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Tympanoplasty With or Without Total Annular Excision in Chronic Suppurative Otitis Media

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Abstract

Background: Type I tympanoplasty is the standard reconstructive operation for inactive mucosal chronic suppurative otitis media (CSOM) with tympanic membrane perforation. Total annular excision (TAE) tympanoplasty removes the residual tympanic membrane and annulus circumferentially before graft placement. It has been proposed to create a uniformly vascular graft bed, reduce epithelial remnants and postoperative granular myringitis, and produce a near-anatomic neotympanum.

Objective: To critically review comparative evidence on tympanoplasty with versus without TAE in patients with mucosal CSOM, emphasizing graft uptake, hearing outcomes, postoperative otorrhea or myringitis, complications, and limitations of the available literature.

Methods: A focused narrative synthesis of peer-reviewed comparative trials and relevant institutional studies was undertaken. Total annular excision was treated as distinct from simple freshening or trimming of the perforation margin. Findings were interpreted according to study design, perforation characteristics, graft material, surgical approach, follow-up, and outcome definitions.

Results: A double-blind randomized trial of 56 patients reported complete graft uptake in 28 of 28 TAE ears versus 27 of 28 conventional ears, no postoperative discharge after TAE versus discharge in 14.3% after conventional tympanoplasty, and greater improvement in air-conduction thresholds. Air-bone-gap improvement was similar (15.43 vs 14.12 dB). A later randomized endoscopic study of 60 patients with large or subtotal perforations found comparable intact-neotympanum rates (83.3% vs 80.0%) but greater median air-bone-gap reduction after TAE (12.5 vs 8.0 dB). A larger institutional comparison found no clear advantage in graft uptake, hearing, or complications, while suggesting a possible role in preventing granular myringitis. Heterogeneity and small samples prevent firm claims of superiority.

Conclusion: TAE appears feasible and safe in selected mucosal CSOM, with a possible advantage for postoperative ear dryness and selected audiometric outcomes. Current evidence does not establish a reproducible improvement in graft uptake over conventional tympanoplasty. Conventional underlay or interlay repair remains appropriate for most routine central perforations; TAE may be considered for large or subtotal perforations, inflamed or unreliable annular remnants, or concern for postoperative myringitis, provided meticulous graft support and follow-up are available.

Keywords: chronic suppurative otitis media; chronic otitis media; tympanoplasty; myringoplasty; total annular excision; tympanic membrane perforation; graft uptake; air-bone gap.

1. Introduction

Chronic suppurative otitis media is characterized clinically by persistent or recurrent middle-ear inflammation and otorrhea through a tympanic membrane perforation. In inactive mucosal disease with an intact ossicular chain and no cholesteatoma, type I tympanoplasty aims to obtain a permanently closed, dry ear and improve conductive hearing. Conventional techniques preserve most of the tympanic membrane remnant and annulus, freshen the perforation edge, elevate a tympanomeatal flap as required, and place fascia, perichondrium, or cartilage in an underlay, overlay, interlay, or combined position.

Despite high closure rates in experienced hands, residual perforation, anterior graft failure, lateralization or medialization, blunting, postoperative otorrhea, epithelial pearls, and granular myringitis remain clinically relevant. TAE was developed as a modification in which the tympanic annulus and residual drum are circumferentially excised, followed by reconstruction with a graft that functions as a new tympanic membrane. The technique challenges the traditional preference for conserving viable drum remnants, and therefore requires evaluation against conventional repair rather than adoption on theoretical grounds alone.

2. Definition and Surgical Rationale

2.1 What total annular excision means

In TAE tympanoplasty, a circumferential incision is made lateral to the annulus, the annulus is separated from the tympanic sulcus, and the residual tympanic membrane-annulus complex is removed. The graft is then positioned to cover the entire tympanic ring and supported according to the surgeon's chosen technique. This is fundamentally different from trimming or de-epithelializing only the margin of a chronic perforation. Studies of margin trimming should not be pooled directly with TAE studies because the extent of tissue removal, graft-bed geometry, risk profile, and biological rationale differ.

