XXXIII CONGRESSO NAZIONALE AIRO

AIRO2023

BOLOGNA,
27-29 OTTOBRE 2023
PALAZZO DEI CONGRESSI

Radioterapia Oncologica: l'evoluzione al servizio dei pazienti

Radiochirurgia encefalica delle lesioni benigne: quale standard nel 2023?

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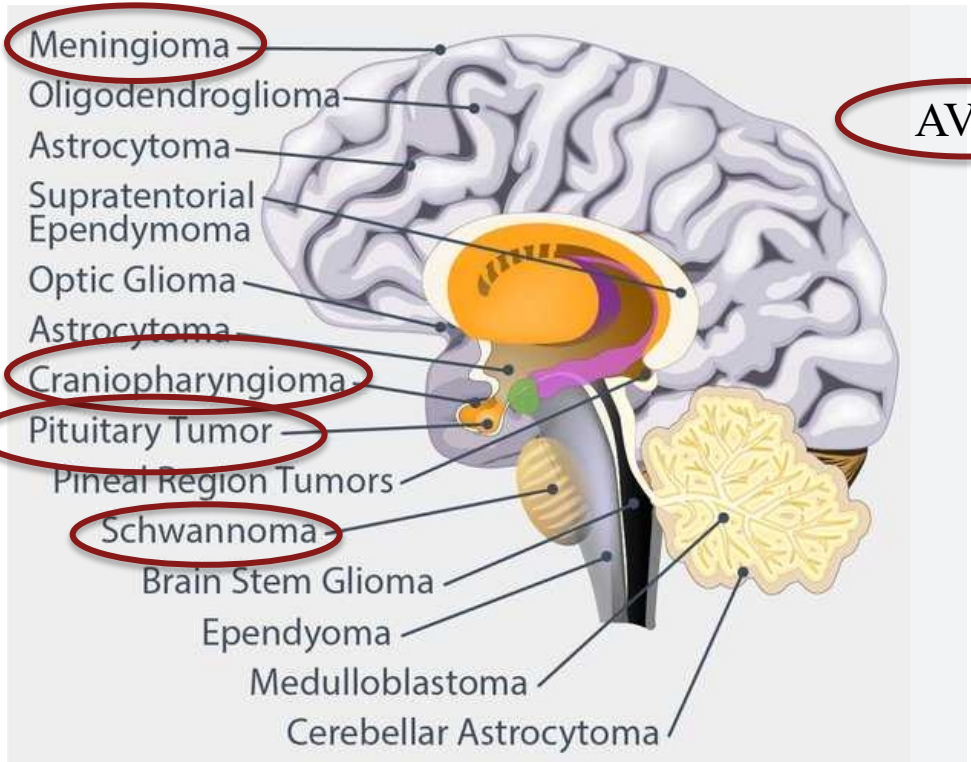
Radioterapia e Oncologia clinica

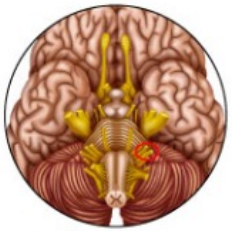
SRS standards in 2023
Benign brain lesions

- Standards are documented agreements containing technical specifications
- Other precise criteria to be used consistently as rules, guidelines, or definition of characteristics


Meningioma
Oligodendroglioma
Astrocytoma
Supratentorial Ependymoma
Optic Glioma
Astrocytoma
Craniopharyngioma
Pituitary Tumor
Pineal Region Tumors
Schwannoma
Brain Stem Glioma
Ependyoma
Medulloblastoma
Cerebellar Astrocytoma
AVM

Level of evidence

2-3



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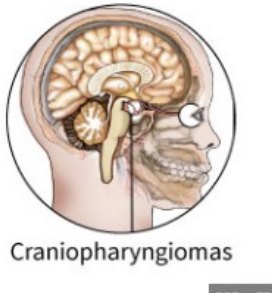

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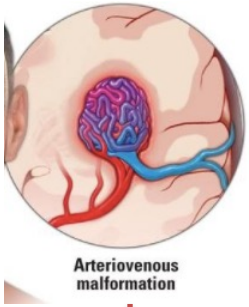


2 – 4

WHO GRADE 1 MENINGIOMA

Meningioma: brain tumor

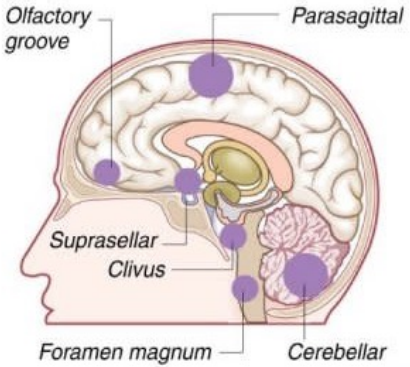
The most common type, accounting for 30 percent of those diagnosed

Meningioma

- 85 percent are benign and slow growing
- Three times more common in women than in men
- Can often be removed entirely with surgery
- Can lead to disability and life-threatening conditions if untreated

Common locations

- The cancer originates in the outer layers of tissue between the skull and the brain
- As the tumors grow they press against the brain and spinal cord



Author, year	3 year LC		5 year LC		10 year LC		Last follow-up LC	
	Pts, N	Rate (95% CI)	Pts, N	Rate (95% CI)	Pts, N	Rate (95% CI)	Pts, N	Rate (95% CI)
Abdelaziz, 2011	-	-	-	-	-	-	23	**95.7**
Aboukais, 2015	19	**49.5 (25.3-69.9)**	-	-	-	-	-	-
Aichholzer, 2000	-	-	-	-	-	-	15	**93.3**
Bledsoe, 2010	116	**99.0**	-	-	-	-	-	-
Chung, 2009	-	-	80	**91.6**	-	-	-	-
Davidson, 2007	-	-	36	**100.0**	36	**94.7 (68.1-99.2)**	-	-
Dina, 2013	uk	**93.0**	uk	**93.0**	-	-	-	-
Franzin, 2007	-	-	123	**90.5**	-	-	-	-
Hasegawa, 2011	-	-	119	**87.0**	119	**71.0**	-	-
Jo, 2011	69	**100.0**	69	**100.0**	69	**100.0**	-	-
Kalogeridi, 2010	14	**100.0**	14	**100.0**	-	-	14	**100.0**
Kano, 2011	9	**100.0**	9	**100.0**	9	**100.0**	-	-
Kim, 2009	9	**89.0 (43.3-98.4)**	9	**89.0 (43.3-98.4)**	9	**67.0 (16.0-91.4)**	-	-
Kimball, 2009	47	**100.0**	20	**100.0**	10	**98.0**	-	-
Kondziolka, 2008	-	-	-	-	488	**95.0**	-	-
Massager, 2013	-	-	-	-	-	-	120	**92.5**
Metellus, 2005	-	-	-	-	-	-	36	**94.4**
Pollock, 2012	-	-	416	**96.0**	416	**89.0**	-	-
Spiegelmann, 2010	-	-	102	**98.0**	-	-	-	-

Pinzi V. et al, Crit Rev Oncol Hematol 2017

DISEASE CONTROL

- 49.5% - 100.0% at 3 years
- 87.0% -100.0% at 5 years
- 67.0% - 100.0% at 10 years

PFS rate

- 91.3% - 100.0% at 3 years
- 78.0% - 98.9% at 5 years
- 53.1 - 97.2% at 10 years

