



ACADEMY OF MEDICINE, SINGAPORE

**TRAINING STANDARDS GUIDELINES FOR
DIAGNOSTIC RADIOLOGISTS PERFORMING
PERCUTANEOUS PERIPHERAL ANGIOPLASTY,
PERIPHERAL AND VISCERAL EMBOLIZATIONS
AND NEUROVASCULAR INTERVENTIONS**

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Training Standards Guidelines for Diagnostic Radiologists Performing Percutaneous Peripheral Angioplasty, Peripheral and Visceral Embolizations and Neurovascular Interventions

BACKGROUND

Over the recent years, percutaneous vascular interventional procedures have grown in popularity and in many conditions have now become the preferred mode of therapy. With the establishment and widespread clinical use of these procedures, the Academy of Medicine, Singapore recognizes a need to set standards of training for medical practitioners performing these procedures so that patients can be assured of a standard quality of care.

The working committee appointed to draw up these guidelines comprised:

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The aim of these guidelines is to define the minimum expected training standards and/or experience required by diagnostic radiologists to qualify them to perform percutaneous interventional vascular procedures. Although these guidelines are not designated as rules, they can be utilized by medical institutions for accreditation of diagnostic radiologists who perform these procedures. This document specifically addresses the performance of peripheral vascular angioplasty, vascular embolization and neurovascular interventional procedures.

It is envisaged that further guidelines will be issued to cover other interventional radiological procedures. These guidelines will be reviewed regularly. This document does not cover experimental and investigative techniques and separate individualized guidelines are suggested for these procedures.

DEFINITIONS

For the purpose of these guidelines, a **diagnostic angiogram** is defined as the percutaneous passage of a catheter into an artery under fluoroscopic guidance with subsequent injection of contrast material and imaging of the entire vascular distribution in question using conventional serial film changers or large field digital imaging systems. For example, peripheral angiography of lower extremity vessels must image the vessels of both lower extremities from the distal aorta to at least the ankles. Cerebral angiography should comprise a full assessment of the arterial, capillary/parenchymal and venous phases in the territory supplied by at least 3 arteries (both carotid arteries and either vertebral artery). Conventional cineradiography or videofluoroscopy alone is not sufficient for the routine recording of peripheral, visceral and cerebral angiographic studies. Measurements of intra-arterial pressure gradients are a useful adjunct and may be necessary to fully assess the significance of vascular occlusive disease as well as the outcome of an interventional procedure.

Angioplasty is defined here as a percutaneous transluminal balloon dilation procedure or similar procedure using an atherectomy, stent, or other interventional device. Such a procedure would generally involve percutaneous vascular access, transluminal passage of a balloon catheter or other interventional device, and treatment at the appropriate sites. The angioplasty procedure includes angiographic and hemodynamic documentation of the result and appropriate clinical follow-up during the patient's hospitalization.

Embolization is defined here as the intravascular deposition of particulate, liquid, or mechanical agents, or autologous blood clot to produce intentional vessel occlusion. Embolic vascular occlusion may be performed at any level from large arteries or veins to the capillary beds, and it may be temporary or permanent in nature. Such a procedure would generally involve percutaneous vascular access, selective or super-selective vascular catheterization and treatment at the appropriate site. The embolization procedure includes angiographic documentation of the result and appropriate clinical follow-up during the patient's hospitalization.

Thrombolysis is defined here as a percutaneous procedure in which mechanical or chemical means are used to lyse intravascular blood clot. The procedure includes angiographic documentation of the result and appropriate clinical follow-up during the patient's hospitalization.

Neurovascular intervention refers to a percutaneous procedure involving the vessels of the spine or head and neck, including the intra and extracranial vessels, which may involve embolization, angioplasty, thrombolysis or drug infusion.

Invasive neurovascular diagnostic test is defined here as a test in which percutaneous methods are used to sample blood or temporarily occlude vessels of the head and neck (including the intracranial vessels) to aid in the establishment of a clinical diagnosis.

