



NEURORADIOLOGY SPECIAL INTEREST GROUP: DIAGNOSTIC AND INTERVENTIONAL TRAINING GUIDELINE

SIG NEURO Working Group 2013

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NEURORADIOLOGY SPECIAL INTEREST GROUP: DIAGNOSTIC AND INTERVENTIONAL FELLOWSHIP

1 Introduction

- 1.1 This curriculum outlines the requirements for subspecialty training for radiologist in neuroradiology, including interventional neuroradiology.
- 1.2 Trainees will usually enter into neuroradiology training 18 months after gazettement or equivalent. This training is either in diagnostic neuroradiology and interventional neuroradiology. However earlier, more focused, individualised training in neuroradiology is being encouraged for those trainees with previous neuroscience experience.
- 1.3 All neuro trainees will have acquired basic knowledge of neuroradiology diagnosis as radiology trainees during core training and will already have acquired basic skills.
- 1.4 This document outlines the training curriculum to become a consultant neuroradiologist or neurointerventionalist. A minimum of 18 months of full-time training locally in neuroradiology is essential and will be accredited as a 'clinical fellow' from the accredited training centre. A further 18 months overseas or training locally for a total of 3 years for completion of NSR training. A trainee undertaking training in neurointerventional procedures requires minimum two years of concentrated neurointerventional training within the stated 3 years. This recommendation conforms to advice of the National Specialist Registrar.
- 1.5 Dedicated neuroradiology training received at other neuroscience centre may be taken into consideration on case-to-case basis based on MBNR recommendation.
- 1.6 All neuroradiology training programs shall be approved and accredited for training by the College of Radiologists (Academy of Medicine, Malaysia). The Training Accreditation Committee (MBNR) visiting team shall include at least a neuroradiologist and a neuro-interventionalist
- 1.7 The aim of subspecialty training in neuroradiology is to enable the trainee to become independent clinically competent, and to consistently interpret the results of neuroradiological investigations accurately and reliably. Where appropriate, trainees shall also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service
- 1.8 The content of training needs to be flexible and appropriate to the ultimate goal of the trainee. Neuroradiology is an expanding specialty with development of

interventional services, paediatric neuroradiology and functional brain imaging, including magnetic resonance spectroscopy. Some trainees may wish to obtain extra training in these areas.

2 Objectives

2.1 The aim of establishing a curriculum for subspecialty training in neuroradiology is to ensure that the trainee acquires:

- knowledge of the relevant embryology and anatomy of the nervous system
- an in-depth understanding of the relevant pathophysiological, and clinical aspects of neurological diseases
- an in-depth understanding of the indications, contraindications and complications of imaging studies of neurological diseases
- an in-depth understanding of the major imaging techniques relevant to neuroradiology, so that they can, with confidence, discuss with their colleagues the choice of best imaging method for a particular clinical problem
- clinical knowledge relevant to neuroradiology so that the trainee may confidently discuss patients with colleagues
- direct practical exposure to interventional procedures to provide them with a full knowledge of the technical problems and risks of the procedures. Some hands-on experience with graded supervision will be required by all trainees in neuroradiology, but will vary from straightforward procedures to more complex procedures depending on the trainee's future job goals
- knowledge of the current developments in neuroradiology

2.2 The trainee shall be fully competent in intermediate and advanced life-support. Formal ALS certification shall be considered.

2.3 Experience will be documented in the Trainee Personal Logbook (TPL) and procedural numbers recorded in a logbook prepared by Malaysian Board Of Neuro, head and neck Radiology (MBNR).

2.4 If experience to fulfill the requirements of subspecialty training cannot be gained in one training centre, it will be necessary for the trainee to have a period of attachment(s) to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

2.5 The expected outcome at the end of this subspecialty training in neuroradiology will

be for the Radiologist to be competent in all aspects of diagnostic neuroradiology imaging, and where applicable interventional neuroradiology.

3 Overview of training

3.1 A training scheme responsible for training in neuroradiology must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), digital subtraction angiography, ultrasound (US) and radionuclide imaging facilities. Trainees shall also have access to neonatal cranial US.

