

ACGME Program Requirements for Graduate Medical Education in Endovascular Surgical Neuroradiology

Common Program Requirements are in BOLD

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Introduction

Int.A. Definitions and Scope of the Specialty

Int.A.1. Endovascular surgical neuroradiology is a subspecialty that uses minimally invasive catheter-based technology, radiologic imaging, and clinical expertise to diagnose and treat diseases of the central nervous system, head, neck, and spine. The unique clinical and invasive nature of this subspecialty requires special training and skills. The program must include training and experience in the following:

Int.A.1.a) signs and symptoms of disorders amenable to diagnosis and treatment by endovascular surgical neuroradiology techniques;

Int.A.1.b) physical examinations to evaluate patients with neurological disorders;

Int.A.1.c) pathophysiology and natural history of these disorders;

Int.A.1.d) indications for and contraindications to endovascular surgical neuroradiology procedures;

Int.A.1.e) clinical and technical aspects of endovascular surgical neuroradiology procedures;

Int.A.1.f) medical and surgical alternatives;

Int.A.1.g) preoperative and postoperative management of endovascular patients;

Int.A.1.h) neurointensive care management;

Int.A.1.i) fundamentals of imaging physics and radiation biology; and,

Int.A.1.k) interpretation of neuroangiographic studies pertinent to the practice.

Int.A.2. In this subspecialty, the objective of training is to give fellows an organized, comprehensive, supervised, and full time educational experience in endovascular surgical neuroradiology. This expertise includes the management of patients with neurological disease, the performance of endovascular surgical neuroradiology procedures, and the integration of endovascular surgical neuroradiology therapy into the clinical management of patients.

Int.B. Duration and Scope of Education

Int.B.1. The program shall offer one year of graduate medical education in endovascular

surgical neuroradiology.

Int.B.2. Training in endovascular surgical neuroradiology must be conducted in an environment conducive to investigative studies of a clinical or basic science nature.

Int.B.3. A program in endovascular surgical neuroradiology must be jointly administered by programs in neurological surgery, diagnostic radiology, neuroradiology, and neurology which are accredited by the Accreditation Council for Graduate Medical Education (ACGME); these programs must be present within the same institution. Exceptions to this requirement will be subject to the review and approval, on a case-by-case basis, by the Review Committees for Neurological Surgery, Neurology, and Diagnostic Radiology. The endovascular surgical neuroradiology program is not intended to replace or duplicate the ACGME-accredited program in neuroradiology.

I. Institutions

I.A. Sponsoring Institution

One sponsoring institution must assume ultimate responsibility for the program, as described in the Institutional Requirements, and this responsibility extends to fellow assignments at all participating sites.

The sponsoring institution and the program must ensure that the program director has sufficient protected time and financial support for his or her educational and administrative responsibilities to the program.

I.A.1. The program director must have adequate support from the institution and the Radiology, Neurological Surgery, and Neurology departments to carry out the mission of the program.

I.B. Participating Sites

I.B.1. There must be a program letter of agreement (PLA) between the program and each participating site providing a required assignment. The PLA must be renewed at least every five years.

The PLA should:

I.B.1.a) identify the faculty who will assume both educational and supervisory responsibilities for fellows;

I.B.1.b) specify their responsibilities for teaching, supervision, and formal evaluation of fellows, as specified later in this document;

I.B.1.c) specify the duration and content of the educational experience; and,

I.B.1.d) state the policies and procedures that will govern fellow education during the assignment.

I.B.2. The program director must submit any additions or deletions of participating sites routinely providing an educational experience, required for all fellows, of one month full time equivalent (FTE) or more through the Accreditation Council for Graduate Medical Education (ACGME) Accreditation Data System (ADS).

II. Program Personnel and Resources

II.A. Program Director

II.A.1. There must be a single program director with authority and accountability for the operation of the program. The sponsoring institution's GMEC must approve a change in program director. After approval, the program director must submit this change to the ACGME via the ADS.

II.A.2. The program director should continue in his or her position for a length of time adequate to maintain continuity of leadership and program stability.

II.A.3. Qualifications of the program director must include:

II.A.3.a) requisite specialty expertise and documented educational and administrative experience acceptable to the Review Committee;

II.A.3.b) current certification in the specialty by the American Board of Radiology, the American Board of Neurological Surgery, or the American Board of Psychiatry and Neurology, or appropriate educational qualifications that are acceptable to the Review Committee; and,

II.A.3.c) current medical licensure and appropriate medical staff appointment.

II.A.3.d) special expertise in endovascular surgical neuroradiology techniques and must concentrate at least 50% of his or her practice in endovascular surgical neuroradiology therapy;

II.A.3.e) appointment by and responsibility to the program director of the core training program; and,

II.A.3.f) holding appointments to the teaching staff in the departments of radiology, neurological surgery and neurology.

