

Structured Training in Clinical Radiology

Fourth Edition



Education Board of Faculty of Clinical Radiology
The Royal College of Radiologists

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1 Introduction

- 1.1 The first version of this document (published in December 1995) was produced in response to the need to formalise the curriculum for specialist training in Clinical Radiology, consequent upon the Calman Report.¹ The second and third editions (published in March 1999 and September 2001) expanded this document in a more detailed and structured form. This new edition replaces all former editions.
- 1.2 The purpose of this document is to define the present curriculum for each phase of training. Training is delivered in a modular fashion and training objectives are identified for all the constituent subspecialties of clinical radiology and leads to the award of the Certificate of Completion of Specialist Training (CCST). In time the new Postgraduate Medical Education Training Board may redefine the CCST and institute a Certificate of Completion of Training (CCT).
- 1.3 The training objectives identified in this document are listed on the modular training objectives forms, which are included in the trainee personal portfolio.
- 1.4 These training objectives are used to assist trainee appraisal and assessment during specialist training and when achieved can verify that training has taken place to the required standard for the CCST to be awarded.
- 1.5 Training for the CCST must take place in departments accredited for training by the Royal College of Radiologists (RCR). Training schemes are centred on teaching and specialist hospitals and include rotations to district general hospitals. All training schemes are visited by the RCR for the purpose of accreditation, on a 4-yearly cycle.
- 1.6 **Clinical radiology**
 - 1.6.1 The specialty of clinical radiology involves all aspects of medical imaging that provide information about anatomy, function and disease states, and those aspects of interventional radiology or minimally invasive therapy which fall under the remit of departments of clinical radiology.
 - 1.6.2 A clinical radiologist requires a good clinical background in order to work in close collaboration with colleagues in other medical disciplines, and should be demonstrably conversant with: the basic sciences relevant to diagnostic and functional imaging; the pathological and functional aspects of disease; current clinical practice as related to clinical radiology; the full range of clinical radiology as indicated in this document; the administration, management and medico-legal aspects of radiological practice; and the basic elements of research in clinical radiology.
- 1.7 **Outline of training programmes in clinical radiology**
 - 1.7.1 Each trainee in clinical radiology undertakes a programme of structured training over a minimum period of 5 years (whole-time equivalent) in order to achieve a level of competence in all aspects of clinical radiology that will enable him/her to practise as a specialist.
 - 1.7.2 Basic science and radiation safety relevant to clinical radiology will be taught over a period of about 3 months during the first year. Thereafter, structured training to cover interpretative and procedural skills in all the required subspecialties (see Section 3.2) will be delivered.
 - 1.7.3 A period of about 12 months will be required to allow for:
 - training in one subspecialty for those who wish to declare a special interest or
 - training in a mixture of two or more subspecialties
 - 1.7.4 Subspecialty training will usually be undertaken in the fifth year, but may be scheduled in a modular fashion at other stages of training. Additional experience in subspecialty training may be needed for subspecialists training in a single subspecialty, such as neuroradiology, interventional radiology and radionuclide radiology/nuclear medicine. Curricula for subspecialty training are published separately.

