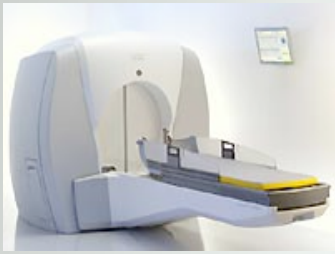
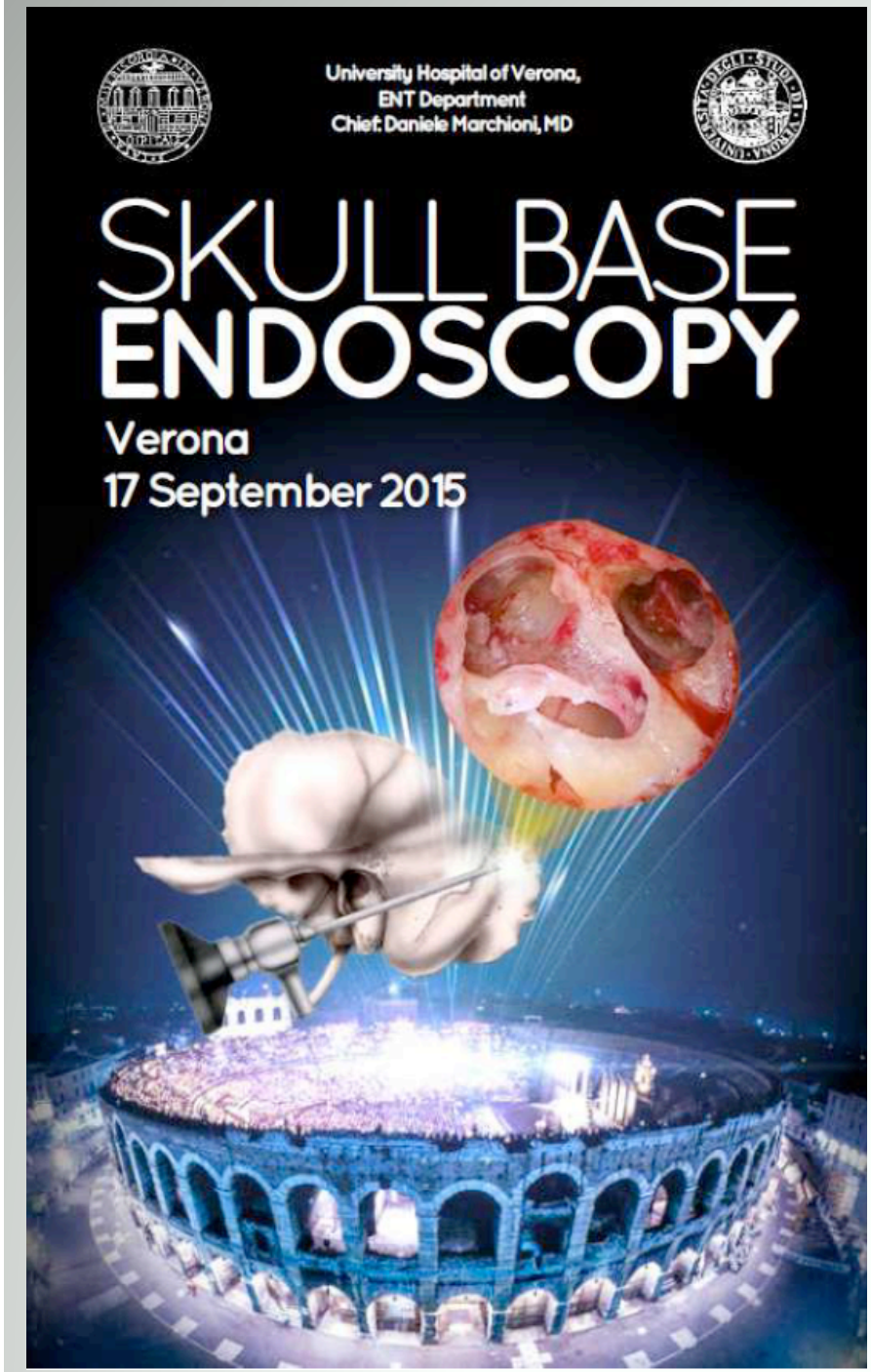
AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA VERONA



DAI DI NEUROSCIENZE
ISTITUTO DI NEUROCHIRURGIA
UOC DI NEUROCHIRURGIA B
USO DI RADIOCHIRURGIA E NCH STEREOTASSICA

GRUPPO INTERDISCIPLINARE
NEURO-ONCOLOGICO VERONESE
(GrINOV)

Verona, Sept. 17th, 2015



GAMMA KNIFE TREATMENT FOR ACOUSTIC NEUROMA. THE VERONA EXPERIENCE

A Nicolato, C Parisi, R Foroni, M Longhi, E Zivelonghi, N Tommasi, L Rosta, GK Ricciardi, PA Polloniato, M Rasi, A D'Ottavio, E Piovan, C Cavedon, GP Pinna, M Meglio

Verona, Sept. 17th, 2015

GAMMA KNIFE IN VSs

GOALS OF RS TREATMENT

RADICAL TREATMENT OF CRITICAL LESIONS WITH VERY LOW RISKS OF PERMANENT COMPLICATIONS AND HEARING PRESERVATION

Verona, Sept. 17th, 2015

GAMMA KNIFE IN IAC-VSs

ADVANTAGES OF GK RS

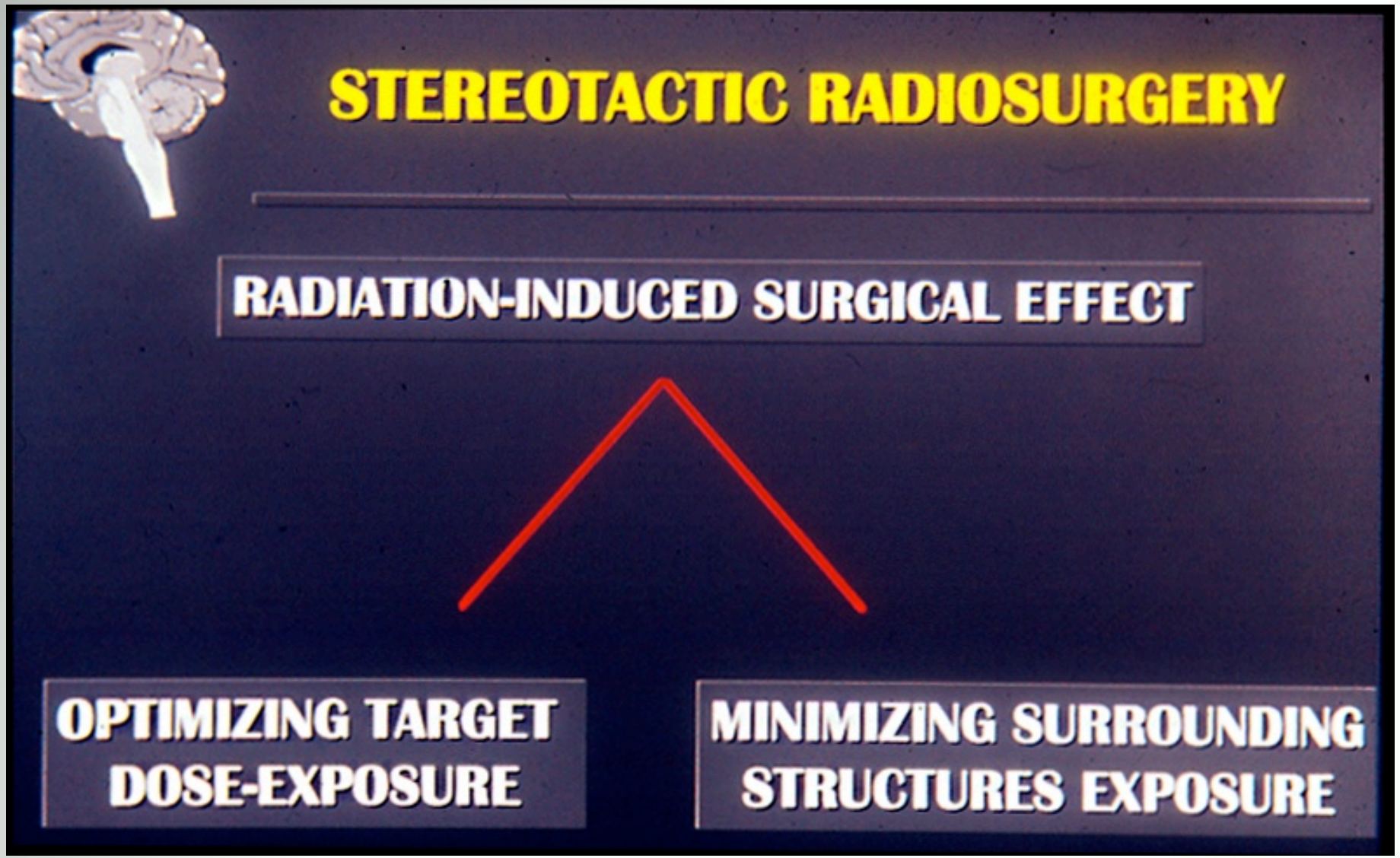
- NO INVASIVENESS
- PREVENTION OF INOPERABLE REMNANT PROGRESSION
- PREVENTION OF FURTHER SURGERY
- EXTREMELY HIGH MECHANICAL AND RADIATION FOCUS PRECISION AND COINCIDENCE (±0.3 mm)
- HIGHLY CONFORMAL DOSE PLANNINGS
- HIGH GRADIENT DOSE
- DIRECT STEREO-MRI ACQUISITION: volumetric and steady-state sequences

GAMMA KNIFE IN IAC-VSs

ADVANTAGES OF GK RS

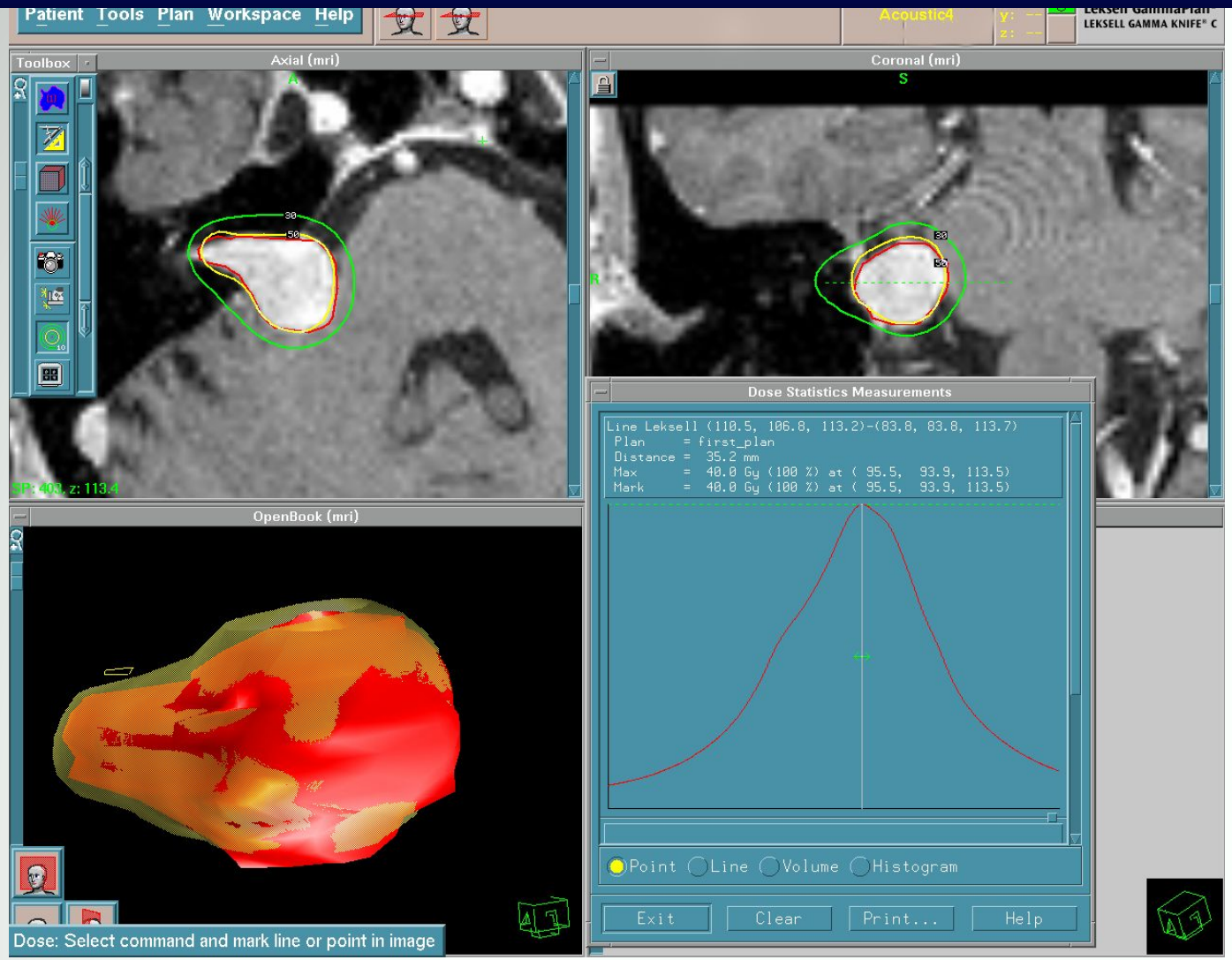
- NO INVASIVENESS
- PREVENTION OF INOPERABLE REMNANT PROGRESSION
- PREVENTION OF FURTHER SURGERY
- EXTREMELY HIGH MECHANICAL AND RADIATION FOCUS PRECISION AND COINCIDENCE (±0.3 mm)
- **HIGHLY CONFORMAL DOSE PLANNINGS**
- **HIGH GRADIENT DOSE**
- **DIRECT STEREO-MRI ACQUISITION: volumetric and steady-state sequences**

