

# CyberKnife Stereotactic Radiosurgery for Vestibular Schwannoma: Meta-Analysis of Long-Term Tumor Control and Hearing Preservation Outcomes

Nolan J. Brown, Julian Gendreau

## INTRODUCTION

Though there is a significant body of research on Gamma Knife radiosurgery in the literature, there are actually more CyberKnife (CKRS) systems in the United States.

## METHODS

We queried three scholarly databases according to PRISMA guidelines to identify all primary studies:

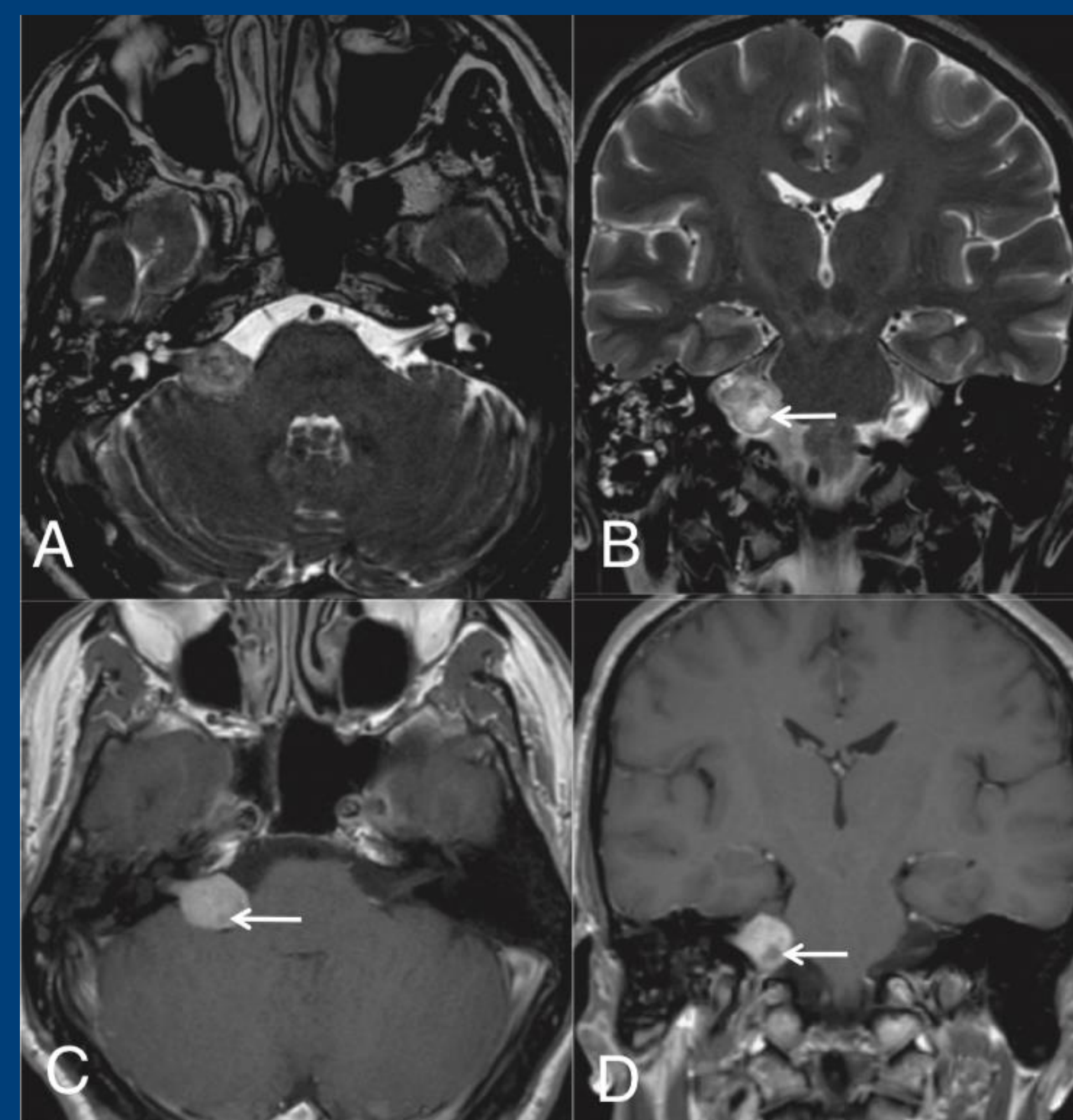
- Reporting local tumor control rates AND
- Reporting hearing preservation rates following CKRS for VS.

## RESULTS

- Fifteen (n=15) studies (7 prospective, 8 retrospective) were included.
- Study periods: 1998-2018
- **2,018 total VS patients** (mean age: 60.2 years, 52% female)
- 309 had undergone prior surgery or radiosurgery