Pinzi V. et al, Crit Rev Oncol Hematol 2017

AIRO2023

Radioterapia Oncologica:
l'evoluzione al servizio dei pazienti

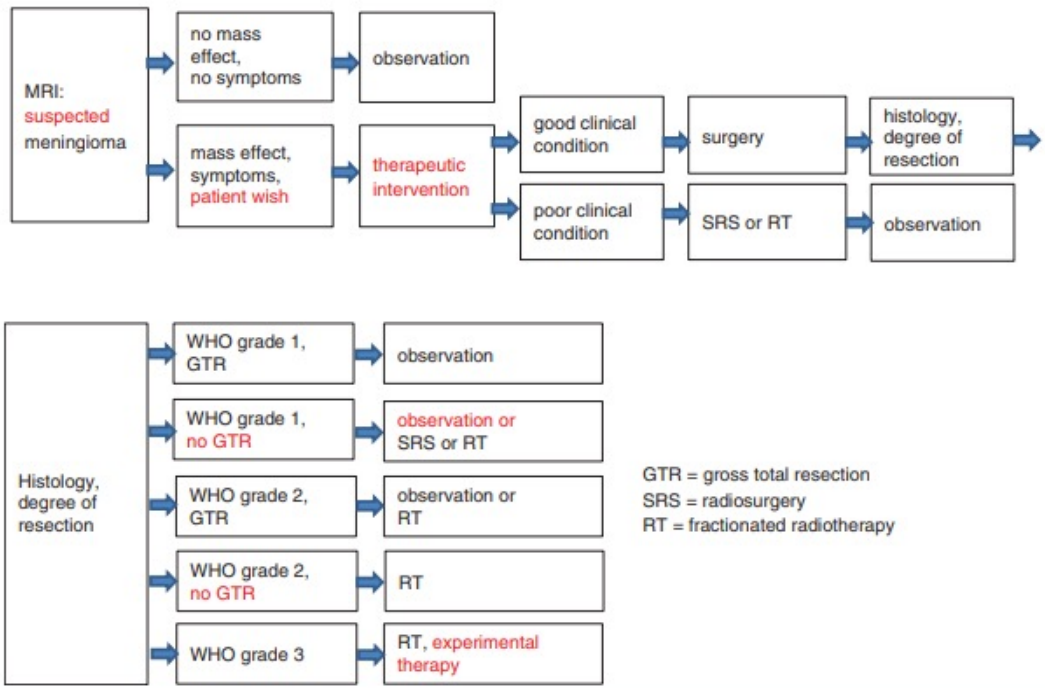


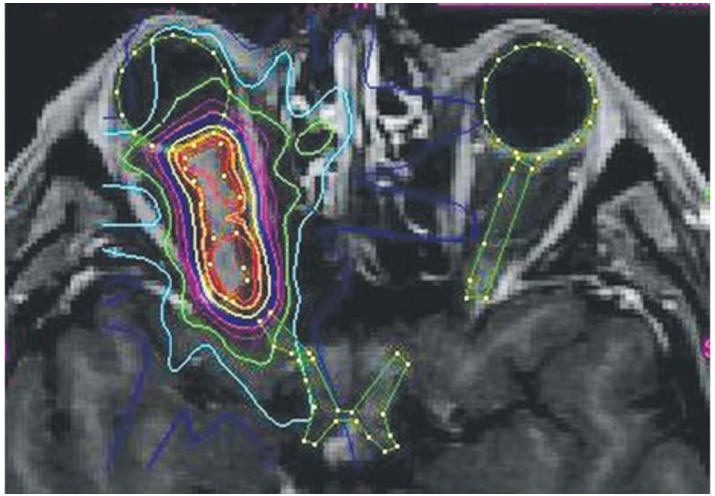
Fig. 2 Recommendations for the therapeutic management of WHO grade 1-3 meningiomas.

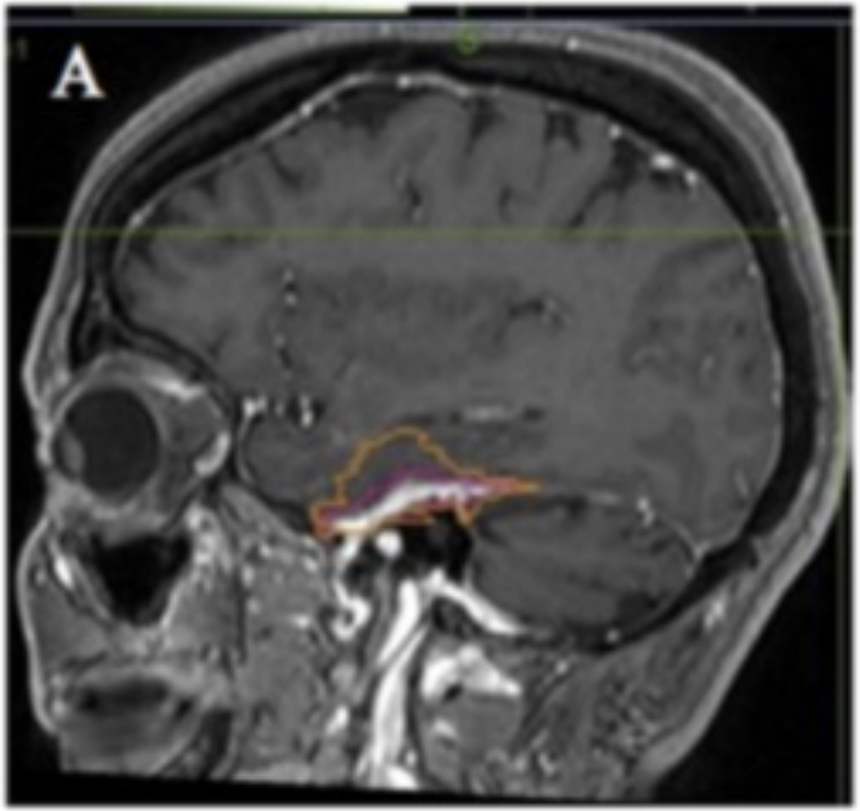
Neuro-Oncology
23(11), 1821–1834, 2021 | https://doi.org/10.1093/neuonc/noab150 | Advance Access date 28 June 2021

EANO guideline on the diagnosis and management of meningiomas

Goldbrunner et al, Neurooncol, 2021

Location
convexity
falx
parasagittal
petrosal
superior
ventral
posterior
CPA
anterior clinoid
sphenoid wing
tentorial
cavernous sinus
tuberculum sellae
petrotentorial, petroclival
olfactory groove
planum sphenoidale
anterior cranial base
foramen magnum
clival
posterior clinoid
others†