2.2 Proposed benefits

The proposed advantages are: removal of chronically inflamed or epithelialized residual tissue; elimination of irregular annular pockets that may harbor granulation; a continuous circumferential raw surface for graft integration; easier placement of a broad graft in large or subtotal perforations; and construction of a smooth neotympanum. These mechanisms could plausibly reduce postoperative discharge and granular myringitis. A larger effective vibratory surface may also influence hearing, although hearing gain is strongly confounded by preoperative perforation size, middle-ear volume, ossicular status, graft stiffness, and postoperative aeration.

2.3 Potential disadvantages

TAE sacrifices viable native tympanic membrane and the annular scaffold. It may increase manipulation near the chorda tympani and ossicular chain, make anterior graft support more demanding, and theoretically increase the risks of blunting, lateralization, medialization, canal stenosis, epithelial entrapment, or an excessively compliant or stiff neotympanum. These concerns are technique-dependent and were not consistently observed in published series, but most studies were too small to exclude uncommon complications.

3. Comparative Clinical Evidence

Study	Design / sample	Population	Comparison	Key results	Interpretation
Verma et al., 2022	Double-blind RCT; n=56	Central perforations; age 15-55 y	Conventional underlay vs TAE	Uptake 27/28 vs 28/28; discharge 14.3% vs 0%; ABG gain 14.12 vs 15.43 dB	Suggests dryness and AC benefit; underpowered for small uptake difference
Agarwal & Chandra, 2023	Institutional comparative study; larger cohort	Dry central perforations with conductive or mixed loss	TAE vs underlay/interlay	No added advantage in uptake, hearing, or complications; favorable neotympanum/low myringitis signal	Supports feasibility; nonrandomized design limits causal inference
Khan et al., 2025	Case-control institutional study	Inactive mucosal COM; large central perforations	Conventional underlay vs TAE	Reported comparative graft, hearing, and complication outcomes	Relevant selected population; detailed estimates require full report appraisal
Shah et al., 2026	Single-blind RCT;	Mucosal COM;	Endoscopic	Intact	No closure

	n=60	large/subtotal perforations; ABG $\geq$ 20 dB	conventional vs endoscopic TAE	neotympanum 80.0% vs 83.3% ($P=.565$); median ABG gain 8.0 vs 12.5 dB ($P=.011$)	advantage; hearing signal favors TAE
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4. Outcome-by-Outcome Synthesis

4.1 Anatomical success

The best comparative data do not show a consistent, clinically important graft-uptake advantage for TAE. In the 2022 trial, the numerical difference was one failure in the conventional arm versus none after TAE; with only 28 ears per group, this result is compatible with chance and cannot establish superiority. In the 2026 endoscopic trial, closure was again numerically higher after TAE but nearly identical between groups and statistically nonsignificant. The appropriate interpretation is non-inferior-looking performance, not proven equivalence, because neither trial was designed or powered as a formal non-inferiority study.

4.2 Hearing outcome

Both randomized comparisons found hearing improvement in each group. The 2022 study reported a greater improvement in air-conduction thresholds after TAE, while mean air-bone-gap gain differed by only 1.31 dB. The 2026 trial reported a larger median air-bone-gap reduction with TAE and a lower postoperative speech-reception threshold. These findings are encouraging, but their clinical importance should be judged against measurement variability and the conventional benchmark of postoperative air-bone gap categories. Future studies should report frequency-specific air- and bone-conduction thresholds, change in four-frequency air-bone gap, the proportion achieving an air-bone gap of 10 or 20 dB or less, and any postoperative sensorineural shift.

4.3 Dry ear, discharge, and myringitis

The most distinctive potential benefit of TAE is control of postoperative inflammation rather than simple closure. In the 2022 randomized trial, postoperative discharge occurred in 14.3% of conventional ears and in no TAE ears. The institutional experience likewise emphasized prevention of granular myringitis. This signal is biologically plausible because TAE removes residual epithelium and potentially diseased annular tissue; however, definitions of discharge and myringitis, use of topical treatment, and timing of assessment were not standardized. Recurrent granular myringitis should be a prespecified, adjudicated endpoint in future trials.

