



Evaluation of Transtympanic Membrane (TTM) Steroid Therapy for Sudden Sensorineural Hearing Loss (SNHL) Treatment

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Abstract

Objective: Transtympanic membrane (TTM) and intratympanic membrane (ITM) steroid injections help recovery of sensorineural hearing loss (SNHL) treatment. Distribution of TTM steroid dosage and patient recovery rates is underexplored. Our systematic review compiles TTM steroid regimens and their hearing recovery rates.

Databases Reviewed: PubMed, OVID, and Google Scholar.

Methods: Search terms included TTM steroid, ITM steroid, and SNHL. Inclusion criteria were measurements for human hearing recovery and full-text articles. Exclusion criteria included reviews and case reports. Primary outcomes were hearing and patient recovery rates.

Results: 29 articles met final inclusion criteria. The gender distribution was 53% male and 47% female. Of the 976 patients receiving TTM steroids, patients received 4, 5, 8, 10, and 24 mg/mL dexamethasone as well as 40, 62.5, and 125 mg/mL methylprednisolone. Hearing recovery ranged from 6.4-41 decibels (dB).

Conclusion: Our study does not support evidence that higher dosages are associated with higher hearing recovery. Variability exists in regimen and outcomes. Our study is a framework for researchers and clinicians to understand TTM dosages and regimens used to date.

Introduction

- Sudden SNHL affects 5-20 per 100,000 people per year
- TTM and ITM steroid injections are common treatments for sudden SNHL
- Dexamethasone (dosage can range from 4-25 mg/mL) and methylprednisolone (40-125 mg/mL) are common steroids that are used for tympanic steroid treatments that can help recovery for sudden SNHL
- The distribution of TTM injection dosage and accompanying patient recovery rates remains underexplored
- There lacks a systematic review that compares various TTM dosages and regimens and their association with hearing recovery

Objective:

- To compile various TTM steroid regimens and their associated hearing recovery rates

