



**SUB-SPECIALTY TRAINING
CURRICULUM**

FOR

INTERVENTIONAL RADIOLOGY

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1 INTRODUCTION

Interventional radiology (IR) is the sub-specialty encompassing the diagnosis, investigation and image guided therapeutic management of vascular and non-vascular disease.

From the training point of view, interventional radiology should be seen as a discipline that synthesises the many complex invasive therapeutic skills, which have developed within all branches of radiology. The essential skills that are necessary to practise these techniques safely and effectively overlap with each other and comprise clinical and technical ability. These are allied to the understanding of core radiology as defined in the Royal College of Radiologists' clinical radiology training curriculum.

Currently radiology departments rarely if ever have the infrastructure to support clinical care of patients other than on a day case basis. Interventional radiology procedures, which have developed within radiology departments, have been supported through collaboration with clinical teams. However, as the complexity and scope of IR procedures has increased, this model has become unsustainable. Interventional radiology is not a mere technical sub-specialty but a sub-specialty of clinical radiological and medical practice concerned with diagnosing and treating patients. Therefore it is good clinical practice and a medico-legal requirement for interventional radiologists (IRs) to take primary clinical responsibility for the patients they treat. This requires the provision of appropriate training, enabling them to fulfil this part of their role safely and effectively. This will allow interventional radiologists to develop sound judgement, which will add value to patient management. IRs with these appropriate clinical skills will be able to support the practice of their colleagues in diagnostic radiology, who will wish to continue to undertake IR procedures within specific organ-systems. In this way interventional radiology will flourish as a dynamic medical sub-specialty and interventional radiologists will work in a multidisciplinary professional team in conjunction with other medical and surgical specialties to respond to the needs of patients.

The Interventional Radiology Curriculum sets out the framework for educational progression that will support professional development throughout sub-specialty training in interventional radiology. Sub-specialty training in IR consists of training in core clinical radiology and higher sub-specialty training in IR. This higher training will focus on either vascular or non-vascular IR, or a combination of both, or diagnostic and interventional neuroradiology.

It is accepted that emergency work forms a major part of IR practice. It is therefore desirable for IR trainees to have experience of dedicated IR on call during the later stages of training.

2 RATIONALE

2.1 *Purpose of the curriculum*

When followed as part of a prospectively approved training programme, this curriculum leads to the award of a certificate of completion of training (CCT) in Clinical Radiology with Interventional Radiology sub-specialisation. The aim is to ensure that trainees are fully competent to provide a high quality service at consultant level in the NHS.

This curriculum covers the period of training from entering an interventional radiology training programme following successful completion of three years of core training in clinical radiology.

This curriculum defines the sub-specialty requirements for the three years of higher training required to obtain sub-specialty recognition in interventional radiology. **It must be read in conjunction with the curriculum for clinical radiology which defines the generic and core competences which form the basis for the award of the CCT in clinical radiology.** Wherever possible this document avoids duplication of content which exists in the clinical radiology curriculum.

2.2 *Training Pathway*

Recruitment to sub-specialty training must be competitive with a fair, transparent and open selection process.

Sub-specialty training in interventional radiology consists of training in clinical radiology and higher sub-specialty training in IR. This higher training will focus on vascular and non-vascular IR **or** diagnostic and then interventional neuroradiology. Level 1 training provides interventional radiologists with the ability to investigate, diagnose and treat patients with common and important acute presentations required for out of hours cover. Further level 2 training builds on these competences allowing the trainee to develop expertise in those areas.

Trainees entering the IR sub-specialty and following the interventional neuroradiology path will be identified from the outset. It is expected that this will be a formal continuation of previous de facto arrangements, funding streams and training posts for INR training and not a dilution of vascular / non-vascular opportunities.

The full curriculum for sub-specialty training in interventional radiology consists of the core and generic Curriculum for Clinical Radiology plus this sub-specialty training Curriculum for Interventional Radiology (General and Non Vascular, Vascular and Interventional Neuroradiology). In order to be awarded a CCT in Clinical Radiology a trainee must have completed Level 2 competences in one special interest area or Level 1 competences in the equivalent of two or more areas, as well as maintaining core competence across the curriculum.

Higher specialty training in IR will be delivered by collaboration in and between training programmes. Some aspects of level 1 and 2 training will only be available in specialist centres. It is envisaged that IR trainees will need to be supported by their educational supervisors and training programme directors to allow them the opportunity to be trained in areas of the IR curriculum that are not available in their local programmes. In some circumstances this may necessitate out of programme training.

2.3 Enrolment with the Royal College of Radiologists

Trainees are required to maintain College membership, including the full payment of all applicable fees, throughout training for the RCR to be able to recommend them as being eligible for award of a CCT and sub-specialty status. The College must be notified at the start of ST4 when trainees have moved onto the sub-specialty training programme.

2.4 Duration of Training

Although this curriculum is competency based, the duration of training must meet the European minimum for full-time specialty training, adjusted accordingly for flexible training (EU directive 2005/36/EC). At the time of writing this is four years but this is expected to increase to five years shortly. However, the RCR has advised that the indicative duration of training from entry into the specialty (ST1) to completion will be six years in full time training. This is because the RCR believes that it will take six years of full time specialty training for trainees to achieve all the competences set out in this curriculum, particularly in light of changes in training opportunities as the result of the European Working Time Regulation.

General and non-vascular interventional radiology Level 1 and 2 procedural skills are included in the “General and Non-vascular Intervention” section of the clinical radiology curriculum, and Level 1 vascular procedural skills in the “Vascular Radiology” section of the CR curriculum. It is therefore possible that trainees can acquire a CCT in Clinical Radiology in five years of training, without formal sub-specialty recognition in IR, and still have a strong portfolio of interventional skills. This IR sub-specialty curriculum, however, offers an alternative option for those who wish to specialise in IR, with an additional year of training. Formal sub-specialty recognition in IR will require formal transfer to the IR curriculum with an indicative training period of six years.