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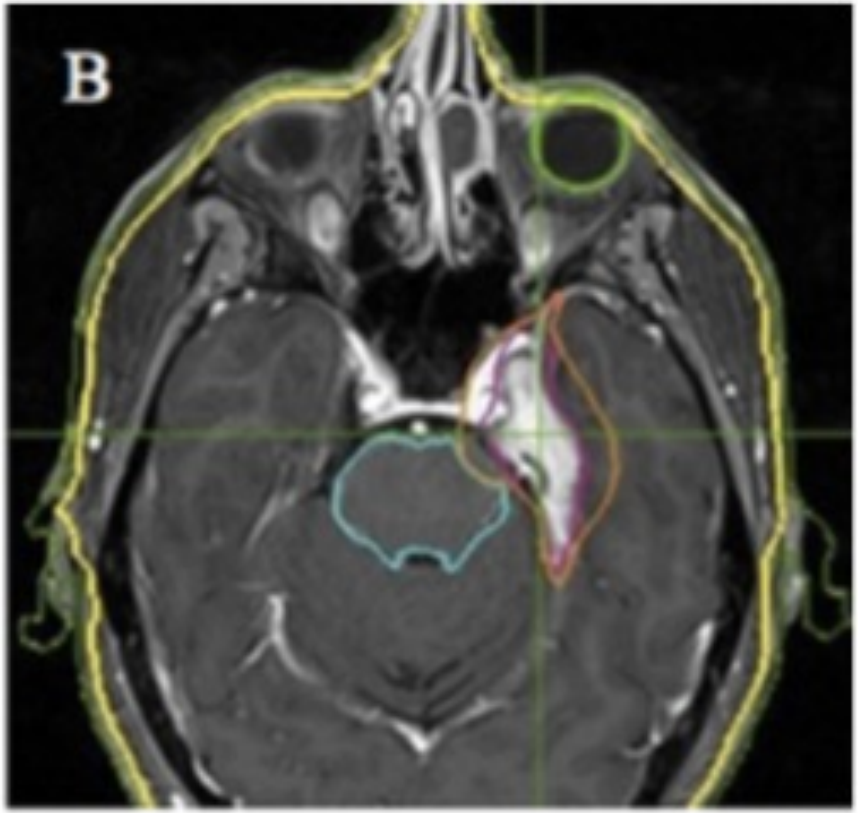

B

Management of cavernous sinus meningiomas: Consensus statement on behalf of the EANS skull base section

Contents lists available at ScienceDirect

Brain and Spine

EANS

1. *The EANS task force recommends that patients with newly diagnosed CSM undergo a complete history and clinical examination by a neuro-ophthalmologist, including visual acuity and fields, oculomotricity, corneal reflex and facial sensory changes. Furthermore, a thorough endocrinological assessment with complementary blood tests should be performed to rule out any preoperative endocrinological deficit whenever the pituitary complex is involved (**Level C**).*

2. *The EANS task force recommends that all patients with a newly discovered lesion compatible with a CSM undergo cerebral MRI with 3D T1 post-gadolinium sequences, 3D T2 anatomical sequences, time-of-flight (TOF) angiographic sequences and Fat sat sequences to assess the lateral/upward/posterior extension of the tumour in the parasellar area, the involvement of CNs II-VI, the overall anatomy of the region and the vasculature, in particular the cavernous segment of the ICA. A cerebral CT scan should also be performed to assess the presence of hyperostosis in the parasellar area when surgery is indicated. The hyperostosis can be seen with sufficient accuracy in T2-weighted images, whenever a CT scan cannot be performed (whatever the reason). As part of the preoperative planning, digital subtraction angiography (DSA) with balloon occlusion test to evaluate the ICA patency as well as tolerance for ICA occlusion can be undertaken (**Level C**).*

3. *The EANS task force recommends patient counselling prior to the treatment of a CSM in order to extensively discuss the risk and benefits of any surgical or non-surgical treatments and natural history of the disease, especially if asymptomatic. Perspectives in terms of QoL, functional impairment and mortality should also be openly discussed (**Level C**).*

Corniola et al, Brain and Spine 2, 2022

*4. The EANS task force recommends that conservative treatment with serial imaging follow-up should be proposed in patients with a newly diagnosed asymptomatic CSM that has no mass effect on the adjacent temporal lobe (**Level C**). Whenever the CSM is suspected to be progestin-induced, hormonal treatment should be discontinued at first.*

5. The EANS task force recommends that SRS or SRT (either single-dose or fractionated) should be considered in the following cases, insofar as the distance to the ON is superior to 3 mm (**Level C**):

- Asymptomatic, > 40 years old patients with a purely intracavernous CSMs < 2.5 cm showing growth on serial imaging after initial conservative treatment;

- Asymptomatic patients with partly extracavernous CSMs showing growth on serial imaging after initial conservative treatment;

- Symptomatic patients with CSMs < 2.5 cm, provided that the symptoms are not related to ON compression

- Symptomatic patients with partly extracavernous CSMs in whom surgery is contraindicated.

*The EANS task force recommends that fractionated RT should be considered in cases that warrant treatment (see above) if the distance to the ON is less than 3 mm and the ipsilateral visual function is good (**Level C**).*

*6. The EANS task force recommends proceeding to surgery in the following cases (**Level C**):*

Biopsy/Decompression	Maximal safe resection	Aggressive surgery/ Cavernous sinus exenteration
Atypical lesion *Unclear diagnosis* *Rapidly symptomatic lesions or unusual radiology* *Alternatively, ^{68}Ga DOTATATE-PET (Klingenstein et al., 2015) or 68Ga DOTATOC-PET (Haslund-Vinding et al., 2021) can be performed (high sensitivity)*	*Symptomatic, partly extracavernous CSM* *Young patients (< 40 years) with asymptomatic, but growing CSM might be considered for surgery, if patient agrees.* *Progressive visual loss due to ON compression*	*Complete visual loss* *Complete ophthalmoplegia* *Complete visual loss and complete ophthalmoplegia* *Recurrence after radiation* *Aggressive tumour histology/behaviour*

Corniola et al, Brain and Spine 2, 2022

Management of cavernous sinus meningiomas: Consensus statement on behalf of the EANS skull base section

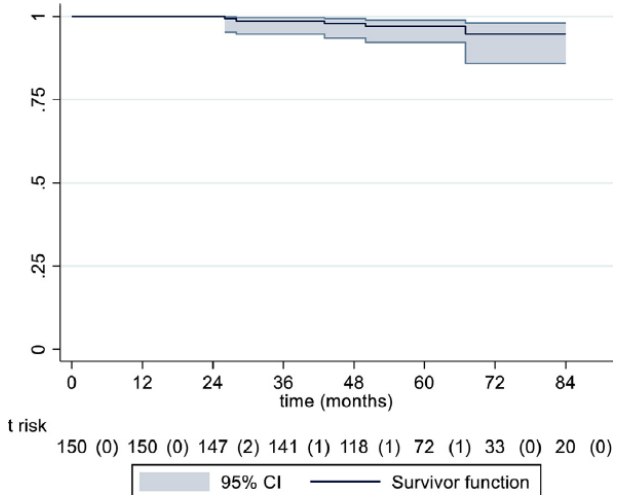
The treatment decision should consider:

- 1) the clinical symptoms and signs on presentation;
- 2) the size of the tumour and its consistency;
- 3) the biological behaviour of the meningioma;
- 4) the preoperative work up: MRI, …;
- 5) the experience of the multidisciplinary team in charge of the patient.