- 1.7.5 The current examination structure is as follows.
- The First FRCR Examination comprises radiation physics and radiation safety
 - The Final FRCR Examination, which is an intermediate examination covering all the subspecialties within clinical radiology, is in two parts: Part A (six modules of multiple choice questions) and Part B (oral examinations and reporting sessions)
 - The regulations and syllabi for these examinations are published separately and are available on the RCR website
- 1.7.6 Trainees entering a radiology training programme are required to have a minimum of 2 years of appropriate clinical experience.
- 1.7.7 A period of research is encouraged. Six months of full-time research in any aspect of diagnostic imaging is allowed as part of the 5 years of specialist training. At the discretion of the Warden, up to 12 months of the 5 years of accredited training may be spent in clinically based research.
- 1.7.8 Trainees who have been admitted to the Fellowship of the Royal College of Radiologists (FRCR) may apply for a CCST no earlier than 3 months before successful completion of 5 years of accredited structured training.
- 1.7.9 Trainers are expected to:
- have substantial expertise in their subspecialty
 - be up-to-date with the requirements of the RCR continuing professional development scheme and be in possession of appropriate supporting certificates
 - have demonstrated an interest in training
 - have appropriate equipment available
 - have a sufficiently large throughput of cases
 - have appropriate teaching resources
- 1.8 This document should be read in conjunction with the published curricula for each of the subspecialties in clinical radiology and the most up-to-date version of the following documents issued by the RCR. The dates of the current versions are provided in the reference list.
- *First Examination for the Fellowship in Clinical Radiology: Examination Syllabus*²
 - *Final Examination for the Fellowship in Clinical Radiology: Examination Syllabus*³
 - *Regulations for Training in Clinical Oncology and Clinical Radiology*⁴
 - *Regulations for the Examinations for the Fellowship of the Royal College of Radiologists in Clinical Radiology*⁵
 - *Training Accreditation in Clinical Radiology: Guidance Notes for Training Schemes*⁶
- 1.9 With the publication of this version of Structured Training in Clinical Radiology, the RCR document below is withdrawn:
- Structured Training in Clinical Radiology, 3rd Edition. London: The Royal College of Radiologists (2001)

2 Basic Principles

- 2.1 The aim of the curriculum is to produce well-trained competent clinical radiologists capable of being appointed as, and to undertake the duties of, a National Health Service (NHS) consultant radiologist to the accepted standard.
- 2.2 This standard has to be achieved before the issue of the CCST in clinical radiology and entry onto the General Medical Council's (GMC) Specialist Register.
- 2.3 A major component of training in clinical radiology is achieved by the apprenticeship system with the trainee undertaking an increasing number of radiological tasks. Each component of the training programme should have a clearly defined structure with supervision of the trainee by senior colleagues (trainers). A named consultant will assume overall responsibility for each subspecialty module of training. Training in more than one subspecialty may take place during a rotational attachment.
- 2.4 Each module of training will define all of the core training objectives. The core training objectives will detail the core knowledge and core skills to be achieved and the core experience to be acquired by the trainee during training.
 - 2.4.1 Core knowledge is the knowledge required by a competent trained radiologist. In this document core knowledge has been defined in terms of clinical systems, incorporating elements of anatomy and radiographic/radiological techniques. Knowledge relating to imaging techniques [computed tomography (CT), ultrasound (US), magnetic resonance imaging (MRI) and radionuclide radiology] are incorporated into the relevant system and no longer defined separately. Core knowledge includes:
 - clinical knowledge, that is medical, surgical and pathological, relating to the specific body system
 - knowledge of current clinical practice
 - knowledge of the indications, contraindications and potential complications of radiological procedures
 - knowledge of the management of procedural complications
 - 2.4.2 Core skills are the practical procedures that are necessary for the trainee to be capable of performing independently but will be supervised during the training period until the necessary level of competence is achieved. Core skills **must** be assessed at a local level.
 - 2.4.3 Core experience is acquired by the trainee during training. The RCR recognises that, within the confines of specialist training, it is not possible for trainees to become competent in all aspects of radiology and, therefore, distinguishes between core skills (which indicates an essential skill) and core experience. Core experience consists of observation, participation, knowledge and understanding of various procedures and investigations, which will not necessarily be performed by every trainee radiologist, but which should be available in most training schemes.
 - 2.4.4 Optional experience refers to investigations, procedures and other aspects of clinical radiology, which may be available in some training schemes. Such experience would be desirable and, if available, would lead to a more rounded training.
 - 2.4.5 The skills that must be acquired and assessed for each module of structured training as well as the core knowledge and core experience appropriate to that module are listed in this document and on the modular training objective forms included in the trainee personal portfolio.
 - 2.4.6 Log books should be used for documenting the skills and experience attained. Log books are mandatory for all interventional procedures irrespective of subspecialty.
 - 2.4.7 The RCR expects that trainee appraisal takes place within each module of training. The purpose of appraisal is to assess the progress of the trainee through each module to anticipate and correct any deficiencies in training at an early stage.
 - 2.4.8 The First FRCR and Final FRCR Part A Examinations currently test knowledge through multiple choice questions. The Final FRCR Part B Examination assesses competence (interpretative, analytical and communication skills).