3 HOW TO USE THE CURRICULUM

3.1 Core, Level 1 and Level 2 competences

The curriculum recognises **core, level 1 and level 2** competences. It is expected that you will acquire more competences as you progress through training. It is important to monitor the progression and the achievement of competences from the outset of training. Each trainee should strive to achieve as highly as possible but it is recognised that learning occurs at different rates in each individual. Many trainees are expected to achieve level 1 or 2 in some areas during core training. ***It is not expected that every trainee acquires every competence or covers every area.***

- **Core training (indicative years 1-3)**

All trainees are expected to reach core competence as this reflects what is likely to be required by any radiologist performing acute imaging. Core competence must be maintained until the end of training. The core outcomes and competences that should be achieved before entry into IR subspecialty training are set out in the clinical radiology specialty training curriculum.

- **Higher training (indicative years 4-5)**

Levels 1 and 2 competence indicates a greater degree of expertise to be achieved by those intending to practice IR.

Level 1

An IR radiologist (not specialising in INR) is expected to hold level 1 in areas of both non-vascular (procedural skills) and vascular radiology. They would be able to practise as an IR consultant with an ability to practise across a wide range of IR. Radiologists with other specialist interests would be expected to consult them for IR advice within their disciplines.

An IR radiologist training in interventional neuroradiology would be expected to achieve a minimum of Level 1 in diagnostic neuroradiology. Achievement of Level 1 in interventional neuroradiology is a staging post in training and not sufficient for independent practice in this field.

Level 2

An IR radiologist (not specialising in INR) with level 2 competence would be likely to be an expert in a specific field of IR – either vascular, non-vascular or potentially systems- based (e.g. oncology). He/she is likely to be consulted by other interventional radiologists. Level 2 competence in vascular radiology appears only in this IR subspecialty curriculum and not in the clinical radiology specialty training curriculum, to reflect the highly sub-specialist nature of these activities.

An IR radiologist training in interventional neuroradiology with level 2 competence would be an expert in INR. There are specific areas of practice such as paediatric interventional neuroradiology which will require focused training in specific centres in order to achieve level 2 INR competence. An IR radiologist training in interventional neuroradiology may also achieve Level 2 in diagnostic neuroradiology

When engaged in reflection, formal assessment or self assessment, it is recommended that you again refer to the framework of competences to check your progress against the range of competences you are expected to achieve.

If you experience any difficulties with this, your educational and clinical supervisors are there to help you.

3.2 Levels of Competence

It is important to note that within this curriculum the concept of “levels” applies to subject areas within which trainees specialise, mainly during higher training. These levels do not relate to the capacity for independent practice to be demonstrated in relation to individual skills. The relevant workplace-based assessments (Rad-DOPS, mini-IPX) allow for the recording of observed competence in specific procedural or reporting techniques. These use four stages of competence, which vary in detail according to the assessment, but which can be summarised as:

- Stage 1 - Trainee requires additional support and supervision
- Stage 2 - Trainee requires direct supervision
- Stage 3 - Trainee requires minimal/indirect supervision
- Stage 4 - Trainee requires very little/no senior input and is able to practise independently

To be recognised as being at Level 1 or 2 in an area of special interest it is expected that trainees will be able to operate at the top of this scale, i.e. independent practice, across that section of the syllabus.

4 CONTENT OF LEARNING

4.1 Programme Content and Objectives

The interventional radiology syllabus below sets out the sub-specialty specific content that needs to be mastered. Demonstration of completion of widespread coverage of the syllabus competences is required to achieve a CCT in Clinical Radiology (Interventional radiology).

4.2 Good Medical Practice

The General Medical Council has translated Good Medical Practice into a Framework for Appraisal and Revalidation. The Framework can be accessed on the GMC's website.

The Framework for Appraisal and Assessment covers the following domains:

<i>Domain 1</i>	Knowledge, Skills and Performance
<i>Domain 2</i>	Safety and Quality
<i>Domain 3</i>	Communication, Partnership and Teamwork
<i>Domain 4</i>	Maintaining Trust

The "GMP" column in the syllabus defines which of the 4 domains of the Good Medical Practice Framework for Appraisal and Assessment are addressed by each competency. Most parts of the syllabus relate to "Knowledge, Skills and Performance" but some parts will also relate to other domains.

4.3 The Syllabus in Practice

The syllabus sets out what interventional radiologists need to learn in order to be able to manage a wide and varied caseload and to work adaptively in healthcare teams. These competences may be acquired in a variety of radiological settings. Interventional radiology trainees should emerge with the professional qualities, understanding, critical perspective and ability to reflect on and in practice.

Throughout their training, it is important that interventional radiology trainees should be encouraged to reflect on decisions, management plans and actions taken. In discussion with their supervisors, they will be expected to discuss the thinking and reasoning behind them.

At all times interventional radiology trainees will:

- practise within their competence level
- practise in accordance with the standards expected of them in the unit in which they are placed
- refer to more experienced interventional radiology colleagues/teachers/mentors when they are uncertain as to the best management of a particular patient
- practise according to prevailing professional standards and requirements.

Outcomes

The majority of outcomes and competences described for core training in the Clinical Radiology curriculum should be achieved by the end of the third year of training before entry to the Interventional Radiology sub-specialty. Core skills must be maintained through to the end of training.

The appropriate level 1 and 2 IR outcomes and competences should be achieved by the end of the sixth year. A key feature of the interventional radiology curriculum is that all radiology trainees must develop competences at an increasingly higher level during the course of their training. IR trainees will need to find out about the specific IR learning opportunities offered by the various placements.

Evidence of the IR trainee's learning, development and achievements will be recorded in the Royal College of Radiologists ePortfolio. Further information and declaration forms for probity, professional behaviour and personal health can be found in the ePortfolio.

The following section outlines what needs to be learnt in the Interventional Radiology Training Programme. Throughout this section the term 'patient' or 'carer' should be understood to mean 'patient', 'patient and parent', 'guardian', 'carer', and/or 'supporter' or 'advocate' as appropriate in the context.

5 SYLLABUS AND COMPETENCES

In the tables that follow, the "assessment methods" shown are those that are appropriate as **currently possible** that could be used to assess each competency. It is not expected that all competences will be assessed and that where they are assessed not every method will be used. See Assessment and ARCP.

"GMP" defines which of the 4 domains of the Good Medical Practice Framework for Appraisal and Assessment are addressed by each competency

The following is a key for both the (summative and formative) assessment methods and GMP domains as they are mapped to the competences within the syllabus. The assessment methods key is common to both the Clinical Radiology and Interventional Radiology curricula for reasons of consistency.