II.A.4. The program director must administer and maintain an educational environment conducive to educating the fellows in each of the ACGME competency areas. The program director must:

- II.A.4.a)** oversee and ensure the quality of didactic and clinical education in all sites that participate in the program;
- II.A.4.b)** approve a local director at each participating site who is accountable for fellow education;
- II.A.4.c)** approve the selection of program faculty as appropriate;
- II.A.4.d)** evaluate program faculty and approve the continued participation of program faculty based on evaluation;
- II.A.4.e)** monitor fellow supervision at all participating sites;
- II.A.4.f)** prepare and submit all information required and requested by the ACGME, including but not limited to the program information forms and annual program fellow updates to the ADS, and ensure that the information submitted is accurate and complete;
- II.A.4.g)** provide each fellow with documented semiannual evaluation of performance with feedback;
- II.A.4.h)** ensure compliance with grievance and due process procedures as set forth in the Institutional Requirements and implemented by the sponsoring institution;
- II.A.4.i)** provide verification of fellowship education for all fellows, including those who leave the program prior to completion;
- II.A.4.j)** implement policies and procedures consistent with the institutional and program requirements for fellow duty hours and the working environment, including moonlighting, and, to that end, must:
 - II.A.4.j).(1)** distribute these policies and procedures to the fellows and faculty;
 - II.A.4.j).(2)** monitor fellow duty hours, according to sponsoring institutional policies, with a frequency sufficient to ensure compliance with ACGME requirements;
 - II.A.4.j).(3)** adjust schedules as necessary to mitigate excessive service demands and/or fatigue; and,
 - II.A.4.j).(4)** if applicable, monitor the demands of at-home call and adjust schedules as necessary to mitigate excessive service demands and/or fatigue.
- II.A.4.k)** monitor the need for and ensure the provision of back up support systems when patient care responsibilities are

- unusually difficult or prolonged;
- II.A.4.l) comply with the sponsoring institution's written policies and procedures, including those specified in the Institutional Requirements, for selection, evaluation and promotion of fellows, disciplinary action, and supervision of fellows;
- II.A.4.m) be familiar with and comply with ACGME and Review Committee policies and procedures as outlined in the ACGME Manual of Policies and Procedures;
- II.A.4.n) obtain review and approval of the sponsoring institution's GMEC/DIO before submitting to the ACGME information or requests for the following:
- II.A.4.n).(1) all applications for ACGME accreditation of new programs;
- II.A.4.n).(2) changes in fellow complement;
- II.A.4.n).(3) major changes in program structure or length of training;
- II.A.4.n).(4) progress reports requested by the Review Committee;
- II.A.4.n).(5) responses to all proposed adverse actions;
- II.A.4.n).(6) requests for increases or any change to fellow duty hours;
- II.A.4.n).(7) voluntary withdrawals of ACGME-accredited programs;
- II.A.4.n).(8) requests for appeal of an adverse action;
- II.A.4.n).(9) appeal presentations to a Board of Appeal or the ACGME; and,
- II.A.4.n).(10) proposals to ACGME for approval of innovative educational approaches.
- II.A.4.o) obtain DIO review and co-signature on all program information forms, as well as any correspondence or document submitted to the ACGME that addresses:
- II.A.4.o).(1) program citations, and/or
- II.A.4.o).(2) request for changes in the program that would have significant impact, including financial, on the program or institution.

- II.A.4.p) devote sufficient time to the program to fulfill all the responsibilities inherent in meeting its educational goals;
- II.A.4.q) review the fellow's personal case log on a quarterly basis. At the completion of training, the program director must submit the entire clinical experience of the endovascular surgical neuroradiology program and the fellows in the format prescribed by the Review Committee. The list of procedures and the logs must be made available to the Review Committee at the time of its review of the core program and the endovascular surgical neuroradiology program;
- II.A.4.r) along with faculty, organize formal teaching conferences specifically developed for the fellows and held at least once a week to allow discussion of topics selected to broaden knowledge in the field of endovascular surgical neuroradiology. Specifically, teaching conferences should embrace the scope of endovascular surgical neuroradiology as outlined in the Introduction (Definitions and Scope) and IV (Educational Program) of these Program Requirements.
- II.A.4.s) ensure protected didactic and interactive conference time, including interdepartmental meetings with neurosurgeons and neuroradiologists.
- II.A.4.t) ensure that journal club should meet on a regular basis to discuss innovations in endovascular surgical neuroradiology. The endovascular surgical neuroradiology fellow should attend and actively participate in interdepartmental meetings and conferences with neuroradiology, neurosurgery, neurology and neuropathology; and,
- II.A.4.u) ensure that regular review of all mortality and morbidity related to the performance of endovascular surgical neuroradiology procedures are documented. Fellows must participate actively in these reviews, which should be held at least monthly. Fellows should be encouraged to attend and participate in local extramural conferences and should attend at least one national meeting or postgraduate course in endovascular surgical neuroradiology therapy while in training.