GAMMA KNIFE IN VSs



AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

STEEP DOSE FALL-OFF



GAMMA KNIFE IN IAC-VSs

- **ADVANTAGES FOR THE PATIENT**
- **ADVANTAGES FOR HEALTH SYSTEM**

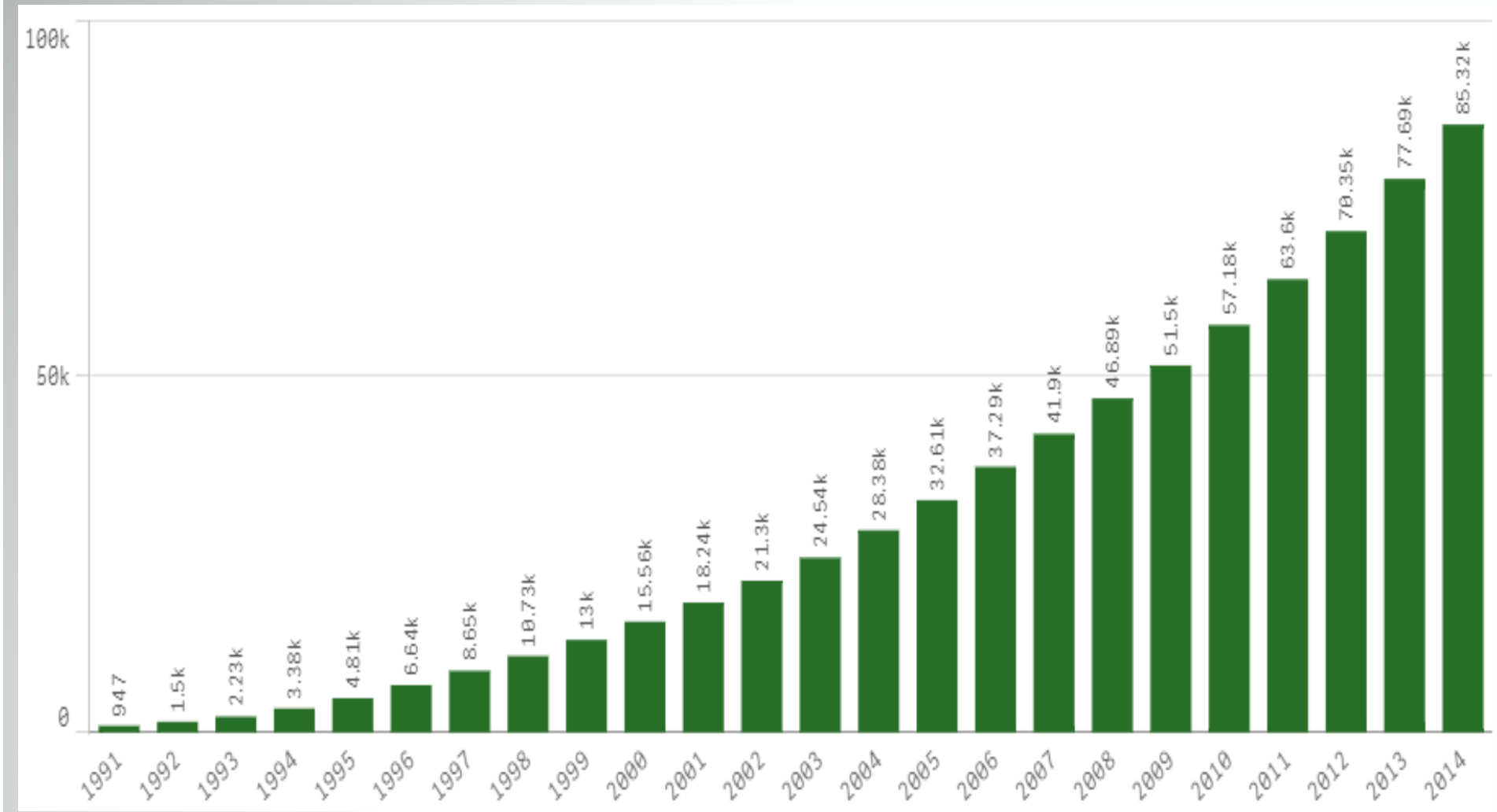
- **NON-INVASIVE TECHNIQUE**
- **DAY SURGERY PROCEDURE**
- **HIGH NET INCOME**

  (€ 7,500, 65% net income for the N.H.S.

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

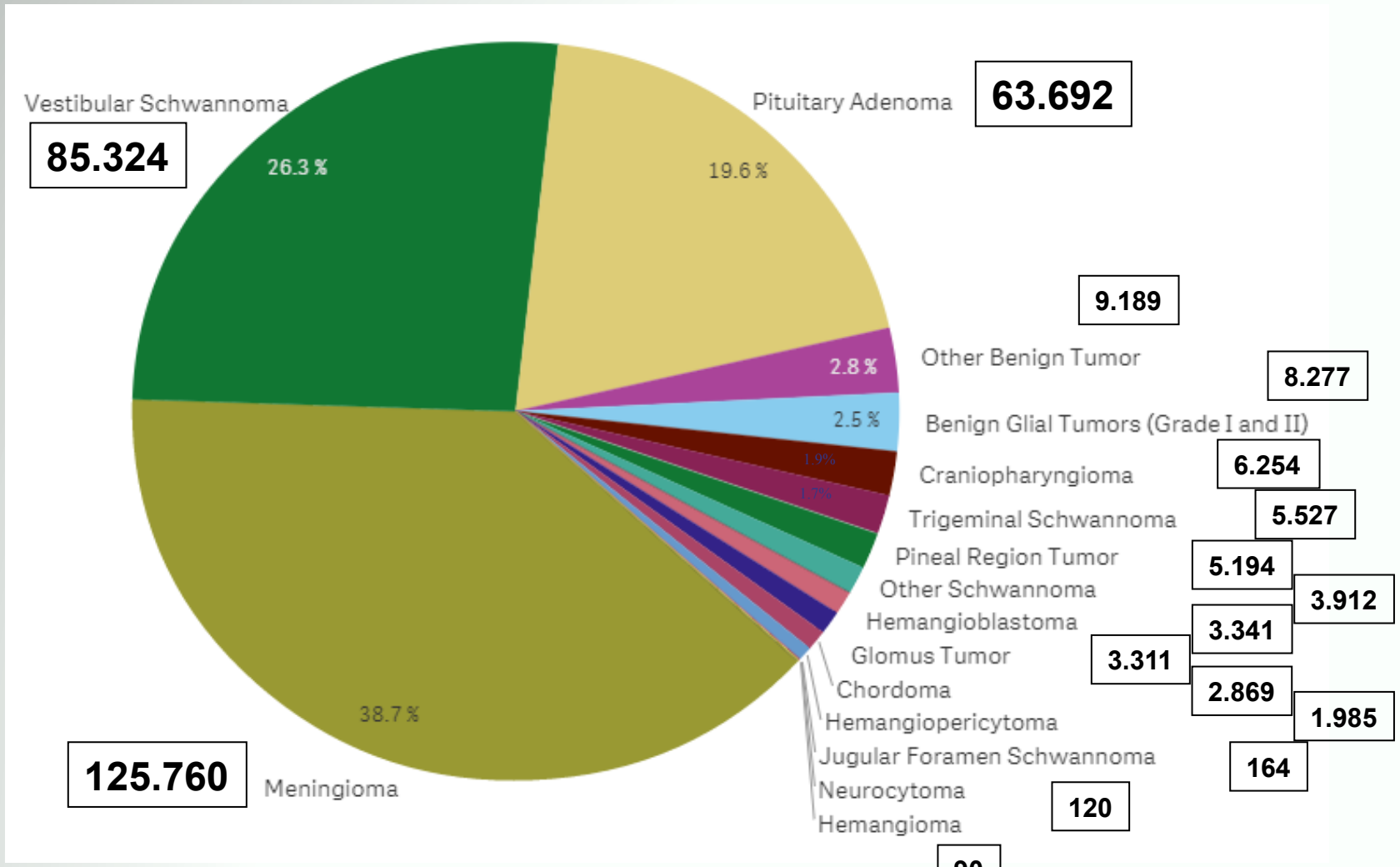
VSs – CUMULATIVE PATIENTS TREATED WORLDWIDE WITH GK



Verona, Sept. 17th, 2015

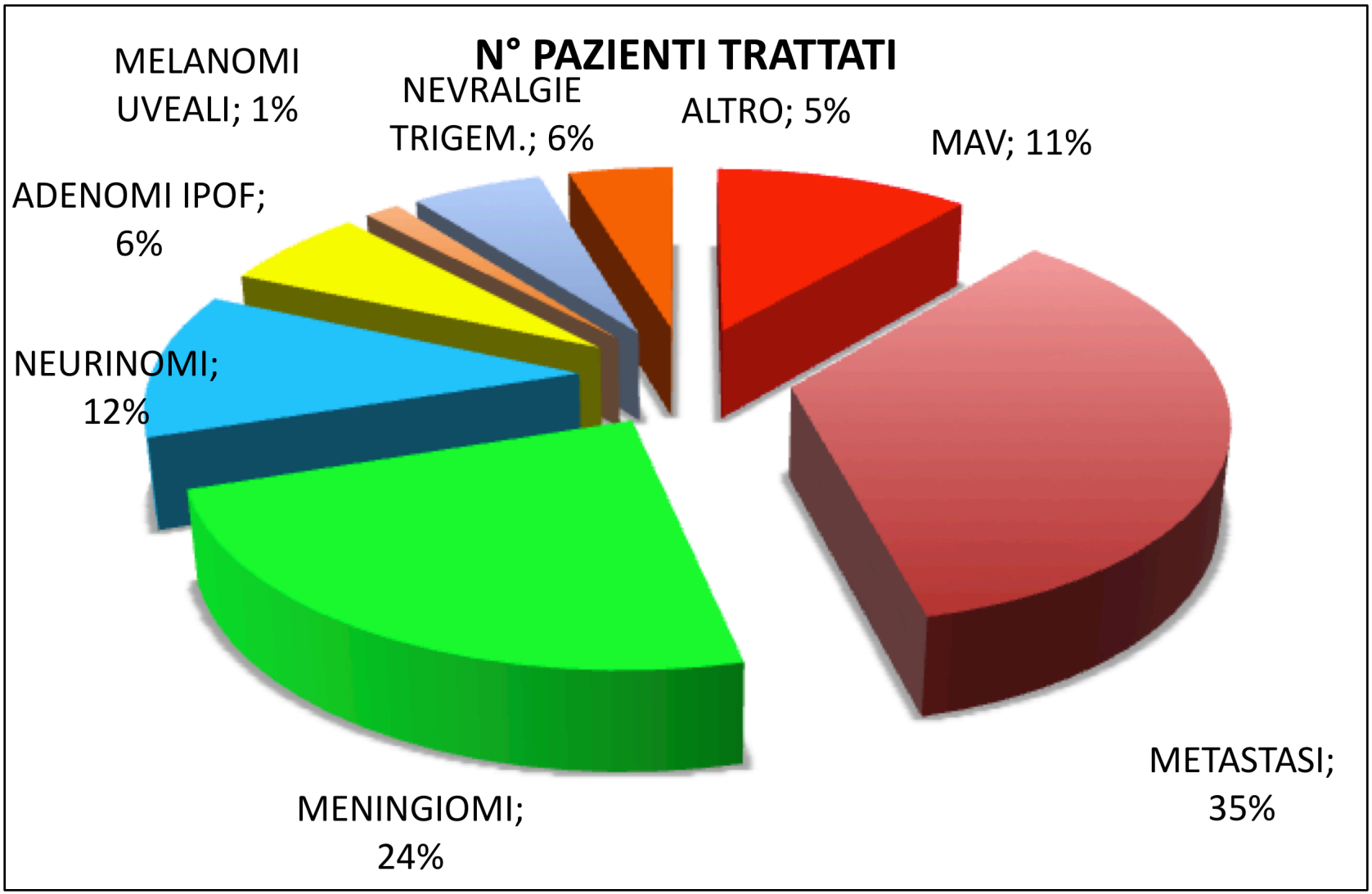
AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