- 2.5 Training schemes will be expected to offer training in a significant proportion of the optional objectives. It is however recognised that the amount of training in the optional objectives will vary between training centres according to the facilities available. Both core and optional objectives will be reviewed by the RCR from time to time as practice changes and newer techniques are introduced.
- 2.6 Years of training activity are not synonymous with years of achievement.
- 2.7 The trainee will be required to develop those basic skills in research methodology which are necessary to structure and perform research under appropriate guidance. These skills will include the ability to review published articles critically and to perform effective literature searches on a given topic. An appreciation of the effective application of research findings in everyday practice will also be required.
- 2.8 The trainee personal portfolio will be used to document that training is progressing satisfactorily through to the award of the CCST. The portfolio, in addition to the log book, will be reviewed at each annual assessment.
- 2.9 Individual progress will be evaluated by an annual review and recorded on a RITA (Record of In-Training Assessment) Form. The RCR recommends that the regional postgraduate medical dean should collaborate with the head of training and the regional postgraduate education adviser when overseeing these reviews. College tutors should also be involved in the process. The RCR also encourages the inclusion of an external assessor (such as a consultant clinical radiologist from another training scheme) in the annual review of trainees.

3 Core Training

3.1 The first year

For most trainees the first year of training represents their first opportunity to learn and acquire radiology skills.

3.1.1 Overview

At the end of the first year the trainee should:

- feel confident in his/her choice of clinical radiology as a career
- have mastered the basic radiation physics and radiation safety required in clinical radiology to the level of the First FRCR Examination (see Section 3.1.2)
- be familiar with the concepts and terminology of diagnostic and interventional radiology
- understand the role and usefulness of the various diagnostic and interventional techniques in all age groups
- understand the responsibilities of a radiologist to the patient including the legal framework and the necessity for informed consent
- be familiar with the various contrast media, drugs (including intravenous sedation) and monitoring used in day-to-day radiological practice, and be aware of indications, contraindications, doses (adult and paediatric) and the management of reactions and complications
- be competent in cardiopulmonary resuscitation
- understand the principles of radiation protection and be familiar with the legal framework for protection against ionising radiation. The trainee should also demonstrate that he/she is capable of safe radiological practice
- be familiar with safety requirements for radionuclide radiology and imaging with non-ionising radiation (i.e., US and MRI)
- have a sound understanding of core radiological and radiographic procedures (see Section 3.1.3.1)
- have developed, under supervision, some core reporting skills (see Section 3.1.3.2)
- understand and practise clinical audit and risk management

3.1.2 Basic sciences

An introductory course on basic radiation physics and radiation safety relevant to clinical radiology is held during the first 3 months of training. The knowledge required for the First FRCR Examination has been defined by the RCR (*First Examination for the Fellowship in Clinical Radiology: Examination Syllabus*).²

3.1.2.1 Physics

The RCR recommends that approximately 30 hours of formal tuition in basic radiation physics and radiation safety, including the current ionising radiation regulations and statutory obligations related to ionising radiation, are delivered before attempting the First FRCR Examination. This teaching is given primarily by medical physicists supplemented by clinical radiologists. Candidates for the First FRCR Examination will be expected to supplement this tuition by a substantial amount of self-directed learning.

Core knowledge

The syllabus identified for the First FRCR Examination² includes the following:

- the fundamental physics of matter and radiation
- practical radiation protection
- statutory regulations and non-statutory recommendations
- the physics of diagnostic radiology and radionuclide radiology techniques

3.1.3 Clinical skills

3.1.3.1 Radiological and radiographic techniques and procedures

In the first year of training the trainee must be introduced to, obtain a sound understanding of, and begin to acquire some of the practical skills that will eventually be required of a consultant clinical radiologist.