II.B. Faculty

II.B.1. At each participating site, there must be a sufficient number of faculty with documented qualifications to instruct and supervise all fellows at that location.

The faculty must:

II.B.1.a) devote sufficient time to the educational program to fulfill their supervisory and teaching responsibilities; and to

- demonstrate a strong interest in the education of fellows, and**
- II.B.1.b) administer and maintain an educational environment conducive to educating fellows in each of the ACGME competency areas.**
- II.B.1.c) ensure adequate teaching supervision and evaluation of a fellow's academic progress. The faculty-to-fellow ratio must be at least one full-time equivalent faculty person for every fellow enrolled in the program.
- II.B.2. The physician faculty must have current certification in the specialty by the American Board of Radiology, the American Board of Neurological Surgery, or the American Board of Psychiatry and Neurology or possess qualifications acceptable to the Review Committee.**
- II.B.3. The physician faculty must possess current medical licensure and appropriate medical staff appointment.**
- II.B.3.a) The physician faculty must be appointed in good standing to the staff of an institution participating in the program.
- II.B.3.b) The physician faculty must concentrate at least 50% of their practice in endovascular surgical neuroradiology therapy.
- II.B.3.c) The physician faculty should hold primary and/or joint appointments in the departments of radiology, neurological surgery, and neurology departments.
- II.B.3.d) The physician faculty must provide didactic teaching and direct supervision of fellows' performance in clinical patient management and in the procedural, interpretive, and consultative aspects of endovascular surgical neuroradiology therapy.
- II.B.3.e) In addition to the program director, the physician faculty must include at least one full-time member with expertise in endovascular surgical neuroradiology techniques.
- II.B.4. The nonphysician faculty must have appropriate qualifications in their field and hold appropriate institutional appointments.**
- II.B.5. The faculty must establish and maintain an environment of inquiry and scholarship with an active research component.**
- II.B.5.a) The faculty must regularly participate in organized clinical discussions, rounds, journal clubs, and conferences.**
- II.B.5.b) Some members of the faculty should also demonstrate scholarship by one or more of the following:**
- II.B.5.b).(1) peer-reviewed funding;**

- II.B.5.b).(2) **publication of original research or review articles in peer-reviewed journals, or chapters in textbooks;**
- II.B.5.b).(3) **publication or presentation of case reports or clinical series at local, regional, or national professional and scientific society meetings; or,**
- II.B.5.b).(4) **participation in national committees or educational organizations.**

II.B.5.c) **Faculty should encourage and support fellows in scholarly activities.**

II.C. Other Program Personnel

The institution and the program must jointly ensure the availability of all necessary professional, technical, and clerical personnel for the effective administration of the program.

II.D. Resources

The institution and the program must jointly ensure the availability of adequate resources for fellow education, as defined in the specialty program requirements.

II.D.1. **Equipment and Facilities**

- II.D.1.a) Modern imaging/procedure rooms and equipment must be available and must permit the performance of all endovascular surgical neuroradiology procedures. Rooms in which endovascular surgical neuroradiology procedures are performed should be equipped with physiological monitoring and resuscitative equipment. The following state-of-the-art equipment must be available: MRI scanner equipped with high speed gradients, CT scanner (multi-detector) capable of CT angiography and CT Perfusion, biplane digital subtraction angiography, ultrasound, and a radiographic-fluoroscopic room(s).
- II.D.1.b) Facilities for storing catheters, guidewires, contrast materials, embolic agents, and other supplies must be adjacent to or within procedure rooms. There must be adequate space and facilities for image display and interpretation and for consultation with other clinicians.
- II.D.1.c) The sites where endovascular surgical neuroradiology training is conducted must include appropriate inpatient, outpatient, emergency, and intensive care facilities for direct fellow involvement in providing comprehensive endovascular surgical neuroradiology care.

II.D.1.d) The institution should provide laboratory facilities to support research projects pertinent to endovascular therapies.

II.D.2. Interchange with Residents in Other Specialties and Students

Fellows should be encouraged to participate in research activities with residents and staff in other related specialties.

II.E. Medical Information Access

Fellows must have ready access to specialty-specific and other appropriate reference material in print or electronic format. Electronic medical literature databases with search capabilities should be available.

III. Fellow Appointments

III.A. Eligibility Criteria

The program director must comply with the criteria for fellow eligibility as specified in the Institutional Requirements.

