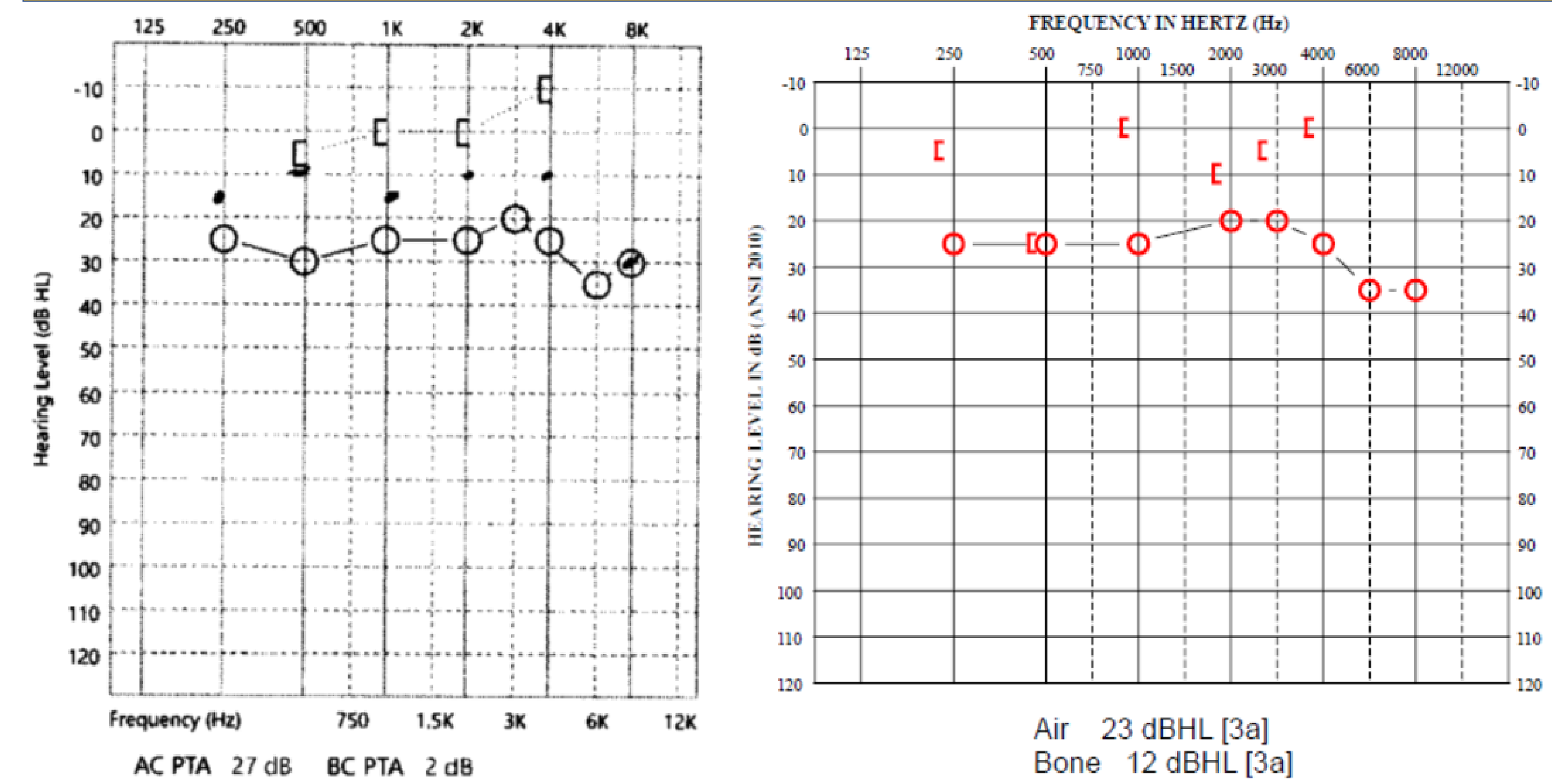
It is important to note, however, that while the use of a CO2 laser for treating tympanic membrane atelectasis has been described in the literature, there is a lack of robust data supporting its efficacy. The limited available evidence suggests the potential benefits of CO2 laser therapy in stimulating collagen growth and preventing retraction pockets, but further research is needed to establish its effectiveness and determine the optimal parameters for its application.

Moreover, the integration of Balloon Eustachian Tuboplasty (BET) and CO2 laser myringoplasty for the management of tympanic membrane atelectasis remains largely unexplored. Although both techniques have been individually documented, there is a notable lack of data on their combined application. Notably, CO2 laser myringoplasty directly addresses the atelectasis, while BET targets the underlying eustachian tube dysfunction responsible for its occurrence. The scarcity of data concerning this combined approach emphasizes the necessity for further investigation and clinical studies to evaluate its feasibility, safety, and therapeutic outcomes.