In any case,
the decision to offer one treatment over another should be taken by a ***multidisciplinary board****, where experienced surgeons and physicians* ***meet and share*** *their expertise*

Corniola et al, Brain and Spine 2, 2022

Hypofractionated Radiosurgery for Large or in Critical-Site Intracranial Meningioma: Results of a Phase 2 Prospective Study



- 7-year LC rate of 95% (95% CI, 0.87-0.99)
- Literature data → an average LC rate of 91.8%

- NO correlation between outcomes, patient characteristics and treatment variables

(probably owing to the small number of PD)

Pinzi et al, IJROBP, 2022

Hypofractionated Radiosurgery for Large or in Critical-Site Intracranial Meningioma: Results of a Phase 2 Prospective Study

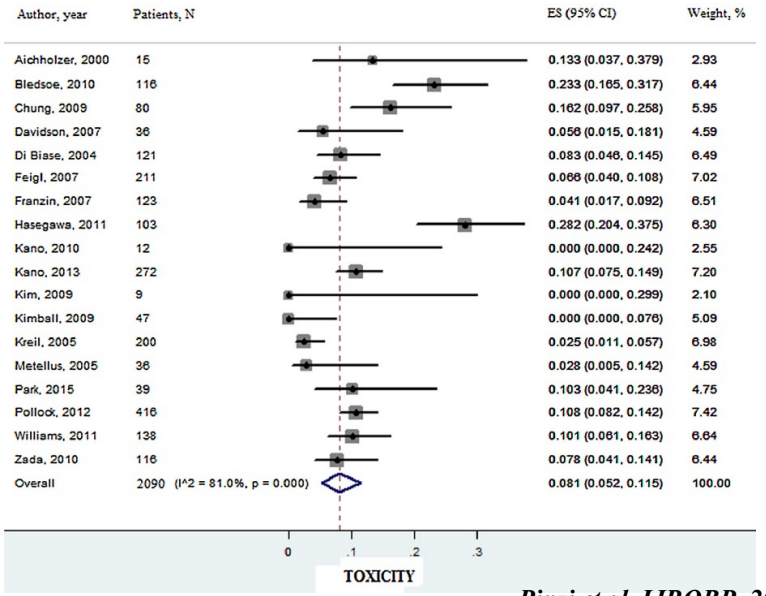
Toxicity rate 12.7% (21 of 166 patients)

5-year minimum follow-up,
Toxicity rate 11.7 % (9 of 77 patients)

Symptom evaluation improvement in 55%

overall estimate of

8.1% (95% CI: 5.2-11.5%)



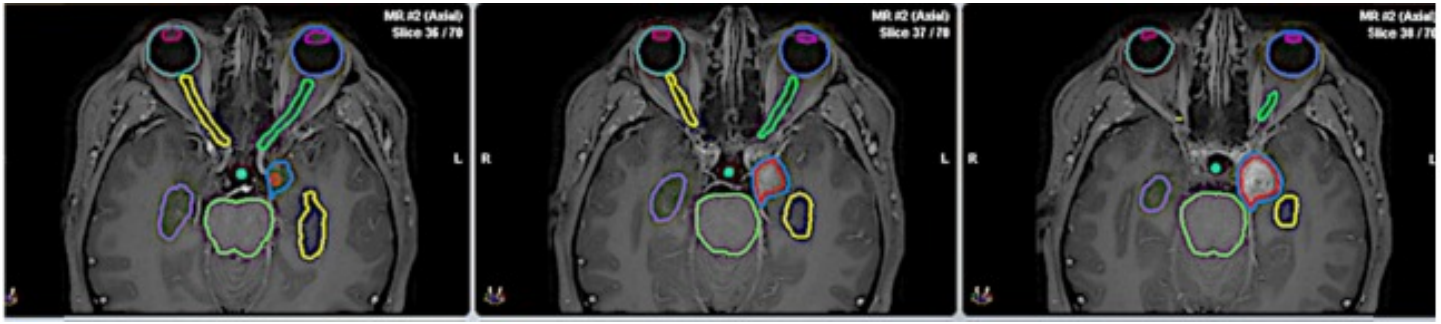
Pinzi et al, IJROBP, 2022

ESTRO ACROP guideline for target volume delineation of skull base tumors

Description of main organs at risk (OARs) contoured in the skull base tumor illustrated in Fig. 1.

OAR	Description
Left optic nerve (lime green; panels 3–6) and right optic nerve (yellow; panels 3–5). Thick, 2–5 mm	The optic nerve is delineated from the posterior edge of eyeball to the optic chiasm (panel 2–3). Visible on both MRI and CT, the latest useful for the relationsship with bony optic canal
Optic chiasm (cyan; panels 2–3). Thick, 2–5 mm	The optic chiasm is located in the suprasellar region (about 1 cm from the pituitary gland) anteriorly to the pituitary stalk. It is formed by the convergence of the optic nerves anteriorly (panel 3) and by the divergence of the optic tracts posteriorly (panel 1); laterally it is in contact/close proximiy to the Internal carotid artery. For a better delineation, coronal and sagittal images are recommended. The optic chiasm is better delineated on T1-weighted MRI sequences, visible also on CT
Right optic tract (lemon; panel 1) and left optic tract (light green; panel 1). Thick 2–5 mm	The optic tracts are visible posteriorly to the optic chiasm and anteriorly/laterally to the midbrain for 10–20 mm. Better delineation on T1-weighted MRI sequences, visible also on CT
Right (aquamarine) and left (dark blue) retina (posterior part of eyeball; panel 1–8). Thick, 2–3 mm	The retina is delineated on MRI and CT as the posterior part of the eyeball
Pituitary gland (cheddar; panels 7–10). Volume 0.25–0.5 cc	The pituitary gland lies on the sella turcica with a cranio-caudal dimension of 10–12 mm and bilaterally is bordered by cavernous sinuses. Visible on axial T1-weighted contrast-enhanced MRI. For a better delineation, coronal and sagittal images are recommended
Pituitary stalk (turquoise; panels 3–7). Thick 1–2 mm	The pituitary stalk has a lenght of 7–10 mm; it is delineated from hypothalamus (cranial limit) just behind the optic chiasm to the pituitary gland (caudal limit). For a better delineation, coronal and sagittal T1-weighted contrast-enhanced MR images are recommended
Brainstem (green; all panels)	The brainstem is seen on both MRI and CT. In craniocaudal direction, the midbrain, pons and medulla oblongata (up to the tip of C3 dens) are delineated. On panels 10 and 11, the right trigeminal nerve (fifth nerve) is delineated from the pons to the entrance of the nerve into Merckel's cave (redorange)
Right hippocampus (purple; panels 1–7) and left hippocampus (gold; panels 1–7). Volume, 2.5–4.0 cc	The hippocampus is constituted by grey matter and is easily distinguishable on T1-weighted MRI sequences. It is delineated as hypointense area medial to the curve of the temporal horn of the lateral ventricle (from panel 7), then continuing in the upward direction, bordered medially by the by the lateral edge of the quadrigeminal cistern (panel 1). Sagittal images can help OAR delineation
Right cochlea (light blue; panels 13–14) and left cochlea (orange; panels 15–16). Volume 0.5–0.6 cc	The cochlea is a spiral structure located in a bony cavity in the petrous portion of the temporal bone, anterior to the labyrinth, lateral to the internal auditory canal. It can be delineated on the basis of CT or MRI (better T2-weighted MR images) without inclusion of the semicircular canals (located laterally and cranially of the cochlea)

ESTRO ACROP guideline for target volume delineation of skull base tumors



Combs SE et al, Radiother Oncol, 2021

ESTRO ACROP guideline for target volume delineation of skull base tumors

Summary of normal tissue constrains using standard fractionated RT (2 Gy per fraction) and SRS (1-5 fractions).