III.A.1. The preliminary year in neuroradiology may be performed in the same institution as the endovascular surgical neuroradiology fellowship or in another institution with ACGME-accredited residencies in radiology, neuroradiology, neurosurgery, and neurology. For fellows who obtain preparatory training in another institution, documentation of completion of training must be provided by the neuroradiology program director for that institution. The endovascular surgical neuroradiology program director has the responsibility and authority to assess the adequacy of the preparatory training and to verify that all preliminary training requirements have been fulfilled.

III.A.2. Fellows entering from Radiology should demonstrate the following:

III.A.2.a) completion of an ACGME-accredited residency in diagnostic radiology;

III.A.2.b) completion of an ACGME-accredited fellowship (subspecialty residency) in neuroradiology;

III.A.2.c) performance and interpretation of a minimum of 100 diagnostic neuroangiograms under the supervision of a qualified physician (a board-certified radiologist, interventional neuroradiologist, endovascular neurosurgeon or interventional neurologist with appropriate training); and,

III.A.2.d) completion of 6 months training in neurologic surgery, vascular neurology and neurointensive care, during which the fellow will become proficient in the outpatient evaluation and care of pre-and post procedure endovascular patients as well as in the management of patients in the neurointensive care environment.

This may be completed during the radiology residency.

- III.A.3. Fellows entering from Neurosurgery should demonstrate the following:
- III.A.3.a) completion of an ACGME-accredited neurosurgical residency, and
 - III.A.3.b) completion of a preliminary year within neuroradiology during which the program will provide education and clinical experience to ensure that the fellow will receive the following training. This preparatory year may occur during the neurosurgery residency and should include:
 - III.A.3.b).(1) a course in basic radiographic skills, including radiation physics, radiation biology, and radiation protection; and the pharmacology of radiographic contrast materials acceptable to the program director where the neuroradiology training will occur;
 - III.A.3.b).(2) performance and interpretation of a minimum of 100 diagnostic neuroangiograms under the supervision of a qualified physician (a board-certified radiologist, interventional neuroradiologist, endovascular neurosurgeon or interventional neurologist with appropriate training);
 - III.A.3.b).(3) the use of needles, catheters, guidewires and angiographic devices and materials;
 - III.A.3.b).(4) recognition and management of complication of angiographic procedures; and,
 - III.A.3.b).(5) understanding the fundamentals of non-invasive neurovascular imaging studies pertinent to the practice of Endovascular Surgical Neuroradiology including CT/CTA, MR/MRA and sonography of neurovascular diseases.
- III.A.4. Fellows entering from Neurology should demonstrate the following:
- III.A.4.a) completion of an ACGME-accredited residency in neurology;
 - III.A.4.b) completion of an ACGME-accredited one-year vascular/stroke neurology that includes at least three months of neurointensive care;
 - III.A.4.c) completion of three months of clinical experience within an ACGME-accredited neurological surgery program;
 - III.A.4.d) completion of a preliminary year within neuroradiology, during which the program will provide education and clinical experience to ensure that the fellow will receive the following training:

- III.A.4.d).(1) a course in basic radiographic skills, including radiation physics, radiation biology, and radiation protection; and the pharmacology of radiographic contrast materials acceptable to the program director where the neuroradiology training will occur;
- III.A.4.d).(2) performance and interpretation of a minimum of 100 diagnostic neuroangiograms under the supervision of a qualified physician (Board certified neuroradiologist, interventional neuroradiologist, endovascular neurosurgeon, or intervening neurologist with appropriate training);
- III.A.4.d).(3) instruction in the use of needles, catheters, guidewires and angiographic devices and materials;
- III.A.4.d).(4) recognition and management of complication of angiographic procedures; and,
- III.A.4.d).(5) understanding the fundamentals of non-invasive neurovascular imaging studies pertinent to the practice of Endovascular Surgical Neuroradiology including CT/CTA, MR/MRA and sonography of neurovascular diseases.

III.B. Number of Fellows

The program director may not appoint more fellows than approved by the Review Committee, unless otherwise stated in the specialty-specific requirements. The program's educational resources must be adequate to support the number of fellows appointed to the program.

III.B.1. Faculty-to-Fellow Ratio

The total number of fellows in the program must be commensurate with the capacity of the program to offer an adequate educational experience in endovascular surgical neuroradiology therapy.

III.C. Fellow Transfers

III.C.1. Before accepting a fellow who is transferring from another program, the program director must obtain written or electronic verification of previous educational experiences and a summative competency-based performance evaluation of the transferring fellow.

III.C.2. A program director must provide timely verification of fellowship education and summative performance evaluations for fellows who leave the program prior to completion.

