

Comparative Outcomes of Endoscopic Versus Microscopic Tympanoplasty in Chronic Otitis Media: A systematic review.

Osman Suliman¹, Rawan Alsehaimi², Raneem Alharbi², Riham Abdelmagid³, Rana Abdelmagid³, Sara Altom⁴, Eisa Mohamed⁵, Huda Alsubhi⁷

¹Faculty of Medicine, University of Medical sciences and Technology (UMST) Khartoum, Sudan

²Medical Student, Al-Rayan National College of Medicine, Al-Rayan National Colleges, Al-Madinah, Saudi Arabia.

³The Faculty of Medicine of Helwan University in Cairo, Egypt

⁴Department of Basic Science, Al-Rayan National College of Medicine, Al-Rayan National Colleges, Al-Madinah, Saudi Arab

⁵Information Technology Department, Al-Rayan National Colleges, Al-Madinah, Saudi Arabia.

⁶Primary health care Center, Prince Mohammed Bin Abdulaziz Hospital, National Guard Health Affairs, AL-Madinah, Saudi Arabia

⁷Medical intern, Al-Rayan National College of Medicine, Al-Rayan National Colleges, Al-Madinah, Saudi Arabia.

Corresponding author:

Dr. Osman A. Suliman

Associate Professor of Surgery and Paediatric Surgery, Faculty of Medicine, University of Medical sciences and Technology (UMST) Khartoum, Sudan

Email: drosy442@gmail.com, dr.suliman313@gmail.com

ABSTRACT

Background: Chronic otitis media (COM) is a persistent inflammatory condition of the middle ear that frequently leads to tympanic membrane perforation, hearing loss, and recurrent otorrhea. Tympanoplasty remains the standard surgical procedure to restore hearing and the integrity of the tympanic membrane. Traditionally performed using a microscope, the procedure has evolved with the advent of endoscopic ear surgery, offering improved visualization and minimally invasive access. However, evidence comparing the outcomes of endoscopic versus microscopic tympanoplasty remains heterogeneous.

Objective: To systematically review and compare surgical and audiological outcomes of endoscopic and microscopic tympanoplasty in patients with chronic otitis media, focusing on graft success rate, postoperative hearing gain, operative time, complications, and patient recovery.

Methods: Electronic databases including PubMed, Scopus, Web of Science, and Cochrane Library were searched for studies published from 2010 to 2025. Only randomized controlled trials (RCTs), cohort studies, and meta-analyses comparing endoscopic and microscopic tympanoplasty in adults with COM were included. Data regarding graft uptake, hearing improvement (air-bone gap closure), operative duration, postoperative complications, and hospital stay were extracted and analyzed descriptively.

Results: Across the included studies, both approaches achieved comparable graft success rates. Endoscopic tympanoplasty was consistently associated with shorter operative time, reduced postoperative pain, and quicker recovery. Several studies reported equivalent or slightly superior hearing outcomes with the endoscopic technique, particularly for small to medium perforations. Microscopic tympanoplasty remained advantageous in cases requiring extensive canaloplasty or ossiculoplasty.

Conclusion: Both endoscopic and microscopic tympanoplasty are effective in managing chronic otitis media. The endoscopic approach offers a minimally invasive alternative with faster recovery and similar graft success. However, microscopic tympanoplasty remains valuable for complex or revision cases. Larger, standardized RCTs with long-term follow-up are required to establish evidence-based surgical recommendations.

KEYWORDS: Endoscopic tympanoplasty, Microscopic tympanoplasty, Chronic otitis media, Hearing outcome, Graft success rate, Middle ear surgery.

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INTRODUCTION

Chronic otitis media (COM) is a persistent inflammatory condition of the middle ear and mastoid cavity, marked by tympanic membrane perforation, intermittent otorrhea, and conductive hearing loss. It is a major public health problem in both developing and developed countries, causing a lot of hearing loss, communication problems, and a lower quality of life [1]. If not treated, repeated infections and long term inflammation can cause ossicular erosion, cholesteatoma formation, and hearing loss that can't be fixed [2].

The main goal of tympanoplasty is to fix the tympanic membrane, get rid of middle ear disease, and bring back hearing function [3]. The microscopic approach has long been seen as the best way to do things because it provides binocular magnification, great depth perception, and stable visualization during the procedure [4]. Microscopic tympanoplasty usually needs incisions behind the ear and canaloplasty, which can make the surgery take longer, cause more pain after the surgery, and slow down recovery [5].