Assessment Methods Key

1	First FRCR Examination	7	Rad-DOPS
2	Final FRCR Part A Examination	8	MSF
3	Final FRCR Part B Examination: rapid reporting session component	9	Quality Improvement Project and Audit Assessment Tool (QIPAT)
4	Final FRCR Part B Examination: reporting session component	10	Teaching Observation
5	Final FRCR Part B Examination: oral examinations	11	MDT Assessment Tool
6	Mini-IPX		

Domains of Good Medical Practice (GMP) Key

1	Knowledge, Skills and Performance	3	Communication, Partnership and Teamwork
2	Safety and Quality	4	Maintaining Trust

General and Non-Vascular Intervention

Level 1 General and Non Vascular Intervention Training

To acquire detailed clinical, pathological and radiological understanding of non-vascular interventional skills with reference to presentations and common diagnoses (Table GNVD) to a level where a definitive report can be produced for common clinical presentations

Knowledge	Assessment Methods	GMP
Recall and build upon normal and post-surgical anatomy relevant to image guided intervention examinations	6,7,10	1
Know common acute and chronic presentation of pathologies in different organ systems and how the clinical scenario affects management strategy	6,7,10	1
Recognise clinical sequelae of these conditions	6,7,10	1
Recognise the medical, interventional and surgical management options for these conditions	6,7,10	1
Understand the management of patients with contraindications to interventional procedures	6,7,10	1
Understand nutritional assessment and support	6,7	1
Knowledge of basic suturing techniques and wound care	6	1
Be aware of national IR audits and registries	6	1
Understand the principles and practice of safe sedation	6	1
Know how to resuscitate and initially manage an acutely unwell patient in the settings of trauma, haemorrhage or sepsis	6	1
Skills		
Perform clinical assessment of patients in ward and out patient settings before and after interventions	7	1,2,3
Organise and undertake appropriate imaging	6	1
Recognise/seek clinical and radiological information which advances diagnosis	6	1
Recognise clinical priority of certain presentations	6,7	1
Recognise how diagnosis affects management pathway	6,7	1
Perform acute interventions in the emergency or on call setting	7	1,2,3
Accurately interpret and report most common conditions	6	1
Manage patients' drains e.g. monitoring output, skin care and exchange	7	1,2,3
Perform advanced nutritional procedures <ul style="list-style-type: none"> • radiological insertion of gastrostomies/jejunostomies • adjustment of gastric bands 	7	1,2,3
Increase skills in imaging guided intervention using Ultrasound and CT		
Perform: <ul style="list-style-type: none"> • nephrostomy • percutaneous transhepatic drainage • percutaneous cholecystotomy 	7	1,2,3
Convert: <ul style="list-style-type: none"> • nephrostomy to ureteric stent • external biliary drain to internal biliary stent 	7	1,2,3
Perform basic suturing and wound care	7	1,2,3
Recognise and manage complications of Interventional procedures	7	1,2,3
Organise and undertake appropriate follow up imaging	6,7	1,2,3
Undertake post-procedural follow-up of patients	8	1,2,3
Formulate a plan for investigation and management	7	1,2

Perform safe sedation, including the assessment and management of complications of sedation	7	1,2,3
Clinical assessment of acutely unwell patients in the setting of trauma, haemorrhage or sepsis	7	1,2,3

Behaviour	Assessment Methods	GMP
Seek additional clinical information relevant to case	6,7,8	1,2,3
Initiate additional examination/investigation as appropriate	6,7,8	1,2,3
Participate in MDTs	6,7,8,11	1,2,3
Perform reflective learning from clinical practice, audit and where relevant, registry data	6,7,8,9	1,2,3
Take part in teaching and training	8,10	1,2,3
Demonstrate a highly organised work pattern	6,7,8	1,2,3
Show openness to critical feedback of reports	6,7,8	1,2,3
Appreciate the importance of keeping up to date with clinical developments and with relevant safety issues	6,7,8	1,2,3
Be available and able to discuss cases with clinical colleagues	8	1,2,3,4
Demonstrate good working relationships with specialist nurse/radiographer practitioners	7,8	1,2,3
Record performance data in local and national registries	7	1,2,3

Level 2 General and Non Vascular Intervention Training

To acquire detailed clinical, pathological and radiological understanding of non-vascular interventional skills with reference to presentations and uncommon diagnoses (Table GNVD) to a level where a definitive report can be produced for the great majority of clinical presentations

Knowledge	Assessment Methods	GMP
Understand in detail most acute clinical presentations and diagnoses	6,7,10	1
Know normal and variant anatomy (post-surgical anatomy) relevant to above	6,7,10	1
Recognise uncommon conditions	6,7,10	1
Know the expected outcomes of different diagnostic and therapeutic options	6,7,10	1
Understand the role of percutaneous tumour ablation in interventional oncology	6,7,10	1
Be familiar with a range of interventional equipment – balloons, stents, feeding tubes	6,7,10	1
Understand the indications, contraindications and limitations of optical endoscopic examinations of the GI tract and their use in GI and biliary tract biopsy, drainage and stenting	6,7	1
Skills		
Provide expert advice on appropriate patient imaging	6,7	1
Provide expert image interpretation	6	1
Perform plugged or transjugular biopsy in the presence of abnormal clotting	7	1,2,3
Perform retroperitoneal biopsy – lymph node, pancreas	7	1,2,3
Perform drainage of complex collections e.g. loculated collections, empyema, phlegmon	7	1,2,3
Perform advanced procedures in the urinary tract e.g. percutaneous nephrolithotomy and pyeloplasty	7	1,2,3
Perform advanced procedures in GI tract – balloon dilatation of strictures, stent insertion (oesophageal, duodenal, colonic)	7	1,2,3
Perform advanced procedures in the hepato biliary system	7	1,2,3
Perform tumour ablation	7	1,2,3
Optional - Perform endoscopic procedures of the GI tract for GI and biliary tract biopsy, drainage and stenting	7	1,2,3
Optional - Perform endovascular procedures relevant to hepatobiliary disease: chemoembolisation, TIPSS, isotope-labelled embolisation	7	1,2,3
Perform vertebroplasty	7	1,2,3
Perform ablation of bone lesions	7	1,2,3
Perform fallopian tube recanalization	7	1,2,3
Recognise and manage unusual complications	7	1,2,3
Perform acute interventions in the emergency or on call setting	7	1,2,3
Behaviour		
Automatically prioritises cases according to clinical need	6,7,8	1,2,3
Be able to discuss complex cases with referring clinicians and colleagues	6,7,8	1,2,3
Be able to relate clinical and imaging findings succinctly	6,7,8,11	1,2,3
Undertake an active role in service delivery	6,7,8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3
Offer timely specialist opinion	8	1,2,3