Organ	Type of radiation	Dose constraint (toxicity rate)	Type of toxicity	References
Brain	Standard fractionation	Dmax <60 Gy to whole organ (<3%)	Symptomatic necrosis	[57,60,63,72,73]
	Single-fraction SRS	12 Gy to <5–10 ml (<10-20%)		
	3-fraction SRS	18 Gy (6 Gy/fx) to <26 ml (3%)		
Brainstem	Standard fractionation	Dmax <54 Gy to whole structure (<5%)	Permanent cranial deficit or necrosis	[57,60,63,65]
	Single-fraction SRS	Dmax <12.5 Gy (<5%; 1% if to 1/3 of brainstem		
	3-fraction SRS	Dmax 18 Gy (6 Gy/fx) to <1 ml (<3%)		
	5-fraction SRS	Dmax 26 Gy (5.2 Gy/fx) to <1 ml (<3%)		
Optic nerve/chiasm	Standard fractionation	Dmax <55 Gy to whole structure (<3%)	Optic neuropathy	[57,58,66,69]
	Single-fraction SRS	Dmax <8 Gy (<3%), Dmax 8-12 Gy (<10%)		
	3-fraction SRS	19.5 Gy (6.5 Gy/fx) (<3%)		
	5-fraction SRS	Dmax 25 Gy (5 Gy/fx)(<3%)		
Cochlea	Standard fractionation	Mean dose ≤45 Gy to whole structure (<15%)	Hearing loss	[57,60,61]
	Single-fraction SRS	Dmax ≤14 Gy (<25%)		
	3-fraction SRS	Dmax 20 (6.67 Gy/fx) (<3%)		
	5-fraction SRS	Dmax 27.5 (5.5 Gy/fx) (3%)		
Pituitary gland	Standard fractionation	Dmax ≤45 Gy to whole gland (20-40% at 5 years)	Hypopituitarism	[59,64,67,68,70]
	Single-fraction SRS	Dmax <15 Gy (2-30% at 5 years)		
Hippocampus	Standard fractionation	Dmax ≤7.3 Gy to 40% of structure (impairment in Wechsler Memory Scale-III Word List delayed recall)	Memory impairment	[71]
Medulla Oblongata	Standard fractionation	Dmax 54 Gy (1%) and 61 Gy (10%)	Myelopathy	[57,60,62]
	Single-fraction SRS	Dmax 13 Gy (1%)		
	3-fraction SRS	Dmax 22.5 Gy (6.67 Gy/fx) (1%)		
	5-fraction SRS	Dmax 30 Gy (6 Gy/fx) (1%)		

Combs SE et al, Radiother Oncol, 2021

TABLE 6. Summary of the ISRS Recommendations for SRS and Meningioma

Recommendations level
Recommendation level II. SRS may be proposed as a primary treatment modality for an asymptomatic or mildly symptomatic meningioma, and should be considered when a complete surgical excision cannot be achieved or is not amenable
Recommendation level II. After surgery, when a residual tumor is not evident or is minimal, a wait-and-scan approach appears to be reasonable with a regular radiological follow-up. At the time of recurrence or progression, SRS should be taken into consideration as a treatment modality. Some studies suggest that the recurrence/progression rate is lower when SRS is delivered as the primary treatment as compared to an adjuvant treatment and this remains to be confirmed.
Recommendation level III. Single-fraction SRS with a dose of 12 to 15 Gy appears to be sufficient to manage benign intracranial meningioma. A prescription dose of at least 14 Gy would be advisable.
Recommendation level III. HSRT may be considered for the treatment of large or/and critically located meningioma. Optimal practice has yet to be defined; however, 25 Gy in 5 fractions is a common approach.
Recommendation level III. SRS generally entails a low risk of neurological deterioration. Patients may experience a clinical improvement without tumor shrinkage.

DO'S

1) **Multidisciplinary** decision

2) **Clinical symptoms and signs** on presentation;

2) **Size** of the tumour;

3) **Site**

4) Biological **behaviour**;

5) **After surgery** always consider SRS/HFSRT

DON'TS

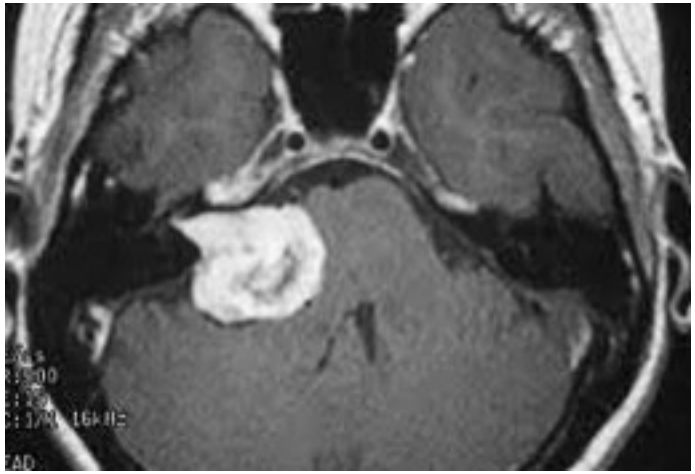
1) Exclude post-operative

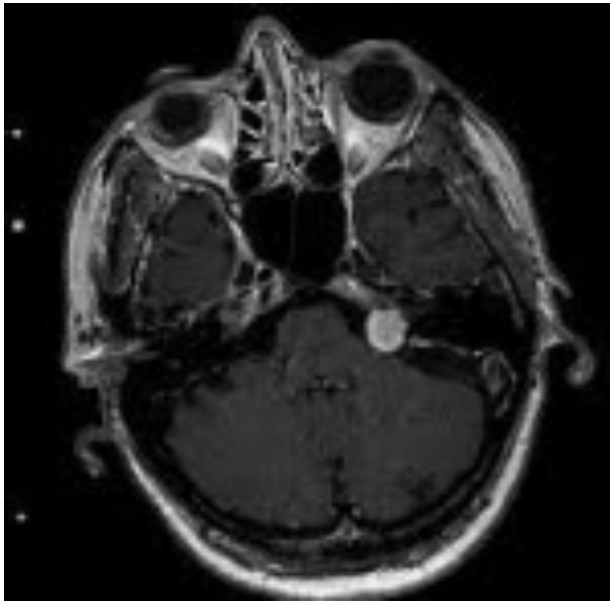
2) Exclude HFSRT

3) No Fup

4) Low SRS doses

VIII c.n. SCHWANNOMA





VIII c.n. SCHWANNOMA

6-8% intracranial tumors

Growth rate: 0,35-2,2 mm/year

No growth: 43%

MANAGEMENT

- Observation
- Microsurgery
- SRS
- FSRT
- Combined treatments

Neuro-Oncology
22(1), 31–45, 2020 | doi:10.1093/neuonc/noz153 | Advance Access date 28 August 2019

EANO guideline on the diagnosis and treatment of vestibular schwannoma

Table 5 Key recommendations

Clinical Situation	Recommendation	Evidence Class	Recomm. Level
Spontaneous VS, small asymptomatic	Observation	III	C
	OR		
	SRS	II	B
Spontaneous VS, small, complete hearing loss	Observation	III	C
	OR		
	SRS	II	B
	superior to		
	Surgery	III	C
Spontaneous VS, large with brainstem compression	Surgery	IV	Good practice point (GPP)
	inferior to		
	Combination surgery + SRS	IV	GPP

Goldbrunner, et al. Neurooncol 2020

Neuro-Oncology
22(1), 31–45, 2020 | doi:10.1093/neuonc/noz153 | Advance Access date 28 August 2019
EANO guideline on the diagnosis and treatment of vestibular schwannoma

MRI protocol should include:

- **T1- weighted** → before and after gadolinium administration

- **T2-weighted/FLAIR (Fluid-attenuated inversion recovery sequences)**

→ **mandatory** to rule out a potential brainstem pathology mimicking VS symptoms, such as multiple sclerosis or glioma

- **FIESTA** [fast imaging employing steady-state acquisition]/ **CISS** [constructive interference in steady state], or **DRIVE** [driven equilibrium pulse

→ to evaluate the vestibulocochlear nerve and its branches and depict the nerve as a linear hypointense structure surrounded by hyperintense CSF within adjacent cisterns

Diffusion-weighted imaging (DWI) → to differentiate VS from arachnoid or epidermoid cysts.

