# Comparing Local vs General Anesthesia in Stapes Surgery: A Systematic Review and Meta-Analysis

Peter Benjamin BS[1], David Ayob BS[1], John Sawires BA[2], Peter Mahany BS[1], Bishoy Benjamin BS[3], Peter Attia BS[1], Yu-Lan Mary Ying[1,4]

[1]Rutgers New Jersey Medical School, Newark, NJ
[2]Lake Erie College of Osteopathic Medicine, Elmira, NY
[3]Lake Erie College of Osteopathic Medicine, Bradenton, FL
[4]Department of Otolaryngology, Rutgers New Jersey Medical School, Newark, NJ

## Abstract

**Introduction:** Stapes surgery is currently performed under local or general anesthesia with no clear evidence suggesting superiority of either method. This study aims to provide an updated review on the differences in stapes surgery outcomes between the two modalities.

**Methods:** This is a PRISMA-guided systematic review and meta-analysis of comparative studies which was searched from database inception to September 8, 2025 in PubMed, Embase, and CINAHL included patients undergoing stapes surgery, comparing anesthetic technique (local (LA) vs general (GA)). Risk of bias (RoB) was assessed with ROBINS-I. Outcomes were air–bone gap (ABG) measures, surgical success (postoperative ABG ≤10 dB), and complications such as sensorineural hearing loss, vertigo, and dead ear, with pooled analysis and heterogeneity ($I^2$).

**Results:** Of 93 studies, 7 met inclusion criteria; 6 (4 serious RoB; 2 moderate RoB) provided extractable comparative data and were included in quantitative synthesis. Across outcomes, 1,085 ears were analyzed (489 LA [45.1%], 596 GA [54.9%]). Five studies found no significant differences between LA and GA for postoperative ABG (MD 0.22 dB [95% CI −1.08 to 1.52]; P = 0.74; $I^2$ = 30%) or change in ABG (MD 0.31 dB [95% CI −1.32 to 1.95]; P = 0.71; $I^2$ = 0%). Three studies showed no significant difference in surgical success (RR 1.02 [95% CI 0.91–1.13]; P = 0.77; $I^2$ = 0%). In terms of complications between LA and GA, 4 studies found no difference in vertigo (RR 1.24 [95% CI 0.61–2.55]; P = 0.55; $I^2$ = 0%) and 3 studies found no difference in developing sensorineural hearing loss (RR 1.31 [95% CI 0.39–4.38]; P = 0.66; $I^2$ = 0%). Similarly, 2 studies found no significant differences in rate of dead ear (RR 0.52 [95% CI 0.07–3.93]; P = 0.53; $I^2$ = 0%).

**Conclusion**: The choice between local and general anesthesia for stapes surgery still rests on evidence weakened by a serious risk of bias. Yet the signal is consistent: across hearing outcomes, surgical success, and every major complication, LA and GA perform similarly. Rather than crowning one technique, the data liberate the surgeon, allowing anesthetic choice to be driven by patient factors, operative context, and preference, not by any illusion of superiority.

## Introduction

- Otosclerosis is a disorder of abnormal bone remodeling of the otic capsule that can cause stapes fixation and ultimately conductive hearing loss.
- Outcomes following stapes surgery are primarily evaluated through the postoperative air–bone gap (ABG), with closure of the ABG to ≤10 dB commonly considered surgical success.
- Stapes surgery may be performed under either local anesthesia (LA) or general anesthesia (GA), and the choice depends heavily on surgeon experience and preference, patient preference, and patient comorbidities.
- Wegner et al. (2013) reported an increased risk of immediate dead ear with GA, but this signal arose from a single contributing study.[1]
- More recently, Bahrami et al. (2025) found no significant differences in audiometric outcomes or overall complications; however, uncertainty persists regarding specific postoperative complications and the overall certainty of the evidence.[2]
- We aimed to compare audiometric outcomes and specific postoperative complications following primary stapes surgery under LA versus GA.