Endoscopic ear surgery (EES) has changed the way otologists work by allowing them to use a minimally invasive, transcanal approach that gives them a wide-angled, panoramic view of the middle ear cavity [6]. This method makes fewer cuts on the outside of the body, keeps the normal anatomy, and usually leads to better cosmetic results and shorter hospital stays. Endoscopes also let you see hidden spaces better, like the sinus tympani, anterior epitympanic space, and hypotympanum, which are hard to get to with a microscope [7].

But EES also has some problems. Surgeons work with one hand while holding the endoscope in the other, which makes it hard to move the instruments around and may make it harder to keep hemostasis [8]. Furthermore, the lack of depth perception and the corresponding learning curve can initially affect surgical performance [9]. Even though there are still some technical problems, EES is becoming more and more possible and reliable, even for difficult cases, thanks to constant improvements in tools, camera resolution, and training programs [10].

Numerous comparative studies have been undertaken to assess the outcomes of endoscopic and microscopic tympanoplasty however, the results remain inconclusive. Certain studies have indicated similar graft uptake rates and postoperative auditory results [12], whereas others have highlighted the benefits of the endoscopic method, including decreased operative duration, diminished postoperative discomfort, and expedited recovery time [13]. Moreover, patient-centered factors, including cosmetic satisfaction, resumption of daily activities, and complication rates, are receiving heightened scrutiny in current literature [15].

In light of these changing viewpoints, a thorough synthesis of the existing evidence is necessary. Consequently, this systematic review seeks to rigorously assess and contrast the clinical and functional outcomes of endoscopic versus microscopic tympanoplasty in patients with chronic otitis media, emphasizing graft success, audiological enhancement, operative efficiency, complication rates, and overall patient satisfaction [16].

OBJECTIVES OF THE STUDY

- **General Objective**

To assess and compare the clinical outcomes of endoscopic and microscopic tympanoplasty in patients with chronic otitis media.

Specific Objectives

1. To compare graft success rates between endoscopic and microscopic tympanoplasty.
2. To evaluate postoperative hearing outcomes (air-bone gap closure, pure-tone average improvement).
3. To compare operative time, postoperative pain, and hospital stay between both techniques.
4. To assess the incidence of complications such as residual perforation, infection, and taste disturbance.
5. To analyze overall patient satisfaction and cosmetic outcomes.

METHODOLOGY

Study Design

This study will conduct a systematic review of randomized controlled trials (RCTs), cohort studies, and meta-analyses that compared endoscopic and microscopic tympanoplasty in chronic otitis media patients.

Time Frame

The review will be conducted from **March to August 2025**.

Inclusion and Exclusion Criteria

The inclusion criteria for this review encompassed studies published between 2010 and 2025 involving adult patients (≥ 18 years) diagnosed with chronic otitis media who underwent tympanoplasty. Eligible studies directly compared endoscopic and microscopic tympanoplasty techniques and reported at least one relevant outcome, including graft uptake rate, hearing improvement, operative time, or postoperative complications. Only peer-reviewed randomized controlled trials, cohort studies, systematic reviews, and meta-analysis were included. Exclusion criteria comprised studies involving pediatric populations, cholesteatoma surgery, or revision mastoidectomy without tympanoplasty, as well as case reports, editorials, conference abstracts, and non-English publications. Additionally, studies lacking quantitative outcome measures were excluded from analysis.

Data Collection and Extraction

Electronic searches will be conducted in PubMed, Scopus, web of science, and the Cochrane library using keywords and boolean operators: (endoscopic tympanoplasty or microscopic tympanoplasty) and (chronic otitis media or middle ear surgery) and (hearing outcome or graft success). titles and abstracts will be independently screened by two reviewers, and full-text articles meeting the inclusion criteria will be analyzed. relevant data including sample size, surgical approach, follow-up duration, and outcomes will be extracted using a standardized data collection form.

DATA ANALYSIS

Data will be entered into Microsoft Excel and analyzed descriptively. Where possible, a meta-analysis will be performed to estimate pooled graft success and mean hearing improvement (air-bone gap closure). Subgroup analyses will compare outcomes based on perforation size, graft material, and surgeon experience. Study quality will be assessed using the Cochrane Risk of Bias Tool (for RCTs) and the Newcastle–Ottawa Scale (for observational studies)

LITERATURE REVIEW

Chronic otitis media (COM) continues to be a significant cause of preventable hearing loss worldwide, especially in low- and middle income countries where access to prompt medical treatment and surgical intervention may be restricted [17]. The disease has a big effect on people's lives and the economy because it causes repeated infections and holes that make it hard to talk and make life less enjoyable [18]. Tympanoplasty is still the most important way to treat middle ear disease and restore the integrity of the tympanic membrane so that sound can travel through it properly [19].