Goldbrunner, et al. Neurooncol 2020

ISRS PRACTICE GUIDELINE

Stereotactic radiosurgery for vestibular schwannoma: International Stereotactic Radiosurgery Society (ISRS) Practice Guideline

May N. Tsao MD[1], Arjun Sahgal MD[1], Wei Xu[2], Antonio De Salles MD[3], Motohiro Hayashi[4], Marc Levivier MD[5], Lijun Ma PhD[6], Roberto Martinez MD[7], Jean Régis MD[8], Sam Ryu MD[9], Ben J. Slotman MD[10] and Ian Paddick MSc[11]

- Single fraction RS: 11-14 Gy to the GTV margin [**strong consensus**].

- Hypofractionated radiation therapy options:
- Examples include 5 Gy x 5 daily, 3 Gy x 10 daily, 4Gy x 10, 6 Gy x 3, 4 Gy x 5 daily [**moderate consensus**].

The best fractionation scheme is not yet defined

18 Gy/3 fr and 25 Gy/5fr are the most common schedules

Tsa MN, et al. J Radiosurg SBRT. 2017

SRS for VS

VESTIBULAR SCHWANNOMA GUIDELINES

Congress of Neurological Surgeons Systematic Review and Evidence-Based Guidelines on the Role of Radiosurgery and Radiation Therapy in the Management of Patients With Vestibular Schwannomas

Question: Is there a difference in outcome based on the dose delivered?
Recommendation: Level 3: As there is no difference in radiographic control using different doses, it is recommended that for single fraction SRS doses, <13 Gy be used to facilitate hearing preservation and minimize new onset or worsening of preexisting cranial nerve deficits.

Question: Is there a difference in outcome based on the number of fractions?
Recommendation: As there is no difference in radiographic control and clinical outcome using single or multiple fractions, no recommendations can be given.

Germano IM, et al. Neurosurgery. 2018

ACOUSTIC SCHWANNOMA

MANAGEMENT

- Tumor size (critical structures)
- VIII – VII nncc function
- Patient presentation and characteristics

1. The use of grading systems at diagnosis and follow-up

Grade	Description	Measurement*	Function %	Estimated Function %
I	Normal	8/8	100	100
II	Slight	7/8	76 - 99	80
III	Moderate	5/8 - 6/8	51 - 75	60
IV	Moderately Severe	3/8 - 4/8	26 - 50	40
V	Severe	1/8 - 2/8	1 - 25	20
VI	Total	0/8	0	0

House JW, Brackmann DE, Otolaryngol Head Neck Surg. 1985

ACOUSTIC SCHWANNOMA

es. The facial nerve was preserved anatomically in 2,058 of these 2,252 cases (91.4%). Among these 2,058 cases, 1,255 (61%) retained a postoperative HB grade I or II status, and 601 (29.2%) retained HB grade III status; the remaining 202 cases (9.8%) had HB grade IV-VI status.

Annals otol rhin lar 2012, R. Ahamad

Grade	Description	Measurement*	Function %	Estimated Function %
I	Normal	8/8	100	100
II	Slight	7/8	76 - 99	80
III	Moderate	5/8 - 6/8	51 - 75	60
IV	Moderately Severe	3/8 - 4/8	26 - 50	40
V	Severe	1/8 - 2/8	1 - 25	20
VI	Total	0/8	0	0

1. The use of grading systems at diagnosis and follow-up

Gardner–Robertson modified hearing classification

Grade	Pure-tone average (dB)	Speech discrimination score (%)
I: Good–Excellent	0–30	70–100
II: Serviceable	31–50	50–69
III: Non-serviceable	51–90	5–49
IV: Poor	91–maximum	1–4
V: None	Not testable	0

Note that when pure-tone average and speech discrimination score do not correspond, the lower class is used.

Gardner G, Robertson JH. Ann Otol Rhinol. 1988

1. The use of grading systems at diagnosis and follow-up

Koos grade	Description
I	Intracanalicular tumor
II	Minimal tumor extension into the cerebellopontine angle, <2 cm
III	Tumor occupies the cerebello-pontine angle but does not dis-place the cerebellar trunk, <3 cm
IV	Large tumor with brainstem dis-placement, >3 cm

Koos WT. Clinical microneurosurgery. 1976

SRS for vestibular schwannoma

2. MRI protocol (diagnosis and follow-up)

- **T1- weighted** before and after gadolinium administration
- **T2-weighted/FLAIR (Fluid-attenuated inversion recovery sequences)**
- **FIESTA** [fast imaging employing steady-state acquisition]/ **CISS** [constructive interference in steady state], or **DRIVE** [driven equilibrium pulse
- **Diffusion-weighted imaging (DWI)** → to differentiate VS from arachnoid or epidermoid cysts.

SRS for vestibular schwannoma

3. Optimal prescription

WHICH DOSES?

- Better outcomes when the peripheral dose is less than 15 Gy
- "Standard dose" (marginal): 13 Gy
- 12 Gy in pt with residual function