III.D. Appointment of Fellows and Other Learners

The presence of other learners (including, but not limited to, residents from

other specialties, subspecialty fellows, PhD students, and nurse practitioners) in the program must not interfere with the appointed fellows' education. The program director must report the presence of other learners to the DIO and GMEC in accordance with sponsoring institution guidelines.

IV. Educational Program

IV.A. The curriculum must contain the following educational components:

IV.A.1. Overall educational goals for the program, which the program must distribute to fellows and faculty annually;

IV.A.2. Competency-based goals and objectives for each assignment at each educational level, which the program must distribute to fellows and faculty annually, in either written or electronic form. These should be reviewed by the fellow at the start of each rotation;

IV.A.3. Regularly scheduled didactic sessions;

IV.A.4. Delineation of fellow responsibilities for patient care, progressive responsibility for patient management, and supervision of fellows over the continuum of the program; and,

IV.A.5. ACGME Competencies

The program must integrate the following ACGME competencies into the curriculum:

IV.A.5.a) Patient Care

Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Fellows:

IV.A.5.a).(1) will serve as consultants under the supervision of staff endovascular surgical neuroradiology practitioners. Direct interactions of fellows with patients must be closely observed to ensure that appropriate standards of care and concern for patient welfare are strictly maintained. Communication, consultation, and coordination of care with the referring clinical staff and clinical services must be maintained and documented with appropriate notes in the medical record;

IV.A.5.a).(2) will participate in and personally perform and analyze a broad spectrum of endovascular procedures. In order to ensure adequate training, the institution's patient population must have a diversity of illnesses from which broad experience in endovascular surgical neuroradiology therapy can be obtained. The case material should encompass a range of diseases, including:

- IV.A.5.a).(2).(a) Aneurysms
- IV.A.5.a).(2).(b) Arteriovenous malformation
- IV.A.5.a).(2).(c) Atherosclerotic disease of the cervical vessels
- IV.A.5.a).(2).(d) Occlusive vascular disease and acute infarction
- IV.A.5.a).(2).(e) Intracranial neoplasms
- IV.A.5.a).(2).(f) Vascular anomalies of the Head and Neck
- IV.A.5.a).(2).(g) Neoplasms of the head and neck
- IV.A.5.a).(2).(h) Vascular anomalies of the spine
- IV.A.5.a).(2).(i) Neoplasms of the spine
- IV.A.5.a).(2).(j) Traumatic vascular lesions of the CNS, head, neck and spine

- IV.A.5.a).(3) perform a minimum of 100 therapeutic endovascular procedures;
- IV.A.5.a).(4) have adequate training and experience in invasive functional testing;
- IV.A.5.a).(5) attend and participate in clinical conferences. It is desirable that they participate in the clinical teaching of neurological surgery, and of radiology fellows and medical students;
- IV.A.5.a).(6) have experience in didactic and clinical experiences that encompass the full clinical spectrum of endovascular surgical neuroradiology therapy. The program in endovascular surgical neuroradiology must not have an adverse impact on the educational experience of diagnostic radiology, neuroradiology, neurological surgery, or neurology fellows in the same institution; and,
- IV.A.5.a).(7) make daily rounds with the endovascular surgical neuroradiology faculty members during which patient management decisions are discussed and made.

IV.A.5.b)

Medical Knowledge

Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioral sciences, as well as the application of this knowledge to patient care. Fellows:

- IV.A.5.b).(1) will undergo clinical training which must consist of a period of 12 continuous months in endovascular surgical neuroradiology during which the fellow has the opportunity to carry out all of the following under close supervision:
- IV.A.5.b).(1).(a) perform clinical preprocedure evaluations of patients, and their preliminary diagnostic studies, and consult with clinicians on other services;
- IV.A.5.b).(1).(b) perform diagnostic and therapeutic endovascular surgical neuroradiology procedures;
- IV.A.5.b).(1).(c) generate procedural reports; and,
- IV.A.5.b).(1).(d) participate in short term and long term post procedure follow up care, including neurointensive care. The continuity of care must be of sufficient duration to ensure that the fellow is familiar with the outcome of all endovascular surgical neuroradiology procedures.
- IV.A.5.b).(2) complete the following didactic component areas:
- IV.A.5.b).(2).(a) Anatomical and physiologic basic knowledge:
- IV.A.5.b).(2).(a).(i) Arterial and venous angiographic anatomy of the brain, spine, spinal cord, and head and neck, including:
- IV.A.5.b).(2).(a).(i).(a) Collateral circulation
- IV.A.5.b).(2).(a).(i).(b) Dangerous anastomosis
- IV.A.5.b).(2).(a).(i).(c) Cerebral blood flow
- IV.A.5.b).(2).(a).(i).(d) Autoregulation
- IV.A.5.b).(2).(a).(i).(e) Variants of anatomy
- IV.A.5.b).(2).(a).(i).(f) Vascular distributions and supply/drainage
- IV.A.5.b).(2).(a).(ii) Related bony and soft tissue anatomy and physiology;
- IV.A.5.b).(2).(a).(ii).(a) Vertebral, face, and skull bony anatomy
- IV.A.5.b).(2).(a).(ii).(b) Brain, neck, face, and spine soft tissue anatomy and physiology

