

Pediatric 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 3-year-old with a favorable-histology Wilms tumor undergoes nephrectomy revealing stage III disease with positive regional lymph nodes. Which of the following best describes the role of radiation therapy in this scenario?

- A. Preoperative radiation is standard before nephrectomy in the United States
- B. Postoperative flank/tumor-bed radiation is indicated for stage III disease with regional nodal involvement, in addition to chemotherapy; whole-abdominal radiation is reserved for diffuse spill or peritoneal disease
- C. Whole-lung radiation is required regardless of pulmonary imaging findings
- D. Radiation has no role since chemotherapy alone is curative at any stage
- E. Radiation is reserved only for anaplastic histology regardless of stage

Answer: B. Postoperative flank/tumor-bed radiation is indicated for stage III disease with regional nodal involvement, in addition to chemotherapy; whole-abdominal radiation is reserved for diffuse spill or peritoneal disease

Rationale: Stage III favorable-histology Wilms tumor with regional nodal involvement is treated with postoperative RT plus chemotherapy in the COG/North American approach. A standard flank/tumor-bed dose is 10.8 Gy in 6 fractions of 1.8 Gy, with the treatment volume determined by the reason for stage III classification and the preoperative disease extent. Whole-abdominal RT, typically 10.5 Gy in 7 fractions of 1.5 Gy, is reserved for diffuse intraperitoneal spill, peritoneal metastases, or comparable extensive intraperitoneal disease.

References:

National Cancer Institute. Wilms Tumor and Other Childhood Kidney Tumors Treatment (PDQ®)—Health Professional Version. Updated periodically.

Dome JS, Graf N, Geller JI, et al. Advances in Wilms tumor treatment and biology: progress through international collaboration. *J Clin Oncol*. 2015;33(27):2999-3007.

Question 2

A 2-year-old with high-risk neuroblastoma completes induction chemotherapy, surgery, and autologous stem-cell transplant. Radiation to the primary tumor bed is generally recommended in which scenario?

- A. Radiation is never used in neuroblastoma given the young patient age
- B. For high-risk neuroblastoma, radiation to the primary site is standard as part of consolidation therapy regardless of resection completeness
- C. Radiation is used exclusively for palliation of bone metastases
- D. Only for low-risk, localized disease with complete resection
- E. Radiation is only added if the tumor is MYCN-amplified and completely resected

Answer: B. For high-risk neuroblastoma, radiation to the primary site is standard as part of consolidation therapy regardless of resection completeness

Rationale: RT to the primary tumor site is a standard component of consolidation for high-risk neuroblastoma following myeloablative therapy and stem-cell rescue, regardless of whether complete surgical excision was achieved. In COG ANBL0532, patients received 21.6 Gy to the preoperative primary tumor volume. For patients with gross residual disease, dose escalation to 36 Gy did not significantly improve local progression, supporting protocol-directed treatment rather than routine empiric dose escalation.

References:

National Cancer Institute. Neuroblastoma Treatment (PDQ®)—Health Professional Version. Updated periodically.

Liu KX, Naranjo A, Zhang FF, et al. Prospective evaluation of radiation dose escalation in patients with high-risk neuroblastoma and gross residual disease after surgery: a report from the Children's Oncology Group ANBL0532 study. *J Clin Oncol.* 2020;38(24):2741-2752.

Question 3

A 6-year-old with average-risk medulloblastoma undergoes craniospinal irradiation followed by a conformal boost to the primary tumor bed. What is the primary rationale for treating the entire craniospinal axis rather than the primary site alone?

- A. CSI is used solely to reduce treatment time
- B. CSI is required because medulloblastoma never responds to chemotherapy
- C. Medulloblastoma has no propensity for CSF dissemination
- D. CSI is used only in infants under 3 years of age
- E. Medulloblastoma has a well-recognized propensity for leptomeningeal spread throughout the neuraxis, requiring treatment of the entire craniospinal axis to address microscopic disseminated disease

Answer: E. Medulloblastoma has a well-recognized propensity for leptomeningeal spread throughout the neuraxis, requiring treatment of the entire craniospinal axis to address microscopic disseminated disease

Rationale: Medulloblastoma has a strong propensity for dissemination through the CSF and along leptomeningeal surfaces. CSI therefore treats potential microscopic disease throughout the brain and spinal subarachnoid space. In contemporary average-risk therapy, CSI is followed by a conformal boost, and cooperative-group data support reducing the boost volume to the tumor bed rather than routinely treating the entire posterior fossa.