SRS for AVM

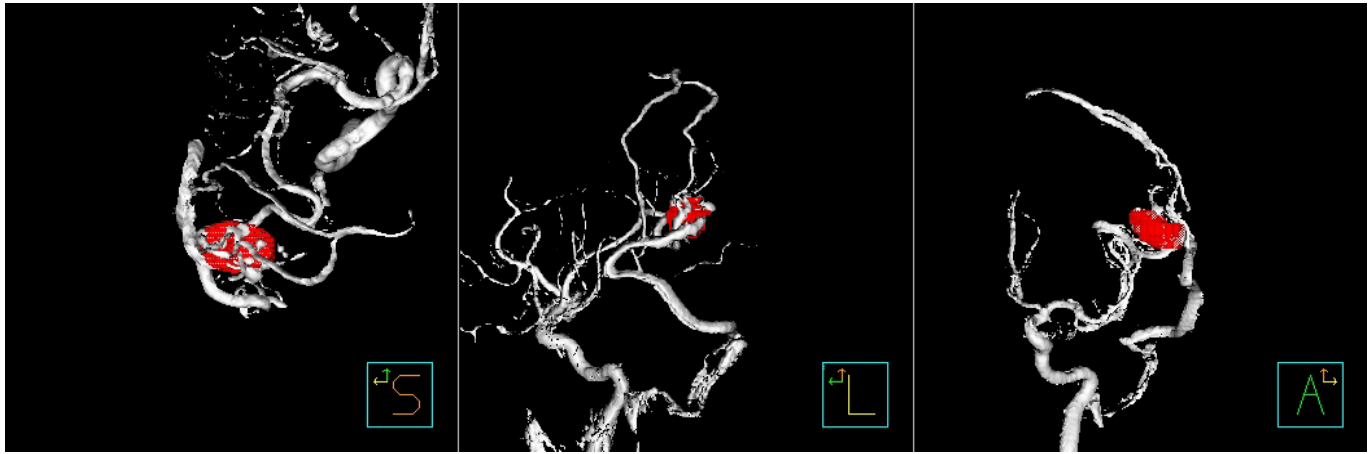
GOAL

Arteriovenous nidus obliteration

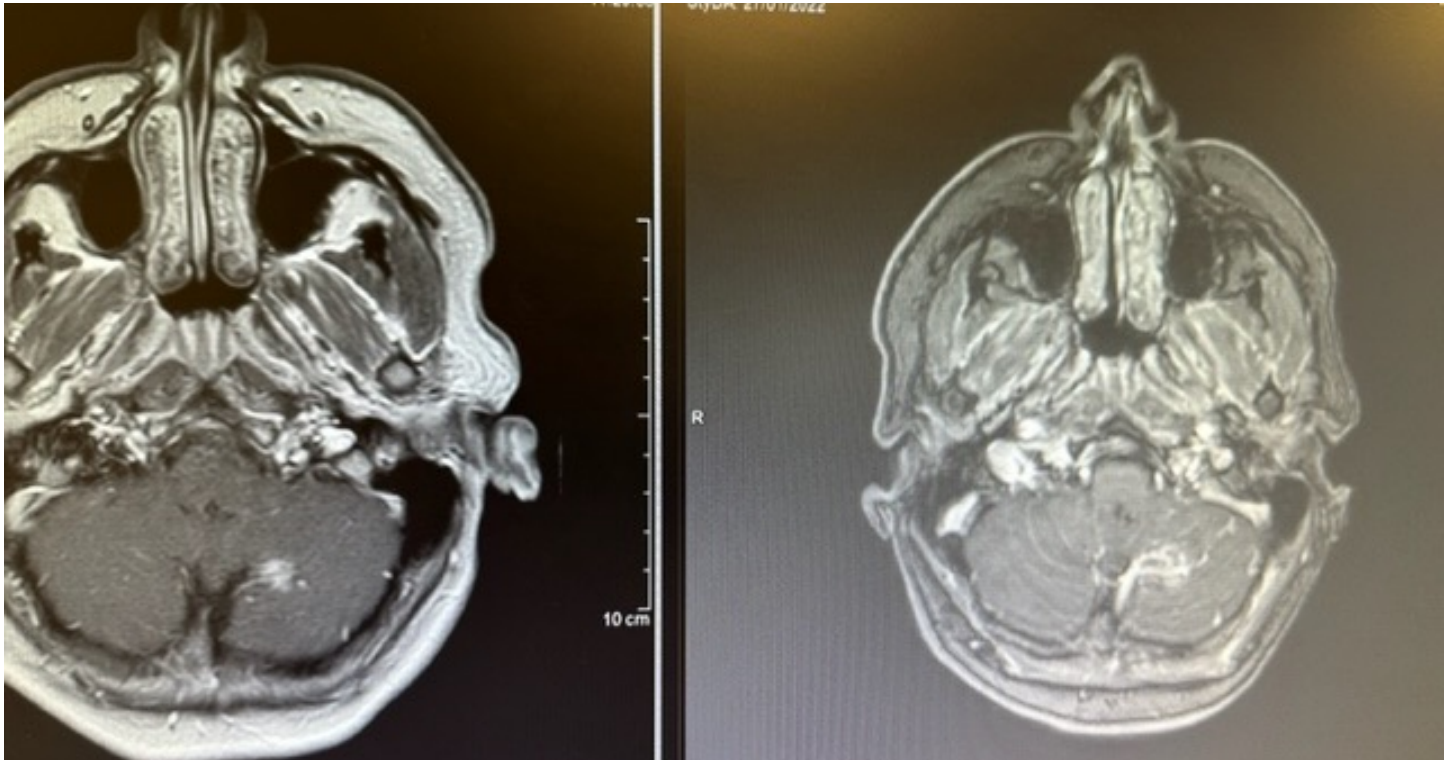
To eliminate bleeding risk

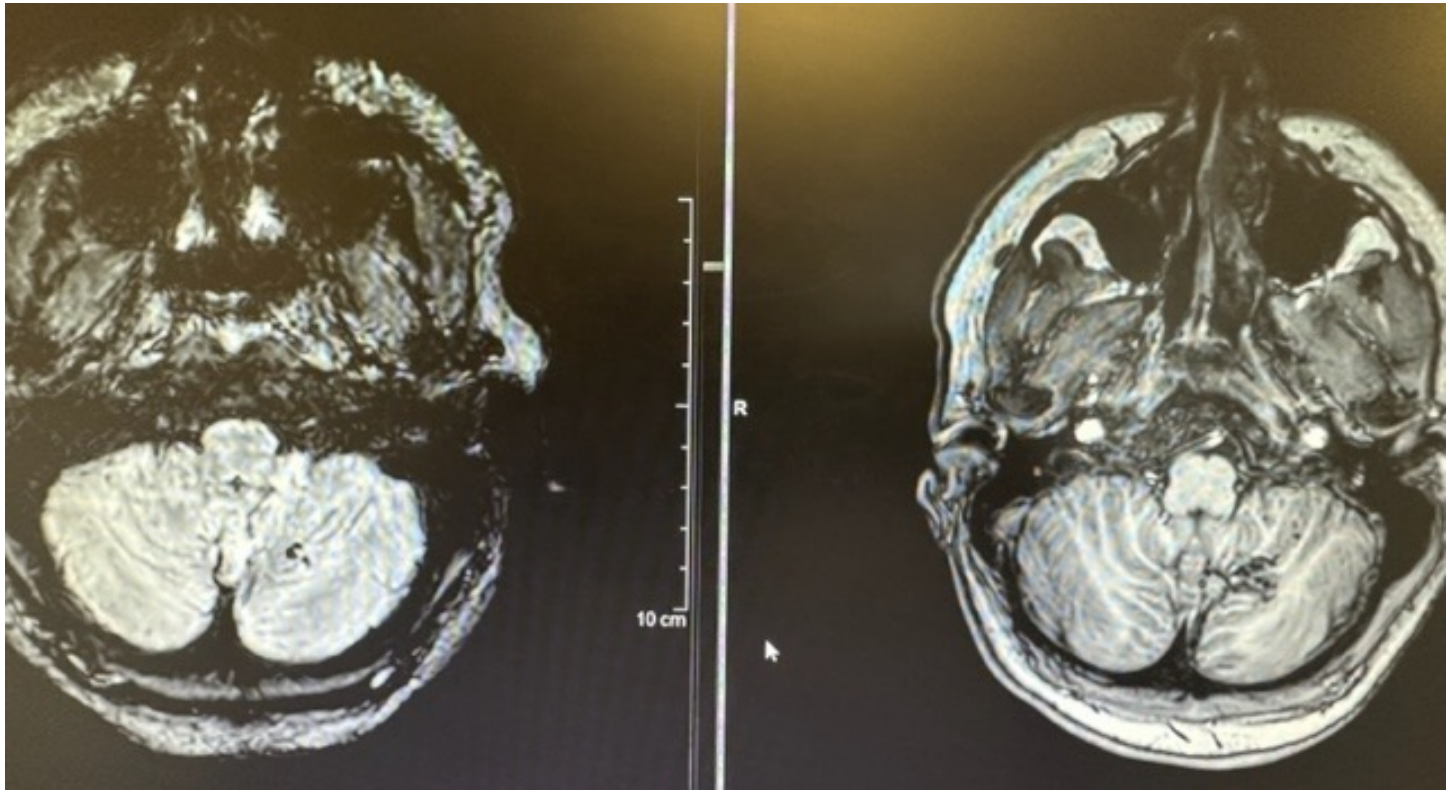
AVM radiosurgery. On angiography, it is defined as 'complete absence of pathological vessels forming the AVM nidus, disappearance or normalization of veins draining the AVM, appearance of normal circulatory kinetics, and absence of visible arteriovenous shunt' [36, 73]. Irradia-