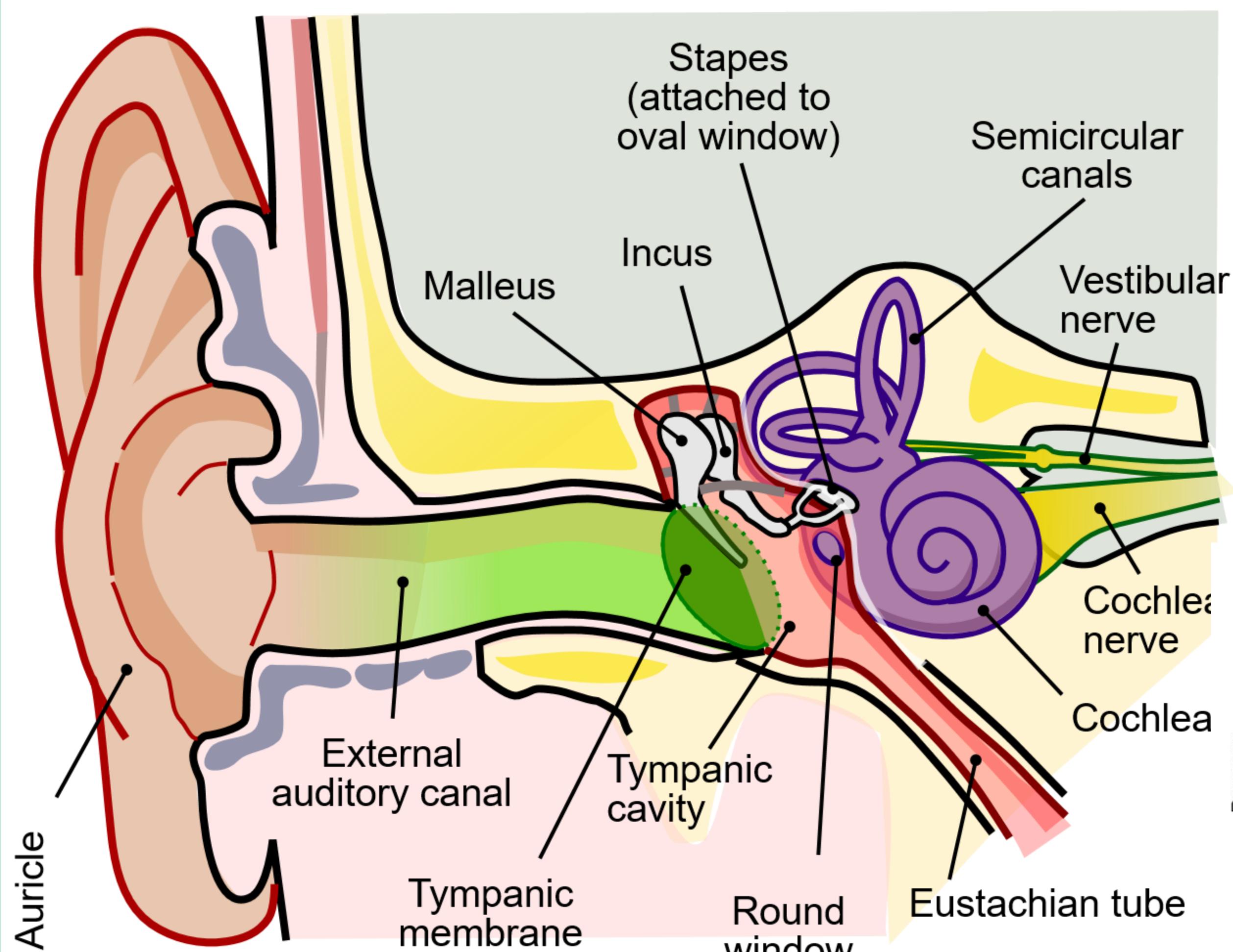


Figure 1: Credit ("Ear Anatomy" by National Institute on Deafness and Other Communication Disorders (NIDCD) is licensed under CC BY 2.0.)

Methods and Materials

- Systematic review was conducted using OVID, Google Scholar, and PubMed; Search Terms: "sensorineural hearing loss" AND "transtympanic steroid injection" OR "intratympanic steroid injection."
- Exclusion: Review articles, case reports, articles that contained two dosages, duplicate articles, and articles on tinnitus and/or Meniere's disease
- Inclusion: Measurements for human hearing recovery and full-text articles
- Primary outcomes: hearing recovery rates (in decibels (dB)).
- Other variables: steroid type and dosage, age, gender, simultaneous non-TTM systemic steroids, and comorbidities.
- Steroid doses were categorized into three groups: (Group A: <40 mg, Group B: 40-70 mg, Group C: >70 mg)
- Kruskal-Wallis test was used to compare hearing recovery across groups (non-normal distribution assumption)
- Analysis repeated for a subset of studies using systemic steroids + TTM injections

