

CNS Radiation Oncology

10 High-Yield Board-Style Practice Questions

Original board-style practice questions for radiation oncology residents, written in ABR single-best-answer format with detailed rationales. These are original questions created for educational review and are not reproductions of actual ABR examination content.

Question 1

A newly diagnosed diffuse glioma in an adult is found to be IDH-wildtype with molecular features consistent with glioblastoma, despite a histologic appearance that might otherwise suggest a lower-grade astrocytoma. Under current WHO classification, how should this tumor be classified?

- A. IDH status is irrelevant to classification
- B. It must be classified solely on histologic appearance, ignoring molecular findings
- C. Molecular findings can establish a diagnosis of glioblastoma, IDH-wildtype, CNS WHO grade 4, even without classic high-grade histology
- D. Molecular testing is used only for research and not clinical classification
- E. This scenario is staged using AJCC TNM criteria

Answer: C. Molecular findings can establish a diagnosis of glioblastoma, IDH-wildtype, CNS WHO grade 4, even without classic high-grade histology

Rationale: Current WHO CNS classification integrates molecular features directly into tumor diagnosis. In an appropriate adult IDH-wildtype diffuse astrocytic glioma, molecular alterations such as TERT promoter mutation, EGFR amplification, or combined whole-chromosome 7 gain and chromosome 10 loss (+7/−10) can establish a diagnosis of glioblastoma, IDH-wildtype, CNS WHO grade 4, even when classic histologic features such as necrosis or microvascular proliferation are absent.

Reference:

Louis DN, Perry A, Wesseling P, et al. The 2021 WHO Classification of Tumors of the Central Nervous System: a summary. *Neuro Oncol.* 2021;23(8):1231-1251.

Question 2

1p/19q codeletion in a diffuse glioma is most associated with which diagnosis and prognostic implication?

- A. Meningioma
- B. It has no diagnostic or prognostic significance
- C. Glioblastoma with a poor prognosis
- D. Medulloblastoma
- E. Oligodendroglioma, associated with a more favorable prognosis and chemosensitivity

Answer: E. Oligodendroglioma, associated with a more favorable prognosis and chemosensitivity

Rationale: Under WHO CNS5, oligodendroglioma is molecularly defined by the presence of an IDH mutation together with whole-arm 1p/19q codeletion. These tumors generally have a more favorable natural history and greater treatment responsiveness than IDH-wildtype diffuse gliomas.

Reference:

Louis DN, Perry A, Wesseling P, et al. The 2021 WHO Classification of Tumors of the Central Nervous System: a summary. *Neuro Oncol.* 2021;23(8):1231-1251.

Question 3

MGMT promoter methylation status in glioblastoma is most directly relevant to which treatment consideration?

- A. Determining radiation dose exclusively
- B. Predicting benefit from temozolomide chemotherapy
- C. Determining whether surgery should be performed
- D. It has no established clinical utility
- E. Determining whether the tumor is primary or metastatic

Answer: B. Predicting benefit from temozolomide chemotherapy

Rationale: MGMT promoter methylation is an important predictive biomarker for benefit from alkylating chemotherapy, particularly temozolomide, and also carries prognostic significance in glioblastoma. Patients whose tumors have MGMT promoter methylation generally derive greater benefit from temozolomide than patients with unmethylated tumors.

Reference:

Hegi ME, Diserens AC, Gorlia T, et al. MGMT gene silencing and benefit from temozolomide in glioblastoma. *N Engl J Med.* 2005;352(10):997-1003.

Question 4

Which imaging approach is most useful when attempting to distinguish tumor recurrence from radiation necrosis after treatment of a high-grade glioma?

- A. Advanced imaging techniques such as MR perfusion or PET, interpreted with conventional imaging and clinical follow-up, because contrast enhancement alone may be similar in both conditions
- B. Standard contrast-enhanced MRI alone is always definitive
- C. Plain CT without contrast is sufficient
- D. Bone scan is the imaging modality of choice
- E. The distinction cannot be evaluated with imaging

Answer: A. Advanced imaging techniques such as MR perfusion or PET, interpreted with conventional imaging and clinical follow-up, because contrast enhancement alone may be similar in both conditions

Rationale: Radiation necrosis and recurrent glioma can both produce new or enlarging contrast enhancement on conventional MRI. Advanced techniques such as perfusion MRI, MR spectroscopy, diffusion imaging, and metabolic PET can provide additional information. Imaging findings should be interpreted together with the clinical course and serial imaging because no single imaging technique is universally definitive.

