Hear, Hear—Differential Hearing Outcomes After Wait-and-scan Verses Up-front Stereotactic Radiosurgery for Initial Management of Sporadic Vestibular Schwannoma: A Systematic Review and Meta Analysis

MacGregor C Thomas, BS[1], Matthew Burris BS[1], Tyler Gunter MD[2], Ozer Algan MD[2], Alexander G Bien[3], Ian F Dunn MD[4], Christopher S Graffeo MD MS[4]
[1]The University of Oklahoma Health Sciences Center, Oklahoma City, OK; Department of Radiation Oncology, University of Oklahoma, Oklahoma City, OK
[3]Department of Otolaryngology, University of Oklahoma, Oklahoma City, OK; [4]Department of Neurosurgery, University of Oklahoma, Oklahoma City, OK

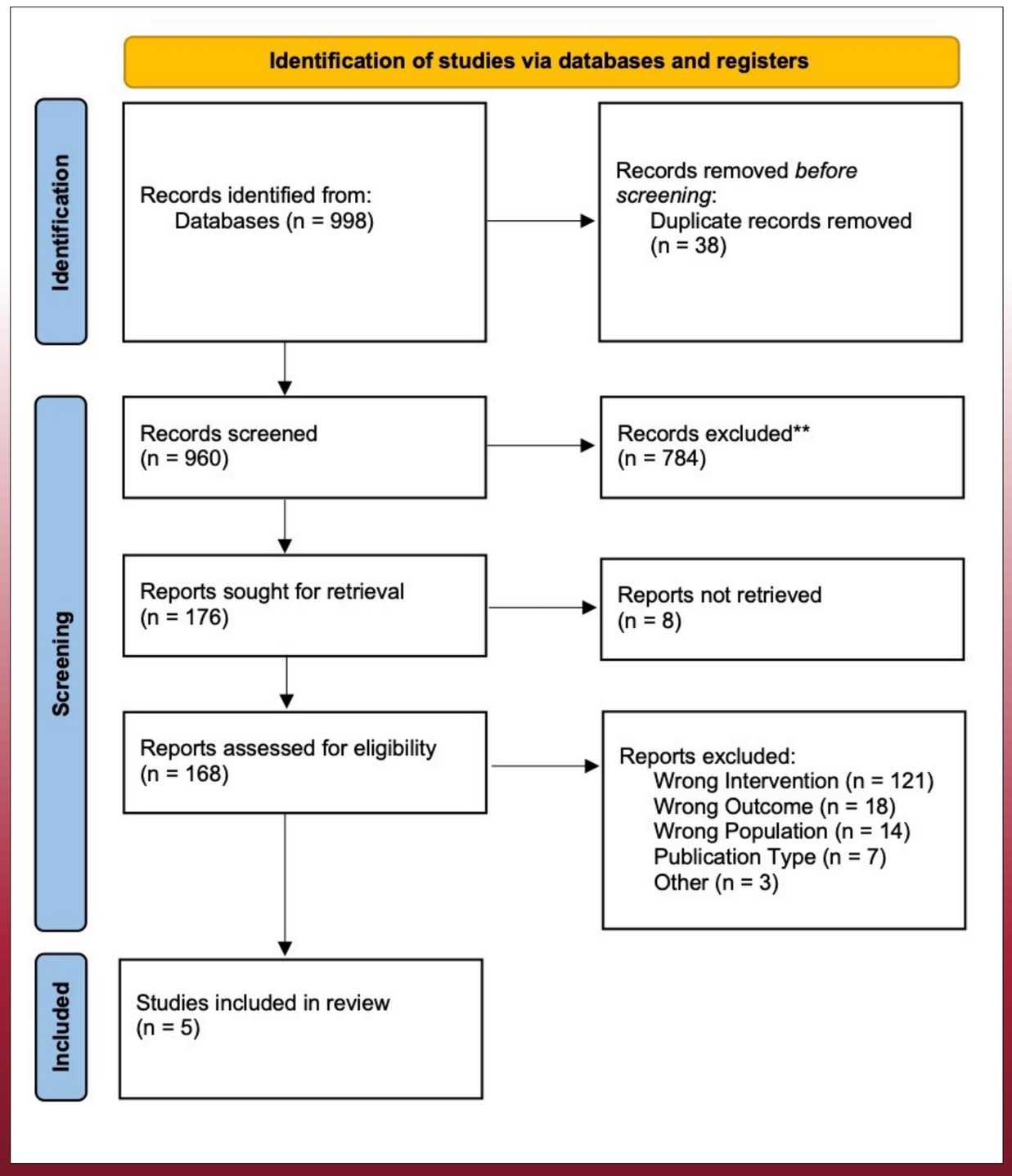
Background

Stereotactic radiosurgery (SRS) is a safe and highly effective primary treatment for small-to-medium vestibular schwannomas (VS). Optimal treatment timing for maximal hearing preservation remains controversial, with some studies advocating early treatment to minimize the risk of hearing loss from tumor growth, while others have indicated that the negative impact of irradiation on cochlear function is the more significant driver of hearing loss.

METHODS

A PRISMA-compliant systematic review and meta-analysis was performed by searching OVID Medline, Embase Classic + Embase, Cochrane Central Register of Controlled Trials, and Cochrane Database of Systematic Reviews during the sampling frame 2000-2024. Studies reporting hearing outcomes in a comparative analysis of wait-and-scan versus primary up-front SRS were included. Five studies met criteria. Hazard ratios (HRs) and/or odds ratios (ORs) for hearing preservation were pooled using meta-analysis of proportions with random effects modeling.