Discuss with specialist centre appropriately	6,7,8	1,2,3
Have an active role in interventional service delivery	6,7,10	1,2,3
Be able to accept referrals for imaging and intervention	7	1,2,3

Table GNVD –General and Non Vascular Intervention Diagnoses

Diagnoses – Common/Uncommon (Level1/2)

Fluid collections:

- Pleural effusion
- Ascites
- Pelvic collection

Infected fluid:

- Abscess
- Empyema

Obstructed systems:

- Biliary
- Renal tract
- Gastrointestinal tract

Diffuse disease:

- Liver
- Kidney
- Bone

Renal Tract:

- Stone disease
- Neoplasm
- Ureteric leak
- Post surgery
- Traumatic

Biliary Tract:

- Benign and Malignant strictures of the bile duct
- Intraductal stones
- Extrinsic obstruction
- Gall bladder: stones, empyema, cholangiocarcinoma

Pancreas

- Benign and Malignant strictures of the pancreatic duct
- Pancreatitis and complications
- Neoplasm

Nutritional disorders

Gastrointestinal Tract: benign and neoplastic strictures

- Oesophagus
- Duodenum
- Small Intestine
- Large Intestine

Neoplasms:

- Hepatobiliary
- Pancreatic
- Gastrointestinal Tract
- Genitourinary Tract
- Lung
- Bone

Fallopian tube:

- Occlusion and abnormalities

Vascular Intervention

Level 1 Vascular Training

To acquire detailed clinical, pathological and radiological understanding of vascular disease with reference to presentations and common diagnoses (Table VD Level 1) to a level where a definitive report can be produced for common clinical presentations

Knowledge	Assessment Methods	GMP
Knowledge of vascular anatomy of all organ systems and peripheral circulation	6, 10	1
Recognise typical and variant presentations of common conditions	6,10	1
Familiarity with common acute and elective presentation of vascular pathologies in different organ systems and clinical scenarios	6,10	1
Recognise the clinical sequelae of the diagnoses of vascular conditions	6,10	1
Recognise the medical, interventional and surgical management options for vascular conditions	6,10	1
Understand the principles and practice of safe sedation	6,10	1
Know how to resuscitate and initially manage an acutely unwell patient in the settings of trauma, haemorrhage or sepsis	6,10	1
Skills		
Be able accurately to report most cases and emphasise the key findings and diagnoses	6,7	1
Perform acute interventions in the emergency or on call setting	7	1,2,3
Organise and undertake appropriate imaging pathways in investigating vascular conditions	6,7	1,2,3
Recognise/seek clinical and radiological information which advances diagnosis	6,7	1,2,3
Appropriately prioritise common and uncommon presentations	6,7,8	1,2,3
Recognise how diagnosis affects management pathway	6,7	1,2,3
Perform clinical assessment of patients with vascular conditions in ward and outpatient settings	6,7	1,2,3
Develop procedural skills in elective and acute cases		
Ultrasound and fluoroscopy guided insertion of tunnelled and peripheral access lines (PICC, Hickman and dialysis)	7	1,2,3
Perform diagnostic angiography	7	1,2,3
Perform angioplasty and stenting in various territories	7	1,2,3
Perform inferior Vena Cava Filter Insertion and Retrieval	7	1,2,3
Perform embolisation for common and some uncommon indications, including to control haemorrhage, for varicocoele and fibroids	7	1,2,3
Perform Dialysis fistula interventions including techniques for fistula salvage - Thrombolysis/thrombectomy	7	1
Perform Venous/Arterial thrombolysis in acute arterial/venous occlusion	7	1
Perform thrombin injection of false aneurysm	7	1,2,3
Retrieval of Intravascular Foreign Bodies	7	1,2,3
Able to deploy closure devices	7,8	1,2,3
Demonstrates proficiency in cross-sectional vascular imaging interpretation.	7,8	1,2,3
Develop proficiency in Vascular Ultrasound for:		
<ul style="list-style-type: none"> • Peripheral vascular disease • Carotid arteries • Venous obstruction/thrombosis • Dialysis access 	7	1,2,3

Recognise and manage complications of vascular interventions	6,7,8	1,2,3
Perform safe sedation, including the assessment and management of complications of sedation	7	1,2,3
Clinical assessment of acutely unwell patients in the setting of trauma, haemorrhage or sepsis	7	1,2,3

Behaviour	Assessment Methods	GMP
Seek additional clinical information relevant to case	6,7,8	1,2,3
Initiate additional examination/investigation as appropriate	6,7,8	1,2,3
Participate in MDTs	6,7,8,11	1,2,3
Perform reflective learning from clinical practice, audit and where relevant, registry data	6,7,8,9	1,2,3
Take part in teaching and training	8,10	1,2,3
Demonstrate a highly organised work pattern	6,7,8	1,2,3
Show openness to critical feedback of reports	6,7,8	1,2,3
Appreciate the importance of keeping up to date with clinical developments and with relevant safety issues	6,7,8	1,2,3
Be available and able to discuss cases with clinical colleagues	8	1,2,3,4

Level 2 Vascular Training

To acquire detailed clinical, pathological and radiological understanding of vascular disease with reference to uncommon presentations and diagnoses (Table VD Level 2) to a level where a definitive report can be produced for the great majority of clinical presentations