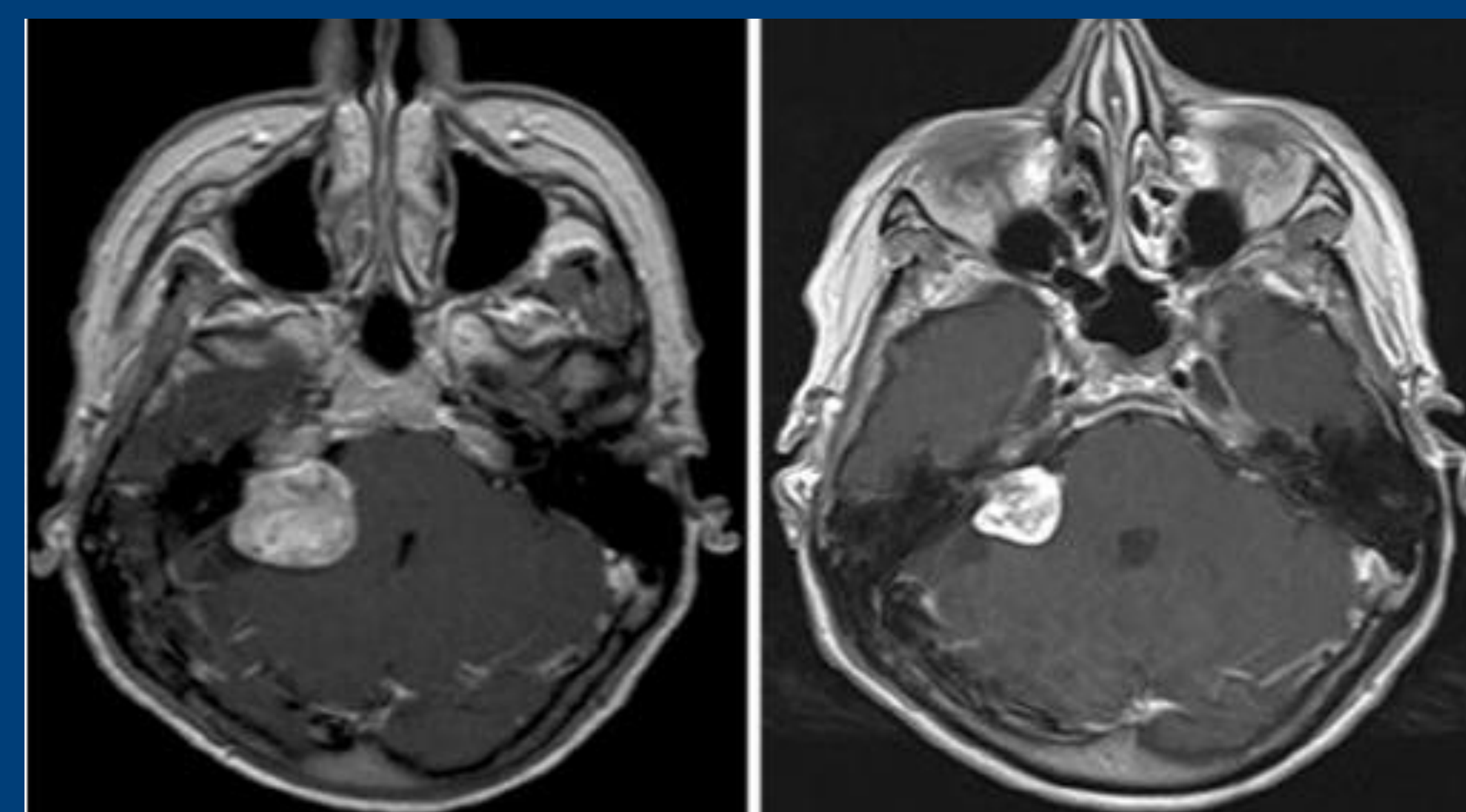
Grades	Pure Tone Audiogram (dB)	Speech Discrimination (%)
I	0-30	70-100
II	31-50	50-69
III	51-90	5-49
IV	91-max	1-4
V	Not testable	0

- **Tumor Control:** defined as either tumor regression or arrest of tumor growth by final follow-up.
- **Hearing Preservation:** defined using one of two systems
  - Gardner-Robertson: serviceable hearing defined as grade I/II, non-serviceable hearing defined as grade III/IV
  - Otolaryngology-Head and Neck Surgery (AAO-HNS) system: class A/B defined as serviceable hearing, non-serviceable hearing defined as class C/D



**Intracanalicular and cisternal VS.** Axial 3D heavily T2-weighted sequence (A) shows a VS expanding from the internal porus acusticus into the cerebellopontine-angle cistern. Coronal T2-weighted image (B) depicts slight mass effect on middle cerebellar peduncle. Cystic degenerative changes seen on T2 are well evident on axial (C) and coronal (D) T1-weighted images after gadolinium (arrows).

**Successful tumor control with notable regression of lesion at 8-year follow-up.** Magnetic resonance imaging obtained in a 59-year-old patient prior to CyberKnife radiosurgery, administered over 4 sessions with biologically effective dose of 52 Gy (left), and at 8-year follow-up.



## RESULTS

- Mean follow-up: **40 months**
- Dosing paradigms varied across studies; no identifiable trends in total dose, marginal dose, or fractionation schema.
- Marginal dose range: 1.90 – 25.78 Gy
- Administered over range of 1-5 fractions
- Pre-2014 dose/fraction regimens similar to post-2014 regimens
- Isodense lines reported in 13/15 studies, range: 55%-95%

To identify potentially significant longitudinal trends, split study cohort into pre- and post-2014 subsets.

- Tumor control: no significant difference between pre- and post-2014 cohorts. (0.96, 95% CI 0.94-0.99) and (0.96, 95% CI 0.95-0.98).
- Hearing preservation: no significant difference between pre- and post-2014 cohorts. (0.82, 95%CI 0.74-0.90) and (0.66, 95%CI 0.55-0.79).
- Pooled **tumor control** rate: **0.96** (95% CI: 0.95-0.98).
- Pooled **hearing preservation** rate: **0.73** (95% CI: 0.66-0.81).

## CONCLUSION

CyberKnife is a widely-used LINAC-based stereotactic radiotherapy system

# 2024 RSS Scientific Meeting

Multidisciplinarity and Innovation  
in Stereotactic Radiotherapy & Radiosurgery

## Join Us at the Fairmont Millennium Park

March 21-23 | Chicago, IL