In the case of plain film radiography, trainees should become familiar with the radiographic technique even if they do not take the radiographs personally.

3.1.3.2 Communication, interpretation and report writing

In the first year of training the trainee must begin to acquire some of the interpretation, reporting and communication skills that will eventually be required of a consultant radiologist.

The RCR recommends a minimum requirement of two sessions per week to be devoted to reporting. For the core, the trainee will have interpreted and formally reported the following under the supervision of a recognised trainer.

Core

- All core procedures and techniques performed by the trainee.
- A selection of radiographs taken for trauma.
- A selection of in-patient and out-patient radiographs.

Optional

- Reporting of US, radionuclide, CT and magnetic resonance investigations.
- Reporting of special procedures not performed by the trainee.
- Reporting of paediatric investigations.

3.1.4 Appraisal and assessment

The first year in clinical radiology can be a difficult year of transition for trainees. Heads of training schemes and College tutors are encouraged to offer advice, a mentor system and a counselling service during the year. The following milestones should be acknowledged.

3.1.4.1 The trainee must meet with the College tutor and/or the head of the training scheme at the beginning of and after 3 months in post, to identify any difficulties and suggest solutions.

3.1.4.2 Candidates failing the First FRCR examination should be counselled by the head of the training scheme and/or the College tutor on each occasion.

3.1.4.3 All trainees should be assessed at the end of the first year by the local training scheme before the annual assessment (RITA) process (defined in Section 2.9). The possible outcomes of this assessment process are listed below:

- **Progress** into the second year of training (RITA C form completed)
- **Conditional progress** into the second year of training (RITA D form completed). A specific action plan will be formulated with the trainee to redress deficiencies in performance. Progress will be re-assessed as appropriate within the second year of training.
- **Directed training without progression** (RITA E form completed). If the trainee is so far short of the objectives from their first year of training such as to prevent them continuing into the second year of training, directed training is recommended to achieve those objectives. The RCR recommends that repetition of the entire first year should only be recommended for exceptional reasons.

3.2 The second to fourth years

After the initial 3-month period of training when the First FRCR Examination syllabus is covered, there will be approximately 45 months of core training during which trainees should receive structured training in all the constituent subspecialties of clinical radiology. The fourth and fifth years of training will usually incorporate 12 months devoted training for one or two subspecialties

for those who wish to declare a specific subspecialty interest (or interests). Although this 12-month period will usually be undertaken in the fifth year of training, it can be distributed in a modular fashion throughout training.

By the end of the fourth year a trainee will usually have had the opportunity to pass the Final FRCR Examination before subspecialty training. The core of knowledge required to pass the Final FRCR Examination has been defined by the RCR (*Final Examination for the Fellowship in Clinical Radiology: Examination Syllabus*).³

During the first 3 to 4 years of training, individual trainees will have had the opportunity to assess their aptitude for, and interest in, the various subspecialties, so that they are in a position to decide the most appropriate areas on which to focus their training in the fifth year.

A small number of trainees may be able to demonstrate experience which might allow an even earlier decision about starting subspecialty training (see Focussed Individualised Training in the glossary).

3.2.1 Overview

3.2.1.1 The framework for core training will consist of rotations which should give appropriate experience in the areas identified below.

System-based subspecialties:

- breast imaging
- cardiac imaging
- gastrointestinal (GI) imaging
- head and neck imaging including ear, nose and throat, and dental
- musculoskeletal and trauma imaging
- neuroradiology
- obstetric imaging and gynaecological imaging
- thoracic imaging
- urology
- vascular imaging including intervention

Technique-based subspecialty:

- radionuclide radiology

Disease-based subspecialty:

- oncological imaging

Age-based subspecialty:

- paediatric imaging

3.2.1.2 The core knowledge for each system-based module includes physics, detailed radiological anatomy and techniques. The trainee will also be expected to have knowledge of how multisystem disease manifests itself.