SRS AVM



target reconstruction on 3D angiography


10 cm
R


10 cm
R

ARTERIOVENOUS MALFORMATIONS

HIGHLIGHT

Patient stratification (risk/benefit and outcomes):

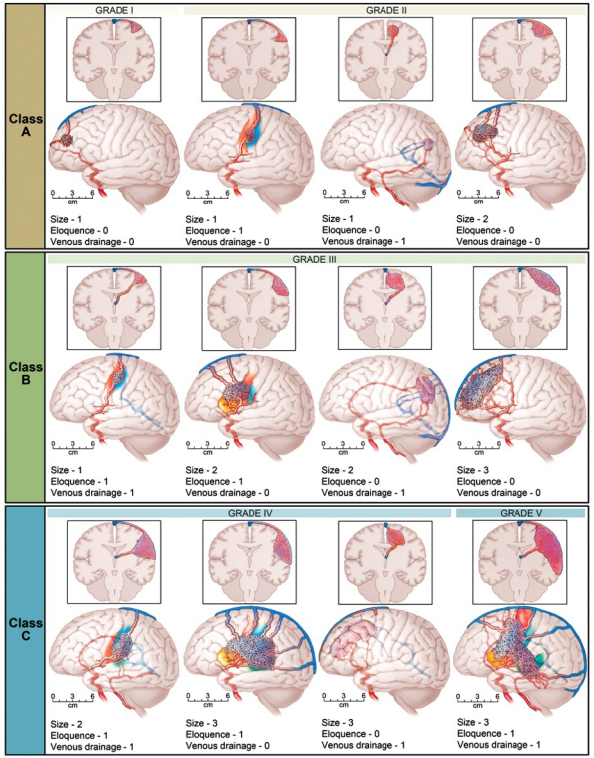
- Size
- Eloquent
- Venous drainage

SPETZLER-MARTIN CLASSIFICATION

	Characteristic	Points assigned
Size	small (<3 cm)	1
	medium (3–6 cm)	2
	large (>6 cm)	3
Eloquence[1]	no	0
	yes	1
Venous drainage	superficial only	0
	any deep	1

[1] Sensorimotor, language, or visual cortex, hypothalamus or thalamus; internal capsule; brainstem; cerebellar peduncles, or cerebellar nuclei.

AVM



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Venous drainage	superficial only	0
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[1] Sensorimotor, language, or visual cortex, hypothalamus or thalamus; internal capsule; brainstem; cerebellar peduncles, or cerebellar nuclei.

SRS for AVM

Stereotactic Radiosurgery for Spetzler-Martin Grade I and II Arteriovenous Malformations: International Society of Stereotactic Radiosurgery (ISRS) Practice Guideline

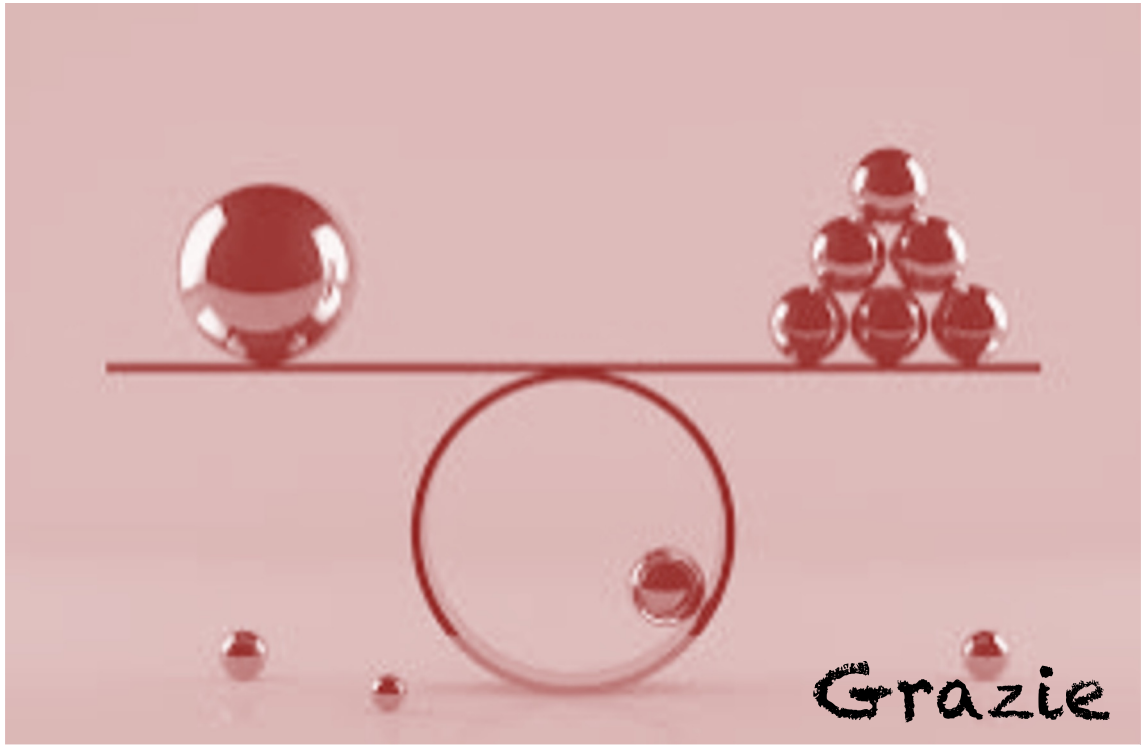
Graffeo et al., Neurosurg, 2020

TABLE 6. ISRS Practice Guidelines for Spetzler-Martin Grade I-II AVM

Recommendation	Level of evidence
SRS is a safe, efficacious treatment for grade I-II AVM.	2b vs 4[a]
SRS is a noninferior alternative to microsurgery in grade I-II AVM.	2b vs 4[a]
SRS may be preferred as primary therapy in grade I-II AVM with eloquent location, deep venous drainage, or other unfavorable features.	4
SRS may be preferred in grade I-II AVM following incomplete primary resection or in patients with medical comorbidities limiting surgical candidacy.	4
Predictive models based on continuous variables (eg, mRBAS, PRAS, and Lawton full model) are preferred over those reliant on categorical parameters (eg, Spetzler-Martin and supplemental grades, VRAS, and HS).	4
Dosimetric data specific to grade I-II AVM support the use of standard practices and parameters for treatment planning in AVM of any grade.	2b vs 4[a]
By dose, the estimated probability of total obliteration 65%-70% at 15 Gy, 75%-80% at 18 Gy, and 85%-90% at 20-25 Gy.	2b vs 4[a]
Minimization of RIC risk is associated with treatment planning that reduces the 12-Gy volume (eg, total volume of AVM and surrounding tissue receiving a dose of 12 Gy or greater).	2b vs 4[a]

SRS dose : from 17 to 30 Gy (mean 25.2 Gy)

Graffeo et al., Neurosurg, 2020


Grazie