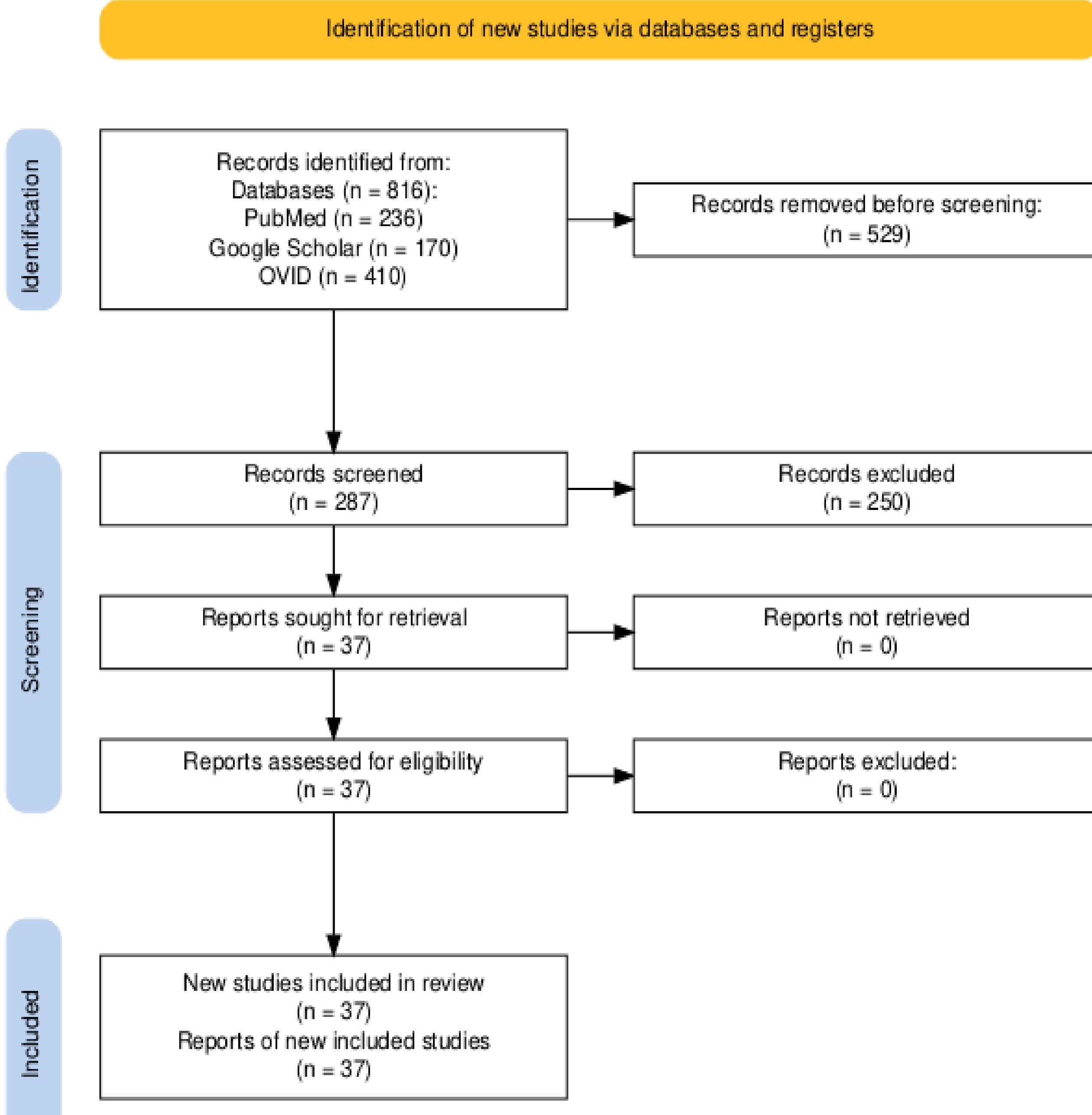


Figure 2. PRISMA filtering pipeline for systematic review

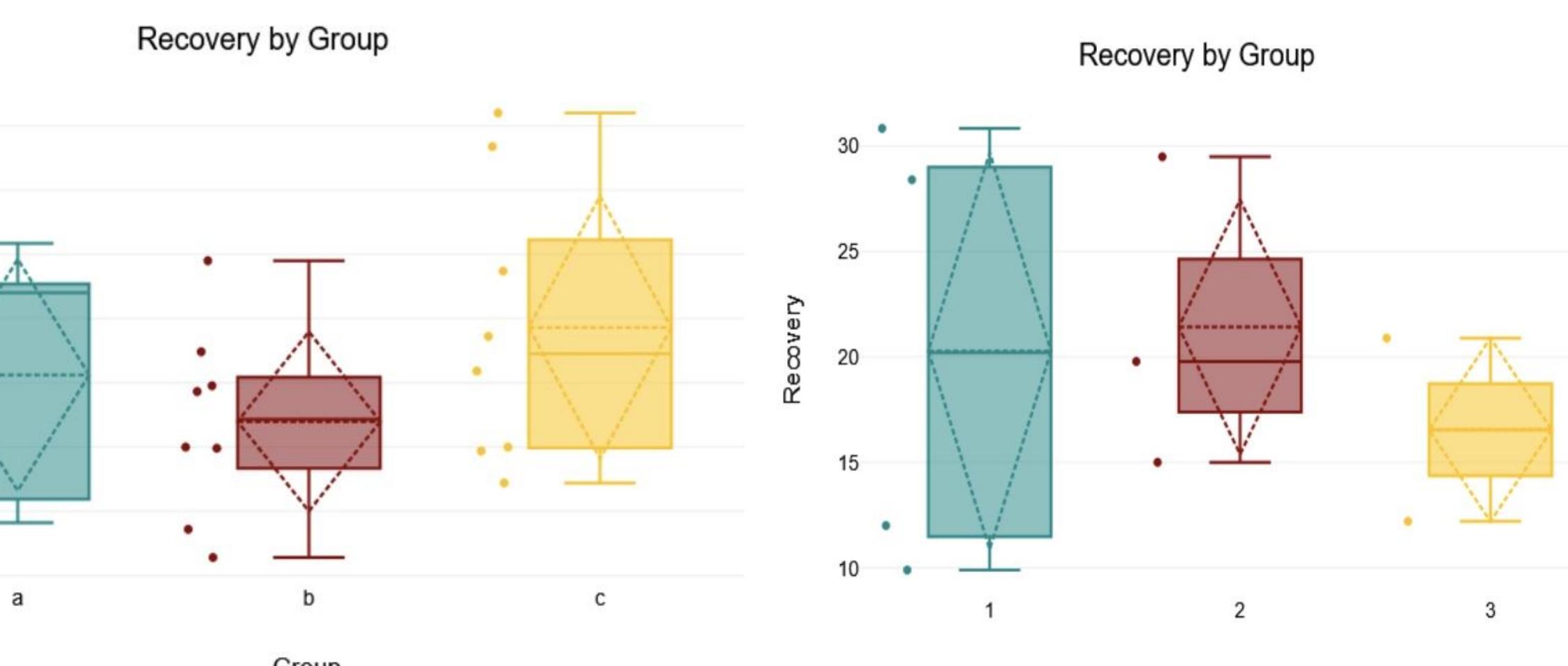


Figure 3: Visual Representation of Statistical Analysis for Level of Steroid Dosage Across All Studies (Left) and Combined Regimen Intensity (Right)

Results

- Gender distribution: 53% male and 47% female.
- 976 patients received TTM steroids
- Of the 29 studies reviewed, 23 studies reported hearing recovery in decibels, which ranged from 6.4-41 decibels (dB).
- For the statistical analysis, we found that there were no significant differences in hearing recovery across groups ($\chi^2(2) = 1.86$, $p = 0.394$). Our post hoc Dunn-Bonferroni test also yielded no significant differences pairwise even after performing a correction ($p \geq 0.51$). We also observed no significant difference amongst groups in the combination therapy analysis when comparing across intensity (in terms of dosage strength) across groups ($\chi^2(2) = 0.28$, $p = 0.87$). Our post hoc Dunn-Bonferroni test for this analysis also yielded no significant differences pairwise even after performing a correction ($p \geq 0.64$)

Discussion and Conclusion

- Wide variability exists in treatment regimen and dosage of tympanic steroid, with a wide variety of patient outcomes reported and hearing recovery rates reported