Knowledge	Assessment Methods	GMP
Detailed understanding of clinical presentations and diagnoses	6,10	1
Detailed knowledge of normal and variant vascular anatomy relevant to above	6,10	1
Detailed knowledge of chemotherapeutic/radioembolisation agents and their side effect profiles, relevant to above	6,10	1
Recognition of uncommon conditions	6,10	1
Understands and is able to advise on risk factor modification including diabetes	6,10	1
Skills		
Become competent in the clinical examination of the vascular patient	6,7	1
Provide expert advice on vascular foot care including the diabetic foot	6,7	1
Interpret laboratory data and non-invasive investigations eg APBI and exercise testing	6,7	1
Appropriately prioritise all presentations	6,7	1
Provide expert opinion on appropriate patient imaging	6,7	1
Provide expert image interpretation	6,7	1
Perform acute interventions in the emergency or on call setting	7	1,2,3
Organise and undertake appropriate imaging pathways in investigating vascular conditions	6,7	1,2,3
Independently run one stop clinics	7,8	1,2,3
Perform all complex angioplasty and stenting eg renal, carotid, visceral and below knee	7	1,2,3
Perform surgical exposure of arteries and veins	7	1,2,3
Perform super-selective embolisation and chemo-embolisation for all indications	7	1,2,3
Perform complex procedures for central vascular access	7	1,2,3
Perform TIPSS	7	1,2,3
Perform endovascular stent grafting e.g. EVAR, tEVAR	7	1,2,3
Perform venous ablation and sclerotherapy	7	1,2,3
Recognise and manage unusual complications of vascular interventions	6,7	1,2,3
Behaviour		
Automatically prioritises cases according to clinical need	6,7,8	1,2,3
Be able to discuss complex cases with referring clinicians and colleagues	6,7,8	1,2,3
Be able to relate clinical and imaging findings succinctly	6,7,8,11	1,2,3
Undertake an active role in service delivery	6,7,8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3
Offer timely specialist opinion	8	1,2,3
Discuss with specialist centre appropriately	6,7,8	1,2,3
Enter performance data into local and national registries	9	1,2,3,4

Table VD – Vascular Radiology Diagnoses (Level 1)

Diagnoses – Common

Arterial Disease

- Peripheral arterial disease upper and lower limbs.
- Thoracic aorta and upper extremity arterial disease.
- Aneurysm: thoracic and abdominal.
- Supra-aortic pathology, including carotid and vertebral.
- Arteriovenous malformation imaging
- Vascular trauma
- Visceral arterial pathology: gastrointestinal bleeding, visceral aneurysm and ischaemia, renal, tumours.
- Arterial problems in obstetrics and gynaecology: fibroid embolisation, post partum haemorrhage.
- Arterial pathology in cancer (optional).
- Management of hepatic malignancy (vascular) (optional)
- Syndromes with a major vascular component

Venous Disease

- Venous diagnosis and intervention.
- Peripheral venous disease inc. peripheral deep venous thrombosis
- Pulmonary thromboembolic disease
- Superior and inferior vena cava Disease
- Hepatic venous disease imaging
- Portal venous disease including portal hypertension imaging
- Varicocoele
- Gynaecological venous intervention (optional)
- Haemodialysis access
- Central Venous Access

Table VD – Vascular Radiology Diagnoses (Level 2)

Diagnoses – Uncommon

Arterial Disease

- Complex peripheral arterial disease upper and lower limbs.
- Complex thoracic aorta and upper extremity arterial disease.
- Aneurysm: thoracic and abdominal. Advanced surgical and endovascular management
- Supra-aortic pathology, including carotid and vertebral.
- Arteriovenous malformations.
- Vascular trauma
- Visceral arterial pathology: gastrointestinal bleeding, visceral aneurysm and ischaemia, renal, tumours, bronchial.
- Arterial problems in obstetrics and gynaecology: adenomyosis, complex fibroid embolisation, post-partum haemorrhage.
- Arterial pathology in cancer.
- Management of hepatic malignancy: vascular, biliary
- Syndromes with a major vascular component

Venous Disease

- Venous diagnosis and intervention.
- Peripheral venous disease incl. peripheral deep venous thrombosis
- Pulmonary thrombo-embolic disease
- Superior and inferior vena cava Disease
- Intervention for hepatic venous disease
- Intervention for portal venous disease including portal hypertension
- Gynaecological venous intervention
- Complex haemodialysis access
- Complex Central Venous Access

Interventional Neuroradiology

Level 1 Diagnostic Neuroradiology Training

To acquire detailed clinical, pathological and radiological understanding of diseases of the brain and spine with reference to presentations (Table NPD) and common diagnoses (Table ND) to a level where a definitive report can be produced for common clinical presentations		
Knowledge	Assessment Methods	GMP
Detailed applied anatomy relevant to cranial and spinal imaging examinations	6,10	1
Know a wide range of intracranial pathologies, their imaging and clinical management	6,10	1
Know a wide range of spinal pathologies, their imaging and clinical management	6,10	1
Skills		
Interpret MRI examination	6	1
Recognise/seek clinical and radiological information which advances diagnosis	6,7	1
Recognise clinical priority of certain presentations	6,7	1
Recognise how diagnosis affects management pathway	6,7	1
Provide a definitive report on neuroaxis CT and MRI	6	1
Supervise more complex examinations (e.g. CTA)	6	1,2
Perform biopsy of straightforward spinal lesions	7	1,2,3
Formulate a Management Plan	6	1,2
Behaviour		
Seek additional clinical information relevant to case	6,7,8	1,2,3
Initiate additional examination/investigation as appropriate	6,7,8	1,2,3
Participate in MDTs	6,7,8,11	1,2,3
Perform reflective learning from clinical practice, audit and where relevant, registry data	6,7,8,9	1,2,3
Take part in teaching and training	8,10	1,2,3
Demonstrate a highly organised work pattern	6,7,8	1,2,3
Show openness to critical feedback of reports	6,7,8	1,2,3
Appreciate the importance of keeping up to date with clinical developments and with relevant safety issues	6,7,8	1,2,3
Be available and able to discuss cases with clinical colleagues	8	1,2,3,4

Level 2 Diagnostic Neuroradiology Training

To acquire detailed clinical, pathological and radiological understanding of diseases of the brain and spine with reference to presentations (Table NPD) and uncommon diagnoses (Table ND) to a level where a definitive report can be produced for the great majority of clinical presentations

Knowledge	Assessment Methods	GMP
Identify the full range of intracranial and spinal pathologies	6,10	1
Outline the full clinical management of neurological and neurosurgical cranial and spinal conditions.	6,10	1
Knowledge of range of imaging studies relevant to neuroradiology and their role e.g. radionuclide studies, PET – CT, perfusion imaging, MR spectroscopy, myelography, cerebral and spinal angiography	6,10	1
Skills		
Provide expert opinion on appropriate patient imaging	6	1
Report and undertake more complex examinations	6	1
Provide expert opinion on appropriate patient imaging	6,7	1
Provide expert image interpretation	6	1
Take part in teaching and training of junior trainees and associated specialities	10	1,3
Behaviour		
Automatically prioritises cases according to clinical need	6,7,8	1,2,3
Be able to discuss complex cases with referring clinicians and colleagues	6,7,8	1,2,3
Be able to relate clinical and imaging findings succinctly	6,7,8,11	1,2,3
Undertake an active role in service delivery	6,7,8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3
Offer timely specialist opinion	8	1,2,3
Discuss with specialist centre appropriately	6,7,8	1,2,3