3.2.1.3 Technique-based subspecialties (CT, MRI, US, interventional and radionuclide radiology) are incorporated (for the purposes of defining structured training) within each system-based module and are no longer defined separately in the trainee portfolio, but are defined in this document for reference. Because some training schemes deliver training centred on technique-based rotations, the core competencies necessary to be acquired are listed (3.2.2.17–3.2.2.21). There is no requirement for training schemes to re-organise training to align with system-based modules, provided that core knowledge, skills and experience are acquired during the period of structured training.

3.2.1.4 In many training schemes it will be possible for trainees to receive training in more than one subspecialty at the same time, and there may also be opportunities to link certain subspecialties (e.g., CT and oncological imaging). Due to the complexities of such rotations and the inherent differences between training schemes, the RCR leaves it to individual training schemes to determine the order of rotations and their duration.

- 3.2.1.5 Training schemes must ensure that their trainees are able to achieve all the core training objectives for each subspecialty.
- 3.2.1.6 Each trainee will participate in an appropriate on-call rota, or other scheme of exposure to acute and emergency radiology, in which he/she will be responsible to a named consultant(s). This should commence before the end of the second year of training.

3.2.2 Clinical skills

- 3.2.2.1 The following sections delineate the core training objectives (knowledge, skills and experience) that will be acquired during the second, third and fourth year rotations. Where an optional objective is given, practical experience is not essential but a theoretical knowledge is still required.
- 3.2.2.2 Each component of the training programme will have a clearly defined structure for the supervision of the trainee by senior colleagues (trainers). There will be a named consultant(s) who will assume overall responsibility for the training given during that period, including the techniques performed and reports issued by the trainee.
- 3.2.3.4 The trainer will also be responsible for undertaking appraisal of the trainee at the beginning, during and at end of the rotation and may be involved in the end of rotation assessment.

3.2.2.4 Core competencies

Core knowledge

- secure knowledge of the current legislation regarding radiation protection
- able to offer advice as to the appropriate examination to perform in different clinical situations

Core skills

- participation in reporting plain radiographs which are taken during the general throughput of the normal working day of a department of clinical radiology
- performing any routine radiological procedures that might be booked during a normal working day
- performing and reporting on-call investigations appropriate to the level of training with the appropriate level of supervision
- attendance at and conducting clinico-radiological conferences and multidisciplinary meetings
- competence at reviewing studies on a workstation and familiarity with digital image manipulation and post-processing

3.2.2.5 Breast

Core knowledge

- knowledge of breast pathology and clinical practice relevant to clinical radiology
- understanding of the radiographic techniques employed in diagnostic mammography
- understanding of the principles of current practice in breast imaging and breast cancer screening
- awareness of the proper application of other imaging techniques to this specialty (e.g., US, MRI and radionuclide radiology)

Core skills

- mammographic reporting of common breast disease

Core experience

- participation in mammographic reporting sessions (screening and symptomatic)
- participation in breast assessment clinics
- observation of breast biopsy and localisation

Optional experience

- performing breast biopsy and localisation

3.2.2.6 Cardiac

Core knowledge

- knowledge of cardiac anatomy and clinical practice relevant to clinical radiology
- knowledge of the manifestations of cardiac disease demonstrated by conventional radiography
- familiarity with the application of the following techniques:
 - echocardiography (including transoesophageal)
 - radionuclide investigations
 - CT
 - MRI
 - angiography, including coronary angiography

Core skills

- reporting plain radiographs performed to show cardiac disease and post-operative appearances
- reporting of common and relevant cardiac conditions shown by US, CT and MRI

Optional experience

- observation of relevant angiographic, echocardiographic and radionuclide studies
- supervising and reporting radionuclide investigations, CT and/or MRI performed to show cardiac disease
- experience in echocardiography (including transoesophageal)
- observing /performing coronary angiography and other cardiac angiographic and interventional procedures

3.2.2.7 Gastrointestinal (including liver, pancreas and spleen)

Core knowledge

- knowledge of GI and biliary anatomy and clinical practice relevant to clinical radiology
- knowledge of the radiological manifestations of disease within the abdomen on conventional radiography, contrast studies (including ERCP), US, CT, MRI, radionuclide investigations and angiography
- knowledge of the applications, contraindications and complications of relevant interventional procedures