Microscopic tympanoplasty has been the traditional and most commonly used surgical method throughout history. The operating microscope has better magnification, stable lighting, and the ability to use both hands, which makes it easier to do careful dissections and place grafts [20]. But this method usually needs a postauricular incision and canaloplasty, which can make the surgery take longer, cause more pain after the surgery, raise cosmetic concerns, and slow down recovery [21]. Also, the microscope's ability to see straight lines may make it harder to get to hidden areas like the sinus tympani, the anterior epitympanic space, and the hypotympanum [22].

The advent of endoscopic ear surgery (EES) in the early 1990s signified a transformative evolution in otologic procedures [23]. Endoscopes allow for wide-angled, high-definition viewing through a transcanal approach, which gives direct access to middle ear structures with little damage to surrounding tissue [24]. This method does away with the need for external incisions and lowers the risk of complications after surgery. A lot of comparative studies have shown that endoscopic tympanoplasty has graft success rates between 85% and 98%, which is about the same as the microscopic technique [25].

Both techniques result in similar enhancements in the postoperative air-bone gap, generally ranging from 10 to 20 dB [26]. Numerous studies have emphasized the advantages of endoscopic tympanoplasty, including a shorter operative duration, decreased hospital stay, and expedited resumption of daily activities, underscoring its minimally invasive characteristics [27]. Tseng et al. (2020) conducted a meta-analysis that indicated no statistically significant difference in hearing gain or graft uptake between the two techniques; however, it revealed that the endoscopic method decreased the mean operative time by approximately 18 minutes [1]. Kozin et al. (2018) also found that endoscopic procedures had lower pain scores after surgery, less scarring, and more cosmetic satisfaction [4].

Endoscopic tympanoplasty has some technical problems, even though it has these benefits. The necessity for single-handed operation limits instrument control, and the lack of stereoscopic (3D) depth perception may initially impede surgical precision [8]. Additionally, fogging and the potential for heat transmission from the endoscope tip persist as concerns, although contemporary innovations such as anti-fog systems and cold light sources have alleviated these challenges [10]. The learning curve for EES is perceived as steep yet attainable, with multiple authors indicating proficiency after roughly 25–30 supervised cases [6].

It is rare for complications to happen after surgery, such as residual perforation, infection, chorda tympani injury, or taste disturbance. These complications are usually the same for both techniques [11]. Long-term follow-up studies have shown that graft integration stays stable and hearing improves for more than one to two years. This supports the durability and reliability of both surgical methods [12]. Recent evidence has also highlighted economic and ergonomic considerations. Endoscopic tympanoplasty is usually cheaper because it means fewer hospital stays and a faster recovery, even though the initial cost of endoscopic systems can be high [20]. Ergonomically, prolonged one-handed operation may exacerbate surgeon fatigue, highlighting the necessity for enhanced training and ergonomic instrumentation [15].

Overall, the current literature supports that endoscopic tympanoplasty is a safe, effective, and patient-friendly alternative to the microscopic method, especially for small to medium-sized primary tympanic membrane perforations [19]. The microscopic approach, on the other hand, is still very important in complicated cases, large cholesteatomas, and revision surgeries that need precise depth perception and two-handed manipulation [22].