BASIC TRAINING

The medical practitioner should be suitably qualified to perform and interpret diagnostic angiograms. Qualified diagnostic radiologists should, by examination, possess the M.Med (Diagnostic Radiology), Singapore, or equivalent diagnostic radiology qualification registrable with the Singapore Medical Council. The practitioner should also have satisfied the requirements set forth by the Specialists Accreditation Board, Singapore and be accredited or be eligible for accreditation as a specialist in diagnostic radiology by the Ministry of Health, Singapore.

PERIPHERAL ANGIOPLASTY AND THROMBOLYSIS

TRAINING STANDARDS

Body of Knowledge

Medical practitioner applicants should have extensive clinical training in the diagnosis and treatment of patients with peripheral vascular disease. The body of knowledge necessary includes the anatomy, natural history, and clinical manifestations of peripheral vascular disease; noninvasive assessment of peripheral vascular disease; indications and contraindications for angioplasty; risks and benefits of angioplasty; recognition of complications; alternative therapies; principles of thrombolytic techniques; and technical aspects and usage of x-ray equipment needed for diagnostic peripheral angiography and percutaneous transluminal angioplasty.

Specific Procedural Training and Experience

Specific training or experience in peripheral diagnostic angiography, peripheral percutaneous transluminal angioplasty and thrombolysis techniques is required. This may be obtained through one of the following:

1. Qualification by Training

An applicant may qualify by completing a training program that includes extensive experience in diagnostic angiography, percutaneous transluminal angioplasty of peripheral vessels and thrombolysis techniques. At a minimum, this experience must include performance of 50 diagnostic peripheral angiograms and 25 renal and/or peripheral percutaneous transluminal angioplasties, and for at least half of these procedures the applicant must be the primary operator. In addition, the applicant should have training and experience in the use of thrombolytic therapy in peripheral arteries, having participated in at least 5 such cases. These requirements would normally be met during an advanced training program of 3 years' duration, part of which may include training in an interventional radiology fellowship program, completed after the basic training requirements listed in the previous section have been met. In all instances, complete and detailed documentation of the aforementioned procedural training should be available.

2. Qualification by Experience

An applicant may qualify by having extensive previous experience in angiographic diagnosis, percutaneous transluminal angioplasty and thrombolysis with acceptable complication and success rates. This experience must include performance of a minimum of 50 diagnostic peripheral angiograms, 25 percutaneous transluminal angioplasties of the renal/peripheral arteries, and for at least half of these procedures, the applicant must be the primary operator. The applicant should have experience in the use of thrombolytic therapy in peripheral arteries, having participated in at least 5 such cases. This applicant should be able to present documentation of results and complications, and confirmation of this data may be requested from the institution where the experience was gained.

3. Qualification by Apprenticeship

These applicants must be prepared to demonstrate knowledge of the principles of diagnosis and therapy of peripheral vascular disease, as outlined in "Body of Knowledge." Clear understanding of the methods of diagnostic angiography must be demonstrated, including knowledge of appropriate radiographic equipment, catheters and catheter techniques, and radiation safety associated with diagnostic and interventional procedures. The apprenticeship should be thoroughly documented and should include each of the following as a minimum:

- Documented performance of 50 diagnostic peripheral angiograms, 25 peripheral percutaneous transluminal angioplasty procedures and 5 peripheral arterial thrombolysis procedures, under the direct supervision of a qualified medical practitioner preceptor. The applicant must have been the primary operator for at least half of these procedures. The requirement for the diagnostic angiograms may be met in part by the previous experience of the operator if appropriate records are submitted (as outlined in "Qualification by Experience")
- Observation of the applicant performing at least 5 peripheral percutaneous transluminal angioplasties by a person already qualified by these standards.