Core skills

- reporting plain radiographs performed to show GI disease
- performing and reporting the following contrast medium examinations:
 - swallow and meal examinations
 - small bowel studies
 - enema examinations
- performing and reporting transabdominal US of the GI system and abdominal viscera
- supervising and reporting CT of the abdomen
- performing:
 - US-guided biopsy and drainage
 - CT-guided biopsy and drainage

Core experience

- experience of the following contrast medium studies:
 - sinogram
 - stomagram
 - GI video studies

- experience of the manifestations of abdominal disease on MRI
- experience of the current application of radionuclide investigations to the GI tract in the following areas:
 - liver
 - biliary system
 - GI bleeding (including Meckel's diverticulum)
 - abscess localisation
 - assessment of inflammatory bowel disease
- experience of the application of angiography and vascular interventional techniques to this subspecialty
- experience of the relevant application of the following interventional procedures:
 - percutaneous biliary stenting

Optional experience

- observation of ERCP and other diagnostic and therapeutic endoscopic techniques
- endoluminal US
- performing T-tube cholangiography
- performing percutaneous cholangiography
- observation of percutaneous gastrostomy
- familiarity with performance and interpretation of the following contrast studies:
 - proctogram
 - pouchogram
 - herniogram
- experience of the relevant application of the following interventional procedures:
 - balloon dilatation of the oesophagus/stent insertion
 - porto-systemic decompression procedures

3.2.2.8 Head and neck imaging including ENT/dental

Core knowledge

- knowledge of head and neck anatomy and clinical practice relevant to clinical radiology
- knowledge of the manifestations of ENT/dental disease as demonstrated by conventional radiography, relevant contrast examinations, US, CT and MRI
- awareness of the application of US with particular reference to the thyroid and salivary glands and other neck structures
- awareness of the application of radionuclide investigations with particular reference to the thyroid and parathyroid glands

Core skills

- reporting plain radiographs performed to show ENT/dental disease
- performing and reporting relevant contrast examinations (e.g., barium studies including video swallows)
- performing and reporting US of the neck (including the thyroid, parathyroid and salivary glands)
- supervising and reporting CT of the head and neck for ENT problems
- supervising and reporting CT for orbital problems
- supervising and reporting MRI of the head and neck for ENT problems
- reporting radionuclide thyroid investigations

Optional experience

- performing biopsies of neck masses (thyroid, lymph nodes etc.)
- observation or experience in performing US of the eye

- supervising and reporting CT and MRI of congenital anomalies of the ear
- reporting radionuclide parathyroid investigations
- performing and reporting of sialography
- performing and reporting of dacrocystography

3.2.2.9 Musculoskeletal including trauma

Core knowledge

- knowledge of musculoskeletal anatomy and clinical practice relevant to clinical radiology
- knowledge of normal variants of normal anatomy, which may mimic trauma
- knowledge of the manifestations of musculoskeletal disease and trauma as demonstrated by conventional radiography, CT, MRI, contrast examinations, radionuclide investigations and US

Core skills

- reporting plain radiographs relevant to the diagnosis of disorders of the musculoskeletal system including trauma
- reporting radionuclide investigations of the musculoskeletal system, particularly skeletal scintigrams
- supervising and reporting CT of the musculoskeletal system
- supervising and reporting MRI of the musculoskeletal system
- performing and reporting US of the musculoskeletal system
- supervising CT and MRI of trauma patients

Core experience

- experience of the relevant contrast examinations (e.g., arthrography)

Optional experience

- familiarity with the application of angiography
- awareness of the role and where practicable, the observation of discography and facet injections
- observation of image-guided bone biopsy

3.2.2.10 Neuroradiology

Core knowledge

- knowledge of neuroanatomy and clinical practice relevant to neuroradiology
- knowledge of the manifestations of central nervous system disease as demonstrated on conventional radiography, CT, MRI and angiography
- awareness of the applications, contraindications and complications of invasive neuroradiological procedures
- familiarity with the application of radionuclide investigations in neuroradiology
- familiarity with the application of CT and magnetic resonance angiography in neuroradiology