## Study Design

### Search Strategy

This systematic review was conducted in accordance with the PRISMA 2020 guidelines.[3] A comprehensive literature search was performed using PubMed, Embase, and CINAHL Complete from inception through September 8, 2025. Studies were excluded if they involved pediatric patients, revision stapes surgery, or stapes surgery performed for indications other than otosclerosis. Risk of bias was assessed using the ROBINS-I tool, and the certainty of evidence using the GRADE framework.[4,5]

### Statistical Methods

Dichotomous outcomes were pooled as risk ratios (RRs) and continuous hearing outcomes as mean differences (MDs), with 95% confidence intervals (CIs). Between-study heterogeneity was assessed using the $I^2$ statistic. Random-effects models were used. Leave-one-out sensitivity analyses were performed across all outcomes. All statistical analyses were conducted using Review Manager (RevMan).

## Discussion

Across six comparative cohort studies, the choice between local and general anesthesia did not influence any measured outcome of stapes surgery. Both approaches produced substantial and comparable hearing improvement, and the small differences observed fell well below any threshold of audiologic relevance. Surgical success was similar between techniques, as was every complication assessed, including sensorineural hearing loss, postoperative vertigo, and dead ear. These findings were consistent across studies and stable to leave-one-out testing, indicating that no individual dataset drove the overall pattern.

Two findings deserve particular emphasis. First, the intraoperative feedback long assumed to make awake local anesthesia safer did not translate into fewer vestibular complications, weakening a central physiologic argument for preferring local anesthesia. Second, the increased risk of dead ear under general anesthesia reported in earlier work did not persist as the evidence base expanded, suggesting that the original signal reflected the limitations of sparse early data. The most important lesson, however, is methodological: more than a decade of additional research has increased the quantity of evidence without improving its quality. Every included study was non-randomized and vulnerable to confounding by indication, since the anesthetic chosen is often dictated by the very patient factors that shape outcomes. The consistency of these results is reassuring, but consistency drawn from low-certainty observational data cannot substitute for a properly controlled comparison.

## Conclusion

- Neither technique demonstrated superiority in hearing outcomes, surgical success, or complications, and this pattern held throughout sensitivity testing.
- The absence of a detectable difference is not the same as proven equivalence. Non-randomized designs, confounding by indication, and rare complication events leave open the possibility of a true difference the current evidence is not equipped to detect.
- Anesthetic selection can reasonably be guided by surgeon experience, patient preference, and comorbidity, rather than by any expectation that one technique yields better results.
- A randomized or rigorously adjusted trial remains the necessary next step to convert a consistent but low-certainty signal into a confident recommendation.

## Results

| Outcomes | No. of ears (studies) | Certainty of evidence (GRADE) | Relative effect (95% CI) | Anticipated Absolute Effects | |
|---|---|---|---|---|---|
| | | | | Risk with GA | Absolute effect with LA |
| **Postoperative ABG** | 817 (5 studies) | ⨁⨁◯◯ **Low** | — | — | **MD 0.22 dB higher** (1.08 lower to 1.52 higher) |
| **Change in ABG** | 817 (5 studies) | ⨁⨁◯◯ **Low** | — | — | **MD 0.31 dB higher** (1.32 lower to 1.95 higher) |
| **Surgical success, ABG ≤10 dB** | 209 (3 studies) | ⨁◯◯◯ **Very low** | RR 1.02 (0.91–1.13) | **824 per 1000** | **16 more per 1000** (74 fewer to 107 more) |
| **Postoperative hearing loss** | 761 (3 studies) | ⨁◯◯◯ **Very low** | RR 1.31 (0.39–4.38) | **12 per 1000** | **4 more per 1000** (7 fewer to 40 more) |
| **Early/transient postoperative vertigo** | 477 (4 studies) | ⨁⨁◯◯ **Low** | RR 1.24 (0.61–2.55) | **61 per 1000** | **15 more per 1000** (24 fewer to 94 more) |
| **Dead ear** | 848 (2 studies) | ⨁◯◯◯ **Very low** | RR 0.52 (0.07–3.93) | **8 per 1000** | **4 fewer per 1000** (8 fewer to 25 more) |

