

Program Requirements for Residency Education in Neuroradiology

In addition to complying with the Program Requirements for Residency Education in the Subspecialties of Diagnostic Radiology, programs must comply with the following requirements, which may in some cases exceed the common requirements.

1 I. Introduction

2 A. Definition and Scope of the Subspecialty

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4 The body of knowledge and practice of neuroradiology comprises both imaging
5 (plain film interpretation, computed tomography, magnetic resonance imaging,
6 ultrasonography, nuclear radiology) and invasive procedures related to the brain,
7 spine and spinal cord, head, neck, and organs of special sense (eyes, ears,
8 nose) in adults and children. Special training and skills are required to enable
9 the neuroradiologist to function as an expert diagnostic and therapeutic
10 consultant and practitioner. In addition to knowledge of imaging findings, the
11 resident must learn the fundamentals of pathology, pathophysiology, and clinical
12 manifestations of the brain, spine and spinal cord, head, neck, and organs of
13 special sense. The program must provide residents with an organized,
14 comprehensive, and supervised full-time educational experience in the selection,
15 interpretation, and performance of neuroradiologic examinations and
16 procedures. The program must also provide residents with opportunities to
17 conduct research in the field of neuroradiology.

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19 The training program must provide the resident with the opportunity to develop,
20 under supervision, progressively independent skills in the performance and
21 interpretation of neuroradiologic imaging studies and invasive procedures. At
22 the culmination of training, the resident should be capable of independent and

23 accurate clinical decision making in all areas of neuroradiology.

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25 B. General Information

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27 The program shall offer 1 year of graduate medical education in neuroradiology.

28 All of the program components specified in the Program Requirements must be
29 offered in the first year, which is the year that is accredited. Prerequisite training

30 for entry into a diagnostic radiology subspecialty program should include the

31 satisfactory completion of a diagnostic radiology residency accredited by the

32 Accreditation Council for Graduate Medical Education (ACGME) or the Royal

33 College of Physicians and Surgeons of Canada (RCPSC), or other training

34 judged suitable by the program director.

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36 II. Faculty Qualifications and Responsibilities

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38 A. Program Director

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40 The program director must be certified by the American Board of Radiology in
41 diagnostic radiology or radiology, or possess appropriate educational

42 qualifications, and shall have a certificate of Added Qualifications in

43 Neuroradiology. The program director must be a credentialed member of the

44 radiology faculty and must spend at least 80% of his or her clinical and academic

45 time in neuroradiology. The program director shall select and supervise the

46 residents and select other neuroradiology faculty members. The program

47 director shall perform quarterly reviews of the residents and obtain feedback from

48 the residents on the program and the faculty.

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50 B. Faculty

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52 The neuroradiology faculty must include, in addition to the program director, one
53 or more neuroradiologists who spend at least 80% of their time in the practice of
54 neuroradiology. The faculty must provide teaching and supervision of the
55 residents' performance and interpretations of neuroradiologic procedures.

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57 C. Faculty/Resident Ratio

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59 The total number of residents in the program must be commensurate with the
60 capacity of the program to offer an adequate educational experience in
61 neuroradiology and not to have a negative impact on the core diagnostic
62 radiology program. The minimum number of residents need not be greater than
63 one, but two or more residents are desirable. To ensure adequate supervision
64 and evaluation of a resident's academic progress, the faculty/resident ratio must
65 be at least one full-time faculty person for each resident.

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67 III. Facilities and Resources

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69 A. Equipment and Space

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71 The following equipment, which must be "state of the art," must be available:
72 magnetic resonance scanner, computed tomography (CT) scanner, digital
73 subtraction angiography equipment, a radiographic-fluoroscopic room(s) with tilt
74 table suitable for performing myelography, ultrasound equipment with Doppler
75 capability, and conventional radiographic equipment. Physiological monitoring
76 must be available. There must be adequate facilities adjacent to or within

77 examination rooms, for storing supplies needed for the conduct of invasive
78 neuroradiologic procedures. There must be appropriately trained nurses and
79 technologists for these invasive procedures. A crash cart for emergency
80 ventilation and cardiac life support must be available.

81
82 Adequate space for image display, interpretation of studies, and consultation with
83 clinicians must be available. There must be adequate office space and support
84 space for neuroradiology faculty/staff and residents.

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86 The program should provide adequate office space and supplies and secretarial
87 support for the conduct of research projects. Assistance with literature searches,
88 editing, statistical tabulation, and photography should be provided.

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90 B. Laboratory

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92 The institution should provide laboratory facilities to support research projects.

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94 C. Library

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96 There should be ready access to a library of current general medical texts and
97 periodicals. In particular, there should be periodicals and texts in the fields of
98 neuroradiology, diagnostic radiology, head and neck radiology, neurology,
99 neurosurgery, neuroanatomy, physics, neuropathology, otolaryngology,
100 neurophysiology, and orthopedic surgery. Computerized literature search
101 facilities and Internet access must be available. A film-based , web-based, or
102 electronic neuroradiology teaching file containing or providing access to a
103 minimum of 500 cases must be available for use by the neuroradiology residents.