Conclusion

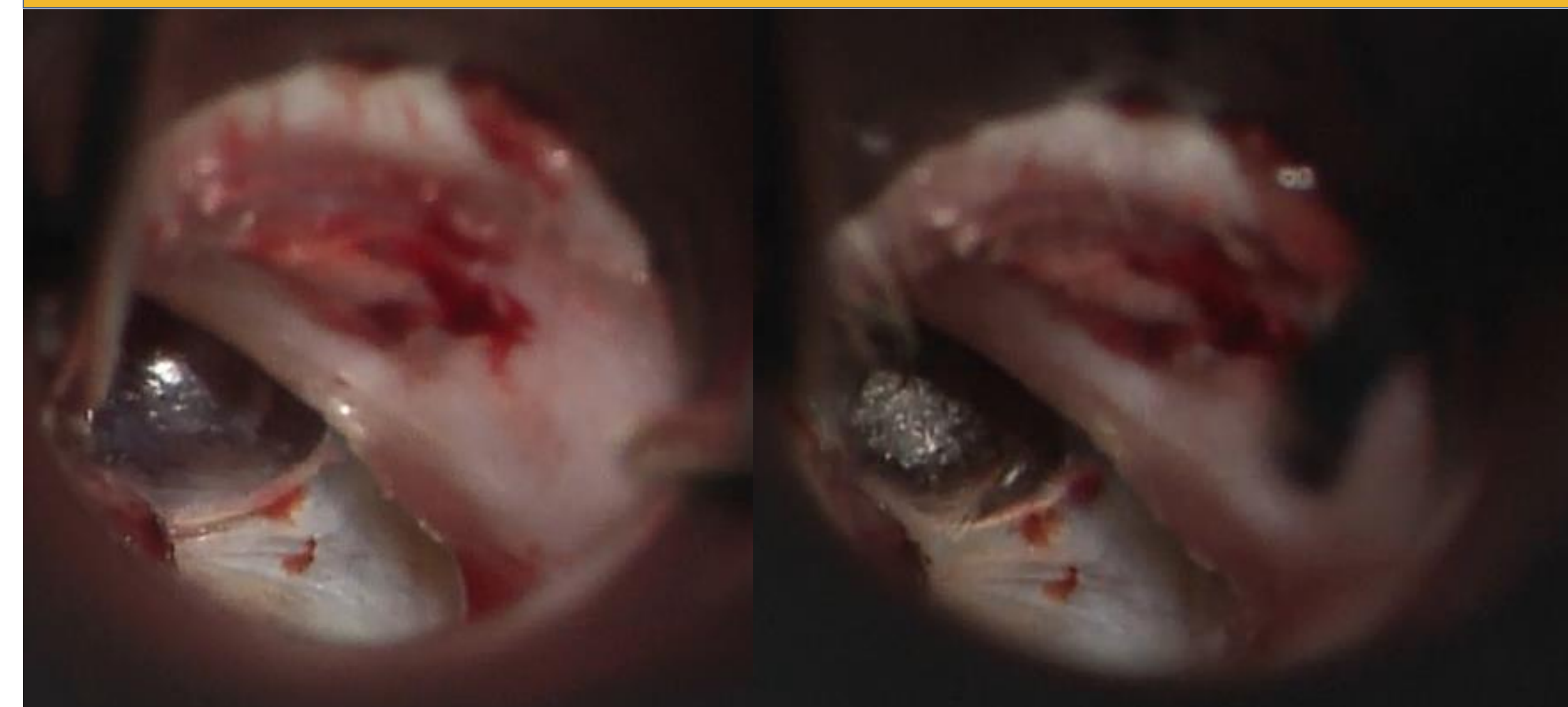
Balloon Eustachian Tuboplasty and CO2 laser myringoplasty can be used to address tympanic membrane atelectasis and prevent reformation of retraction pockets.

Table Pre and Post operative audiometry data



Left – Audiogram demonstrating PTA prior to surgical intervention with BET and CO2 laser myringoplasty. Right – Audiogram demonstrating PTA 6 months following surgical procedure

Figure: CO2 laser resurfacing of atelectatic pocket



Left – Atelectatic pocket visualized in the anterior superior quadrant of the tympanic membrane, elevated with the use of nitrous oxide.

Right – Atelectatic pocket following CO2 laser myringoplasty demonstrating contraction of the atelectatic pocket.

Video of Demonstrating CO2 Laser Resurfacing of the Retraction Pocket



Scan the QR code to watch a narrated video demonstrating the technique

References

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2. Ostrowski VB, Bojrab DI. Minimally invasive laser contraction myringoplasty for tympanic membrane atelectasis. *Otolaryngol Head Neck Surg.* 2003 May;128(5):711-8. doi: 10.1016/S0194-59980300255-9. PMID: 12748566.

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