BENIGN TUMORS – CUMULATIVE PATIENTS TREATED WORLDWIDE WITH GK



Verona, Sept. 17th, 2015

GAMMA KNIFE IN VSs – AOUI VERONA



Otology & Neurotology
32:834–837 © 2011, Otology & Neurotology, Inc.

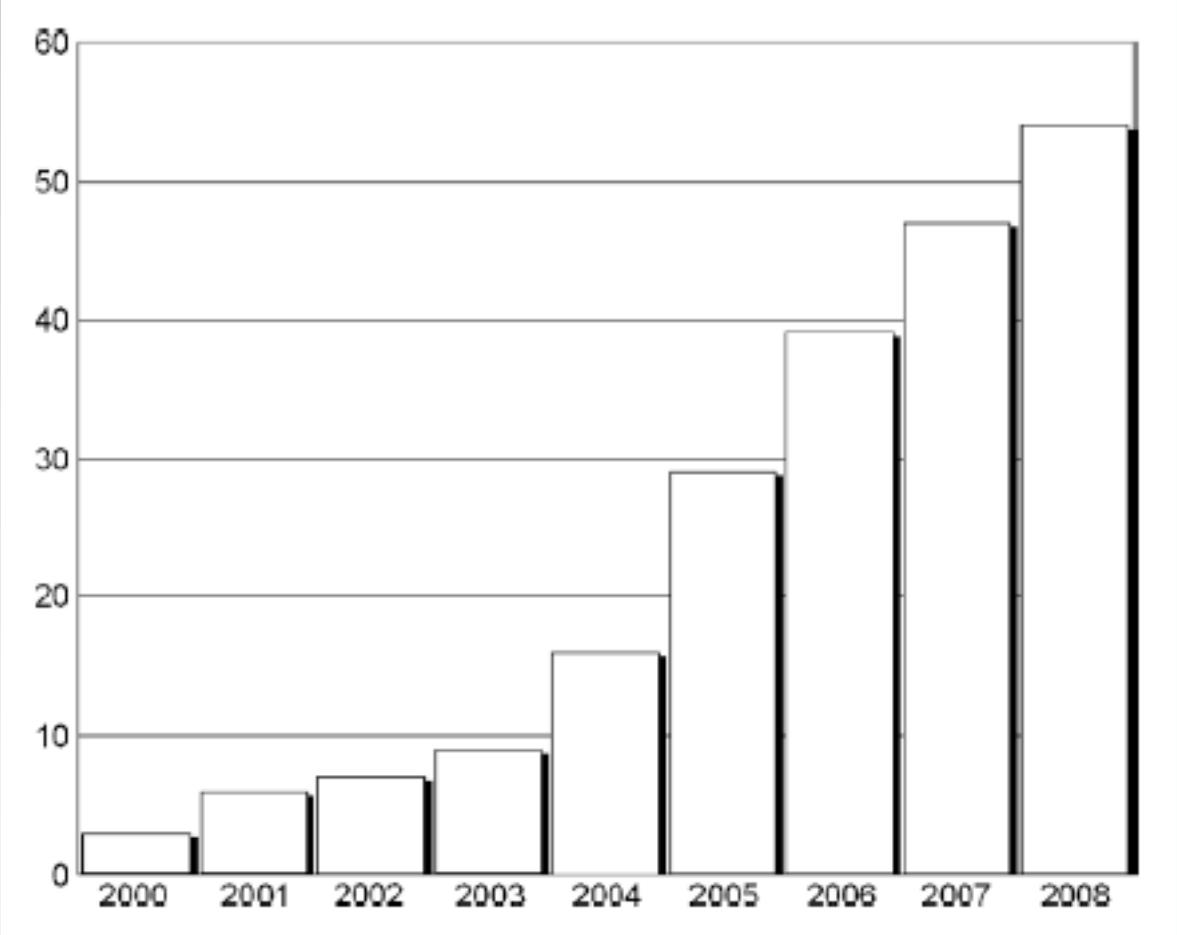
Stereotactic Radiosurgery for Vestibular Schwannomas: A Survey of Current Practice Patterns of Neurotologists

*Michael A. German, *Shawn Zardouz, *Mehdi K. Sina, *Kasra Ziai, and *†Hamid Reza Djalilian

**Division of Neurotology and Skull Base Surgery, Department of Otolaryngology-Head and Neck Surgery; and †Department of Biomedical Engineering, University of California, Irvine, California, U.S.A.*

This article discusses the results of a cross-sectional survey of members of the American Neurotology Society (ANS) that was conducted to ascertain practitioner attitudes and behaviors pertaining to radiation as a treatment modality for VS.

Verona, Sept. 17th, 2015



Cumulative number of neurotology performing SRS between 2000 and 2008

The maximum size recommended for radiation by Members of the American Neurotology Society who perform SRS for VSs was 2.5 cm

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN VSs

INDICATIONS

Radiosurgery Practice Guideline Initiative

Stereotactic Radiosurgery for Patients with

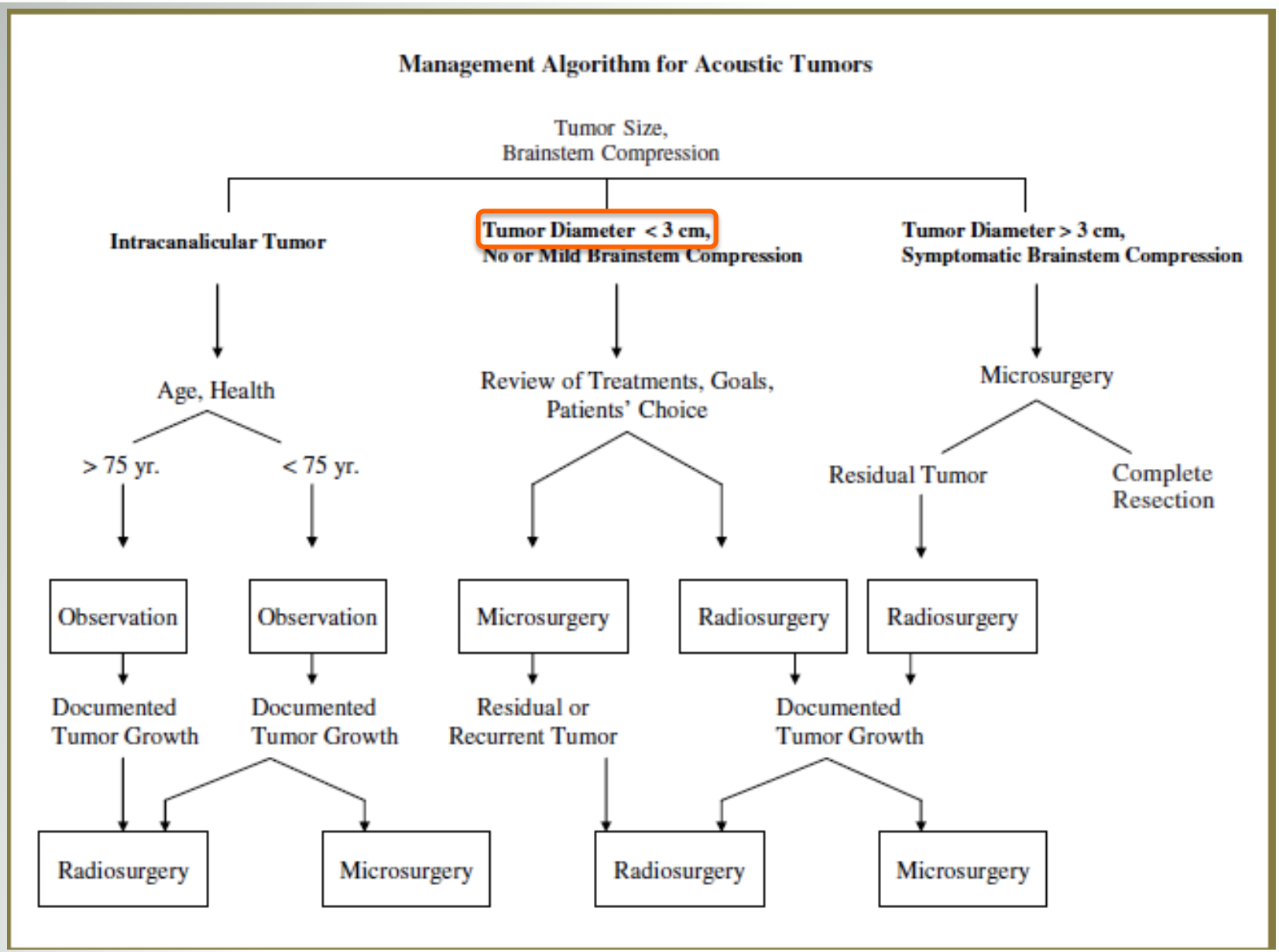
Vestibular Schwannomas

Radiosurgery Practice Guideline Report #4-06

ORIGINAL GUIDELINE: May 2006
MOST RECENT LITERATURE SEARCH: March 2006

This practice guideline, together with a report on "Vestibular Schwannoma Management" is an original guideline approved by the IRSA® (International RadioSurgery Association) Board of Directors and issued in May 2006.