3.2 Clinical knowledge will be acquired by a variety of means. This will include close liaison with the appropriate surgical and medical teams and participation in combined clinical and radiological meetings. Clinical inter-relationships are necessary with:

- neurosurgery (paediatric and adult)
- neurology (paediatric and adult)
- neuropsychiatry
- neuropathology
- neurophysiology
- neuroanaesthesia/critical care and emergency medicine
- trauma
- Head and neck diseases

Other specialties will also provide important training opportunities, in particular ophthalmology, otology, genetics, endocrinology, psychiatry, neuro-oncology, maxillofacial surgery, spinal surgery and rehabilitation services.

3.3 It may be appropriate for the trainee to have a regular attachment to ward rounds, outpatient clinics and theatre sessions in order to further clinical knowledge relevant to the subspecialty.

3.4 The trainee is expected to attend and to conduct appropriate clinico-radiological meetings under supervision.

3.5 The trainee shall participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

3.6 The trainee shall be involved in research and have the opportunity to attend and present at national and international meetings. The progression of research projects to formal peer-reviewed publication shall be supported and encouraged by the supervising consultant(s).

- 3.7 Attendance at the Malaysian, Asian, British, European and American Neuroradiology Societies meetings shall be encouraged.
- 3.8 The trainee shall be encouraged to become a member of the College of Radiology, Academy of Medicine of Malaysia
- 3.9 The trainee is expected to participate in undergraduate and postgraduate teaching including training for MRAD, FRCR, and MBBS.
- 3.10 The trainee shall continue to participate in the radiologist on-call rota in diagnostic as well as interventional neuroradiology if required with appropriate consultant cover
- 3.11 Subspecialty training in neuroradiology is assessed and accredited by the TAC and approved by the COR and NSR.

4 Requirements of subspecialty training

- 4.1 All Neuroradiology trainees are required to undergo basic health screening inclusive of hepatitis and HIV screening.
- 4.2 All Neuroradiology trainees are required to obtain their own Medical Indemnity Insurance throughout their posting.
- 4.3 A comprehensive knowledge of normal brain function and neurological diseases, including:
 - the embryology, anatomy, normal variants and physiology of the central and peripheral nervous system, organs of special senses, head and neck, and spine and spinal cord in adults and children
 - the pathological correlation of diseases and variations of the central nervous system, including the spine, head, neck and cranium and disorders of the ophthalmological and otorhinolaryngological systems, including appropriate applications and interpretation of the various imaging modalities
 - local, national and where appropriate, international imaging guidelines
- 4.4 Knowledge and understanding of the physical principles and technical background for the performance of CT, MRI, angiography, US, conventional imaging and myelography for the diagnostic imaging of the head, spine and spinal cord, neck and

organs of special senses in adults and children. Exposure to magnetic resonance spectroscopy (MRS)/functional imaging and nuclear medicine studies [single photon emission computed tomography (SPECT), positron emission tomography (PET)] related to neuroradiology shall be available.

- 4.5 To develop the interpretative skills of CT, MRI, angiography, US, conventional imaging and myelography for the diagnostic imaging of the head, spine and spinal cord, neck and organs of special senses in adults and children.
- 4.6 The trainee shall know the inherent strengths and limitations of these modalities, as well as appropriate imaging protocols for neuroradiological consultation.
- 4.7 Knowledge of the techniques involved in the imaging used to evaluate and treat neurological diseases, including interventional procedures and the management of the complications of these procedures.
- 4.8 Knowledge of pharmacology, particularly with respect to contrast media and invasive procedures.
- 4.9 Knowledge of patient protection and safety in neuroradiology.
- 4.10 Understanding of fundamentals of quality assurance (management) in neuroradiology.
- 4.11 Acquisition of specific skills to enable competence in clinical neuroradiological skills in children and adults including:
 - diagnostic and interpretative skills
 - manual and procedural skills
 - basic endovascular and therapy
 - computer skills in imaging acquisition and post-processing skills
 - the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation of neurological diseases, to a high professional standard
 - good communication with patients and professional colleagues
 - competence in style of reporting
 - ability to manage post procedure care for invasive diagnostic, therapeutic techniques and neuroradiological emergencies
 - ability to manage patients and to obtain valid informed consent for all procedures
 - competence in effective consultation, presentation of scholarship material and ability to teach neuroradiology to peers and residents in other disciplines
 - ability to evaluate medical literature critically and to conduct