- We summarized the existing treatment regimens that researchers and clinicians have used to date
- Significant differences across dosage strength were not observed
- Our most common dosage was 4-5 mg/mL dexamethasone, and the range of hearing recovery in those treated with dexamethasone ranged from 11-41 dB recovery
- Single-dose TTM and regimens with ITM and systemic administration both showed wide variability within hearing recovery

Table 1: Summary of Dosage, Hearing Recovery, and Patient Recovery

Type & Dosage of Steroid	Hearing Recovery (Mean dB)	Patient Recovery (% PTA Improvement)
4 mg/mL Dexamethasone (n=347)	9.9–41 dB	37%–100% (≥ 10 dB, ≥ 15 dB, ≥ 30 dB depending on study criteria)
5 mg/mL Dexamethasone (n=208)	8.6–30.84 dB	34.8%–79.4% (≥ 10 dB, ≥ 15 dB, ≥ 16 dB depending on study criteria)
8 mg/mL Dexamethasone (n=35)	20.9 dB	48.60% (depending on study criteria)
10 mg/mL Dexamethasone (n=45)	12.2 dB	-
24 mg/mL Dexamethasone (n=40)	15 dB	37.5% (≥ 20 dB PTA or SDS improvement)
40 mg/mL Methylprednisolone (n=145)	14.68–28.7 dB	46%–73% depending on criteria (≥ 15 dB or ≥ 18 dB PTA decrease)
62.5 mg/mL Methylprednisolone (n=34)	38.4 dB	77% (≥ 10 dB PTA decrease)
125 mg/mL Methylprednisolone (n=67)	6.4 dB	66% (any improvement in PTA)

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