

HONG KONG COLLEGE OF RADIOLOGISTS

Higher Subspecialty Training in Interventional Neuroradiology

[This document should be read in conjunction with the *Guidelines on Higher Specialist Training (Radiology)*]

1. INTRODUCTION

- 1.1 Neuroradiology is a subspecialty that involves diagnostic imaging and interventional radiology in the management of diseases of the central and peripheral nervous system.
- 1.2 Interventional Neuroradiology is an essential element in the Neuroradiology domain. Radiologists who perform interventional radiology procedures need to acquire knowledge and a specific skill set to effectively and safely manage patients with neurovascular conditions. They also need to master Diagnostic Neuroradiology for reviewing the diagnosis prior to interventional procedures, planning of procedures and following up of patients.
- 1.3 Interventional Neuroradiology is a category A subspecialty.

2. OBJECTIVES

At the completion of the training programme, trainees are expected to:

- (a) have acquired the knowledge of basic neuroanatomy, clinical knowledge relevant to neuroradiology and interpretation of the various imaging modalities relevant to the interventional neuroradiology management strategies of various neurovascular and other CNS pathology.
- (b) be able to give advice on the best imaging and interventional treatment strategies based on individual needs;
- (c) have a thorough understanding of the indications, contraindications, limitations and potential complications of diagnostic and interventional neuroradiology;
- (d) have acquired basic skills of interventional neuroradiology procedures.

3. TRAINING REQUIREMENTS

3.1 TRAINING CENTER REQUIREMENTS

3.1.1 Equipment Requirements:

- (a) Multidetector CT scanner.
- (b) Ultrasound equipment with colour Doppler facility.
- (c) Biplane Digital subtraction angiographic equipment.
- (d) MR scanner with at least 1.5 Tesla field strength.
- (e) Access to nuclear medicine facilities for performance of radionuclide investigations.

3.1.2 Clinical/Radiological Service Requirements:

- (a) Neurosurgical department.
- (b) Neurologist service from Medical department.
- (c) Paediatric Neurology service, Psychiatry department, and Neuropathology service are optional though desirable.

3.2 TRAINER REQUIREMENTS

As specified in the Guidelines on Higher Specialist Training (Radiology).

3.3 DURATION OF TRAINING

6 months of Interventional Neuroradiology training is mandatory. A trainee who chooses Interventional Neuroradiology as one of their higher subspecialty training rotations MUST also choose an additional 3 months of Diagnostic Neuroradiology rotation making it a total of 9 months of training rotation. This 9-month of Interventional and Diagnostic Neuroradiology training has to be consecutive. However, all requirements listed in the Interventional and Diagnostic Neuroradiology programmes can be completed anytime in any order within this 9-month period. There is no need for the trainee to finish the Diagnostic Neuroradiology training before he/she started the Interventional Neuroradiology training.

3.4 DUTY SESSIONS

Perform five or more neuroradiology related sessions per week, among which there should be at least:

- 1 CT session,
- 1 MRI session and
- 2 angiography/interventional session.

The other 1 session can be MRI, angiography or CT.

3.5 MINIMUM NUMBER OF EXAMINATIONS / PROCEDURES REQUIRED FOR 6 MONTHS OF INTERVENTIONAL NEURORADIOLOGY TRAINING

Examination/Procedure		Training	Requirement (Exam codes)
CT examinations <i>Including</i>	Brain Orbit/Face/PNS Spine CT angiogram (head/neck) CT brain perfusion	Perform and report	300 150 20 20 40 10
MR examinations <i>Including</i>	Brain/Brain stem Spine MR angiogram (plain/contrast) MR perfusion	Perform and report	300 150 50 50 10
Ultrasound examinations <i>Including</i>	Doppler ultrasound of the carotid / vertebral arteries	Perform and report	20
Diagnostic angiograms		Perform and report	300
<i>Including</i>	Carotid, vertebral and spinal angiograms		
Neurointerventional procedures		Assist or perform under direct supervision by neuroradiology trainer or co-trainer	40
<i>Including those for the treatment of:</i>	Cerebral aneurysm		15
	cerebral AVM/DAVF/CCF; spinal DAVF/AVM; head&neck AVM/AVF; intracranial/ head & neck/spinal tumors		3
	Acute ischaemic stroke		10
	Carotid stenosis		10
	Non-vascular spinal conditions (i.e. vertebroplasty, kyphoplasty, epidural injection, dorsal root ganglia ablation etc.)		2

Note:

The minimum numbers of CT/MRI/USG/diagnostic angiogram examinations/procedures required as shown in the table above are independent of those required for the 3-month Diagnostic Neuroradiology training. That is, trainees need to satisfy the requirements in both the 3-month Diagnostic Neuroradiology and 6-months Interventional Neuroradiology (except for the 4 observations of neurointerventional procedures stated in the Training Guidelines of Diagnostic Neuroradiology). The record forms in the appendices are adapted for recording all examinations performed by the trainee in both the 6 months of interventional neuroradiology and 3 months of diagnostic neuroradiology training periods.