**Figure 1a**. Certainty of Evidence Grade Analysis

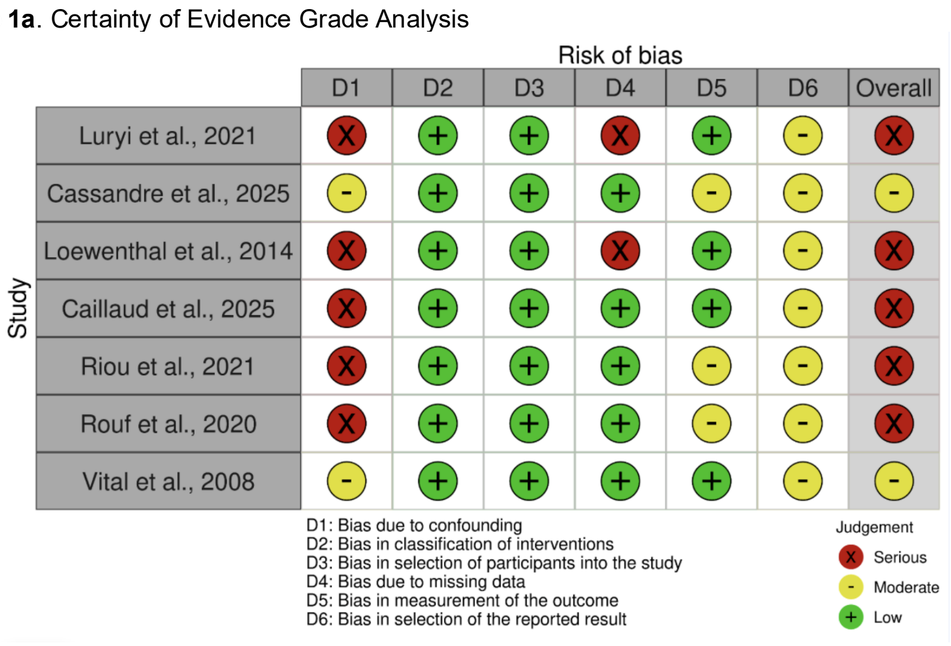



**Figure 1b**. Risk of Bias Analysis (RoB)

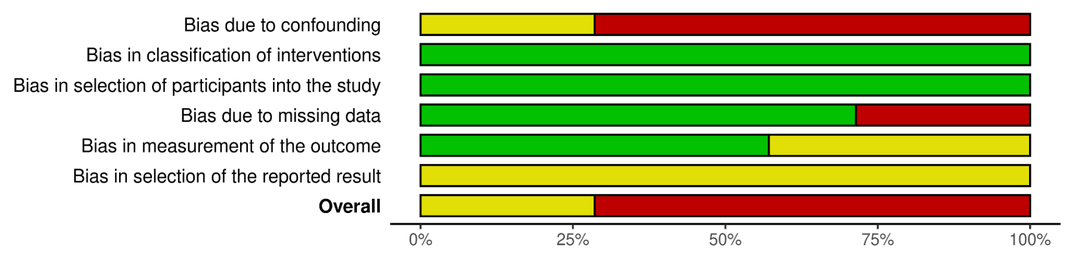



**Figure 1c**. RoB Analysis by Domain

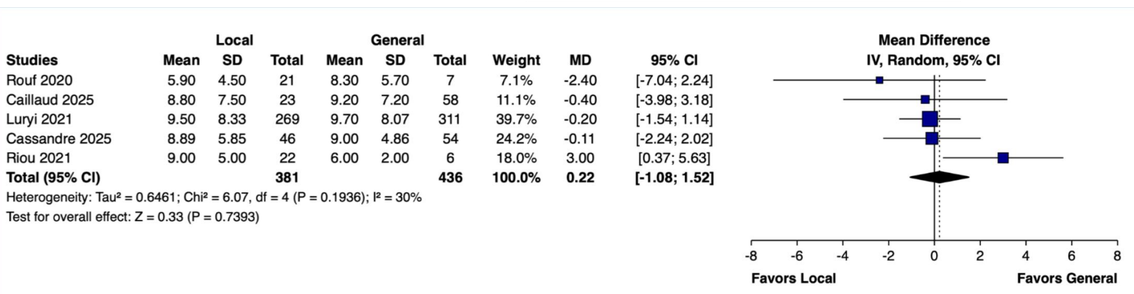



**Figure 2a**. Post-operative Air-bone gap (ABG)

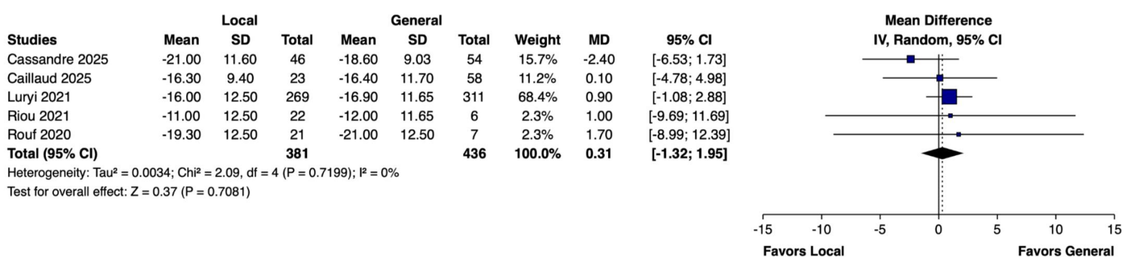



**Figure 2b**. Change in Air-bone gap (pre-operative to post-operative)

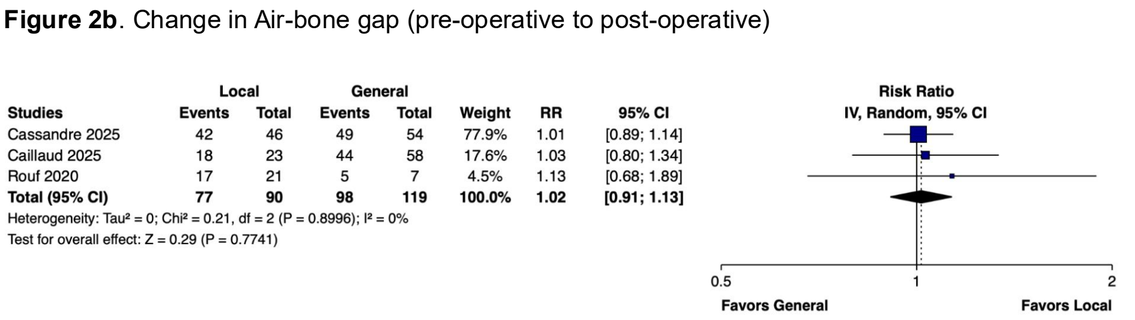



**Figure 3.** Surgical Success (characterized by Air-bone gap ≤ 10 dB)

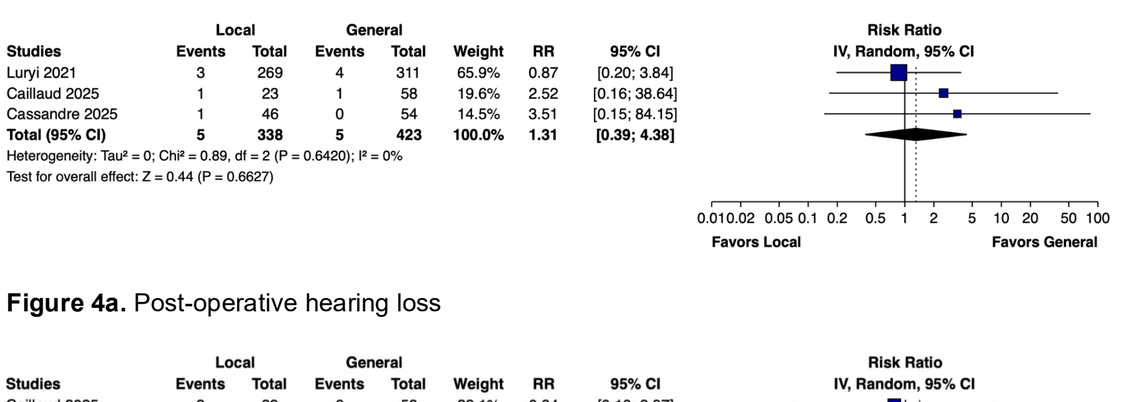