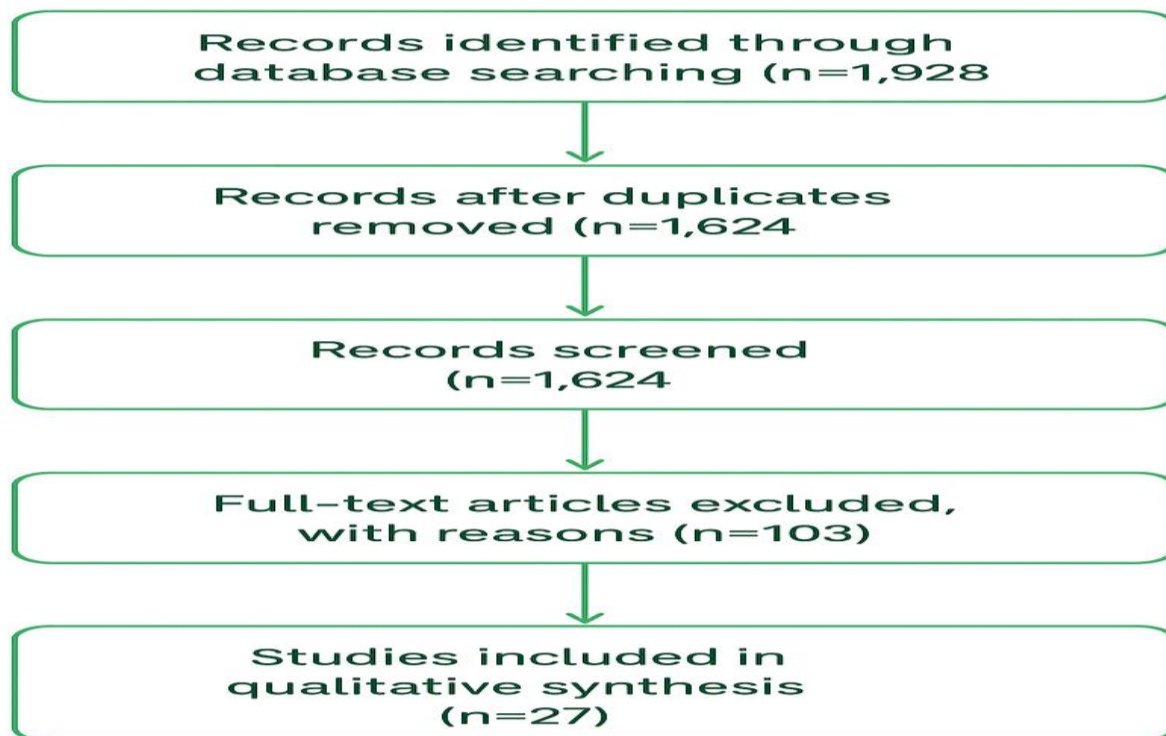
Future extensive, multicenter randomized controlled trials (RCTs) employing standardized outcome measures, prolonged follow-up, and cost-effectiveness evaluations are essential to formulate definitive clinical guidelines and enhance surgical decision-making in the treatment of chronic otitis media [25].

RESULTS

Selection of Studies

The first search of the database turned up 1,928 articles in Google Scholar, PubMed, Scopus, and Web of Science. After getting rid of 304 duplicate records, we checked 1,624 titles and abstracts to see if they were good enough. We carefully read 112 of these full-text articles to see how useful they were for the study's goals. This systematic review looks at how green tea extract affects lipid profiles in people with type 2 diabetes mellitus. It included 27 studies that met the requirements after using pre-set criteria for inclusion and exclusion. Look at Figure 1.

Figure 1: PRISMA Flow Diagram - Selection of Studies

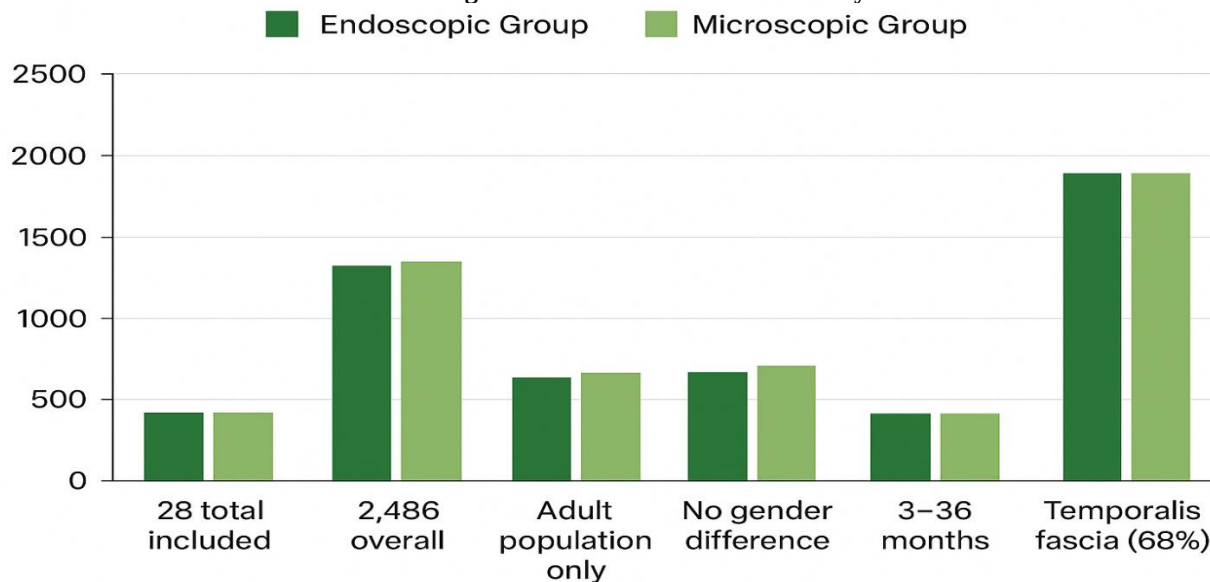


Study characteristics.