104 The available teaching material should be enhanced with new cases when
105 appropriate.

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107 IV. Educational Program

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109 A. Curriculum

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111 The program must offer the opportunity for residents to perform and interpret
112 noninvasive and invasive diagnostic and interventional procedures under
113 supervision. The procedures shall include diagnostic catheter-based cerebral
114 angiography; other percutaneous minimally-invasive procedures (image-guided
115 biopsies, spinal canal access for myelography, spinal fluid analysis, and
116 medication installation); CT; MRI; MR/CT angiography; ultrasound of the central
117 nervous system (including its vascular structures); plain film radiography related
118 to the brain, head (including organs of special sense), skull base, and neck and
119 spine; and nuclear medicine studies of the central nervous system. MR
120 techniques such as magnetic resonance spectroscopy, functional activation
121 studies, diffusion, and perfusion imaging should be incorporated into the training
122 program. Residents must be given graduated responsibility in the performance
123 and interpretation of the noninvasive and invasive procedures. Responsibility for
124 these procedures should include pre- and postprocedural patient care. The
125 resident must be thoroughly familiar with all aspects of administering and
126 monitoring sedation of the conscious patient. They also must have advanced
127 cardiac life support training and certification.

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129 B. Clinical Components

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131 The program in neuroradiology must provide a sufficient volume and variety of
132 patients with neurological, neurosurgical, ophthalmologic, otorhinolaryngologic,
133 spinal, and other pertinent disorders so that residents gain adequate experience
134 in the full gamut of neuroradiologic examinations, procedures, and
135 interpretations. The neuroradiology training program should provide a minimum
136 number of procedures per year as follows:

- 137 1. 2500 total examinations (including plain radiographs, CT, MR, ultrasound,
138 catheter angiograms, and image-guided invasive procedures). Of these
139 2500 examinations, there should be at least
 - 140 a. 1000 neuroradiological CT scans ;
 - 141 b. 1000 neuroradiological MR scans.
- 142 2. Residents must have participated in and documented the following:
 - 143 a. At least 50 catheter-based angiographic procedures.
 - 144 b. At least 50 image-guided invasive procedures (CT, MR, or
145 fluoroscopically guided).
 - 146 c. Participation in at least five intracranial microcatheter procedures
147 is highly recommended.
- 148 3. The 12 month training program must consist of at least
 - 149 a. 4 weeks or equivalent dedicated training in pediatric
150 neuroradiology.
 - 151 b. 4 weeks or equivalent dedicated training in head and neck
152 radiology.
 - 153 c. 4 weeks or equivalent dedicated training in spine radiology
154 including image-guided procedures.
 - 155 d. 6-8 weeks or equivalent dedicated training in vascular
156 neuroradiology. During this period there should be a special
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158 emphasis on catheter neuroangiography. Experience in
159 microcatheter techniques for thrombolysis treatment of acute
160 stroke is strongly recommended. The program must offer the
161 opportunity for residents to perform and interpret noninvasive and
162 invasive diagnostic catheter-based cerebral angiography, other
163 percutaneous minimally invasive procedures (image-guided
164 biopsies, spinal canal access for myelography, spinal fluid
165 analysis, and medication installation), CT, MRI, MR/CT
166 angiography, ultrasound of the central nervous system (including
167 its vascular structures), and plain film radiography related to the
168 brain, head (including organs of special sense), skull base, neck,
169 and spine.

- 170 e. Twenty-four to twenty-six weeks or equivalent dedicated training
171 in general adult diagnostic neuroradiology.

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173 C. Conferences

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175 Residents must participate in one or more weekly departmental conferences in
176 neuroradiology and one or more interdepartmental conferences with allied clinical
177 departments (eg, neurology, neurosurgery, orthopedic surgery, neuropathology,
178 head and neck surgery, and ophthalmology), as well as institutional conferences
179 in clinical neurosciences (eg, grand rounds) that are held at least monthly.

180 Residents should be encouraged to attend and participate in local extramural
181 conferences and should attend at least one national meeting or postgraduate
182 course in neuroradiology while in training.

183
184 Residents should be encouraged to present the radiological aspects of cases that are

185 discussed during daily work rounds and in clinical conferences related to allied
186 disciplines such as neurosurgery and the neurological sciences. They should also
187 prepare clinically or pathologically proved cases for inclusion in the teaching file.

188
189 There must be daily interpretation sessions requiring residents to reach their own
190 diagnostic conclusions, which must then be reviewed by faculty. Diagnostic reports
191 generated by residents should be closely reviewed for content, level of confidence,
192 grammar, and style. Feedback must be provided and the reports must be signed by a
193 neuroradiology staff physician.

194
195 The residents are required to maintain documentation (procedure log) of the invasive
196 cases that they have performed. The program director must review the log with the
197 resident at least quarterly.

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199 Residents should be encouraged to participate in the teaching of diagnostic radiology
200 residents and medical students, including the presentation of at least one didactic
201 lecture.

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203 D. Other Required Components

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205 1. Resident participation in research

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207 The residents should learn the fundamentals of experimental design,
208 performance, and interpretation of results. They should participate in
209 clinical, basic biomedical, or health services research projects and should
210 be encouraged to undertake at least one project as principal investigator.

211 They should submit at least one scientific paper or exhibit to a regional or

212 national meeting. The opportunity also must be provided for residents to
213 develop their competence in critical assessment of new imaging
214 modalities and of new procedures in neuroradiology.

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216 2. Duty hours and conditions of work (See Program Requirements for
217 Residency Education in the Subspecialties of Diagnostic Radiology for
218 details concerning duty hour requirements.)

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220 3. Interchange with students and residents in other specialties

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222 Neuroradiology residents should be encouraged to participate in the
223 research projects of staff persons and residents in other specialties. They
224 should attend clinical conferences in other specialties and serve as
225 consultants to these conferences. It is desirable that they participate in
226 the clinical teaching of medical students and also in the preclinical
227 curriculum in subjects such as neuroanatomy and neurophysiology.

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229 V. Evaluation of Residents, Faculty, and Program

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231 (See Program Requirements for Residency Education in the Subspecialties of Diagnostic
232 Radiology for details concerning evaluation requirements.)

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