Hemangiopericytoma

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Contents

8.1 General Principles of Simulation and Target Delineation

- Adjuvant radiotherapy should be considered for both gross and subtotal resection.
- CT simulation in the supine position with a thermoplastic mask for immobilization and thin slice (1–2 mm) acquisition.
- Obtain volumetric thin slice (1–2 mm) T1 post-gadolinium axial MRI sequences and T2/FLAIR MRI sequences.
- To aid in target delineation, fusion of both preoperative and postoperative MRI, T1 gadolinium +/− T2/FLAIR should be considered with the CT simulation scan (Fig. 8.1).
- Table 8.1 summarizes the suggested target volumes. Figure 8.2 shows an example.

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L. M. Halasz et al. (eds.), *Intracranial and Spinal Radiotherapy*, Practical Guides in Radiation Oncology, https://doi.org/10.1007/978-3-030-64508-3_8

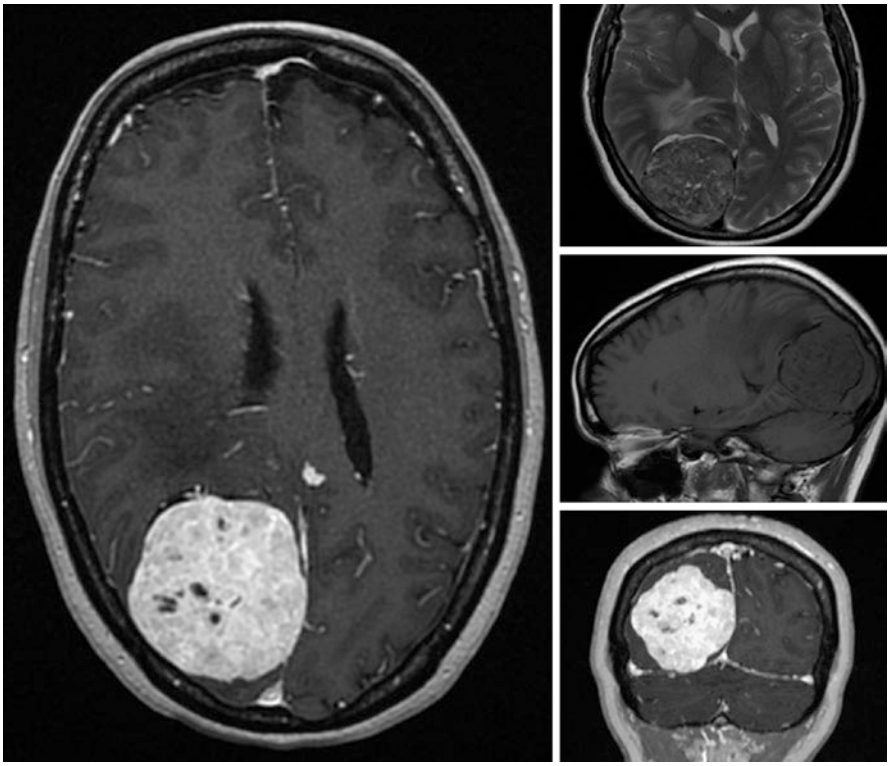


Fig. 8.1 Preoperative MRI for a 57-year-old patient who presented with intermittent headaches and left-sided homonymous hemianopia. Imaging revealed a right parietal occipital extra-axial mass inseparable from the posterior falx measuring 6.3 cm. Left: T1 MRI with gadolinium. Right: Top, axial T2 propeller; middle, sagittal T1 FLAIR; bottom, coronal T1 with gadolinium

Table 8.1 Suggested target volumes

Target volumes	Definition and description
GTV	Gross residual enhancing disease on T1 post-gadolinium images.
CTV	Grade 1: CTV = GTV + 0–0.5 cm. Grades 2 to 3: CTV = GTV + 0.5–2.0 cm and note the CTV should also include the surgical cavity, respecting anatomic barriers to spread including the bone, dura, falx cerebri, and tentorium. The preoperative MRI should be used to guide the extent of surgical cavity delineation along the dura. Some also apply a margin of 0.5–2.0 cm beyond the surgical cavity and more so for grade 3
PTV	PTV = CTV + 0.3–0.5 cm depending on patient positioning, mask fit, image guidance technique.