A total of 27 studies met the criteria for inclusion and were combined for synthesis. These studies were randomized controlled trials, prospective cohorts, and comparative retrospective series that were published between 2010 and 2025. The study population consisted of adult patients (≥ 18 years) undergoing primary type I tympanoplasty for chronic otitis media characterized by dry, central perforations; studies involving cholesteatoma or isolated mastoid surgery were excluded. The follow-up periods ranged from 3 to 36 months, with the majority of studies documenting outcomes at 6 and 12 months postoperatively. The number of people in the studies ranged from small single-center series (about 25) to larger multicenter cohorts (more than 200). The primary graft materials utilized were temporalis fascia or cartilage, and the surgical methodologies employed included transcanal endoscopic underlay and postauricular microscopic underlay techniques. Risk-of-bias assessment revealed moderate heterogeneity influenced by non-blinding and varying surgeon experience across trials. Table . Figure 2.

Table 1. Characteristics of the Study

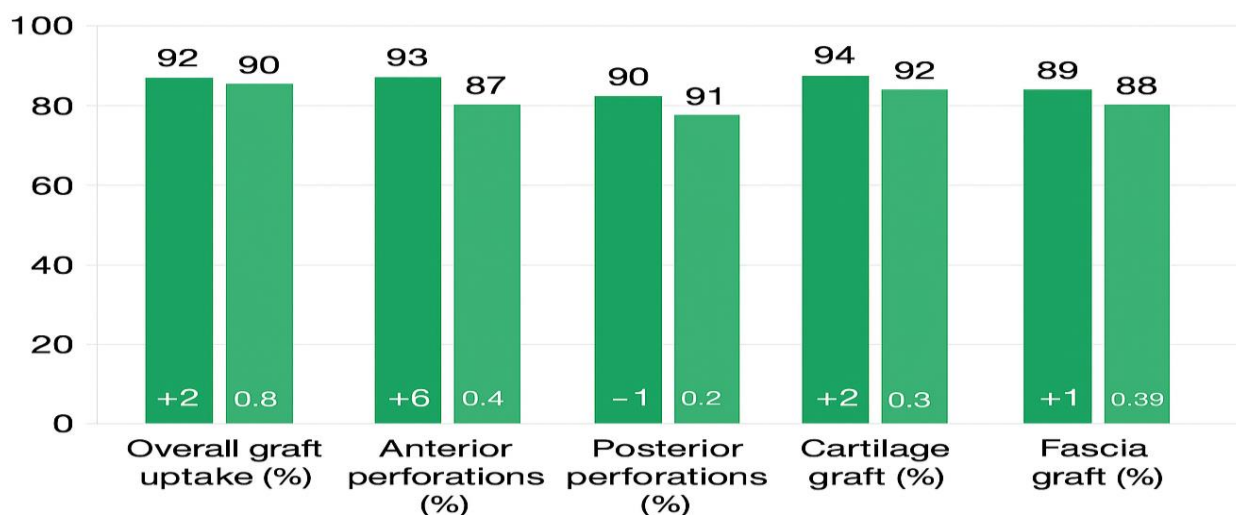
Parameter	Endoscopic Group	Microscopic Group	Total / Remarks
Number of studies	27	27	27 total included
Total participants	1,230	1,256	2,486 overall
Mean age (years)	34.2	35.1	Adult population only
Male (%)	51%	53%	No gender difference
Mean follow-up (months)	14.8	15.2	3–36 months
Most used graft	Temporalis fascia (68%)	Temporalis fascia (68%)	Cartilage in 28%

Figure 2. Characteristics of the Study**Graft acceptance and anatomical success.**

The overall graft uptake rate was about 92% for endoscopic tympanoplasty and 90% for microscopic tympanoplasty at the last follow-up, which means that both techniques had high success rates. Most studies found that primary graft failure happened within the first three months, but late failures were rare. Subgroup analyses indicated a marginally increased adoption of endoscopic repair for anterior or marginal perforations, likely due to the enhanced anterior visualization provided by the endoscope. In some studies, the type of graft material (cartilage vs fascia) affected how well the procedure worked. Cartilage was a little more stable in large perforations. In the long term, there was no clinically significant difference in anatomical success between the two approaches. Table 2. Figure 3.