Verona, Sept. 17th, 2015


Management Algorithm for Acoustic Tumors
Tumor Size,
Brainstem Compression
Intracanalicular Tumor
Tumor Diameter < 3 cm,
No or Mild Brainstem Compression
Tumor Diameter > 3 cm,
Symptomatic Brainstem Compression
Age, Health
> 75 yr.
< 75 yr.
Review of Treatments, Goals,
Patients' Choice
Microsurgery
Residual Tumor
Complete
Resection
Observation
Observation
Microsurgery
Radiosurgery
Radiosurgery
Documented
Tumor Growth
Documented
Tumor Growth
Residual or
Recurrent Tumor
Documented
Tumor Growth
Radiosurgery
Microsurgery
Radiosurgery
Microsurgery

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN VSs

OUR EXPERIENCE

February 1993 – August 2015

TREATED PATIENTS:	**9,100**
VSs:	**1,013**

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN VSs

OUR EXPERIENCE

Reprint from

J. Kanzaki, M. Tos, M. Sanna, D.A. Moffat, T. Kunihiro, Y. Inoue (Eds.)

Acoustic Neuroma: Consensus on Systems for Reporting Results

Gamma Knife Radiosurgery in Vestibular Schwannomas: Clinical and Radiological Impact on the Tumor Course

Massimo Gerosa, Antonio Nicolato, Roberto Foroni, and Albino Bricolo

2002

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN VSs

OUR EXPERIENCE

J Neurosurg 113:128–135, 2010

Gamma Knife surgery in vestibular schwannomas: impact on the anterior and posterior labyrinth

Clinical article

MASSIMO GEROSA, M.D.,[1] NAZARENA MESIANO, M.D.,[2] MICHELE LONGHI, M.D.,[1] ANTONIO DE SIMONE, PH.D.,[1] ROBERTO FORONI, PH.D.,[1] ANGELA VERLICCHI, M.D.,[1] BRUNO ZANOTTI, M.D.,[3] AND ANTONIO NICOLATO, M.D.[1]

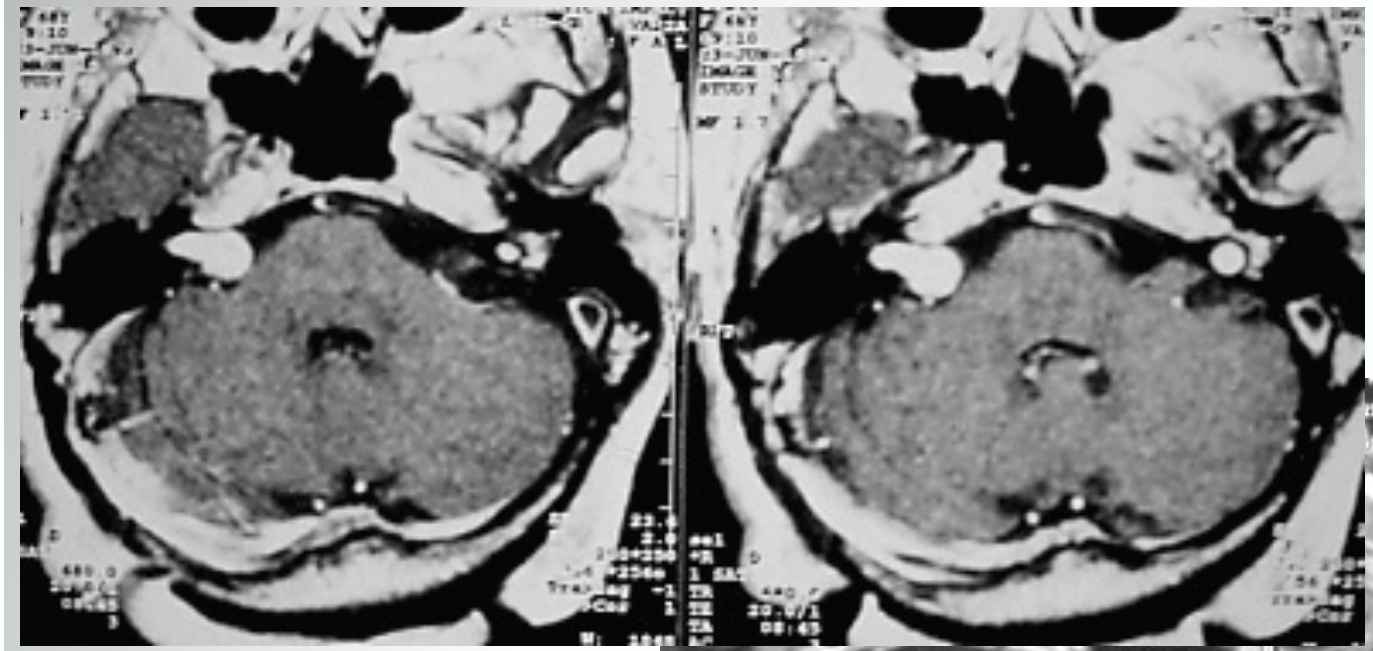
	%
• HEARING PRESERV. (G-R 1/2)	66.0
• TGC	93.0
• FACIAL IMPAIRMENT	2.7

Verona, Sept. 17th, 2015

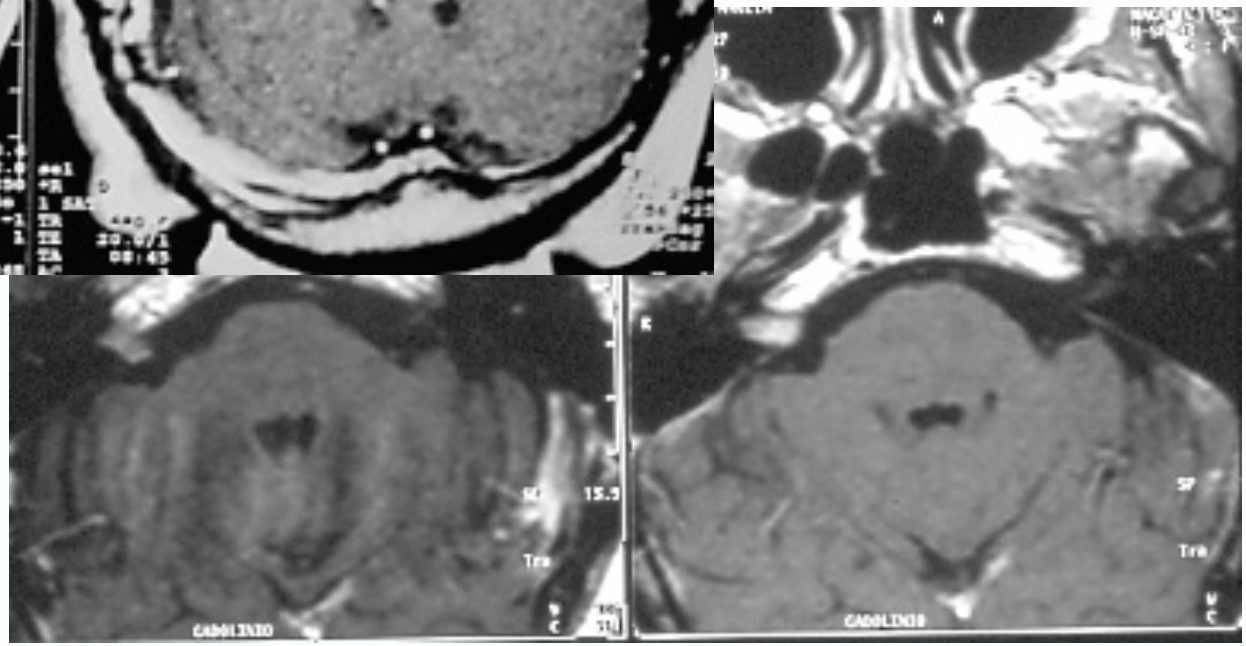
AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN VSs

OUR EXPERIENCE



PRE-GK MRI



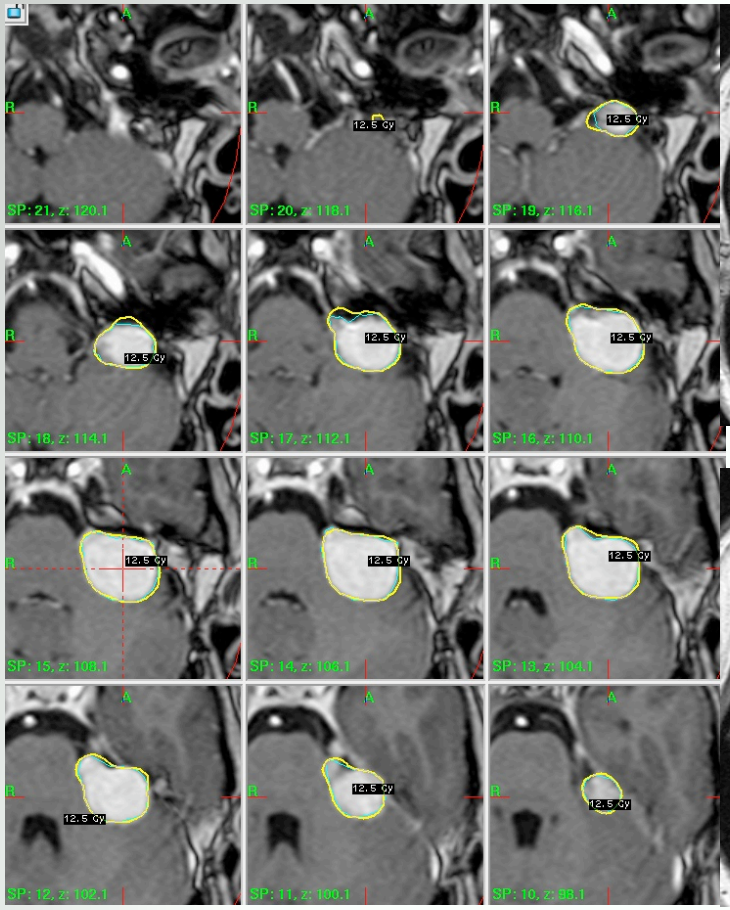
POST-GK MRI
AT 50 mos.

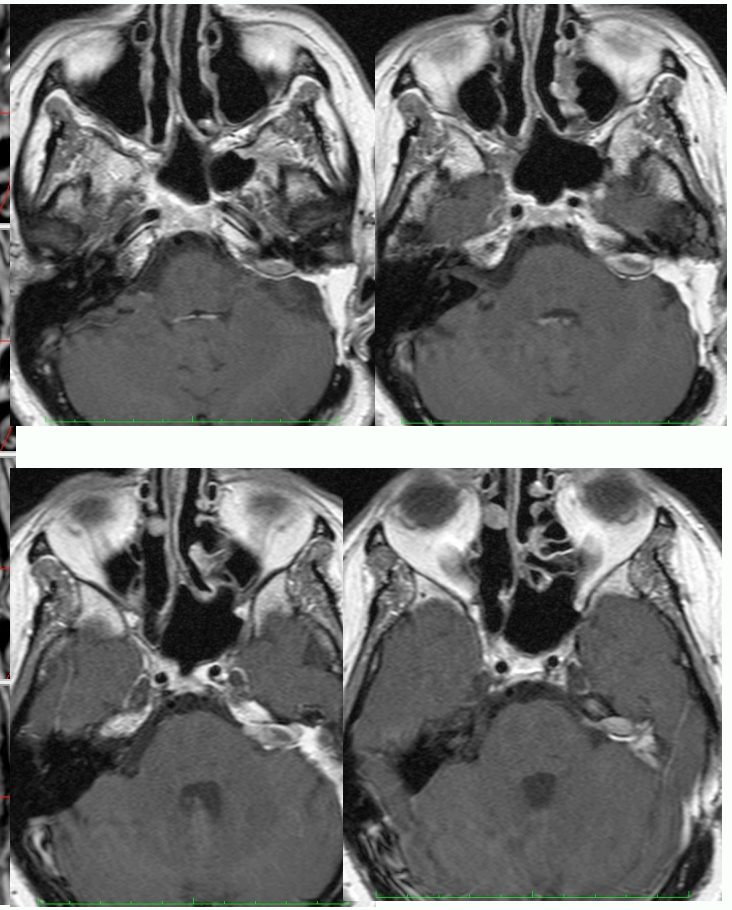
AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN VSs

OUR EXPERIENCE

MR on GK day





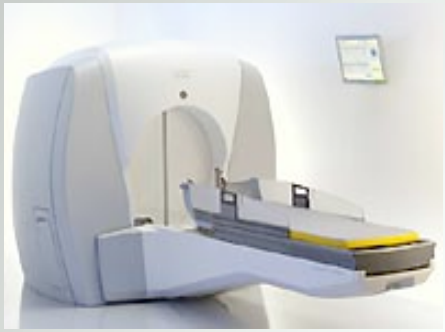
MR FU AT 37 mos.