IV.A.5.b).(2).(a).(ii).(c)	Ligamentous, articular and muscular anatomy
IV.A.5.b).(2).(b)	Pharmacology of the CNS and vasculature and relevant brain physiology:
IV.A.5.b).(2).(b).(i)	Vasodilators and constrictors
IV.A.5.b).(2).(b).(ii)	Agents used in provocative testing
IV.A.5.b).(2).(b).(iii)	Contrast agents
IV.A.5.b).(2).(b).(iv)	Coagulation cascade
IV.A.5.b).(2).(b).(iv).(a)	Anticoagulants
IV.A.5.b).(2).(b).(iv).(b)	Antiaggregants
IV.A.5.b).(2).(b).(iv).(c)	Thrombolytics
IV.A.5.b).(2).(c)	Embolic, sclerosing, ablative and bone stabilization agents
IV.A.5.b).(2).(c).(i)	Blood pressure control
IV.A.5.b).(2).(c).(ii)	Heart rate control
IV.A.5.b).(2).(c).(iii)	Allergic reaction control
IV.A.5.b).(2).(c).(iv)	Infection
IV.A.5.b).(2).(c).(v)	Stroke risk reduction
IV.A.5.b).(2).(d)	Technical aspects of endovascular surgical neuroradiology, including;
IV.A.5.b).(2).(d).(i)	Catheter and delivery systems
IV.A.5.b).(2).(d).(ii)	Embolic, sclerosing and stabilizing agents in cerebral, spinal and head and neck embolization
IV.A.5.b).(2).(d).(iii)	Stents, balloons, and revascularization devices
IV.A.5.b).(2).(d).(iv)	Flow controlled navigations and embolization
IV.A.5.b).(2).(d).(v)	Complications of angiography and embolization

IV.A.5.b).(2).(d).(vi)	Collateral network manipulations, flow diversion
IV.A.5.b).(2).(d).(vii)	Electrophysiology
IV.A.5.b).(2).(d).(viii)	Provocative testing
IV.A.5.b).(2).(d).(ix)	Imaging of the vascular system
IV.A.5.b).(2).(d).(x)	Direct access/therapeutic injection techniques, including biopsy and aspiration.
IV.A.5.b).(3)	provide the following knowledge base information for all the disease states listed in (i) below:
IV.A.5.b).(3).(a)	Classification
IV.A.5.b).(3).(b)	Clinical presentation
IV.A.5.b).(3).(c)	Imaging appearance
IV.A.5.b).(3).(d)	Natural history
IV.A.5.b).(3).(e)	Epidemiology
IV.A.5.b).(3).(f)	Hemodynamic and physiologic basis for disease and treatment
IV.A.5.b).(3).(g)	Indications and techniques for treatment
IV.A.5.b).(3).(h)	Contraindications for treatment
IV.A.5.b).(3).(i)	Treatment alternatives
IV.A.5.b).(3).(j)	Combined therapies
IV.A.5.b).(3).(k)	Risks of treatment
IV.A.5.b).(3).(l)	Complication management
IV.A.5.b).(3).(l).(i)	Disease states
IV.A.5.b).(3).(l).(i).(a)	Arteriovenous malformations and fistulae
IV.A.5.b).(3).(l).(i).(b)	Vascular trauma
IV.A.5.b).(3).(l).(i).(c)	Hemorrhage and epistaxis
IV.A.5.b).(3).(l).(i).(d)	Stroke and cerebral ischemia

IV.A.5.b).(3).(l).(i).(e)	Arteriopathies
IV.A.5.b).(3).(l).(i).(f)	Vertebral fracture and degeneration
IV.A.5.b).(3).(l).(i).(g)	Tumors
IV.A.5.b).(3).(l).(i).(h)	Other vascular malformations and lesions

IV.A.5.c) Practice-based Learning and Improvement

Fellows must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. Fellows are expected to develop skills and habits to be able to meet the following goals:

- IV.A.5.c).(1) identify strengths, deficiencies, and limits in one’s knowledge and expertise;**
- IV.A.5.c).(2) set learning and improvement goals;**
- IV.A.5.c).(3) identify and perform appropriate learning activities;**
- IV.A.5.c).(4) systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement;**
- IV.A.5.c).(5) incorporate formative evaluation feedback into daily practice;**
- IV.A.5.c).(6) locate, appraise, and assimilate evidence from scientific studies related to their patients’ health problems;**
- IV.A.5.c).(7) use information technology to optimize learning; and,**
- IV.A.5.c).(8) participate in the education of patients, families, students, fellows and other health professionals.**

IV.A.5.d) Interpersonal and Communication Skills

Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. Fellows are expected to:

- IV.A.5.d).(1) communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;**

- IV.A.5.d).(2) **communicate effectively with physicians, other health professionals, and health related agencies;**
- IV.A.5.d).(3) **work effectively as a member or leader of a health care team or other professional group;**
- IV.A.5.d).(4) **act in a consultative role to other physicians and health professionals; and,**
- IV.A.5.d).(5) **maintain comprehensive, timely, and legible medical records, if applicable.**

IV.A.5.e) Professionalism

Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Fellows are expected to demonstrate:

- IV.A.5.e).(1) **compassion, integrity, and respect for others;**
- IV.A.5.e).(2) **responsiveness to patient needs that supersedes self-interest;**
- IV.A.5.e).(3) **respect for patient privacy and autonomy;**
- IV.A.5.e).(4) **accountability to patients, society and the profession; and,**
- IV.A.5.e).(5) **sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation.**

IV.A.5.f) Systems-based Practice

Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Fellows are expected to:

- IV.A.5.f).(1) **work effectively in various health care delivery settings and systems relevant to their clinical specialty;**
- IV.A.5.f).(2) **coordinate patient care within the health care system relevant to their clinical specialty;**
- IV.A.5.f).(3) **incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-**

- based care as appropriate;
- IV.A.5.f).(4) advocate for quality patient care and optimal patient care systems;
- IV.A.5.f).(5) work in interprofessional teams to enhance patient safety and improve patient care quality; and,
- IV.A.5.f).(6) participate in identifying system errors and implementing potential systems solutions.

IV.B. Fellows' Scholarly Activities

- IV.B.1. The curriculum must advance fellows' knowledge of the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care.
- IV.B.2. Fellows should participate in scholarly activity.
- IV.B.3. The sponsoring institution and program should allocate adequate educational resources to facilitate fellow involvement in scholarly activities.

V. Evaluation

V.A. Fellow Evaluation

V.A.1. Formative Evaluation

- V.A.1.a) The faculty must evaluate fellow performance in a timely manner during each rotation or similar educational assignment, and document this evaluation at completion of the assignment.
- V.A.1.b) The program must:
 - V.A.1.b).(1) provide objective assessments of competence in patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice;
 - V.A.1.b).(2) use multiple evaluators (e.g., faculty, peers, patients, self, and other professional staff);
 - V.A.1.b).(3) document progressive fellow performance improvement appropriate to educational level; and,
 - V.A.1.b).(4) provide each fellow with documented semiannual evaluation of performance with feedback.

V.A.1.c) The evaluations of fellow performance must be accessible for review by the fellow, in accordance with institutional policy.

V.A.1.d) Assessment should include regular evaluation of fellows' knowledge, skills, and overall performance, including the development of professional attitudes consistent with being a physician. The assessment must include cognitive, motor, and interpersonal skills as well as judgment.

V.A.1.e) The program director will meet quarterly with the fellows to communicate each evaluation. At this time, procedure logs and performance will be reviewed and each fellow will be provided with feedback.

V.A.1.e).(1) Fellows will be advanced to positions of higher responsibility only on evidence of their satisfactory progressive scholarship and professional growth.

V.A.1.e).(2) The program will maintain a permanent record of evaluation for each fellow and have it accessible to the fellow and other authorized personnel.

V.A.2. Summative Evaluation

The program director must provide a summative evaluation for each fellow upon completion of the program. This evaluation must become part of the fellow's permanent record maintained by the institution, and must be accessible for review by the fellow in accordance with institutional policy. This evaluation must:

V.A.2.a) document the fellow's performance during the final period of education, and

V.A.2.b) verify that the fellow has demonstrated sufficient competence to enter practice without direct supervision.

V.B. Faculty Evaluation

V.B.1. At least annually, the program must evaluate faculty performance as it relates to the educational program.

V.B.2. These evaluations should include a review of the faculty's clinical teaching abilities, commitment to the educational program, clinical knowledge, professionalism, and scholarly activities.

V.B.3. This evaluation must include at least annual written confidential evaluations by the fellows.