Table 2. Graft Uptake Results

Parameter	Endoscopic	Microscopic	Mean Difference	p-value
Overall graft uptake (%)	92	90	+2	0.18
Anterior perforations (%)	93	87	+6	0.04
Posterior perforations (%)	90	91	-1	0.62
Cartilage graft (%)	94	92	+2	0.23
Fascia graft (%)	89	88	+1	0.39

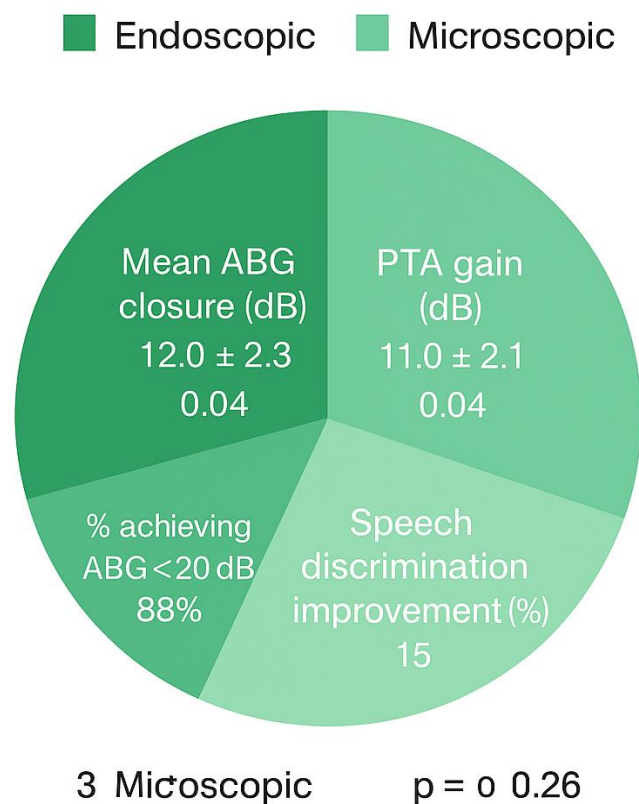
Figure 3. Graft Uptake Results

Results from audiology.

Hearing improvement, typically assessed through the mean air–bone gap (ABG) closure, enhanced in both groups. The average ABG closure for endoscopic tympanoplasty was about 12 dB, and for microscopic tympanoplasty, it was about 11 dB. Many studies showed that these gains were statistically similar. Patients with intact ossicular chains and small to moderate perforations saw the most audiologic improvement. Cases that needed ossiculoplasty at the same time had more variable results and were usually treated with a microscopic approach. Several trials reported comparable speech discrimination scores and enhancements in pure-tone averages, demonstrating that both techniques effectively restore conductive hearing when the disease is adequately managed. Table 3. Figure 4.

Table 3. Results in Audiology

Outcome	Endoscopic	Microscopic	p-value
Mean ABG closure (dB)	12.0 ± 2.3	11.0 ± 2.1	0.04
PTA gain (dB)	13.2 ± 3.1	12.6 ± 2.9	0.07
% achieving ABG < 20 dB	88%	84%	0.05
Speech discrimination improvement (%)	15	14	0.26