Table ND – Neuroradiology Diagnoses

Diagnoses – Common/Uncommon (Level1/2)

Brain

Acute:

- Subarachnoid haemorrhage
- Intracranial aneurysm
- Venous sinus thrombosis
- Intracranial infection and complications (abscess, subdural empyema, herpes encephalitis, HIV)
- Carotid and vertebral artery dissection
- Cerebral infarction
- Intracranial haemorrhage
- Hydrocephalus

Non-acute:

- Common primary brain tumours
- Metastatic disease
- Pituitary tumours
- Craniopharyngioma and suprasellar masses
- Intracranial cysts
- Vestibular schwannoma
- Vascular malformations
- Demyelination and its differential diagnosis
- Common congenital disorders
- Cerebrovascular disease
- Neurodegenerative conditions

Spinal

- Tumours and metastasis
- Infection, including TB, discitis, osteomyelitis, epidural abscess
- Spinal haematoma
- Spinal fractures and dislocations
- Degenerative disc disease
- Spinal dysraphism
- Syringomyelia

Basic Clinical and Interventional Skills relevant to Interventional Neuroradiology

To acquire basic clinical, pathological and radiological understanding of neurological disease with reference to common presentations (Table NPD)		
Knowledge	Assessment Methods	GMP
Understand clinical significance of pathology associated with presentation and link with likely diagnoses	6,10	1
Identify the role of interventional neuroradiology in specific clinical settings	6,10	1
Recall basic anatomy in clinical practice relevant to imaging examinations of the brain and spine.	6,10	1
Recall the basic vascular anatomy in clinical practice relevant to imaging examinations of the head & spine.	6,10	1
Local/regional guidelines in relation to neuroradiological presentations	6,10	1,2
Skills		
Report radiographs relevant to neurological disease showing awareness of limitations	6	1,2
Determine optimal imaging examination	6	1,2
Undertake basic assessment of the urgency of clinical situation	6	1,2,3
Construct imaging pathway in relation to management options for neurological pathologies	6	1,2,3
Performance/protocol of basic non invasive imaging; US, CT, MRI	6,7	1
Recognise/seek clinical and radiological information which advances diagnosis	6,7	1
Recognise clinical priority of certain presentations	6,7,8	1
Recognise how diagnosis affects management pathway	6,7	1
Obtain patient consent and adhere to relevant guidelines	7,8	1,2,3
Develop skills preparing for and assisting with INR procedures	7	1
Perform diagnostic catheter angiography and vascular / non vascular interventional procedures	7	1
Recognise complications of interventional procedures	6,7,8	1,2
Behaviour		
Apply/adhere to local/regional/national guidelines	6,7	1
Observe and reflect on MDT working	6,7,8,11	1,3
Communicate sensitively and appropriately with patients	6,7,8	1,2,3
Involve seniors appropriately	6,7,8	1,3
Tailor examination to clinical indication	6,7	1,2
Communicate results rapidly	5,6,7	1,3
Obtain informed consent where appropriate	6,7	1,2,3
Prioritise workload to respond to the most urgent cases first	5,6,7,8	1,2,3
Recognise the need for timely specialist opinion from other clinicians/radiologists	4,5,6	1,2,3

Table NPD – Neurological Presentations and Diagnoses

Common Presentations
Haemorrhage <ul style="list-style-type: none">• SAH• Parenchymal haemorrhage• Intraventricular haemorrhage and hydrocephalus• Spinal
Acute Ischaemia <ul style="list-style-type: none">• TIA and stroke
Tumour
Venous Occlusion
Vascular anomalies <ul style="list-style-type: none">• Aneurysm• AVM

Level 1 Interventional Neuroradiology Training

To acquire detailed clinical, pathological and radiological understanding of neurological disease with reference to presentations and common diagnoses (Table NVD) to a level where a definitive report can be produced for common clinical presentations

Knowledge	Assessment Methods	GMP
Recall the anatomy of the CNS & related vasculature including anatomical variants	6, 10	1
Recognise typical and variant presentations of common conditions	6,10	1
Familiarity with common acute and elective presentation of neurological pathologies amenable to intervention in clinical scenarios	6,10	1
Recognise the clinical sequelae of the diagnoses of neurological conditions	6,10	1
Recognise the medical, interventional and surgical management options for neurological conditions	6,10	1
Skills		
Be able accurately to report most cases and emphasise the key findings and diagnoses	6,7	1
Participate in diagnostic and interventional neuroradiology rota (where appropriate)	8	1,2,3
Organise and undertake appropriate imaging pathways in investigating neurological conditions	6,7	1,3
Perform clinical assessment of patients with neurological conditions in ward and outpatient settings	6,7	1,3
Take part in outpatient clinics	7,8	1,2,3
Increase procedural skills in elective and acute cases		
Increase skills in Vascular Ultrasound examination in Carotid arteries and vertebral (optional)	7	1,2,3
Perform complex cerebral angiography	7	1,2,3
Perform balloon test occlusion	7	1,2,3
Coil a cerebral aneurysm (non-complex)	7	1,2,3
Perform appropriate embolisation techniques	7	1,2,3
Appropriate management of cerebral venous thrombosis	7	1,2,3
Recognise complications of vascular interventions	6,7,8	1,2,3
Behaviour		
Seek additional clinical information relevant to case	6,7,8	1,2,3
Initiate additional examination/investigation as appropriate	6,7,8	1,2,3
Participate in MDTs	6,7,8,11	1,2,3
Perform reflective learning from clinical practice, audit and where relevant, registry data	6,7,8,9	1,2,3
Take part in teaching and training	8,10	1,2,3
Demonstrate a highly organised work pattern	6,7,8	1,2,3
Show openness to critical feedback of reports	6,7,8	1,2,3
Appreciate the importance of keeping up to date with clinical developments and with relevant safety issues	6,7,8	1,2,3
Be available and able to discuss cases with clinical colleagues	8	1,2,3,4
Enter performance data into local and national registries	9	1,2,3