4.4 Complications and technical burden

Published studies describe TAE as technically feasible with routine microscopic or endoscopic instruments and have not demonstrated a major excess of complications. Nonetheless, available sample sizes cannot reliably detect uncommon adverse events. Comparative reports should explicitly record taste disturbance, chorda tympani injury, canal-wall trauma, epithelial pearl or iatrogenic cholesteatoma, anterior blunting, graft lateralization or medialization, atelectasis, recurrent perforation, infection, and need for revision. Operating time and surgeon learning curve are also relevant because a modest clinical benefit may not justify greater technical complexity in a straightforward small central perforation.

5. Methodological Limitations

The literature has five major limitations. First, the number of controlled studies and participants is small. Second, eligibility varies from general central perforations to specifically large or subtotal perforations, creating clinical heterogeneity. Third, operative variables such as endoscopic versus microscopic access, graft material, graft thickness, underlay or interlay positioning, malleus relationship, and canal packing may influence outcomes independently of annular excision. Fourth, outcome definitions and follow-up intervals are inconsistent; six-month closure can overestimate durable success. Fifth, most evidence comes from single centers, limiting generalizability and leaving room for surgeon-specific performance effects.

The term CSOM also deserves precision. Modern literature increasingly uses chronic otitis media and distinguishes active from inactive mucosal disease and cholesteatomatous disease. The reviewed TAE evidence largely concerns mucosal disease without cholesteatoma and should not be extrapolated to unsafe ears, ossicular discontinuity requiring reconstruction, adhesive disease, or uncontrolled infection.

6. Practical Patient Selection

Clinical setting	Preferred consideration	Reasoning
Small or medium, dry central perforation with healthy remnant	Conventional type I tympanoplasty	High expected closure rate; no demonstrated incremental benefit from sacrificing healthy annulus
Large or subtotal perforation	Either technique; TAE is reasonable in experienced hands	Randomized evidence shows similar closure and a possible hearing benefit

Recurrent discharge or granular myringitis involving remnant/annulus	Consider TAE after excluding active middle-ear pathology	Removal of chronically inflamed residual tissue addresses the proposed disease substrate
Poor anterior rim or difficult graft stabilization	Individualize technique and graft support	TAE may simplify a uniform graft bed but can also increase support demands
Cholesteatoma, adhesive disease, ossicular reconstruction	Disease-directed tympanoplasty; do not extrapolate TAE evidence	Existing comparisons do not adequately represent these conditions

7. Suggested Design for a Definitive Comparative Study

A multicenter, assessor-blinded randomized controlled trial should enroll adults with inactive mucosal chronic otitis media and large or subtotal central perforations. Randomization should be stratified by perforation size, anterior involvement, smoking, contralateral-ear status, and surgeon. Both groups should use the same access route, graft material, graft thickness, ossicular criteria, antibiotic policy, and packing protocol; the only intended difference should be total annular excision.

The primary outcome should be an intact, dry tympanic membrane at 12 months, confirmed by blinded otoendoscopy. Key secondary outcomes should include recurrent otorrhea and granular myringitis, four-frequency air-bone-gap change, proportion with postoperative air-bone gap ≤ 20 dB, speech-reception threshold, disease-specific quality of life, complications, operating time, postoperative pain, and revision surgery. Analyses should follow intention-to-treat principles, report effect estimates with 95% confidence intervals, and include a prespecified subgroup for subtotal perforations. Follow-up at 24 months would establish durability.

8. Conclusion

Total annular excision tympanoplasty is a credible reconstructive option for selected patients with mucosal CSOM. Comparative evidence suggests that it can achieve anatomical results similar to conventional tympanoplasty, may reduce postoperative discharge or granular myringitis, and may improve selected audiometric measures. It has not, however, shown a consistent graft-uptake advantage. The evidence is insufficient to recommend routine TAE for every central perforation. A selective strategy is most defensible: preserve the annulus in uncomplicated ears with healthy remnants, and consider TAE in large or subtotal perforations or when residual annular disease is thought to contribute to recurrent inflammation. Better standardized, adequately powered multicenter trials are needed before claims of superiority can be made.

Declarations

Funding: None.

Conflicts of interest: None declared.

Ethics approval: Not applicable to a narrative review.

Author note: Patient-level treatment decisions should be based on otoscopic findings, middle-ear status, audiometry, surgeon experience, and local protocols.

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