References:

Packer RJ, Gajjar A, Vezina G, et al. Phase III study of craniospinal radiation therapy followed by adjuvant chemotherapy for newly diagnosed average-risk medulloblastoma. *J Clin Oncol.* 2006;24(25):4202-4208.

Michalski JM, Janss AJ, Vezina LG, et al. Children's Oncology Group phase III trial of reduced-dose and reduced-volume radiotherapy with chemotherapy for newly diagnosed average-risk medulloblastoma. *J Clin Oncol.* 2021;39(24):2685-2697.

Question 4

A 10-year-old with localized Ewing sarcoma of the femur completes neoadjuvant chemotherapy and undergoes limb-sparing resection. Pathology shows a microscopically positive surgical margin. What is the most appropriate subsequent local-control consideration?

- A. Postoperative radiation therapy should be considered because microscopic residual disease/positive margin increases the risk of local recurrence, in addition to continued systemic chemotherapy
- B. Whole-bone radiation is required regardless of surgical findings
- C. Amputation is mandatory
- D. Radiation is contraindicated after surgical resection
- E. No further local therapy is needed

Answer: A. Postoperative radiation therapy should be considered because microscopic residual disease/positive margin increases the risk of local recurrence, in addition to continued systemic chemotherapy

Rationale: A microscopically positive surgical margin (R1 resection) increases the risk of local recurrence in Ewing sarcoma and is an important indication for postoperative RT. Contemporary recommendations generally use approximately 45–50.4 Gy for microscopic residual disease, depending on the treatment protocol. 50.4 Gy is a commonly recommended contemporary dose for gross-total resection with microscopic residual disease. Higher doses are generally required when gross residual disease remains. Local-control decisions should also incorporate tumor site, response to induction chemotherapy, surgical findings, and anticipated morbidity.

References:

National Cancer Institute. Ewing Sarcoma Treatment (PDQ®)—Health Professional Version. Updated periodically.

Donaldson SS. Ewing sarcoma: radiation dose and target volume. *Pediatr Blood Cancer.* 2004;42(5):471-476.

Question 5

Compared with photon radiotherapy, proton therapy is increasingly favored for pediatric CNS tumors primarily because of which dosimetric advantage?

- A. Protons are only used for pediatric extremity tumors
- B. Protons have no biological effect
- C. Protons eliminate the need for anesthesia
- D. Protons are less expensive in nearly all cases
- E. Protons deposit their dose within a finite range with minimal exit dose beyond the target, substantially reducing integral dose to surrounding developing normal tissue compared with photon techniques

Answer: E. Protons deposit their dose within a finite range with minimal exit dose beyond the target, substantially reducing integral dose to surrounding developing normal tissue compared with photon techniques

Rationale: Proton therapy reduces unnecessary radiation beyond the target because of its finite range and limited exit dose. In pediatric CNS tumors and particularly craniospinal irradiation, this can substantially decrease integral dose to developing normal tissues and reduce exposure of structures such as endocrine organs, heart, lungs, gastrointestinal tract, cochlea, and uninvolved brain. Pediatric medulloblastoma studies support favorable late-toxicity profiles with proton therapy.

References:

- Yock TI, Yeap BY, Ebb DH, et al. Long-term toxic effects of proton radiotherapy for paediatric medulloblastoma: a phase 2 single-arm study. *Lancet Oncol.* 2016;17(3):287-298.
- Ho ESQ, Barrett SA, Mullaney LM. A review of dosimetric and toxicity modeling of proton versus photon craniospinal irradiation for pediatric medulloblastoma. *Acta Oncol.* 2017;56(8):1031-1042.

Question 6

For a child with standard-risk medulloblastoma treated with craniospinal irradiation, chemotherapy, and a tumor-bed boost, what is the standard conventional CSI dose?