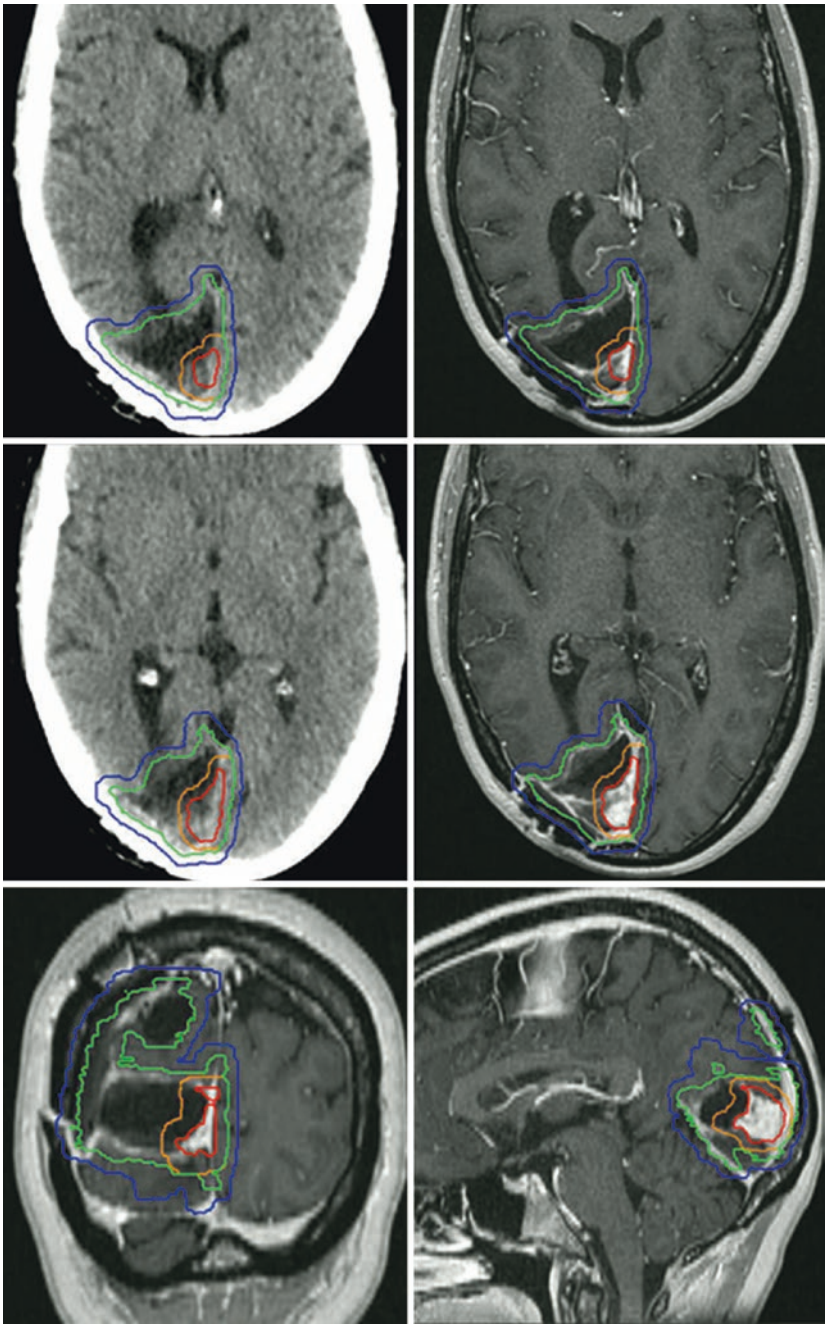


Fig. 8.2 Contours and imaging *after* the patient underwent subtotal resection for WHO grade II hemangiopericytoma. Postoperative MRI revealed focal nodularity suspicious for residual tumor. Postoperative imaging is shown on axial CT (upper and middle left) and T1 MRI with gadolinium on axial (upper and middle right), coronal (bottom left), and sagittal (bottom right) slices. GTV is shown in red, CTV in green, PTV1 in orange, and PTV2 in blue. 70 Gy was prescribed to PTV1 and 64 Gy was prescribed to PTV2 in 35 fractions

