Early Radiosurgery Improves Hearing Preservation in Vestibular Schwannoma Patients with Normal Hearing at the Time of Diagnosis

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Introduction

Vestibular schwannomas are increasingly diagnosed in patients with normal hearing because of advances in magnetic resonance imaging. We sought to evaluate whether stereotactic radiosurgery (SRS) performed earlier after diagnosis improved long-term hearing preservation in this population.

Methods

We queried our prospectively gathered quality assessment registry and found the records of 1,134 acoustic neuroma patients who underwent SRS during a 15-year period (1997-2011). We identified 88 patients who had vestibular schwannomas, but normal hearing with no subjective hearing loss at the time of diagnosis. All patients were Gardner-Robertson class I at the time of SRS. Fifty-seven patients underwent early (<2 years from diagnosis) SRS and 31 patients underwent late (>2 years after diagnosis) SRS. At a median follow-up time of 75 months, we evaluated patient outcomes.

Table 1. Patient Characteristics at Time of Radiosurgery

Table 1 Characteristics of 88 vestibular schwannoma patients at the time of radiosurgery

Characteristic	Treat ≤2 years after diagnosis, n=57	Treat >2 years after diagnosis, n=31	*P* value	Total, n=88
Median age, y (range)	47 (20-71)	48 (23-65)	.16	48 (20-71)
Gender			.071	
Male, n (%)	29 (51%)	9 (29%)		38 (43%)
Female, n (%)	28 (49%)	22 (71%)		50 (57%)
Symptoms at diagnosis, (total incidence, isolated incidence)				
Hearing loss (total, isolated)	0, 0	0, 0		0, 0
Tinnitus (total, isolated)	34, 26	22, 16		56, 42
Vertigo (total, isolated)	12, 8	6, 3		18, 11
Imbalance (total, isolated)	6, 2	2, 1		8, 3
Trigeminal neuropathy (total, isolated)	2, 0	1, 0		3, 0
Facial neuropathy (total, isolated)	3, 0	0, 0		3, 0
Headache (total, isolated)	5, 2	2, 2		7, 4
Incidental (total)	6	2		11
Tumor side PTA (dB): median (range)	12 (0-30)	17 (2-30)	.005	13 (0-30)
Nontumor side PTA (dB): median (range)	8 (0-25)	8 (0-23)	.89	8 (0-25)
Tumor side SDS (%): median (range)	100 (76-100)	96 (84-100)	.57	100 (76-100)
Nontumor side SDS (%): median (range)	100 (80-100)	100 (96-100)	.82	100 (80-100)
Tumor volume (cc): median (range)	0.74 (0.13-12.80)	0.67 (0.11-3.90)	.092	0.72 (0.11-12.80)
Margin dose (Gy): median (range)	12.5 (11.5-13)	12.5 (12-13)	.68	12.5 (11.5-13)
Maximum dose (Gy): median (range)	25 (17.86-26)	25 (20-26)	.61	25 (17.86-26)
SRS date (mm/dd/yy): median (range)	12/22/05 (11/11/97-04/15/11)	03/04/05 (04/21/99-06/15/11)	.36	05/10/05 (11/11/97-06/15/11)

Abbreviations: PTA = pure tone average; SDS = speech discrimination score; SRS = stereotactic radiosurgery.

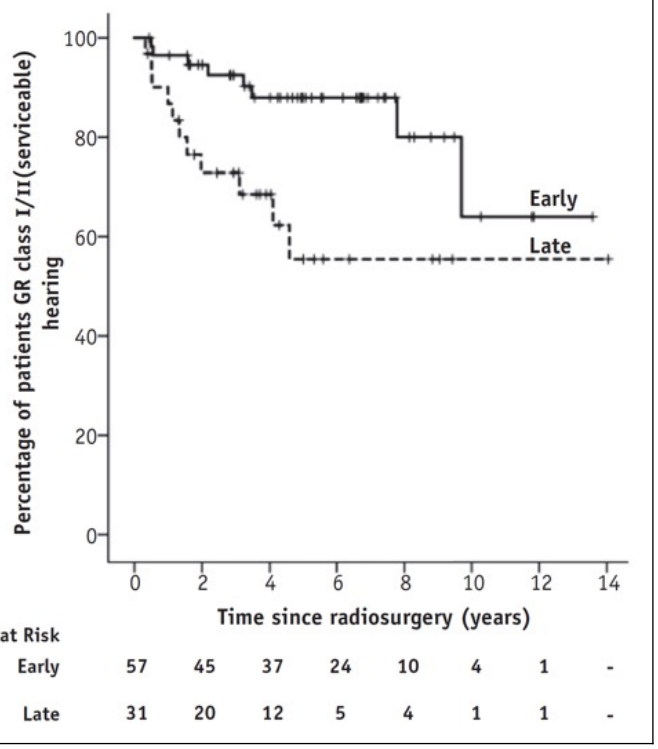
Table 2. Hearing and Clinical Outcome After Radiosurgery