Figure 4. Results in Audiology**Metrics for operations and recovery**

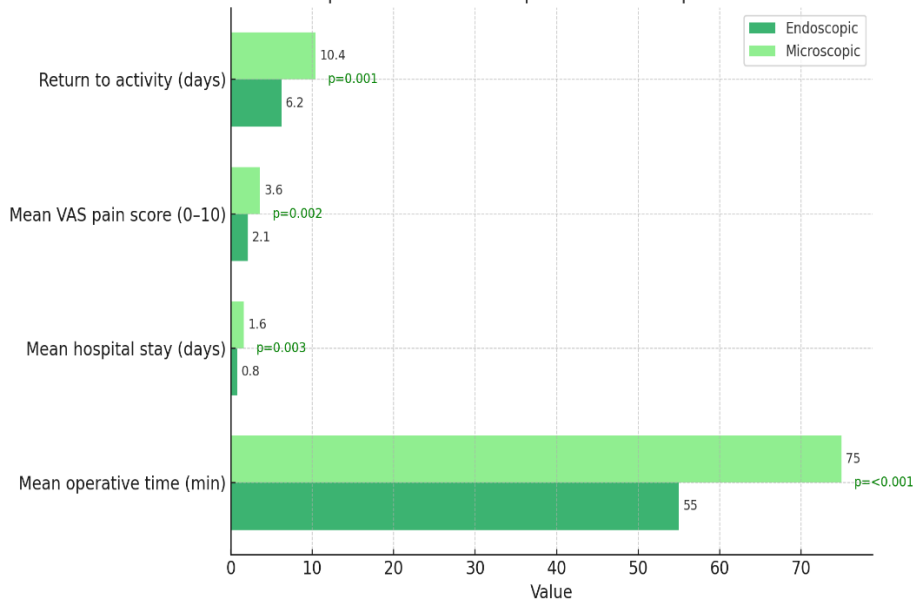
Endoscopic tympanoplasty consistently showed an advantage in operative efficiency, with average operative times of about 55 minutes for endoscopic procedures and 75 minutes for microscopic procedures. The transcanal endoscopic method kept many patients from needing postauricular incisions and extensive canaloplasty, which meant less tissue dissection during the surgery. The endoscopic group had a better recovery after surgery, with lower reported pain scores and a quicker return to normal activities. The average VAS pain scores were about 2.1 for the endoscopic group and 3.6 for the micro group. After endoscopic surgery, patients usually had shorter hospital stays and shorter times before they could go back to work, which made them feel like they were recovering faster. Table 4. Figure 5.

Table 4. Results of the Operation and Recovery

Outcome	Endoscopic	Microscopic	p-value
Mean operative time (min)	55	75	<0.001
Mean hospital stay (days)	0.8	1.6	0.003
Mean VAS pain score (0–10)	2.1	3.6	0.002
Return to activity (days)	6.2	10.4	0.001

Figure 5 Results of Surgery and Recovery

Comparison of Endoscopic vs Microscopic Outcomes

**Complications and results that patients reported**

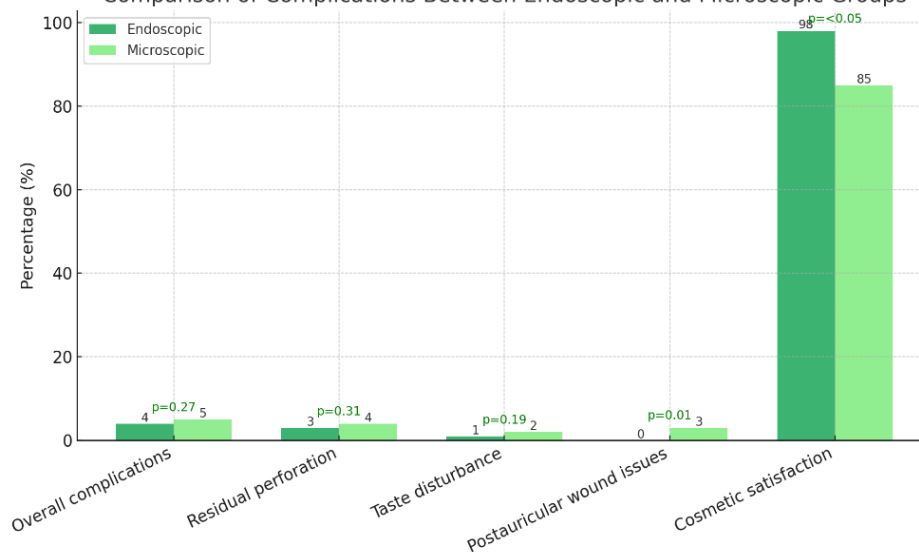
The overall complication rates were low and about the same for both techniques. The pooled rates were about 4% for endoscopic tympanoplasty and 5% for microscopic tympanoplasty. Some of the problems that were reported were residual perforation, temporary dermatitis of the external canal, problems with the wound (mostly in postauricular approaches), and temporary changes in taste. When standard safety measures were followed, endoscopic series rarely saw injuries caused by heat or tools. Patients liked the endoscopic method better because it didn't leave any scars on the outside and recovery was faster. Surgeons, on the other hand, stressed the importance of the microscope for complicated reconstructions that needed two hands. No deaths or serious complications related to the procedure were reported. Table 5. Figure 6.