PERIPHERAL AND VISCERAL EMBOLIZATION

TRAINING STANDARDS

Body of Knowledge

Medical practitioner applicants should have extensive clinical training in the diagnosis and percutaneous treatment of hemorrhage, vascular tumours and other vascular abnormalities. The body of knowledge necessary includes the anatomy, natural history and clinical manifestations of these conditions and abnormalities; indications and contraindications for embolization; risks and benefits of embolization; different types of temporary and permanent embolic material; recognition of complications; alternative therapies; principles of embolization techniques; and technical aspects and usage of x-ray equipment needed for diagnostic peripheral and visceral angiography and percutaneous embolization.

Specific Procedural Training and Experience

Specific training or experience in peripheral and visceral diagnostic angiography, and embolization techniques is required. This may be obtained through one of the following:

1. Qualification by Training

An applicant may qualify by completing a training program that includes extensive experience in diagnostic angiography. At a minimum, this experience must include performance of 50 diagnostic visceral angiograms and 25 catheter embolizations, and for at least half of these procedures the applicant must be primary operator. These requirements would normally be met during an advanced training program of 3 years' duration, part of which may include training in an interventional radiology fellowship program, completed after the basic training requirements listed in the previous section have been met. In all instances complete and detailed documentation of the aforementioned procedural training should be available.

2. Qualification by Experience

An applicant may qualify by having extensive previous experience in angiographic diagnosis and catheter embolization with acceptable complication and success rates. This experience must include performance of a minimum of 50 diagnostic visceral angiograms and 25 catheter embolizations and for at least half of these procedures, the applicant must be the primary operator. This applicant should be able to present documentation of results and complications, and confirmation of this data may be requested from the institution where the experience was gained.

3. Qualification by Apprenticeship

These applicants must be prepared to demonstrate knowledge of the principles of embolization techniques as outlined in "Body of Knowledge." Clear understanding of the methods of diagnostic angiography must be demonstrated, including knowledge of appropriate radiographic equipment, catheters and catheter techniques, and radiation safety associated with

diagnostic and interventional procedures. The apprenticeship should be thoroughly documented and should include each of the following as a minimum:

- Documented performance of 50 diagnostic visceral angiograms and 25 catheter embolization procedures, under the direct supervision of a qualified medical practitioner preceptor. The applicant must have been the primary operator for at least half of these procedures. The requirement for the diagnostic angiograms may be met in part by the previous experience of the operator if appropriate records are submitted (as outlined in "Qualification by Experience")
- Observation of the applicant performing at least 5 catheter embolizations by a person already qualified by these standards.

NEUROVASCULAR INTERVENTION

TRAINING STANDARDS

Body of Knowledge

Medical practitioner applicants should have extensive clinical training in the diagnosis and treatment of patients with neurological disease. The body of knowledge necessary includes the anatomy, natural history, and clinical manifestations of neurological diseases; noninvasive assessment of neurological diseases; indications and contraindications for neurovascular embolization, angioplasty and thrombolysis, and invasive neurodiagnostic tests outlined within this document; risks and benefits of embolization, angioplasty, thrombolysis and invasive neurodiagnostic tests; different types of embolic material, thrombolytic agents and angioplasty equipment; principles for the performance of embolization, angioplasty, thrombolysis and invasive neurodiagnostic tests; recognition and treatment of complications; alternative therapies; and technical aspects and usage of x-ray equipment needed for diagnostic cerebral and supra-aortic angiography and percutaneous neurovascular interventions.

Specific Procedural Training and Experience

Specific training or experience in neurodiagnostic angiography and neurointerventional techniques is required. A medical practitioner may be qualified by the following routes:

1. Comprehensive:

a. Qualification by Training

An applicant may qualify by completing a training program that includes extensive experience in diagnostic cerebral angiography, percutaneous neurovascular interventions including catheter embolization, percutaneous angioplasty and intravascular thrombolytic techniques. At a minimum, this experience must include performance of 100 diagnostic cerebral angiograms and training in a recognized neurovascular interventional centre during which the applicant must have performed or assisted in at least 100 neurovascular interventional procedures. These requirements would normally be met during an advanced training program of 3 years' duration, part of which may include training in an interventional neuroradiology fellowship program, completed after the basic training requirements listed in the previous section has been met. In all instances complete and detailed documentation of the aforementioned procedural training should be available.