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN VSs

SUMMARY OF RECENT SRS LITERATURE



Author	N° Pts	Device	FU period	LTC %	Hear. Preser.	Facial N. Preserv.	Malign. Transfor.
Boari 2014	379	GK	Med.69.5m	97.1	49%	98,9%	0.0
Hasegawa 2013	440	GK	Med.12.5y.	93.0 (92% ≥10y.)	43% at 5y.	99.7	Annual incidence: 0,02

Verona, Sept. 17th, 2015

COMPARISON MS vs. SRS

Author	Type of study	TC %	TC %	Hear. %	Preser. %	FacialN %	Preser. %	Cost-effectiveness
		MS	SRS	MS	SRS	MS	SRS	MS vs. SRS
Sarmiento 2013 (Ø≤3 cm)	Focused re: • 3 prospec, • 6 retrosp, • Variuos case series	94-100	90.5-100	0-5	40-68	66-83	98-100	MS: • over 2 times higher than SRS. • 0.5% postop. mortality
Wolbers 2013 (Ø≤3 cm)	Focused re: • 6 cohort studies selected	—	—	—	Better Hear. preser.	—	Better Facial N. outcome	SRS: • Better QOL • No mortality • No surg/ anaes. compl.
Myrseth 2009 **(Ø≤2.5cm)**	Prospetive open, non-randomized study	Compa rable	Compara ble	0.0	68.0 at 2 y.	53.6	98.3	SRS: Better QOL at 2y (Glasgow Benefit Inventory questionnaire)

MS: microsurgery; SRS: stereotactic radiosurgery

COMPARISON MS vs. SRS

CONCLUSIONS

Sarmiento JM, et al. IMPROVING OUTCOME IN PATIENTS WITH VESTIBULAR SCHWANNOMAS. MICROSURGERY *versus* RADIOSURGERY *(focused review)*.

J NEUROSURG SCI 2013;57:23-44

SRS can be considered as the the primary modality of choice for treatment of most vestibular schwannomas that are <3cm

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

COMPARISON MS vs. SRS

CONCLUSIONS

Open Access Research

BMJ open accessible medical research

What intervention is best practice for vestibular schwannomas? A systematic review of controlled studies

John G Wolbers,[1] Alof HG Dallenga,[1] Alejandra Mendez Romero,[2] Anne van Linge[3]

BMJ Open 2013;**3:e001345.** doi:10.1136/bmjopen-2012-001345
(focused review).

The available evidence indicates radiosurgery to be the best practice for solitary vestibular schwannomas up to 30 mm in cisternal diameter.

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

COMPARISON MS vs. SRS

CONCLUSIONS

VESTIBULAR SCHWANNOMA: SURGERY OR GAMMA KNIFE RADIOSURGERY? A PROSPECTIVE, NONRANDOMIZED STUDY

Erling Myrseth, M.D.
Department of Neurosurgery, Haukeland University Hospital, Bergen, Norway

Per Møller, M.D., Ph.D.
Department of Otorhinolaryngology, Haukeland University Hospital, and Institute of Surgical Science, University of Bergen, Bergen, Norway

Paal-Henning Pedersen, M.D., Ph.D.
Department of Neurosurgery, Haukeland University Hospital, and Institute of Surgical Science, University of Bergen, Bergen, Norway

Morten Lund-Johansen, M.D., Ph.D.
Department of Neurosurgery, Haukeland University Hospital, and Institute of Surgical Science, University of Bergen, Bergen, Norway

Reprint requests:
Erling Myrseth, M.D., Department of Neurosurgery, Haukeland University Hospital, N-5021 Bergen, Norway. Email: erling.myrseth@helse-bergen.no

Received, May 16, 2008.
Accepted, October 23, 2008.

OBJECTIVE: To conduct a prospective, open, nonrandomized study of treatment-associated morbidity in patients undergoing microsurgery or gamma knife radiosurgery (GKRS) for vestibular schwannomas.

METHODS: Ninety-one patients with vestibular schwannomas with a maximum tumor diameter of 25 mm in the cerebellopontine angle were treated according to a prospective protocol either by GKRS (63 patients) or open microsurgery (28 patients) using the suboccipital approach. Primary end points included hearing function, according to the Gardner-Robertson scale, and facial nerve function, according to the House-Brackmann scale at 2 years. Clinical data included a balance platform test, score for tinnitus and vertigo using a visual analog scale, and working ability. Patients responded to the quality-of-life questionnaires Short-Form 36 and Glasgow Benefit Inventory.

RESULTS: Three elderly GKRS patients withdrew; all remaining patients were followed for 2 years. Both primary end points were highly significant in favor of GKRS ($P < 0.001$). Evidence of reduced facial nerve function (House-Brackmann grade 2 or poorer) at 2 years was found in 13 of 28 open microsurgery patients and 1 of 60 GKRS patients. Thirteen of 28 patients who underwent surgery had serviceable hearing (Gardner-Robertson grade A or B) preoperatively, but none had serviceable hearing postoperatively. Twenty-five of 60 GKRS patients had serviceable hearing before treatment, and 17 (68%) of them had serviceable hearing 2 years after treatment. The tinnitus and vertigo visual analog scale score, as well as balance platform tests, did not change significantly after treatment, and working status did not differ between the groups at 2 years. Quality of life was significantly better in the GKRS group at 2 years, based on the Glasgow Benefit Inventory questionnaire. One GKRS patient required operative treatment within the 2-year study period.

CONCLUSION: This is the second prospective study to demonstrate better facial nerve and hearing outcomes from GKRS than from open surgery for small- and medium-sized vestibular schwannomas.

KEY WORDS: Facial nerve function, Gamma knife radiosurgery, Hearing preservation, Microsurgery, Quality of life, Vestibular schwannoma

Neurosurgery 64:654–663, 2009 DOI: 10.1227/01.NEU.0000340684.60443.55 www.neurosurgery-online.com

This prospective study demonstrates better facial nerve and hearing outcomes from GKRS than from open surgery for small- and medium-sized (maximum tumor Ø ≤25 mm) vestibular schwannomas.

Neurosurgery 2009

Prospetive open, non-randomized study

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

OUR EXPERIENCE

February 1993 – August 2015

TREATED PATIENTS:	**9,100**
VSs:	**1,013**
IAC-VSs:	**107**

IAC: internal acoustic canal

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

OUR EXPERIENCE

February 1993 – August 2015
107 TREATED PATIENTS

M/F	54/53
MEAN AGE (Range)	56.1 yrs. (12–80)
SURGICAL RESIDUAL	**13/107 pts. (12.1%)**
MEAN VOLUME (RANGE)	**0.19 mL (0.04–0.70)**
Mean PI/ PD/ MD /#ISOCENTERS	52.1% / 12.1Gy / 23.3Gy / 3.7

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

OUR EXPERIENCE

February 1993 – August 2012

66 TREATED PATIENTS WITH AT LEAST 36-MONTH-F-U

MEDIAN SURVIVAL TIME	52.6 Mos
ALIVE	66/66 (100%) Pts.
TGC	**65/66 (98,5%)**
HEARING PRESERVATION	**22/47 (46.8%) Pts. (47 Pts. with GR I-III pre-GK)**
FACIAL PRESERVATION	**65/66 (98,5%)***
OTHER WORSENING (tinnitus, ataxia)	3/66 (4.5%)
MALIGNANT TRANSFORMATION	**0/66**