Reference:

Soni N, Ora M, Mohindra N, Menda Y, Bathla G. Diagnostic performance of PET and perfusion-weighted imaging in differentiating tumor recurrence or progression from radiation necrosis in posttreatment gliomas: a review of literature. *AJNR Am J Neuroradiol.* 2020;41(9):1550-1557.

Question 5

Diffuse midline glioma, H3 K27-altered, arising in the pons of a child, is best characterized by which of the following?

- A. A tumor staged using the AJCC TNM system
- B. A tumor occurring exclusively in adults
- C. A tumor that never requires radiation therapy
- D. A tumor with an excellent prognosis after surgery alone
- E. A generally poor-prognosis CNS WHO grade 4 tumor with diffuse infiltrative growth in a critical location that usually precludes complete surgical resection

Answer: E. A generally poor-prognosis CNS WHO grade 4 tumor with diffuse infiltrative growth in a critical location that usually precludes complete surgical resection

Rationale: Diffuse midline glioma, H3 K27-altered, is a CNS WHO grade 4 tumor characterized by aggressive biology and diffuse growth in midline CNS structures. Pontine tumors generally cannot be completely resected safely. Radiation therapy remains the principal standard local treatment and can provide temporary tumor control and symptomatic benefit, although long-term prognosis remains poor.

References:

- Louis DN, Perry A, Wesseling P, et al. The 2021 WHO Classification of Tumors of the Central Nervous System: a summary. *Neuro Oncol.* 2021;23(8):1231-1251.
- van den Bent M, Saratsis AM, Geurts M, Franceschi E. H3 K27M-altered glioma and diffuse intrinsic pontine glioma: semi-systematic review of treatment landscape and future directions. *Neuro Oncol.* 2024;26(Supplement_2).

Question 6

A fit patient with newly diagnosed glioblastoma undergoes gross total resection and is planned for standard postoperative chemoradiation. What is the most commonly prescribed radiation dose and fractionation?

- A. 45 Gy in 25 fractions
- B. 50.4 Gy in 28 fractions
- C. 60 Gy in 30 fractions
- D. 70 Gy in 35 fractions

Answer: C. 60 Gy in 30 fractions

Rationale: For an appropriately fit patient with newly diagnosed glioblastoma, standard postoperative chemoradiation consists of 60 Gy in 30 fractions (2 Gy per fraction) with concurrent temozolomide, followed by adjuvant temozolomide. This approach was established by the landmark EORTC/NCIC trial.

Reference:

Stupp R, Mason WP, van den Bent MJ, et al. Radiotherapy plus concomitant and adjuvant temozolomide for glioblastoma. *N Engl J Med.* 2005;352(10):987-996.

Question 7

For an older but reasonably fit patient with newly diagnosed glioblastoma, which hypofractionated radiation schedule is commonly used with concurrent and adjuvant temozolomide to shorten overall treatment time while maintaining efficacy?

- A. 60 Gy in 30 fractions
- B. 40 Gy in 15 fractions
- C. 34 Gy in 10 fractions
- D. 25 Gy in 5 fractions

Answer: B. 40 Gy in 15 fractions

Rationale: For older patients with newly diagnosed glioblastoma who are appropriate candidates for combined-modality therapy, 40 Gy in 15 fractions over approximately 3 weeks is a well-established hypofractionated regimen. In the landmark elderly-patient trial, adding concurrent and adjuvant temozolomide to short-course radiation improved overall survival, with particularly substantial benefit among patients with MGMT-methylated tumors. More abbreviated radiation schedules may be appropriate for selected frail patients.

Reference:

Perry JR, Laperriere N, O'Callaghan CJ, et al. Short-course radiation plus temozolomide in elderly patients with glioblastoma. *N Engl J Med.* 2017;376(11):1027-1037.

Question 8

When treating a brain metastasis measuring 2.0 cm or less in maximum diameter with single-fraction stereotactic radiosurgery (SRS), which dose corresponds to the RTOG 90-05 size-based maximum tolerated dose?