b. Qualification by Experience

An applicant may qualify by having extensive previous experience in diagnostic cerebral angiography and percutaneous neurovascular interventions including catheter embolization, percutaneous angioplasty and intravascular thrombolysis with acceptable complication and success rates. This experience must include performance of a minimum of 100 diagnostic cerebral as well as the performance of 100 neurovascular interventional procedures either as primary operator or assistant. This applicant should be able to present documentation of results and complications, and confirmation of this data may be requested from the institution where the experience was gained.

c. Qualification by Apprenticeship

These applicants must be prepared to demonstrate knowledge of the principles of diagnosis and therapy of neurological diseases, as outlined in "Body of Knowledge." Clear understanding of the methods of diagnostic angiographic must be demonstrated, including knowledge of appropriate radiographic equipment, catheters and catheter techniques, and radiation safety associated with diagnostic and interventional procedures. The apprenticeship should be thoroughly documented and should include the following as a minimum:

- Documented performance of a minimum of 100 diagnostic cerebral angiograms as well as the performance of 100 neurovascular interventional procedures either as primary operator or assistant under the direct supervision of a qualified medical practitioner preceptor. The requirement for the diagnostic angiograms may be met in part by the previous experience of the operator if appropriate records are submitted (as outlined in "Qualification by Experience")
- Observation of the applicant performing at least 5 neurovascular interventions by a person already qualified by these standards.

2. Categorical

This route allows applicants to qualify and perform within a restricted field of neurovascular interventional practice. Regardless of the category of the procedure the medical practitioner must be prepared to demonstrate knowledge of the principles of diagnosis and therapy of neurological diseases, as outlined in "Body of Knowledge." Clear understanding of the methods of diagnostic angiography must be demonstrated, including knowledge of pertinent vascular anatomy, appropriate radiographic equipment, catheters and catheter techniques, and radiation safety associated with diagnostic and interventional procedures.

An applicant may qualify by having extensive previous experience in the respective category, with acceptable complication and success rates, or by apprenticeship under the direct supervision of a qualified medical practitioner preceptor.

- Documented performance of a minimum of 50 diagnostic cerebral angiograms and the appropriate number of procedures as outlined below. The applicant should be able to present documentation of results and complications and data may be requested from the institution where the experience was gained.

a. Extracranial embolization:

This includes embolization for epistaxis and pre-operative tumour embolization involving the extracranial vasculature. An applicant may qualify by having performed or assisted in at least 25 procedures with 15 as primary operator.

b. Supra-aortic or intracranial thrombolysis, angioplasty, stenting and chemo-infusion:

The practitioner should have performed 20 procedures with 10 as primary operator.

c. Invasive neurovascular diagnostic test:

The practitioner should have performed or assisted in 10 procedures with 5 as primary operator.

MAINTENANCE OF EXPERIENCE

Maintenance of a standard quality of care in the above procedures requires ongoing experience in the performance of these procedures with acceptable success and complication rates. The practitioner should participate in his/her respective institution's quality improvement program that monitors indications, success rates and complications. The practitioner should also actively participate in Continuing Medical Education programs in interventional radiology as it is vital to keep abreast with developments in a rapidly developing field.

REFERENCES

1. Levin DC, Becker GJ, Dorros G, Goldstone J, King SB, Seeger JM, et al. Training standards for physicians performing peripheral angioplasty and other percutaneous peripheral vascular interventions. *Circulation* 1992;86:1348-1350.
2. Drooz AT, Lewis CA, Allen TE, Citron SJ, Cole PE, Freeman NJ, et al. Quality improvement guidelines for percutaneous transcatheter embolization. *J Vasc Interv Radiol* 1997;8:889-895.
3. Picard L, Negro M, Ter Brugge K, Mawad M, Lasjaunias P, Vinnula F, et al. 1998 World Federation of Interventional and Therapeutic Neuroradiology – Guidelines for fellowship training programmes in interventional neuroradiology. *Interv Neuroradiol* 1998;4:195-197

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