8.2 Dose Prescription

- Grade 1: 50–54 Gy in 25–30 daily fractions.
- Grades 2 to 3: 60 Gy in 30 daily fractions or consider a 35-fraction simultaneous integrated boost protocol—residual GTV plus high-dose PTV to 70 Gy in 35 fractions (PTV1) with a 64 Gy volume encompassing the residual GTV, CTV, and low-dose PTV (PTV2). The latter is our in-house practice and data are not yet reported to validate this approach.

8.3 Treatment Planning Techniques (Figs. 8.3 and 8.4)

– 3D-CRT, IMRT, VMAT, or proton therapy may be used.
– Treatment planning objective: Cover 95% of the PTV by 95% of the prescribed dose while respecting OAR constraints.

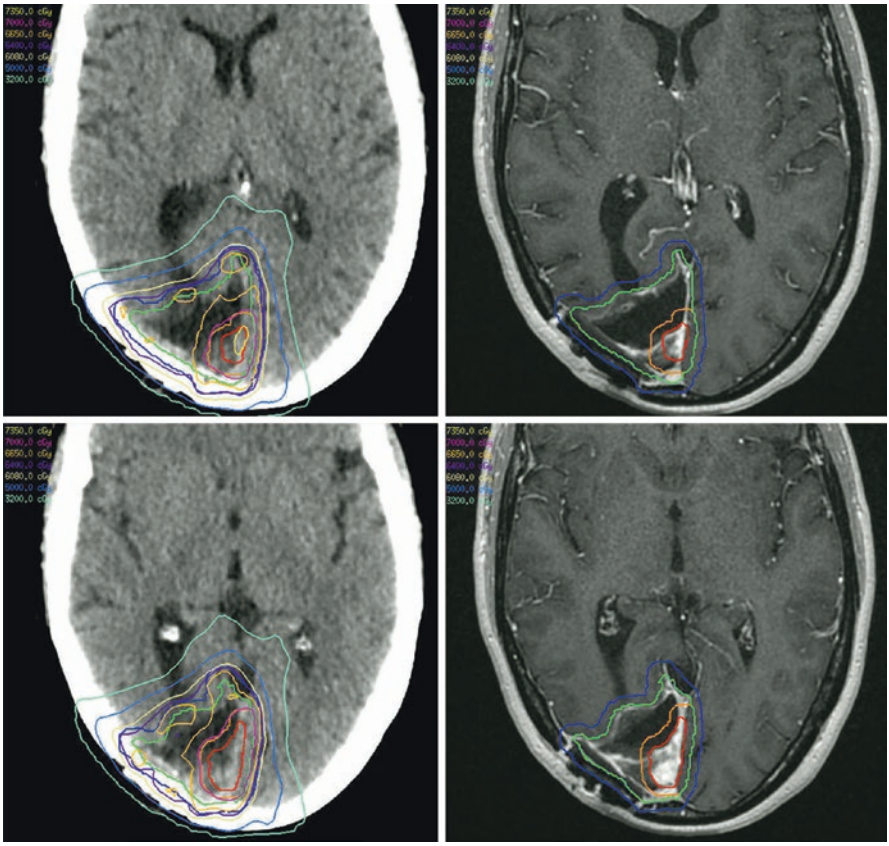
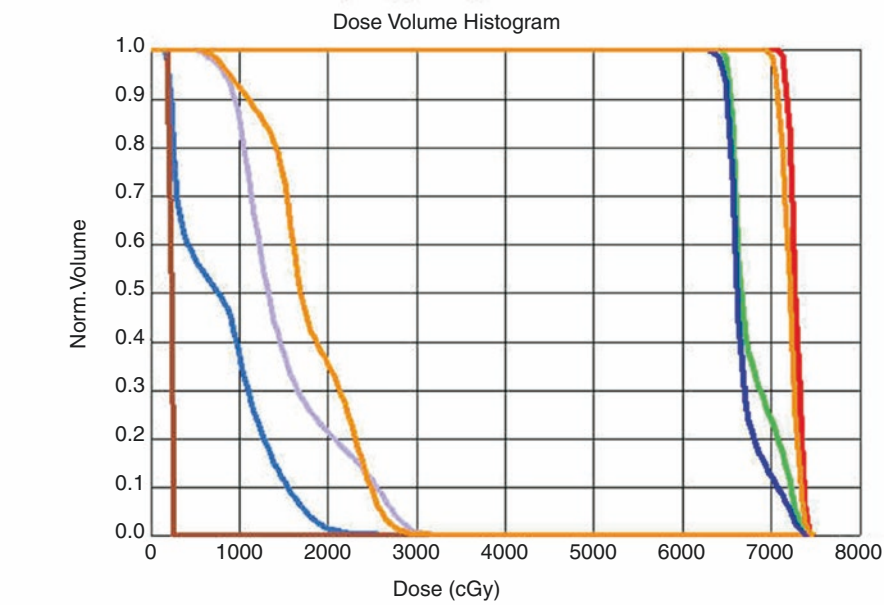