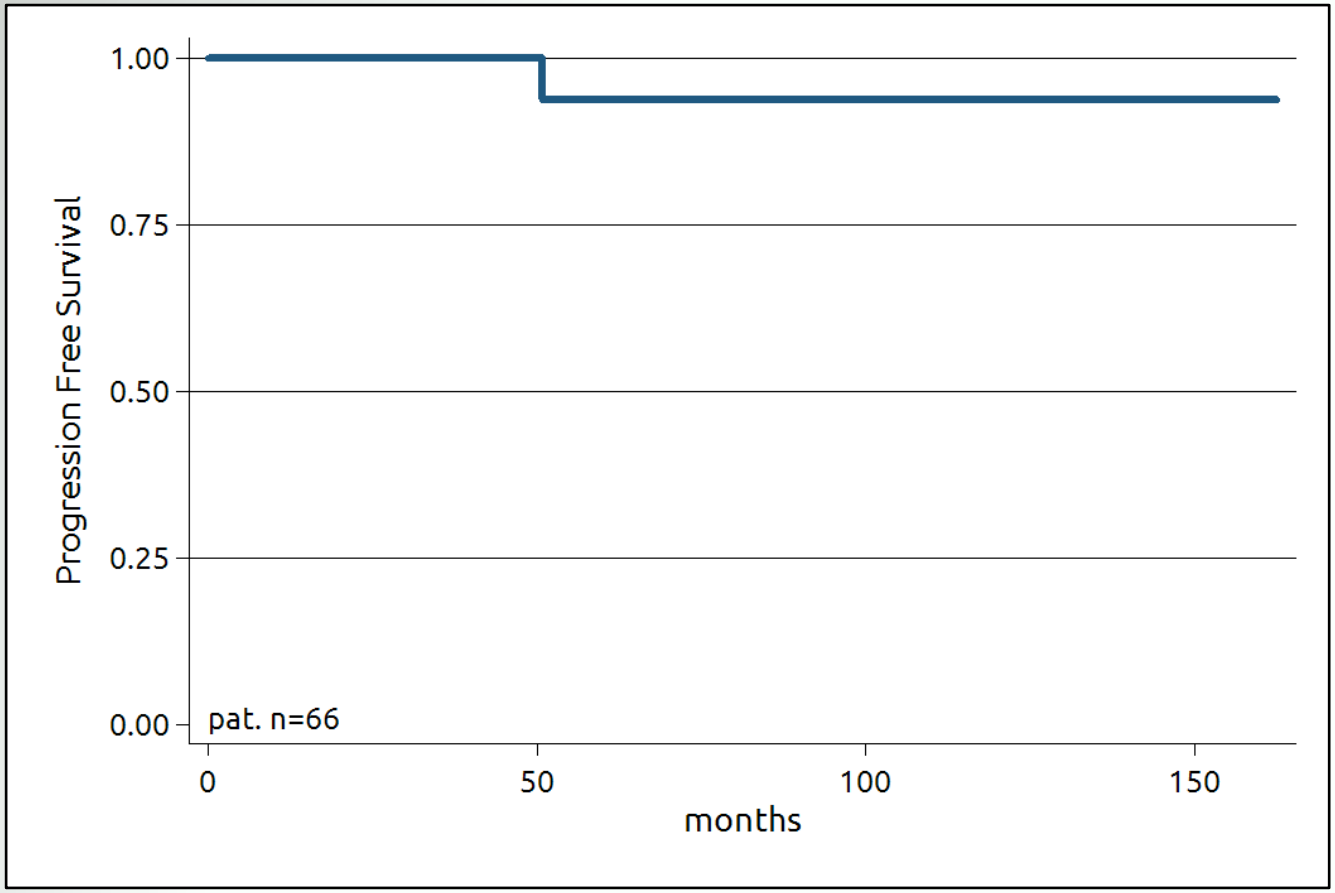
***mild spasm of facial nerve**

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

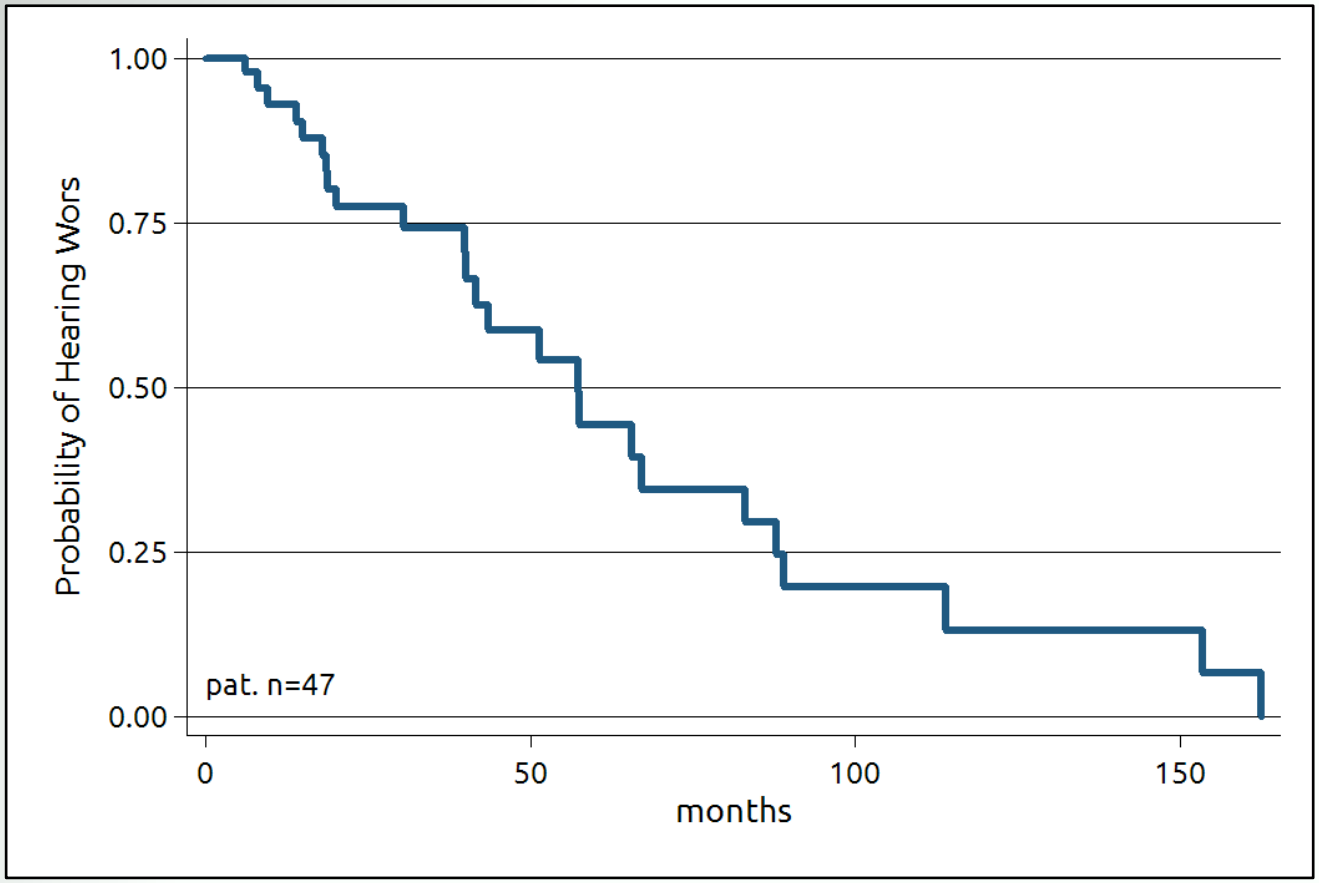
OUR EXPERIENCE



ACTUARIAL PFS RATE: 96% at 10 Y.

GAMMA KNIFE IN IAC-VSs

OUR EXPERIENCE



ACTUARIAL HEARING PRESERVATION RATE: 43% at 5 Y.

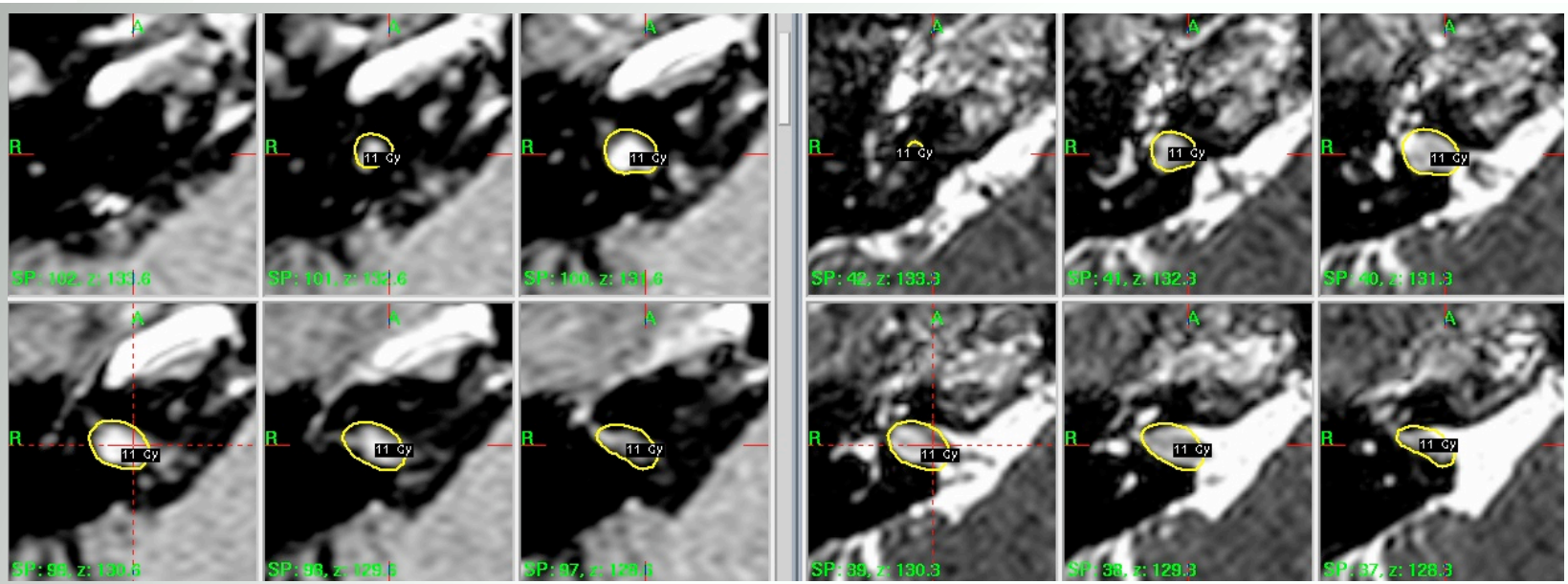
GAMMA KNIFE IN IAC-VSs

STATISTICAL ANALYSIS: prognostic factors influencing hear.wors.

Independent variables	Odds Ratio	p-value	# Observ.	Statistically significant
Pre-GK VS increased volume const	1.05 1.428571	0.946 0.469	32	N
Post-GK intra-VS necrosis time const	1.011856 .5319617	**0.049** 0.228	38	**Y**
Average dose to the cochlea const	.8609878 1.862945	0.509 0.497	23	N
VS volume (mL) const	.3367242 1.285514	0.679 0.665	45	N
Prescription dose (Gy) const	.6008056 561.6	**0.031** 0.029	47	**Y**

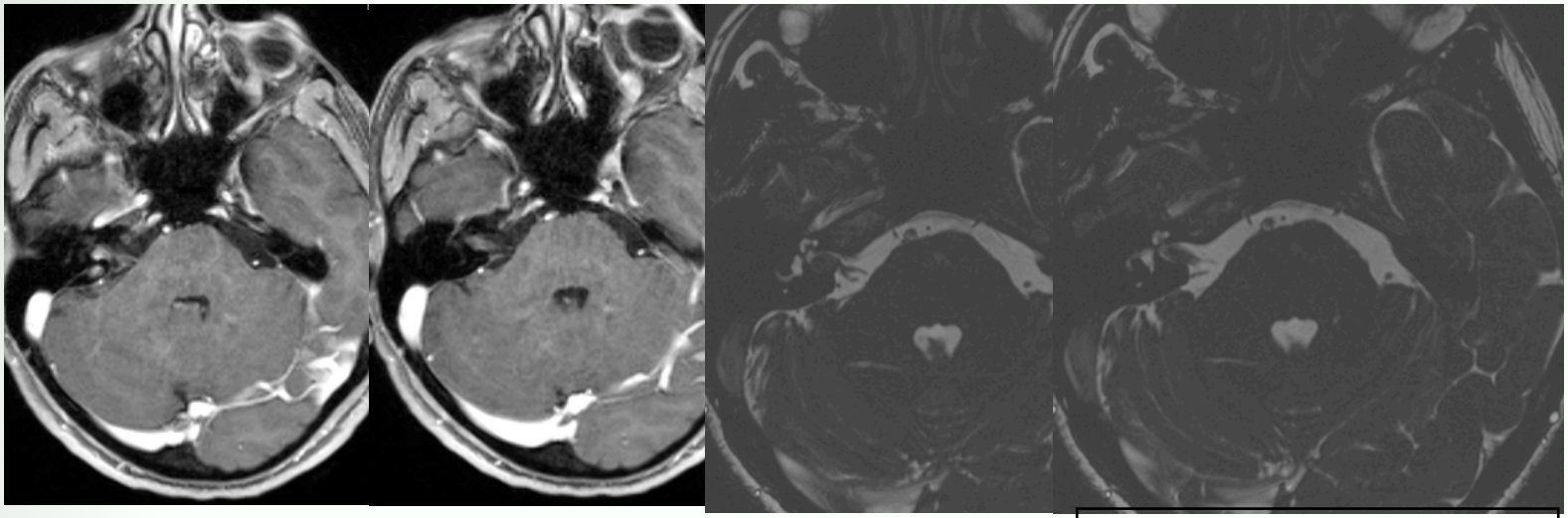
Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA



MR on GK day, Jan 2012

MR FU AT 22 mos.

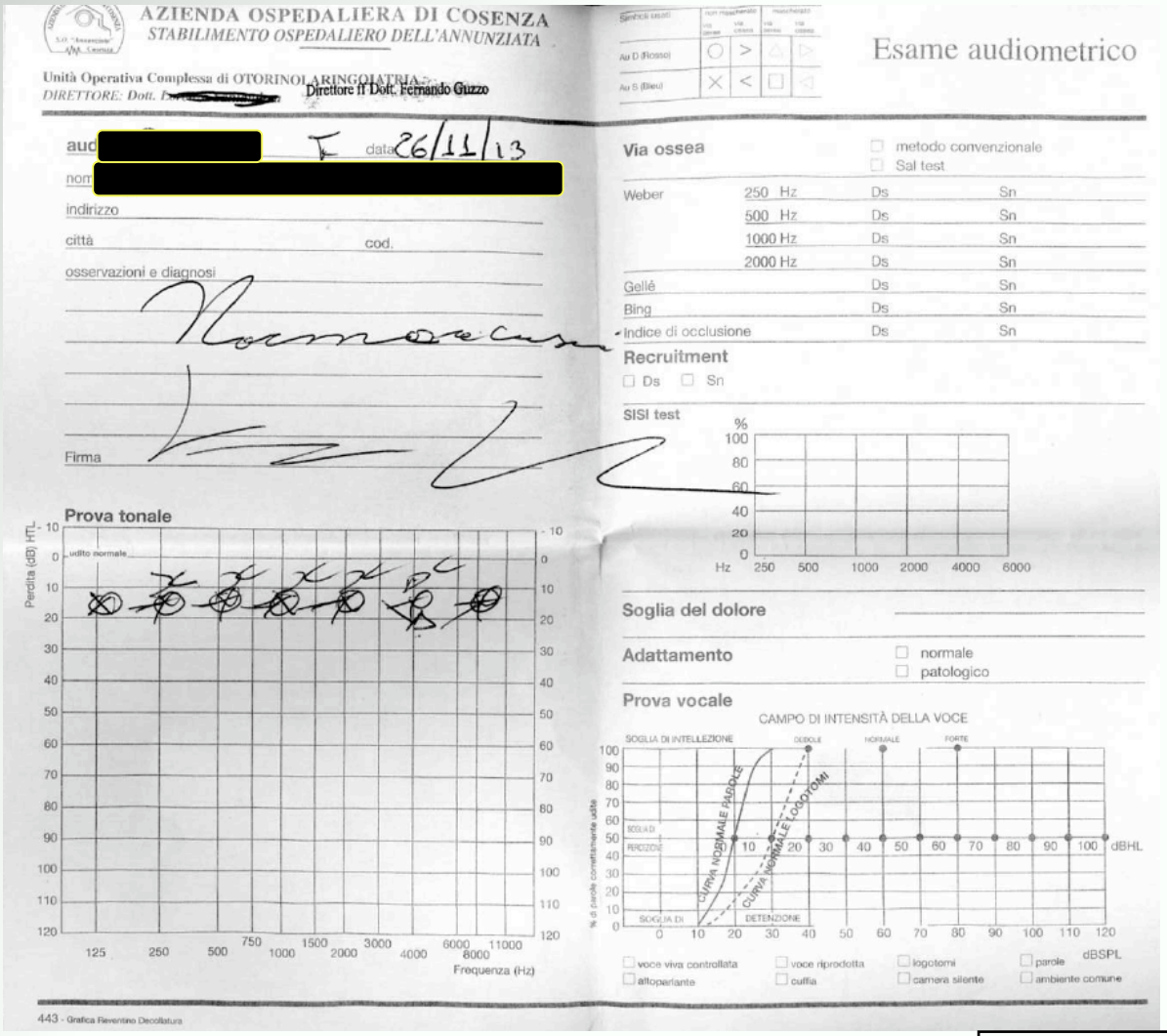


Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

AUDIOGRAM on Nov, 2013



AZIENDA OSPEDALIERA DI COSENZA
STABILIMENTO OSPEDALIERO DELL'ANNUNZIATA

Unità Operativa Complessa di OTORINOLARINGOIATRIA
DIRETTORE: Dott. [redacted]
Direttore f.f. Dott. Fernando Guzzo

aud [redacted] data 26/11/13
nom [redacted]
indirizzo
città cod.
osservazioni e diagnosi
Normoacusia
Firma