- A. 23.4 Gy
- B. 12 Gy
- C. 18 Gy
- D. 36 Gy
- E. 45 Gy

Answer: A. 23.4 Gy

Rationale: 23.4 Gy CSI combined with chemotherapy is the established conventional standard for average/standard-risk medulloblastoma in children old enough to receive CSI, followed by a tumor-bed boost to a cumulative dose of approximately 54–55.8 Gy. COG ACNS0331 investigated reducing CSI to 18 Gy in younger children with average-risk disease but did not establish 18 Gy as the general standard. Molecularly selected treatment de-intensification using lower CSI doses is being evaluated separately in favorable-risk subgroups.

References:

- Packer RJ, Gajjar A, Vezina G, et al. Phase III study of craniospinal radiation therapy followed by adjuvant chemotherapy for newly diagnosed average-risk medulloblastoma. *J Clin Oncol.* 2006;24(25):4202-4208.
- Michalski JM, Janss AJ, Vezina LG, et al. Children's Oncology Group phase III trial of reduced-dose and reduced-volume radiotherapy with chemotherapy for newly diagnosed average-risk medulloblastoma. *J Clin Oncol.* 2021;39(24):2685-2697.

Question 7

When whole-lung irradiation is indicated for a child with Wilms tumor and pulmonary metastases, what is a standard radiation dose for a patient 12 months of age or older?

- A. 6 Gy in 4 fractions
- B. 10.5 Gy in 7 fractions

- C. 18 Gy in 10 fractions
- D. 24 Gy in 12 fractions
- E. 12 Gy in 8 fractions

Answer: E. 12 Gy in 8 fractions

Rationale: When whole-lung irradiation (WLI) is indicated, the standard COG dose for children 12 months of age or older is 12 Gy in 8 fractions of 1.5 Gy. For infants younger than 12 months, the dose is generally reduced to 10.5 Gy in 7 fractions. Importantly, WLI is not required for every child presenting with pulmonary metastases. COG AREN0533 demonstrated that WLI could be omitted in selected patients with favorable-histology Wilms tumor and lung-only metastases who achieved a complete pulmonary response to initial chemotherapy and met protocol-defined biologic criteria.

References:

Dix DB, Seibel NL, Chi YY, et al. Treatment of stage IV favorable histology Wilms tumor with lung metastases: a report from the Children's Oncology Group AREN0533 study. *J Clin Oncol.* 2018;36(16):1564-1570.

National Cancer Institute. Wilms Tumor and Other Childhood Kidney Tumors Treatment (PDQ®)—Health Professional Version. Updated periodically.

Question 8

Which radiation approach best reflects contemporary treatment of pediatric Hodgkin lymphoma when radiation therapy is indicated?

- A. Extended-field radiation to uninvolved and involved lymph-node regions
- B. Total nodal irradiation
- C. Radiation therapy alone without chemotherapy
- D. Low-dose, response-adapted limited-volume radiation therapy following chemotherapy
- E. Routine dose escalation above 40 Gy

Answer: D. Low-dose, response-adapted limited-volume radiation therapy following chemotherapy

Rationale: Modern pediatric Hodgkin lymphoma treatment is risk- and response-adapted. RT can be omitted in selected patients who achieve an adequate response to chemotherapy, whereas patients requiring RT receive substantially smaller treatment volumes and lower doses than were historically used. Dose and target definitions are protocol dependent. In EuroNet-PHL-C1, for example, patients without an adequate response received 19.8 Gy, while RT was omitted in appropriately selected adequate responders. Other pediatric cooperative-group protocols have used response-adapted doses and volumes according to initial disease sites and response. Thus, the key contemporary principle is selective, low-dose, response-adapted, limited-volume RT rather than routine large-field irradiation.

References:

Donaldson SS, Link MP, Weinstein HJ, et al. VAMP and low-dose, involved-field radiation for children and adolescents with favorable, early-stage Hodgkin's disease: results of a prospective clinical trial. *J Clin Oncol.* 2002;20(14):3081-3087.