- A. 24 Gy
- B. 20 Gy
- C. 18 Gy
- D. 15 Gy

Answer: A. 24 Gy

Rationale: RTOG 90-05 established maximum tolerated single-fraction SRS doses of 24 Gy for tumors ≤ 2.0 cm, 18 Gy for tumors 2.1–3.0 cm, and 15 Gy for tumors 3.1–4.0 cm. Importantly, RTOG 90-05 studied previously irradiated recurrent primary brain tumors and brain metastases. These doses remain an important historical size-based reference, but contemporary SRS prescriptions are individualized according to tumor size, location, prior radiation therapy, normal-brain dose constraints, and risk of radiation necrosis.

Reference:

Shaw E, Scott C, Souhami L, et al. Single dose radiosurgical treatment of recurrent previously irradiated primary brain tumors and brain metastases: final report of RTOG protocol 90-05. *Int J Radiat Oncol Biol Phys.* 2000;47(2):291-298.

Question 9

The phase III NRG Oncology CC001 trial randomized patients with brain metastases receiving whole-brain radiation therapy (WBRT) and memantine to hippocampal avoidance or standard WBRT. What was the key finding?

- A. Hippocampal avoidance worsened intracranial disease control
- B. Hippocampal-avoidance WBRT plus memantine significantly reduced the risk of cognitive function failure compared with WBRT plus memantine, without a significant difference in overall survival or intracranial progression
- C. Hippocampal avoidance eliminated the need for memantine
- D. There was no cognitive benefit from hippocampal avoidance

Answer: B. Hippocampal-avoidance WBRT plus memantine significantly reduced the risk of cognitive function failure compared with WBRT plus memantine, without a significant difference in overall survival or intracranial progression

Rationale: NRG Oncology CC001 demonstrated that hippocampal avoidance during WBRT plus memantine significantly reduced the risk of cognitive function failure compared with WBRT plus memantine alone, without compromising overall survival or intracranial progression-free survival. Longer-term analysis confirmed sustained cognitive and patient-reported benefits. HA-WBRT plus memantine is therefore a standard approach for appropriate patients receiving WBRT, including patients without metastases in the hippocampal avoidance region.

References:

Brown PD, Gondi V, Pugh S, et al. Hippocampal avoidance during whole-brain radiotherapy plus memantine for patients with brain metastases: phase III trial NRG Oncology CC001. *J Clin Oncol.* 2020;38(10):1019-1029.

Gondi V, Deshmukh S, Brown PD, et al. Sustained preservation of cognition and prevention of patient-reported symptoms with hippocampal avoidance during whole-brain radiotherapy for brain metastases: final results of NRG Oncology CC001. *Int J Radiat Oncol Biol Phys.* 2023;117(3):571-580.

Question 10

The phase III INDIGO trial evaluated vorasidenib, an oral IDH1/IDH2 inhibitor, in patients with residual or recurrent grade 2 IDH-mutant glioma following surgery. What was the principal clinical implication of this trial for radiation oncology practice?

- A. Vorasidenib should replace radiation therapy for all grades of glioma
- B. Vorasidenib significantly improved progression-free survival and delayed the time to next intervention, allowing appropriately selected patients to defer radiation therapy and chemotherapy
- C. Vorasidenib showed no benefit over placebo
- D. Vorasidenib is effective only when combined with concurrent radiation therapy

Answer: B. Vorasidenib significantly improved progression-free survival and delayed the time to next intervention, allowing appropriately selected patients to defer radiation therapy and chemotherapy

Rationale: In the phase III INDIGO trial, vorasidenib significantly improved progression-free survival in patients with residual or recurrent grade 2 IDH-mutant glioma who had undergone surgery but had received no previous anticancer therapy. Median PFS was 27.7 months with vorasidenib versus 11.1 months with placebo (HR 0.39), and time to the next anticancer intervention was significantly prolonged (HR 0.26). Thus, vorasidenib provides an option for

appropriately selected patients who otherwise could be observed after surgery to delay radiation therapy and chemotherapy; it should not be interpreted as replacing these treatments for all patients with IDH-mutant glioma.

Reference:

Mellinghoff IK, van den Bent MJ, Blumenthal DT, et al.; INDIGO Trial Investigators. Vorasidenib in IDH1- or IDH2-mutant low-grade glioma. *N Engl J Med.* 2023;389(7):589-601.

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