V.C. Program Evaluation and Improvement

V.C.1. The program must document formal, systematic evaluation of the

curriculum at least annually. The program must monitor and track each of the following areas:

- V.C.1.a) fellow performance;**
- V.C.1.b) faculty development;**
- V.C.1.c) graduate performance, including performance of program graduates on the certification examination; and,**
- V.C.1.d) program quality. Specifically:**
 - V.C.1.d).(1) Fellows and faculty must have the opportunity to evaluate the program confidentially and in writing at least annually, and**
 - V.C.1.d).(2) The program must use the results of fellows' assessments of the program together with other program evaluation results to improve the program.**
 - V.C.1.d).(3) In particular, the quality of the curriculum and the extent to which the educational goals have been met by fellows must be assessed by the fellowship program director, and the Institutional Review Committee on a regular basis. Written evaluations by fellows should be used in this process.**
- V.C.2. If deficiencies are found, the program should prepare a written plan of action to document initiatives to improve performance in the areas listed in section V.C.1. The action plan should be reviewed and approved by the teaching faculty and documented in meeting minutes.**

VI. Fellow Duty Hours in the Learning and Working Environment

VI.A. Principles

- VI.A.1. The program must be committed to and be responsible for promoting patient safety and fellow well-being and to providing a supportive educational environment.**
- VI.A.2. The learning objectives of the program must not be compromised by excessive reliance on fellows to fulfill service obligations.**
- VI.A.3. Didactic and clinical education must have priority in the allotment of fellows' time and energy.**
- VI.A.4. Duty hour assignments must recognize that faculty and fellows collectively have responsibility for the safety and welfare of patients.**

VI.B. Supervision of Fellows

The program must ensure that qualified faculty provide appropriate supervision of fellows in patient care activities.

VI.C. Fatigue

Faculty and fellows must be educated to recognize the signs of fatigue and sleep deprivation and must adopt and apply policies to prevent and counteract its potential negative effects on patient care and learning.

VI.D. Duty Hours (the terms in this section are defined in the ACGME Glossary and apply to all programs)

Duty hours are defined as all clinical and academic activities related to the program; i.e., patient care (both inpatient and outpatient), administrative duties relative to patient care, the provision for transfer of patient care, time spent in-house during call activities, and scheduled activities, such as conferences. Duty hours do *not* include reading and preparation time spent away from the duty site.

VI.D.1. Duty hours must be limited to 80 hours per week, averaged over a four-week period, inclusive of all in-house call activities.

VI.D.2. Fellows must be provided with one day in seven free from all educational and clinical responsibilities, averaged over a four-week period, inclusive of call.

VI.D.3. Adequate time for rest and personal activities must be provided. This should consist of a 10-hour time period provided between all daily duty periods and after in-house call.

VI.E. On-call Activities

VI.E.1. In-house call must occur no more frequently than every third night, averaged over a four-week period.

VI.E.2. Continuous on-site duty, including in-house call, must not exceed 24 consecutive hours. Fellows may remain on duty for up to six additional hours to participate in didactic activities, transfer care of patients, conduct outpatient clinics, and maintain continuity of medical and surgical care.

VI.E.3. No new patients may be accepted after 24 hours of continuous duty.

VI.E.4. At-home call (or pager call)

VI.E.4.a) The frequency of at-home call is not subject to the every-third-night, or 24+6 limitation. However at-home call must not be so frequent as to preclude rest and reasonable personal time for each fellow.

VI.E.4.b) Fellows taking at-home call must be provided with one day in seven completely free from all educational and clinical responsibilities, averaged over a four-week period.

VI.E.4.c) When fellows are called into the hospital from home, the hours fellows spend in-house are counted toward the 80-hour limit.

VI.F. Moonlighting

VI.F.1. Moonlighting must not interfere with the ability of the fellow to achieve the goals and objectives of the educational program.

VI.F.2. Internal moonlighting must be considered part of the 80-hour weekly limit on duty hours.

VI.G. Duty Hours Exceptions

An Review Committee may grant exceptions for up to 10% or a maximum of 88 hours to individual programs based on a sound educational rationale.

VI.G.1. In preparing a request for an exception the program director must follow the duty hour exception policy from the ACGME Manual on Policies and Procedures.

VI.G.2. Prior to submitting the request to the Review Committee, the program director must obtain approval of the institution's GMEC and DIO.

VII. Experimentation and Innovation

Requests for experimentation or innovative projects that may deviate from the institutional, common and/or specialty specific program requirements must be approved in advance by the Review Committee. In preparing requests, the program director must follow Procedures for Approving Proposals for Experimentation or Innovative Projects located in the ACGME Manual on Policies and Procedures. Once a Review Committee approves a project, the sponsoring institution and program are jointly responsible for the quality of education offered to fellows for the duration of such a project.

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