3.5.1 Please refer to the following appendices for the RIS coding:

- Angiogram (Appendix I)
- Interventional Neuroradiology procedures (Appendix II)
- CT examination (Appendix III)
- MR examination (Appendix IV)
- US examination (Appendix V)
- Optional requirements (Appendix VI)

3.5.2 For trainee who is unable to complete the minimal required number of neurointerventional procedures in his / her own centre during his/her neurointerventional training, arrangement to assist or perform in other recognized higher training centres in Hong Kong is allowed. Trainee can also supplement the case numbers in the rest of their two-year Higher Specialist Training period. This should be clearly recorded in the training record.

3.6 CLINICAL RADIOLOGICAL CONFERENCES AND OTHER MEETINGS

Present cases in interventional neuroradiology related CRC held at least twice a month.

3.7 PRESENTATIONS AND PUBLICATIONS

Please refer to the Guidelines on Higher Specialist Training (Radiology).

3.8 OTHER REQUIREMENTS

3.8.1 The appendices must be completed and attached to the trainee's logbook to reflect the training experience.

3.8.2 Optional exposure requirements:

It would be an advantage if the trainee has the following working experience:

- (a) Reporting of plain radiographs in the investigation of neurological disorders,
- (b) Transcranial Doppler of intracranial circulation
- (c) Orbital ultrasonography

- (d) Conventional/CT/MR myelography
- (e) PET or SPECT isotope brain scanning
- (f) Imaging for stereotactic brain biopsy/planning
- (g) Neuro-navigation procedures
- (h) Vessel wall imaging
- (i) Observing open neurosurgical operations
- (j) Transradial/transulnar approach to perform cerebral angiograms or neurointerventions
- (k) Attend outpatient clinics and/or inpatient consultations and see patients before and after they had undergone neurointerventional procedures.

3.8.3 Trainee is preferred to have simulation training in cerebral, carotid, and acute ischemic stroke intervention modules before performing interventional neuroradiology procedures.

Version endorsed by HKAM Council Meeting on 18 November 2021 and effective from 1 July 2022

Trainee Experience in Interventional Neuroradiology Training**[Angiograms]**

Trainee's Name:

Training Period (Interventional + diagnostic neuroradiology):

From _____ to _____

Perform and report at least 300 + 20 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
6105	Carotid arteriogram	
6106	Vertebral arteriogram	
6113	Spinal arteriogram	
	Total	

Other Angiogram examinations

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
6102	Arch aortogram	
6107	Subclavian arteriogram	
	Total	

Optional

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
6402	IV Conebeam CT angio. (optional)	

Total number of Angiogram examinations experienced**in 9 months is _____.**(Signed) _____
Neuroradiology Trainer

Trainee Experience in Interventional Neuroradiology Training**[Interventional Neuroradiology procedures]**

Trainee's Name:

Training Period (Interventional + diagnostic neuroradiology):

From _____ to _____

Perform and report at least 40 neuro-interventional procedures in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
6311.BE/ 6311.BS	EVT of cerebral aneurysm	
6311.BE/ 6311.HE/ 6311.SE / 6311.SA/ 6311.ST/7510/ 7512.OR/7512.OT/	EVT of cerebral AVM/DAVF/CCF; spinal DAVF/AVM; head&neck AVM/AVF; intracranial / head & neck / spinal tumor;	
6311.BX	EVT for acute ischaemic stroke	
6311.HS	EVT for carotid stenosis	
7502.OT	Vertebroplasty; dorsal root ganglia ablation; nerve root block etc.	
	Total	

Note:

1. EVT = endovascular treatment
2. Different centre may adopt individualized RIS codes for some of the interventional procedures. Trainees may use these individualized RIS codes to count their workloads instead.

Total number of Interventional Neuroradiology procedures experienced***in 9 months is _____.***

(Signed) _____
Neuroradiology Trainer

Trainee Experience in Interventional Neuroradiology Training**[CT Examination]**

Trainee's Name:

Training Period (Interventional + diagnostic neuroradiology):

From _____ to _____

Overall Requirement: Perform and report at least 300 + 90 examinations in 6 + 3 months**Brain: At least 150 + 90 examinations in 6 + 3 months**

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
4101	Brain plain	
4102	Brain +con.	
	Total	

Orbit/Face/PNS: At least 20 + 10 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
4105	Orbit plain	
4106	Orbit +con.	
4113	Sinuses & Face plain	
4114	Sinuses & Face + con.	
	Total	

Spine: At least 20 + 10 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
4305	Cervical spine plain	
4306	Cervical spine +con.	
4307	Thoracic spine plain	
4308	Thoracic spine +con.	
4309	Lumbar spine plain	
4310	Lumbar spine +con.	
4311	LS spine plain	
4312	LS spine +con.	
4313	Sacrum plain	
4314	Sacrum +con.	
	Total	

CT angiogram(head/neck): At least 40 + 20 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
4404	CT angiography	
	Total	

CT brain perfusion: At least 10 + 4 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
4119	Brain Perfusion	
4120	Brain Pefusion + Diamox	
	Total	

Others:

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
4103	Temporal plain	
4104	Temporal +con.	
4419	Plain Neurosurgery stereotactic planning	
4420	Contrast Neurosurgery stereotactic planning	
	Total	

Total number of CT examinations performed and reported

in 9 months is _____.