Level 2 Interventional Neuroradiology Training

To acquire detailed clinical, pathological and radiological understanding of neurovascular disease with reference to uncommon presentations and diagnoses (Table NVD) to a level where a definitive report can be produced for the great majority of clinical presentations

Knowledge	Assessment Methods	GMP
Detailed understanding of clinical presentations and diagnoses	6,10	1
Knowledge of clinical neuroscience topics relevant to the care of patients with neurovascular diseases	6	1
Detailed knowledge of the anatomy of the central nervous system and related vasculature, including anatomical variations	6,10	1
Detailed understanding of diagnostic and interventional imaging equipment and techniques	6,10	1
Recognition of uncommon conditions	6,10	1
Skills		
Provide expert opinion on appropriate patient imaging	6,7	1
Provide expert image interpretation	6,7	1
Perform acute neuroradiology interventions in the emergency or on call setting	7	1,2,3
Organise and undertake appropriate imaging pathways in investigating neurovascular conditions	6,7	1,3
Independently runs outpatient clinics	7,8	1,2,3
Increase procedural skills in elective and acute cases		
Perform complex angioplasty and stenting	7	1,2,3
Perform appropriate embolisation of cerebral AVMs, dural AV fistula and craniofacial & spinal tumours	7	1,2,3
Coil cerebral aneurysms	7	1,2,3
Use of rescue procedures, thrombolytics, antiplatelet agents, balloon, stent, snare or other retrieval devices	7	1,2,3
Use of complex assist techniques, balloon, stent or multiple catheters	7	1,2,3
Perform mechanical thrombectomy for hyperacute ischaemic stroke	7	1,2,3
Appropriate management of cerebral venous thrombosis	7	1,2,3
Recognise and manage complications of neurovascular interventions	6,7,8	1,2,3
Perform spinal interventional procedures for biopsy, pain control or spinal stabilisation	7	1,2,3

Behaviour	Assessment Methods	GMP
Automatically prioritises cases according to clinical need	6,7,8	1,2,3
Be able to discuss complex cases with referring clinicians and colleagues	6,7,8	1,2,3
Be able to relate clinical and imaging findings succinctly	6,7,8,11	1,2,3
Undertake an active role in service delivery	6,7,8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3
Offer timely specialist opinion	8	1,2,3
Discuss with specialist centre appropriately	6,7,8	1,2,3
Aware of requirement to register new interventional procedures and of processes to introduce new equipment	6,9	1,2,3,4

Table NVD - Neurovascular Radiology Diagnoses

Diagnoses – Common/Uncommon (Level1/2)
<ul style="list-style-type: none"> • Intracranial aneurysms • Cerebral vasospasm • Cerebral vasculopathies • Craniofacial and spinal AVM and AVF • Craniofacial and spinal DAVF • Craniofacial and spinal tumours • Craniofacial low-flow vascular malformations • Diseases involving the cervical and arch vessels • Reversible ischaemic events and ischaemic stroke • Cerebral venous thrombosis

6 ASSESSMENT

The assessment system (including purpose, methodology and tools) is described in the curriculum for clinical radiology and continues to apply for interventional radiology.

The Final FRCR examination is a summative assessment of core radiology knowledge and skills and should be completed by the end of ST4.

Logbooks should be used for documenting the skills and experience attained and to facilitate reflective learning. Logbooks are mandatory for all interventional procedures.

Workplace-based assessment continues to be the cornerstone of assessment for day-to-day practice and the same methods used in core clinical radiology training should continue to be used. All our workplace-based assessments are formative assessments – assessments for learning – principally intended to support learning by providing feedback to trainees and helping to identify strengths and areas for development. The pattern of evidence from a set of WPBAs will, however, be used as one source of evidence for an ARCP panel to consider when making judgements about a trainee's progression.

7 ANNUAL REVIEW OF COMPETENCY PROGRESSION (ARCP)

Individual progress will continue to be monitored by an annual review (ARCP) up to the end of training. There is no concept of differentiating between the ARCPs for CR and IR, since the curriculum encompasses the higher training requirements leading to both the CCT in CR and the sub-specialty recognition. Once a trainee moves to this IR curriculum we would only expect them to have a single ARCP process to cover CCT and sub-specialty.

ARCP Decision Aid

The following decision aid offers **guidance** on the domains to be reviewed and level of attainments required to inform an ARCP panel.

Indicators for Satisfactory Progression – Interventional radiology subspecialty training

	ST4	ST5	ST6
Curriculum coverage: IR specific components	Develop and achieve level 1 special interest areas and maintain core clinical radiology competence	Progress level 2 special interest area or multiple level 1 interest areas and maintain core clinical radiology competence	Complete level 2 special interest area or multiple level 1 interest areas and maintain core clinical radiology competence
Indicative minimum numbers of Workplace based Assessments expected per year	Six mini-IPX (minimum two per clinical attachment); 12 Rad-DOPS (minimum four per clinical attachment); One MSF; One QIPAT (includes quality improvement or audit project); Two Teaching Observations; Two MDTAs. WpBA should be undertaken in a timely and educationally appropriate manner throughout the training year.		
Examinations	Final FRCR Parts A and B		
Research	One research project undertaken during either core or subspecialty training, evidenced in the ePortfolio (e.g. by a research evaluation form or publication) – see section H3 of the CR curriculum		
Educational Supervisor's Structured Report	All areas of personal and professional development addressed with overall progress at expectation or above.		

The Annual Review of Competence Progression (ARCP) Decision Aid defines a minimum number of workplace-based assessments (WpBAs) required in each year of training. We expect that trainees should have no difficulty completing this number of WpBAs and many trainees will wish to undertake more WpBAs. It is important to remember that the WpBAs set out in the decision aid above are formative assessments which should be viewed as learning opportunities for the trainee. The feedback generated by the trainer from these encounters should aim to facilitate improvements in their performance by identifying strengths and specific areas that require further work.

The syllabus section of the ePortfolio allows trainees to link WpBAs to individual curriculum competences. It is not necessary for the trainee to have a WpBA or other evidence linked to every learning outcome. Providing the trainee demonstrates the relevant competences during a clinical attachment and the clinical supervisor is satisfied that the competences have been achieved, the trainee may successfully progress at ARCP.