Table 2 Hearing and clinical outcome after radiosurgery (early treatment: n=57; late treatment: n=31)

Characteristic	Treat ≤2 years after diagnosis, n=57	Treat >2 years after diagnosis, n=31	*P* value
Preservation of GR class I*			<.0001
Percentage (Greenwood 95% CI range)			
1 year	95% (89%-101%)	84% (71%-97%)	-
3 year	89% (81%-97%)	65% (48%-81%)	-
5 year	77% (65%-89%)	33% (15%-51%)	-
10 year	51% (24%-77%)	29% (12%-47%)	-
Preservation of GR class I/II*			.006
Percentage (Greenwood 95% CI range)			
1 year	96% (92%-101%)	87% (75%-99%)	-
3 year	93% (85%-100%)	73% (57%-89%)	-
5 year	88% (79%-97%)	55% (34%-77%)	-
10 year	64% (33%-95%)	55% (34%-77%)	-
Tumor control†			.73
Number (rate)			
Tumor decreased size	31 (55%)	18 (58%)	-
Tumor stable size	23 (40%)	10 (32%)	-
Tumor increased size	3 (5%)	3 (10%)	-

Abbreviations: CI = confidence interval; GR class = Gardner-Robertson class.
* Mantel-Cox log-rank test.
† Fisher exact test.

Figure 1. Percentage of Patients with Serviceable Hearing Following Radiosurgery



Results

Tumor control rates were defined as tumors that were decreased or stable in size. Control rates were similar in the early (95%) and late (90%) treatment groups (P=0.73). Patients in the early treatment group retained serviceable (Gardner-Robertson class I/II) hearing and normal (Gardner-Robertson class I) hearing longer than did patients in the late treatment group (serviceable hearing, P=0.006; normal hearing, P<0.0001, respectively). At 5 years after SRS, an estimated 88% of the early treatment group retained serviceable hearing and 77% retained normal hearing, compared with 55% with serviceable hearing and 33% with normal hearing in the late treatment group.

Table 3. Prognostic Factors for Hearing Outcomes

Table 3 Cox proportional hazards regression analysis of prognostic factors for hearing outcomes

Variable	Stepwise analysis, HR (CI)*	*P* value	Nonstepwise analysis, HR (CI)*	*P* value
Patient age (<50 y vs ≥50 y)	1.07 (0.47-2.39)	.88	-	-
Tumor-side PTA (<20 dB vs ≥20 dB)	0.29 (0.13-0.64)	.002	0.29 (0.15-0.58)	.0009
Tumor-side SDS (≥80% vs <80%)	0.36 (0.08-1.73)	.20	-	-
Tumor volume (<0.75 cc vs ≥0.75 cc)	1.02 (0.51-2.04)	.95	-	-
Gender (male vs female)	1.08 (0.76-1.54)	.66	-	-
Time to radiosurgery (≤2 y vs >2 y)	-	-	0.58 (0.41-0.81)	.002

Abbreviations: CI = confidence interval; HR = hazard ratio; PTA = pure tone average; SDS = speech discrimination score.
* Confidence intervals are 95%, calculated with Greenwood method.

Conclusions

SRS within 2 years after initial diagnosis of a vestibular schwannoma in normal hearing patients was associated with improved retention of all hearing measures compared with later SRS treatments in a similar patient cohort.

Learning Objectives

Treating vestibular schwannomas earlier with SRS may result in higher rates of hearing preservation versus late treatment

References

Akpinar B, Mousavi SH, McDowell MM, Niranjan A, Faraji AH, Flickinger JC, Lunsford LD. Int J Radiat Oncol Biol Phys. 2016 Jun 1;95(2):729-34.