- neuroradiological research
 - ability to conduct or supervise quality assurance
- 4.12 The core requirements for a neuroradiologist or a specialist interventional neuroradiologist are similar, apart from the total number of interventional procedures performed (Section 7.5.11).
- 4.13 Regardless of the imaging technique concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of such investigations accurately and reliably.
- 4.14 During the training period it is recommended that the trainee receive the following:
- CT: the equivalent of two sessions per week
 - MRI (neuro): the equivalent of two sessions per week
 - angiography (neuro): the equivalent of two sessions per week
 - meetings/teaching: the equivalent of one session per week
 - research: the equivalent of one session per week
 - myelography/radiculography: the opportunity to observe, and whenever possible, obtain hands-on experience of the limited number of these procedures now carried out
- 4.15 During the training period the trainee shall also gain experience in the following:
- Plain radiography including:
- primary care examinations
 - skull, facial and spinal trauma
 - paediatric examinations including NAI
- Optional experience:*
- radionuclide radiology including SPECT imaging and PET
 - US including neonatal cranial US and Doppler
- 4.16 The techniques listed and the time devoted to each will be reviewed at intervals along with the number of cases required, as it is recognised that some procedures may become obsolete and new techniques will be developed (eg: functional brain imaging and magnetic resonance spectroscopy).
- 4.17 The trainee shall become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.

4.18 The trainee shall become fully aware of the local and national guidelines in obtaining informed patient consent.

5 Interventional neuroradiology requirements

5.1 All Neurointerventional trainees are required to undergoes basic health screening inclusive of hepatitis and HIV screening.

5.2 All Neurointerventional trainees are required to obtain their own Medical Indemnity Insurance throughout their posting.

5.3 All radiologist training in neuroradiology shall have a basic understanding of interventional techniques so that they have full knowledge of indications, technical problems, contraindications and risk of procedures. Trainees with a special interest in interventional neuroradiology will need more extensive experience.

5.4 All trainees in interventional neuroradiology shall complete at least 1 year of diagnostic neuroradiology training.

5.5 Trainees who wish to spend a significant part of their work as a consultant in interventional neuroradiology shall spend around 2 years in a training post in which substantially the whole time is devoted to interventional neuroradiology.

5.6 Neurointerventional trainees need to develop clinical judgment. The risks and benefits of each therapeutic procedure need to be appreciated. Training might include a clinical attachment.

5.7 Neurointerventional trainees shall have adequate exposure to neurosurgical operations and ward/high dependency unit management of acutely ill patients.

5.8 Regular involvement in neurosciences audit and mortality/morbidity meetings is necessary to understand risk management for different clinical conditions.

5.9 It is the responsibility of the trainee to be aware of the current local and national guidelines in obtaining informed patient consent.

5.10 All neurointerventional trainees must have thorough knowledge of techniques of sedation and analgesia required to perform these procedures, as well as patient monitoring throughout and following the procedures.

- 5.11 Neurointerventional trainees shall be aware of the full range of intra- and post-operative complications and their management.
- 5.12 Neurointerventional trainees shall participate minimum of 30 neuroradiological interventional procedures of which a substantial proportion will be for intracranial vascular lesions. The trainee shall be the first operator/primary assistant in around a third of cases.
- 5.13 It is desirable that the neurointerventional trainees also attend other centres, especially if the range and quantity of interventional procedures is limited.

6 Appraisal and assessment

- 6.1 Regular 6 monthly appraisal of the trainee will be done by consultant supervisor recognized by MBNR.
- 6.2 Methods of trainee assessment will include:
- regular direct observation of clinical techniques (including communication skills) ability to obtain informed consent and sedation skills) by the supervisor
 - regular formal review of the trainee's skills in the accurate interpretation of investigations for neurological diseases
 - a final assessment of overall professional competence prior to the final record of in-training assessment review
- 6.3 Review of training program
- It is expected that trainees will complete a feedback form for each subspecialty training period undertaken.
 - It is expected that the training committee responsible for organising subspecialty training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant subspecialty curriculum. The analysis and subsequent actions shall be formally recorded.
 - The MBNR will regularly review these records to ensure that subspecialty training complies with the appropriate subspecialty curriculum.
- 6.4 Review of subspecialty curriculum
- The MBNR with assistance from CoR will regularly review this subspecialty curriculum to ensure that it complies with current neuroradiological practice.