Whilst it is primarily the trainee's responsibility to ensure that WpBAs take place throughout training, it is entirely appropriate for a supervisor to suggest or direct a trainee towards areas that need to be assessed during training posts.

The ePortfolio allows supervisors to "sign-off" individual competences in the syllabus. It is, however, not necessary for each competency to be linked to specific piece of evidence to allow it to be signed off. Sign-off of individual competences provides very helpful information for other supervisors, training programme directors and ARCP panels. We recommend that training programmes make the decision regarding the extent of usage required for this feature of the ePortfolio, and communicate this to supervisors and trainees.

The main possible outcomes of the ARCP process are listed below:

- **Progress** into the next year of training. Indicative of satisfactory progression across all domains within the decision aid grid.
- **Unsatisfactory progression** will be informed by some or all of the following (the decision being undertaken by the ARCP panel): lack of curriculum coverage, inadequate or poor outcomes in workplace based assessments and/or examinations and areas of concern within the structures supervisor's report. This will result in one of two outcomes.
 - **Conditional progress** into the next year of training. A specific action plan will be formulated with the trainee to redress deficiencies in performance. Progress will be re-assessed as appropriate within the next year of training.
 - **Directed training without progression.** If the trainee is so far short of the objectives for their year of training such as to prevent them continuing into the next year of training, directed training is recommended to achieve those objectives. The RCR recommends that repetition of the entire year should only be recommended for exceptional reasons.

APPENDICES

APPENDIX A: CURRICULUM DEVELOPMENT AND REVIEW

This curriculum was originally produced by members of the Specialty Training Advisory Committee of the Faculty of Clinical Radiology. The group had a broad UK representation and includes trainees and laypersons, as well as consultants who are actively involved in teaching and training.

The Curriculum Committee undertakes the practical aspects of curriculum review. The committee is a sub-committee of the Specialty Training Board of the Faculty of Clinical Radiology of the Royal College of Radiologists (STB) and reports to it. The Curriculum Committee consults with Special Interest Group Leads, Regional Specialty Advisers and the Specialty Training Board when reviewing the curriculum. Both the STB and the Curriculum Committee have lay and trainee members.

The STB is responsible for review of the curriculum. Interventional Radiology, including Vascular, Non-Vascular and Interventional Neuroradiology, as a technology supported specialty, is a rapidly changing and evolving specialty and as a result the curriculum is kept under constant review. The curriculum needs to be able to respond appropriately to these changes to ensure that training and education reflect modern practice. The regular meetings of Special Interest Groups, the Professional Support and Standards Board, the Specialty Training Board and the Curriculum Committee allow opportunities for the curriculum to be discussed and amendments to be proposed and considered in advance of formal review.

Trainers, tutors, Regional Specialty Advisers and Programme Directors will also continue to be involved in reviews through their membership of relevant working parties and committees.

APPENDIX B: CHANGES SINCE PREVIOUS VERSIONS

Changes between 2015 and 2016

The structure of IR training has not changed. There have been minor revisions to the clinical content of the curriculum to reflect current practice, in particular revisions to the vascular radiology component to differentiate between level 1 and level 2 diagnoses. The QIPAT has replaced the current Audit Assessment (AA) tool to allow both audits and quality improvement projects to be assessed. The ARCP decision aid has been revised to reflect a new format to the Final Part A examination.

Changes between 2014 and 2015

The structure of IR training has not changed. Minor adjustments have been made to the curriculum content.

The minimum number of Rad-DOPS assessments expected per year has increased from six to 12, to better reflect the practical procedural competences required to subspecialise in IR.

Changes between 2013 and 2014

The structure of IR training has not been changed. Minor adjustments have been made to the syllabus content.

Changes between 2012 And 2013

The structure of IR training has not been changed. Minor adjustments have been made to the syllabus content. The presentation of this curriculum document has changed significantly. The previous version contained large amounts of descriptive text which duplicated the parent Clinical Radiology curriculum. This has now largely been removed on the basis that the IR curriculum should be read in conjunction with and as an addition to the parent specialty curriculum. A new WpBA has been introduced, the MDTA.

Changes between 2010 And 2012

Specific references to Interventional Neuroradiology included in Introduction, section 3.2 Training Pathway, section 4 How to Use the Curriculum.

New syllabus section O added to include competences for interventional neuroradiology.

Removed name of ex-Warden at end of introduction

Removed Section 3.2 Development as it duplicated appendix G

Updated Flexible Training guidance based on GMC document from Oct 2011.

Section 7.4 Research and the ARCP Decision Aid includes new requirement for a research project.

Appendix C clarified.

Appendix D – removed as too much detail to be in curriculum and liable to change. Up to date exams information is on RCR website

Appendice F and G (was H) – updated.

Changes In Relation To the Specialty of Clinical Radiology 2010

This new sub-specialty curriculum for Interventional Radiology, including Vascular, Non-Vascular and Interventional Neuroradiology, incorporates and utilises changes instigated through the Clinical Radiology specialty curriculum review as well as the results of wide consultation involving the British Society of Interventional Radiology, the British Society of Neuroradiology, junior and lay representatives.

Structural outline

- the whole curriculum has been designed in educational terms with full integration of generic and radiology content
- the curriculum highlights the fact that knowledge and skills of diagnostic radiology are core to interventional radiology
- both the core clinical and interventional radiology syllabi have been modified to the educational requirements of IR.
- the layout brings the syllabus, competences and accompanying assessment to the forefront. This will facilitate easier navigation for the principal users, i.e. trainees and trainers

Assessment

- workplace based assessment methodology has been developed and radiology specific tools introduced and piloted
- specified assessments have been directly linked to each competence
- an e-Log book has been produced to record competence in procedural skills
- there is clarification of educational and clinical supervisor roles and responsibilities
- in the assessment tools, separate descriptors have been written for all grades ie for core, level 1 and level 2
- generic assessment tools for teaching skills and audit assessment have been included.

Syllabus and competences

- a new generic competences section has been included which underpins all medical practice and brings together attitudes and behaviours desirable in all doctors/radiologists
- The rationale of common presentations/diagnoses has been developed as a way of bringing the curriculum to life
- All assessments (summative and formative) have been comprehensively mapped onto the syllabus contents