Esame audiometrico

Via ossea — metodo convenzionale — Sal test

		Ds	Sn
Weber	250 Hz	Ds	Sn
	500 Hz	Ds	Sn
	1000 Hz	Ds	Sn
	2000 Hz	Ds	Sn
Gellé		Ds	Sn
Bing		Ds	Sn
Indice di occlusione		Ds	Sn

Recruitment — Ds Sn

SISI test

Prova tonale

Soglia del dolore

Adattamento — normale — patologico

Prova vocale

voce viva controllata — voce riprodotta — logotomi — parole
altoparlante — cuffia — camera silente — ambiente comune

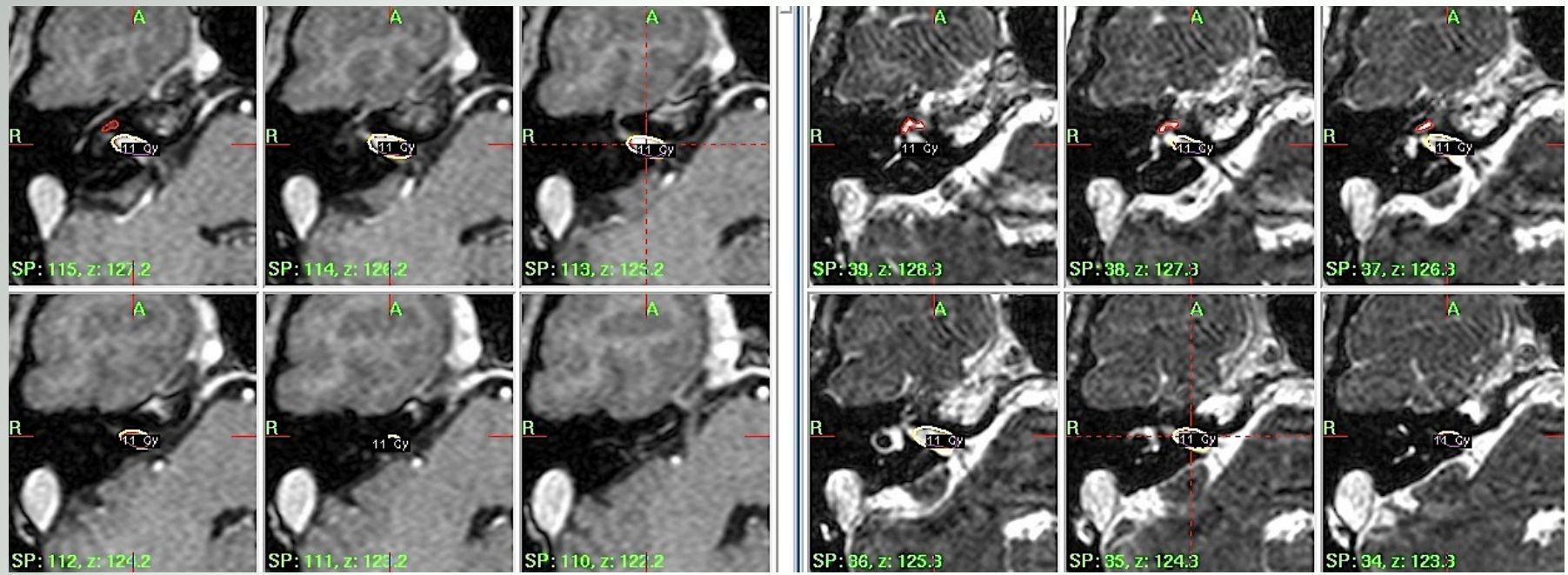
443 - Grafica Reventino Decollatura

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

OUR EXPERIENCE



MR on GK day, October 4th, 2012

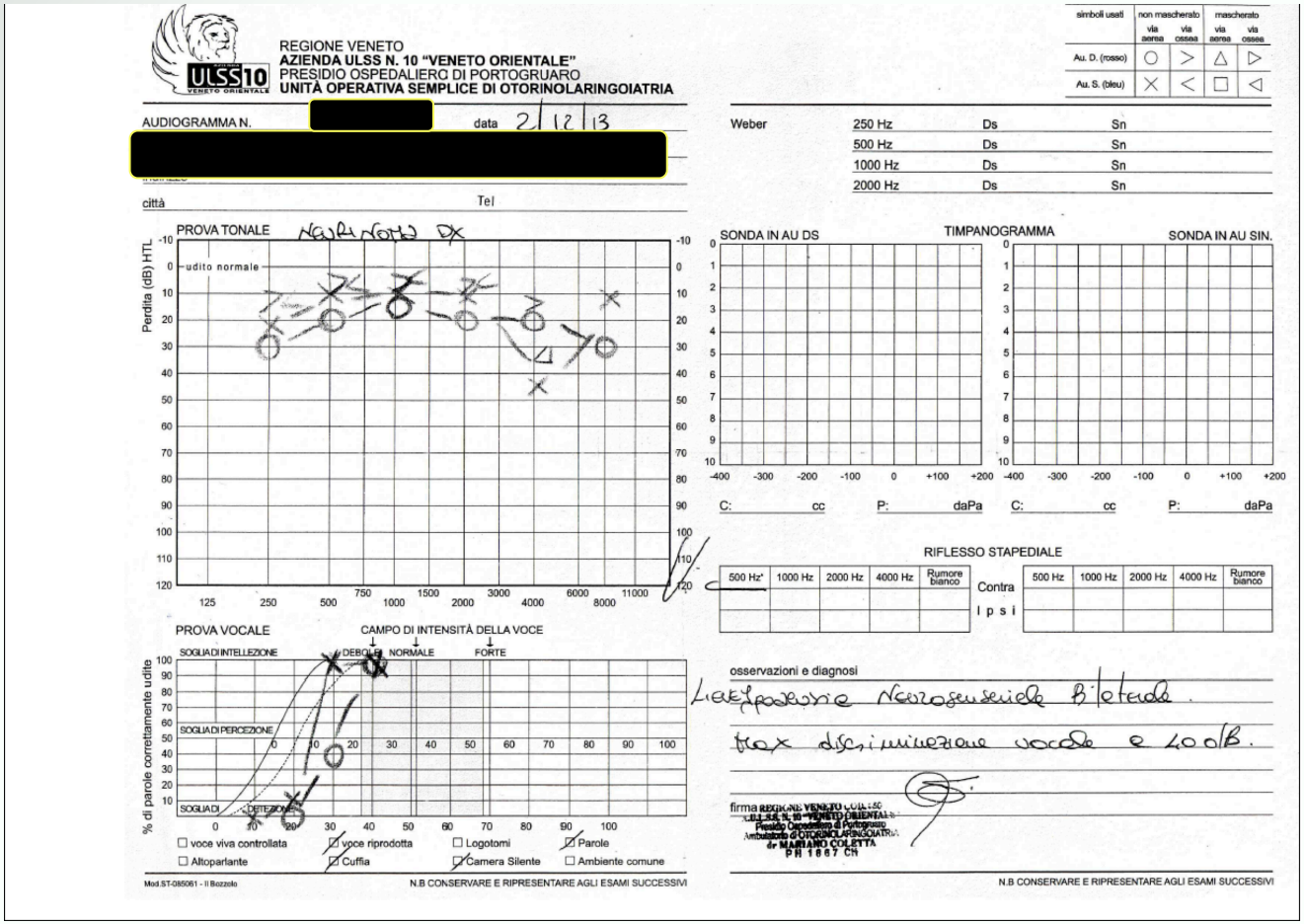
Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

OUR EXPERIENCE

AUDIOGRAM on Dec. 2nd, 2013



Verona, Sept. 17th, 2015

GAMMA KNIFE IN IAC-VSs

Author	N° Pts	Device	FU period (Median)	LTC %	Hear. Preser.	Facial N Preser.	Prog.Fact. for hear. Deterior.
Kim 2013	60	GK	62.0 m.	100 clinical TC	57 .0 PTA≤50 dB SDS≥50%	—	•TVE≥20%
Present series	66 47 p. GR I-III	GK	52.6 m.	98.5 (96%at10y)	46.8% (43% at5y.)	99.7	• Necrosis time • PD (Gy)

PTA: pure tone average
SDS: speach discrimination score
TVE: transient volume expansion

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

Facial Nerve Outcome after Vestibular Schwannoma Resection: A Comparative Meta-Analysis of Endoscopic versus Open Retrosigmoid Approach

Abdullah Alobaid[1] Mohammed Aref[1] Michael Ross Bennardo[1] Forough Farrokhyar[2] Kesava Reddy[1]

[1]Division of Neurosurgery, McMaster University, Hamilton, Ontario, Canada
[2]Department of Surgery, McMaster University, Hamilton, Ontario, Canada

Address for correspondence Abdullah Alobaid, MD, FRCSC, 96 St. Patrick Street, Apt. 1210, Toronto, Ontario M5T1V2, Canada (e-mail: abdullah.alobaid@medportal.ca).

J Neurol Surg B 2015;76:157–162.

Verona, Sept. 17th, 2015

Table 1 Final studies included in the analysis

	Study	No. of patients included in final analysis
Open approach	Samii et al[7–10]	962
	Colletti and Fiorino[12]	103
	Moffat et al[13]	50
	Jung et al[14]	30
	Mazzoni et al[15]	150
	Tonn et al[16]	508
	Strauss[17]	22
	Lassaletta et al[18]	65
	Maw et al[19]	40
	Yamakami et al[20]	50
	Darwish et al[21]	97
	Zhang et al[22]	105
	Samii et al[23]	200
	Sinha and Sharma[24]	58
	Veronezi et al[25]	20
	Yang et al[11]	110
	Chen et al[26]	103
	Chen et al[27]	145
	Zhao et al[28]	89
	Di Maio et al[29]	47
	Gerganov et al[30]	53
Endoscopic approach	Göksu et al[31]	32
	Magnan et al[32]	119
	Kabil and Shahinian[33]	112
	Shahinian and Ra[5]	527

META-ANALYSIS REVIEW FOR ALL ARTICLES DESCRIBING BOTH APPROACHES FOR VS FROM 1996 TO 2011:

- **21 OPEN APPROACH**
- **4 ENDOSCOPIC APPROACH**

SELECTED ARTICLES.