(Signed) _____
Neuroradiology Trainer

Trainee Experience in Interventional Neuroradiology Training**[MR Examination]**

Trainee's Name:

Training Period (Interventional + diagnostic neuroradiology):

From _____ to _____

Overall Requirement: Perform and report at least 300 + 240 examinations in 6 + 3 months**Brain: At least 150 + 90 examinations in 6 + 3 months**

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8101	Brain plain	
8102	Brain+con.	
8113	Brain stem and craniocervical junction plain	
8114	Brain stem and craniocervical junction plain + con.	
	Total	

Orbits: At least 13 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8103	Orbit plain	
8104	Orbit +con.	
	Total	

IAM/CP angle and brain stem: At least 10 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8105	IAM/CP angle plain	
8106	IAM/CP angle + con.	
	Total	

Pituitary: At least 13 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8107	Pituitary plain	
8108	Pituitary +con.	
	Total	

Spine: At least 50 + 25 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8201	Cervical spine plain	
8202	Cervical spine +con.	
8203	Thoracic spine plain	
8204	Thoracic spine +con.	

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8205	Lumbar spine plain	
8206	Lumbar spine +con.	
8207	Survey plain	
8208	Survey +con.	
8210	MR Myelography	
	Total	

MR angiogram: At least 50 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8501	Plain MR Angiography	
8521	MRA/V (Head&Neck) + con.	
	Total	

MR perfusion: At least 10 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8610	MR Brain Perfusion Imaging (including Arterial Spin Labelling)	
	Total	

Special MRI Examination: At least 40 examinations in 6 + 3 months (Please see the table in section 3.5 of Diagnostic Neuroradiology for the minimum requirement for each subtype of special MRI examination)

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
8601	Single voxel Proton MR Spectroscopy	
8605	Multi-voxel Proton MR Spectroscopy	
8608	Diffusion Weighted Imaging(Brain)	
8609	Diffusion Tensor Imaging	
8603	Functional MRI (Brain mapping)	
8611	Quantitative flow analysis	
	Total	

Total number of MRI examinations performed and reported

in 9 months is _____.

(Signed) _____
Neuroradiology Trainer

Trainee Experience in Interventional Neuroradiology Training**[Ultrasound Examination]**

Trainee's Name:

Training Period (Interventional + diagnostic neuroradiology):

From _____ to _____

Overall requirement: Perform and report at least 20 + 20 examinations in 6 + 3 months**Doppler Examination: At least 20 + 10 examinations in 6 + 3 months**

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
3302	Doppler carotids	

Brain: At least 5 examinations in 6 + 3 months

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
3201	Infant brain	

Optional

<i>RIS Coding</i>	<i>Name of Procedures</i>	<i>No. of Examinations</i>
3303	Doppler orbits	
3305	Doppler Transcranial	
	Total	

Total number of Ultrasound examinations performed and reported**in 9 months is _____.**(Signed) _____
Neuroradiology Trainer

Trainee Experience in Interventional Neuroradiology Training

Trainee's Name:

Training Period (Interventional + diagnostic neuroradiology):

From _____ to _____

Optional Exposure

<i>RIS Coding</i>	<i>Name of Procedure</i>	<i>No. of Examinations</i>
1601, 1602, 1603, 1604, 1610, 1611	Plain film reporting	
2301, 2302, 2303, 2304	Myelography	
8520	Plain MR Venography	
9001	SPECT	
9004	SPECT/CT without CT reporting	
9005	SPECT/CT with CT reporting	
9020	Cisternography In-DTPA	
9021	Cisternography Tc-DTPA	
9022	Cisternography In-DTPA CSF Leak	
9023	Cisternography Tc-DTPA CSF Leak	
9040	Cerebral perfusion (HMPAO)	
9040.01	Cerebral perfusion (HMPAO) with Diamox	
9041	Cerebral perfusion (HMPAO with stabilising agent)	
9042	Cerebral perfusion (HMPAO with stabilising agent) + Diamox	
9045	Cerebral perfusion (ECD)	
9046	Cerebral perfusion (ECD) + Diamox	
9050	Dacryoscintigraphy	
9099	Miscellaneous Neurology	
9P13	Brain PET-CT FDG (3D)	
9C13	Brain PET-CT FDG (3D) + con.	
9P19	Miscellaneous Neurology PET-CT	
9C19	Miscellaneous Neurology PET-CT + con.	
9P90	Regional Brain PET-CT scan	
	Total	

(Signed) _____

Neuroradiology Trainer