Fig. 8.3 Treatment plan for the case presented in Fig. 8.2. Yellow is the 73.5 Gy isodose line (105% of 70 Gy), pink is the 70 Gy isodose line, orange is the 66.5 Gy isodose line (95% of 70 Gy), purple is the 64 Gy isodose line, light orange is the 60.8 Gy isodose line (95% of 64 Gy), and light blue is the 32 Gy isodose line (50% of 64 Gy)



ROI Statistics

Line Type	ROI	Trial or Record	Min.	Max.	Mean	Std. Dev.
	BRAINSTEM	brai	170.1	2590.4	788.6	528.4
	COCHLEA_R	brai	211.3	254.1	228.5	10.2
	CTV64	brai	6362.7	7492.9	6777.4	257.9
	GTV70	brai	7094.2	7465.8	7273.4	72.0
	HIPPOCAMPUS_L	brai	479.8	3181.3	1516.9	591.8
	HIPPOCAMPUS_R	brai	531.9	3136.9	1782.6	513.5
	PTV64	brai	5961.6	7492.9	6687.2	218.3
	PTV70	brai	6852.1	7492.9	7205.6	95.2

Fig. 8.4 Dose-volume histogram (DVH) for the case described. 97% of PTV2 is covered by 64 Gy and 96% of PTV1 is covered by 70 Gy. 100% of PTV2 is covered by 95% of 64 Gy (60.8 Gy), and 100% of PTV1 is covered by 95% of 70 Gy (66.5 Gy)

Table 8.2 Recommended dose constraints for critical organs at risk for 1.8–2 Gy/day fractionation schemes

Organ at risk	Suggested dose constraints
Optic nerves and chiasm	Dmax <54 Gy
Brain stem	Dmax <54–60 Gy
Cochlea	Mean ≤30–45 Gy
Eyes	Dmax <45 Gy
Lenses	Dmax <10 Gy
Hippocampi	Mean dose <20 Gy if achievable
Pituitary gland	Dmax 30–45 Gy and mean <30 Gy if achievable

Note: Dmax refers to the maximum point dose

Table 8.3 Side effects

Acute	Fatigue, dermatitis, alopecia, headache, cerebral edema causing nausea/vomiting and headaches
Subacute	Somnolence syndrome, cerebral edema
Long-term	Hypopituitarism, hearing loss, cataracts, leukoencephalopathy, neurocognitive deficits, radiation necrosis, and second malignancies

– Daily IGRT with cone-beam CT matching to the bone is recommended.
– Tables 8.2 and 8.3 delineate the dose constraints and side effects, respectively.

Further Reading

Kubicky CD, Sahgal A, Chang EL, Lo SS (2014) Rare primary central nervous system tumors. Rare Tumors 6(3):5449