Kelly KM, Cole PD, Pei Q, et al. Response-adapted therapy for the treatment of children with newly diagnosed high-risk Hodgkin lymphoma (AHOD0831): a report from the Children's Oncology Group. *Br J Haematol.* 2019;187(1):39-48.

Mauz-Körholz C, Landman-Parker J, Fernández-Teijeiro A, et al. Response-adapted omission of radiotherapy in children and adolescents with early-stage classical Hodgkin lymphoma and an adequate response to OEPA (EuroNet-PHL-C1). *Lancet Oncol.* 2023;24(3):252-261.

Question 9

The SIOP PNET5-MB trial evaluated reduced-dose craniospinal irradiation of 18 Gy in a favorable-risk subset of medulloblastoma. Which molecular subgroup was eligible for this treatment de-intensification?

- A. Group 3 medulloblastoma
- B. Group 4 medulloblastoma
- C. SHH-activated medulloblastoma

- D. WNT-activated medulloblastoma
- E. TP53-mutant medulloblastoma

Answer: D. WNT-activated medulloblastoma

Rationale: The favorable-risk stratum of SIOP PNET5-MB evaluated treatment de-intensification in children with carefully selected localized WNT-activated medulloblastoma. Treatment consisted of 18 Gy CSI followed by a 36 Gy boost to the tumor region, for a cumulative tumor-region dose of 54 Gy, together with reduced-intensity maintenance chemotherapy. Eligibility required favorable clinical and molecular features, including localized disease, appropriate postoperative residual-disease criteria, classic histology, and molecular confirmation of WNT activation. Updated results from the favorable-risk cohort reported a 3-year event-free survival of approximately 89% in the intention-to-treat population and 91% in the per-protocol population after reduced-dose CSI and chemotherapy. These findings support the feasibility of molecularly selected de-intensification, but 18 Gy CSI should not be generalized to all patients with medulloblastoma or automatically to every WNT-activated tumor.

References:

- Mynarek M, Milde T, Padovani L, et al. SIOP PNET5 MB trial: history and concept of a molecularly stratified clinical trial of risk-adapted therapies for standard-risk medulloblastoma. *Cancers (Basel)*. 2021;13(23):6077.
- Mynarek M, et al. Treatment de-intensification for WNT medulloblastoma: results from the favourable-risk arm of the SIOP-PNET5-MB study. *Neuro-Oncology Pediatrics*. 2026.

Question 10

In pediatric rhabdomyosarcoma, which patient is most appropriately treated without radiation therapy under contemporary COG risk-adapted approaches?

- A. A patient with gross residual FOXO1 fusion-positive rhabdomyosarcoma
- B. A patient with completely resected Group I embryonal/fusion-negative rhabdomyosarcoma
- C. Any patient achieving a complete response to chemotherapy
- D. Any patient with microscopic residual disease after surgery
- E. Any patient with metastatic rhabdomyosarcoma who responds to chemotherapy

Answer: B. A patient with completely resected Group I embryonal/fusion-negative rhabdomyosarcoma

Rationale: Patients with Group I completely resected embryonal/fusion-negative rhabdomyosarcoma can generally be treated with systemic therapy without RT. Earlier Intergroup Rhabdomyosarcoma Study data established excellent outcomes for Group I embryonal RMS without RT, and modern COG risk-adapted approaches retain this principle. In contrast, microscopic or gross residual disease generally requires local RT, and response to chemotherapy alone is not sufficient justification for omitting radiation. FOXO1 fusion status is an important contemporary risk-stratification factor and should be incorporated into treatment decisions.

References:

- Wolden SL, Anderson JR, Crist WM, et al. Indications for radiotherapy and chemotherapy after complete resection in rhabdomyosarcoma: a report from Intergroup Rhabdomyosarcoma Studies I to III. *J Clin Oncol*. 1999;17(11):3468-3475.
- Walterhouse DO, Pappo AS, Meza JL, et al. Shorter-duration therapy using vincristine, dactinomycin, and lower-dose cyclophosphamide with or without radiotherapy for patients with newly diagnosed low-risk rhabdomyosarcoma: a report from the Children's Oncology Group. *J Clin Oncol*. 2014;32(31):3547-3552.

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