Figure 1. PRISMA 2020 flowchart



RESULTS

Only two studies reported HRs for hearing preservation as a function of watch-and-wait as compared to up-front SRS for initial VS management among patients with intact baseline hearing (Milner, HR=0.37 [95%CI=0.11-1.25]; Akpinar, HR=0.58 [95%CI=0.41-0.82]). The pooled HR for hearing preservation after up-front SRS as compared to watch-and-wait was **0.56** (95%CI=0.40-0.78), without significant heterogeneity (I^2=0). Three additional studies reported ORs rather than HRs (Tveiten, OR=3.33 [95%CI=2.25-4.93]; Dhayalan, OR=0.75 [95%CI=0.34-1.68]; Schnurman, OR=0.52 [95%CI=0.09-2.96]). HRs were converted to ORs, and the overall combined odds of preserved hearing at a median interval of 62.76 months after SRS was **0.86** (95%CI=0.28-2.62), as compared to watch-and-wait strategies. Heterogeneity between included studies was high (I^2 = 91). Z-scoring was used as a sensitivity analysis to test between the pooling strategies, without a significant difference detected (p=0.471).

Figure 2. Results of pooled hazard ratios

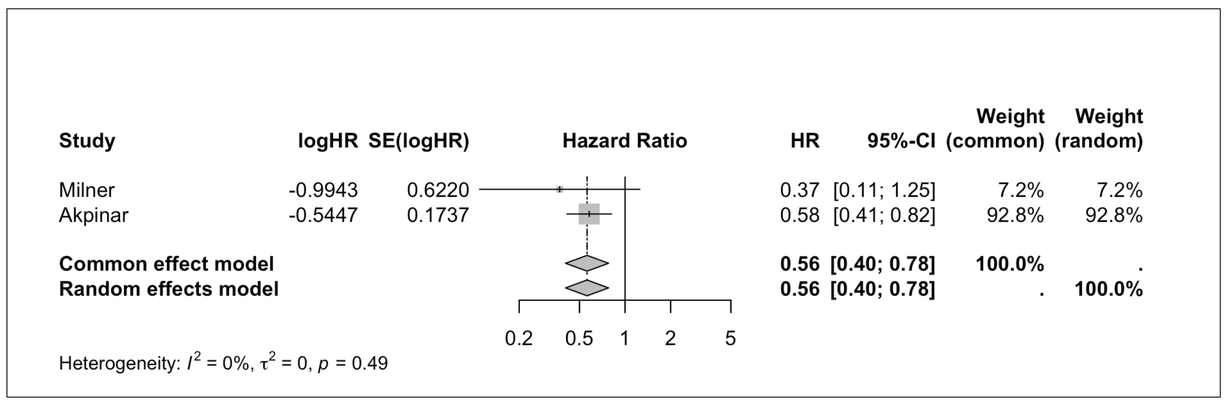
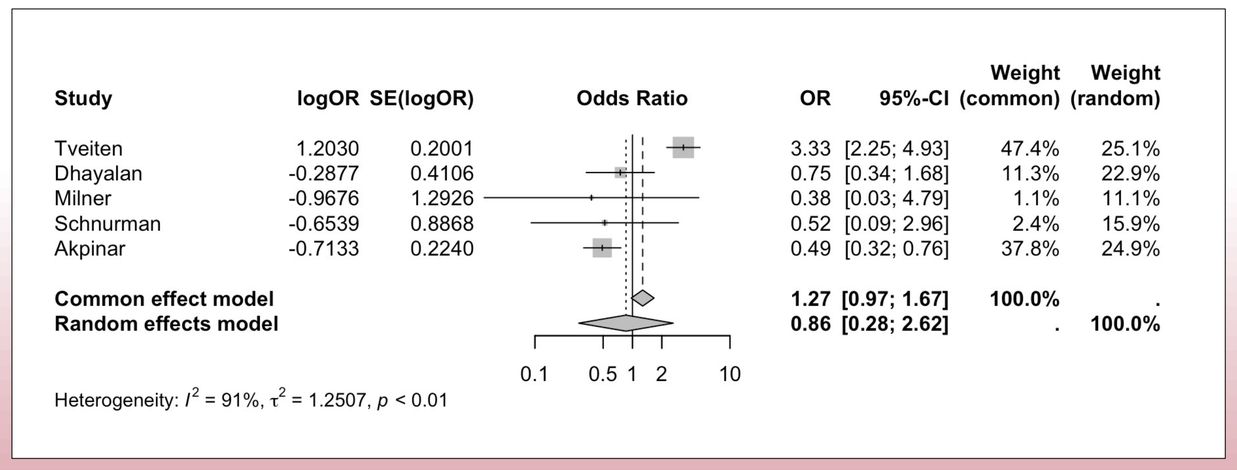


Figure 3. Results of pooled odds ratios



CONCLUSION

Data regarding hearing outcomes after SRS versus watch-and-wait for initial management of VS in patients with intact hearing are heterogeneous, uncertain, and likely influenced by publication bias and other sources of systematic error. Preliminary interpretation of the current study results suggests that hearing preservation may be advantaged by up-front irradiation, as evidenced by significant HR findings. However, the OR analysis indicates a non-significant benefit for the watch-and-wait approach. The conversion of HRs to ORs inherently sacrifices robustness and leaves the results vulnerable to error by losing time-to-event analysis, and the high variability in ORs may further cast doubt on these findings. Further study is required to reconcile and validate these findings, ideally in a randomized, multicenter, longitudinally followed cohort.

Contact
MacGregor C Thomas, BS
Department of Neurosurgery
University of Oklahoma Health Sciences Center
macgregor-thomas@ouhsc.edu

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