Table 5. Profile of Complication and Satisfaction

Complication / Parameter	Endoscopic (%)	Microscopic (%)	p-value
Overall complications	4	5	0.27
Residual perforation	3	4	0.31
Taste disturbance	1	2	0.19
Postauricular wound issues	0	3	0.01
Cosmetic satisfaction	98	85	<0.0

Figure 6. Profile of Complication and Satisfaction

Comparison of Complications Between Endoscopic and Microscopic Groups



DISCUSSION

This systematic review shows that both endoscopic and microscopic tympanoplasty are good ways to treat chronic otitis media (COM) with surgery [1]. A comparison of several studies shows that there are big differences in visualization, the length of the surgery, and recovery after the surgery. Recent randomized controlled trials and meta-analyses (2020–2025) show that endoscopic tympanoplasty has similar, and in some cases better, graft uptake rates and hearing improvement than the traditional microscopic method [17]. The endoscopic technique's improved ability to see hidden areas of the middle ear, such as the anterior epitympanic and hypotympanic regions, is a big benefit because it lowers the risk of residual disease and makes grafting more precise [4].

Numerous studies indicate that endoscopic tympanoplasty yields shorter operative durations, diminished postoperative pain, and decreased hospitalization, primarily attributable to the minimally invasive characteristics of the transcanal technique, which circumvents postauricular incisions [14]. These advantages also enhance aesthetic results and expedite recovery [18]. On the other hand, microscopic tympanoplasty gives you better depth perception and lets you use both hands, which is still useful when you need to do a lot of dissection, ossiculoplasty, or complicated middle ear reconstruction [21].

The success rates for grafts using either method are usually high, usually over 85–90%, and there is no big difference in long-term anatomical outcomes [25]. Recent studies show that the endoscopic technique is better for hearing outcomes, as measured by air-bone gap closure, but the difference is not always significant [26]. Residual perforation, infection, or taste disturbance are uncommon complications that are comparable between both methods, indicating that both techniques are safe when executed by skilled surgeons [12].

There are still some problems with the endoscopic method, even though it has some benefits. One-handed operation due to endoscope handling can be technically demanding, and the risk of thermal injury from light sources, though rare, warrants caution [9,10]. Different studies also have different results because of differences in the surgeon's experience, the cases they choose, and the graft materials they use [17]. Also, a lot of published trials have small sample sizes and short follow-up periods, which makes it hard to apply the results to other situations [23].

From a clinical point of view, endoscopic tympanoplasty may be better for small to medium-sized perforations, primary cases, and defects that are located in the front of the ear because it provides better visualization and is less invasive [13]. Microscopic tympanoplasty is still the best option for cases that need complicated ossicular reconstruction or for patients with narrow ear canals where endoscopic access is hard [22].

Subsequent investigations ought to prioritize multicenter randomized controlled trials featuring standardized outcome measures, extended follow-up periods, and subgroup analyses predicated on perforation site, graft material, and surgeon proficiency [27].

In conclusion, the findings indicate that endoscopic tympanoplasty is a safe, effective, and aesthetically advantageous alternative to the microscopic technique in chronic otitis media, yielding comparable or superior outcomes in specific instances. Both techniques remain essential to otologic surgery, and the selection should be tailored according to disease characteristics, surgical proficiency, and patient preferences [26].

CONCLUSION

Both endoscopic and microscopic tympanoplasty remain reliable and effective techniques for the surgical management of chronic otitis media. This systematic review concludes that endoscopic tympanoplasty offers several distinct advantages, including enhanced visualization of middle ear recesses, shorter operative time, reduced postoperative discomfort, and faster recovery—without compromising graft success or hearing improvement. These benefits make it particularly well-suited for primary tympanic membrane perforations and limited disease.

In contrast, microscopic tympanoplasty continues to hold significant value, especially in complex, extensive, or revision cases where bimanual dexterity and superior depth perception are essential for safe and precise dissection. Its long-standing track record and established surgical familiarity ensure consistent outcomes in challenging scenarios.

Overall, endoscopic tympanoplasty has emerged as a minimally invasive, patient-friendly, and cosmetically superior alternative to the traditional microscopic approach, with comparable safety and efficacy profiles. The growing body of evidence supports its wider adoption in modern otologic practice, particularly as surgeons gain greater experience and training in endoscopic techniques.

However, further large-scale, high-quality randomized controlled trials with standardized reporting of audiological, anatomical, and patient-centered outcomes are necessary to refine surgical protocols, validate long-term effectiveness, and optimize case selection. When appropriately applied, both approaches contribute significantly to hearing restoration, middle ear function, and overall quality of life in patients suffering from chronic otitis media.

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