**Figure 4a.** Post-operative hearing loss

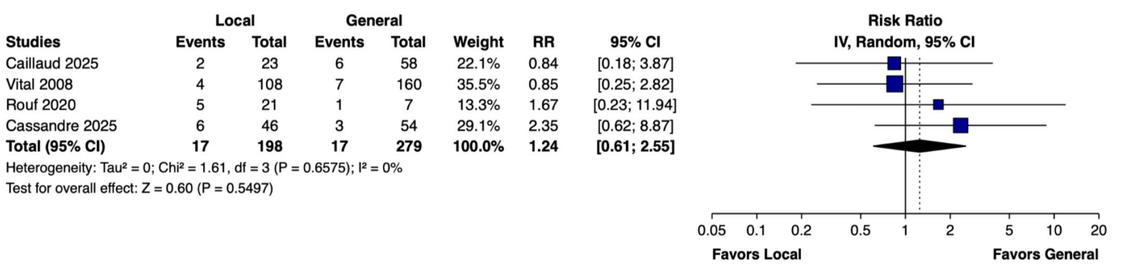



**Figure 4b.** Post-operative Vertigo

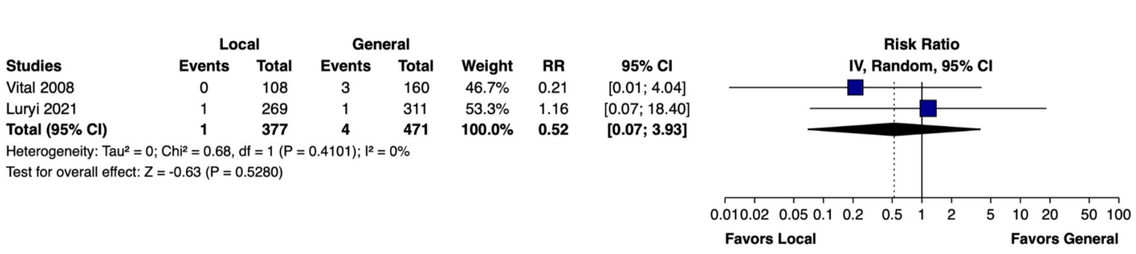



**Figure 4c.** Post-operative Dead Ear

## Contact

Peter Benjamin, B.S.
Rutgers New Jersey Medical School
pb732@njms.rutgers.edu

## References

1. Wegner I, Bittermann AJ, Zinsmeester MM, van der Heijden GJ, Grolman W. Local versus general anesthesia in stapes surgery for otosclerosis: a systematic review of the evidence. Otolaryngol Head Neck Surg. 2013;149(3):360-365. doi:10.1177/0194599813493393
2. Bahrami M, Bayat R, Akbari A, Alipour M, Afzalzadeh M, Samieirad S. General versus local anesthesia in stapes surgery for otosclerosis: systematic review and meta-analysis. Laryngoscope. 2026;136(4):1588-1600. doi:10.1002/lary.70211
3. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. doi:10.1136/bmj.n71
4. Sterne JA, Hernán MA, Reeves BC, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ. 2016;355:i4919. doi:10.1136/bmj.i4919
5. Guyatt GH, Oxman AD, Vist GE, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. BMJ. 2008;336(7650):924-926. doi:10.1136/bmj.39489.470347.AD