Verona, Sept. 17th, 2015

GAMMA KNIFE IN IAC-VSs

Table 2 Summary of meta-analysis comparing open series with minimal access endoscopic series with 95% confidence interval

	Open retrosigmoid, % (95% CI)	Minimal access endoscopic retrosigmoid, % (95% CI)
Good facial nerve outcome (HB 1 or 2)	67.0% (61–73%)	94% (92–95%)
GTR	91% (80–98%)	97% (92–99%)
Meaningful hearing (PTA < 80 dB and speech discrimination > 20%)	22.6% (10.4–37.6%)	46% (38–54%)
CSF leak	8.2% (4.8–12.3%)	4.6% (2.3–7.2%)
Wound infection	1.3% (0.6–2.3%)	2.6% (1.5–4.0%)
Recurrence	5.4% (1.8–10.1%)	2.2% (1.3–3.4%)
Death	0.9% (0.3–2%)	0%

Facial nerve Outcome (HB 1)	**98.0%-100.0%**
LTC	**90.5%-100.0%**
Hearing Preservation (GR I-II)	**40.0%-68.0%**
Other surgical complications	**0.0%**
Death	**0.0%**

Verona, Sept. 17th, 2015

GAMMA KNIFE IN IAC-VSs

CONCLUSIONS

SRS IN VSs ALLOWS:

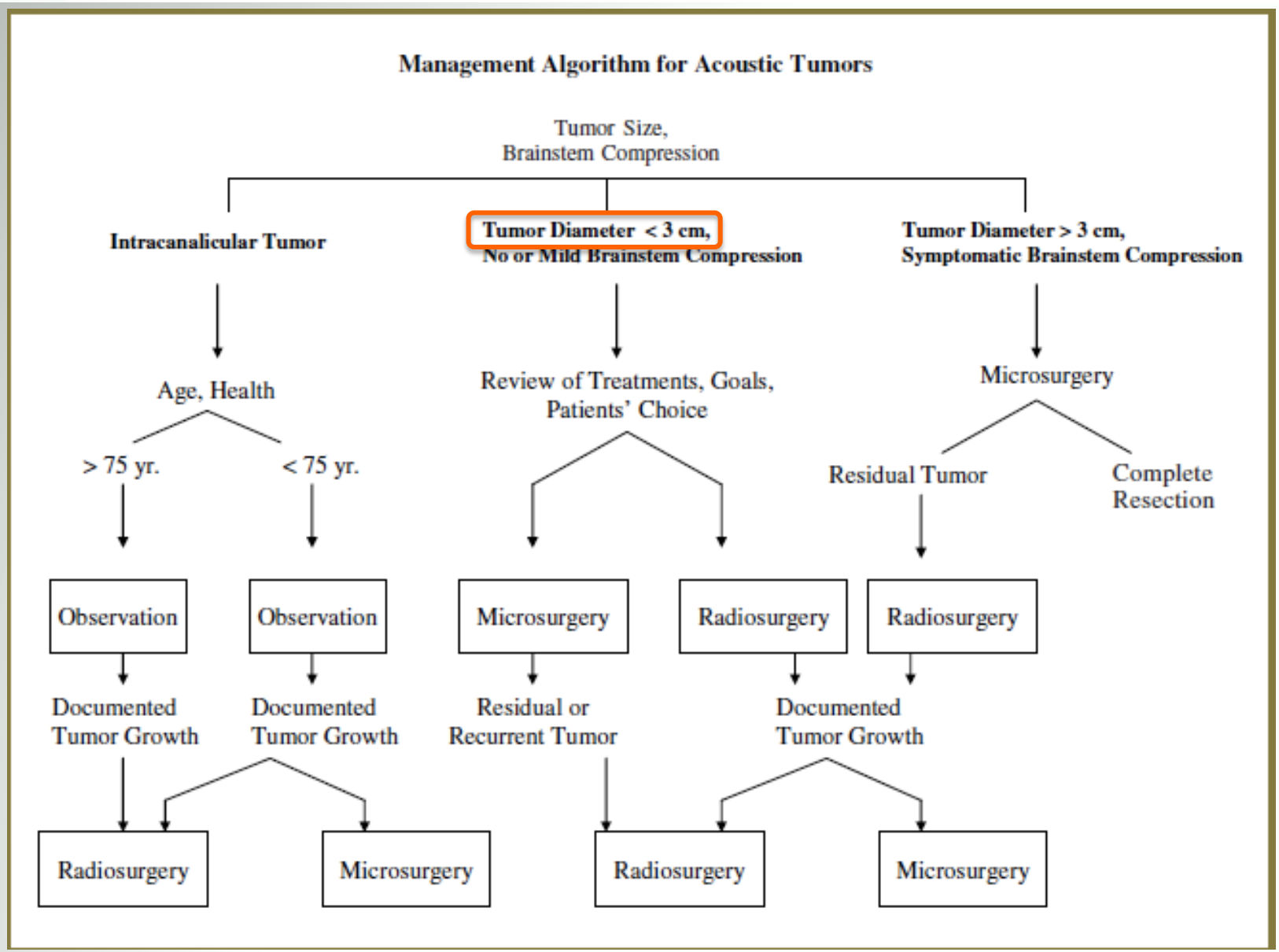
- VERY HIGH TGC
- POSSIBILITY OF HEARING PRESERVATION
- VERY HIGH RATE OF FACIAL NERVE PRESERVATION
- NO RISK OF “SURGICAL” COMPLICATIONS
- DAY SURGERY PROCEDURE
- HIGH NET INCOME FOR HEALTH SYSTEM

GAMMA KNIFE IN IAC-VSs

CONCLUSIONS

- ……THEN, NO NEED FOR FURTHER STUDIES ?

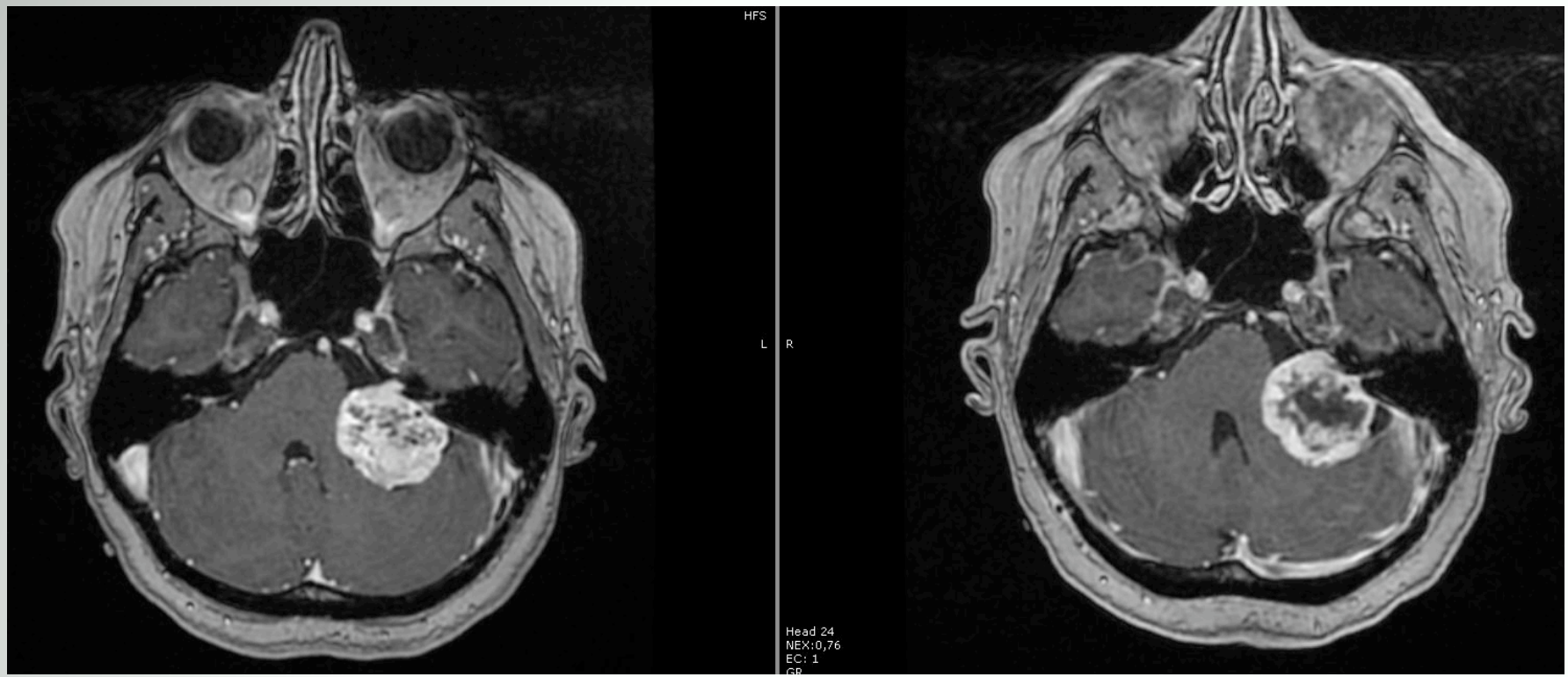
- Ø ≤ 2 cm: GK/SRS
- Ø ≥ 3 cm (USA), Ø ≥ 2.5 cm (EC):
  - microsurgical endoscopic approach
- **2 cm > Ø < 2,5 cm:**
  - what is the goal standard for these VSs ?


Management Algorithm for Acoustic Tumors
Tumor Size,
Brainstem Compression
Intracanalicular Tumor
Tumor Diameter < 3 cm,
No or Mild Brainstem Compression
Tumor Diameter > 3 cm,
Symptomatic Brainstem Compression
Age, Health
> 75 yr.
< 75 yr.
Review of Treatments, Goals,
Patients' Choice
Microsurgery
Residual Tumor
Complete
Resection
Observation
Observation
Microsurgery
Radiosurgery
Radiosurgery
Documented
Tumor Growth
Documented
Tumor Growth
Residual or
Recurrent Tumor
Documented
Tumor Growth
Radiosurgery
Microsurgery
Radiosurgery
Microsurgery

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

GAMMA KNIFE IN IAC-VSs

CONCLUSIONS

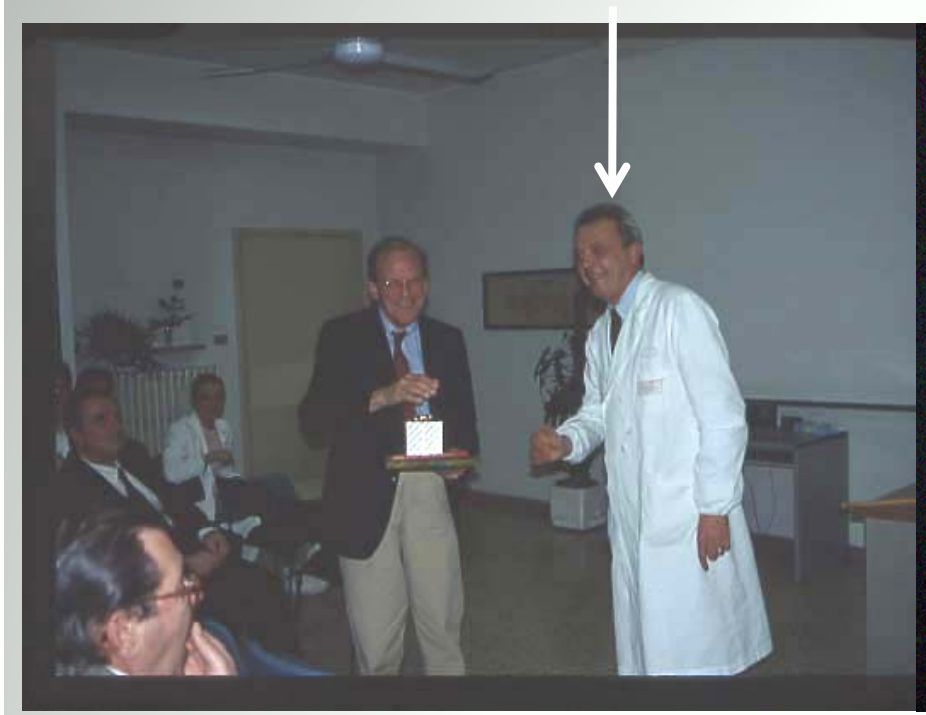


VS WITH Ø > 3 cm TREATED WITH PROTON BEAM:……

Verona, Sept. 17th, 2015

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA

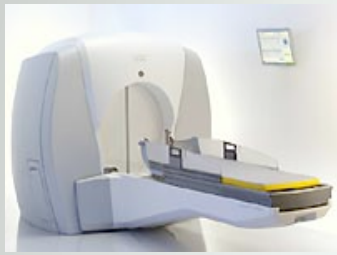
GAMMA KNIFE VERONA: 20 YEAR-RESULTS



February 1993 – February 2013

Verona, 13 Dicembre 2013

AZIENDA OSPEDALIERA UNIVERSITARIA INTEGRATA
VERONA



NEURO
Gruppo Verona
ONCOLOGICO

THANK YOU FOR THE ATTENTION