Core skills

- reporting plain radiographs in the investigation of neurological disorders
- supervising and reporting cranial and spinal CT
- supervising and reporting cranial and spinal MRI

Core experience

- observation of cerebral angiograms and their reporting
- observation of carotid US including Doppler
- experience in MR and CT angiography and venography to image the cerebral vascular system

Optional experience

- performing and reporting cerebral angiograms
- performing and reporting myelograms
- performing and reporting carotid US including Doppler
- performing and reporting transcranial US
- observation of interventional neuroradiological procedures
- observation of magnetic resonance spectroscopy
- experience of functional brain imaging techniques (radionuclide and MRI)

3.2.2.11 Obstetrics and gynaecology

Core knowledge

- knowledge of obstetric and gynaecological anatomy and clinical practice relevant to clinical radiology
- knowledge of the physiological changes affecting imaging of the female reproductive organs
- knowledge of the changes in maternal and foetal anatomy during gestation
- awareness of the applications of angiography and vascular interventional techniques
- awareness of the applications of MRI in gynaecological disorders and obstetrics

Core skills

- reporting plain radiographs performed to show gynaecological disorders
- performing and reporting transabdominal and endovaginal US in gynaecological disorders, including possible complications of early pregnancy (e.g., ectopic)
- supervising and reporting CT in gynaecological disorders
- supervising and reporting MRI in gynaecological disorders

Core experience

- performing and reporting hysterosalpingography

Optional experience

- supervising and reporting MRI in obstetric applications (e.g., assessing pelvic dimensions)
- observation of foetal MRI
- observation of angiography and vascular interventional techniques in gynaecological disease
- performing and reporting transabdominal and endovaginal US in obstetrics

3.2.2.12 Oncology

Core knowledge

- knowledge of oncological pathology and clinical practice relevant to clinical radiology
- familiarity with tumour staging nomenclature
- familiarity with the application of US, radionuclide investigations, CT and MRI, angiography and interventional techniques in oncological staging, and monitoring the response of tumours to therapy
- familiarity with the radiological manifestations of complications which may occur in tumour management

Core skills

- reporting plain radiographs performed to assess tumours
- performing and reporting US, CT, MRI and radionuclide investigations in oncological staging and monitoring the response of tumours to therapy
- performing image-guided biopsy of masses under US and CT guidance

3.2.2.13 Paediatric

Core knowledge

- knowledge of paediatric anatomy and clinical practice relevant to clinical radiology
- knowledge of disease entities specific to the paediatric age group and their clinical manifestations relevant to clinical radiology
- knowledge of disease entities specific to the paediatric age group and their manifestations as demonstrated on conventional radiography, US, contrast studies, CT, MRI and radionuclide investigations
- the management of suspected non-accidental injury

Core skills

- reporting plain radiographs performed in the investigation of paediatric disorders including trauma
- performing and reporting US in the paediatric age group
- performing and reporting routine fluoroscopic procedures in the paediatric age group, particularly:
 - contrast studies of the urinary tract
 - contrast studies of the GI system

Core experience

- experience of supervising and reporting CT, MRI and radionuclide investigations in the paediatric age group

Optional experience

- the practical management of the following paediatric emergencies:
 - neonatal GI obstruction
 - intussusception

3.2.2.14 Thoracic

Core knowledge

- knowledge of thoracic anatomy and clinical practice relevant to clinical radiology
- knowledge of the manifestations of thoracic disease as demonstrated by conventional radiography and CT
- knowledge of the application of radionuclide investigations to thoracic pathology with particular reference to radionuclide lung scintigrams
- knowledge of the application, risks and contraindications of the technique of image-guided biopsy of thoracic lesions

Core skills

- reporting of plain radiographs performed to show thoracic disease
- supervising and reporting radionuclide lung scintigrams
- supervising and reporting CT of the thorax, including high-resolution examinations and CT pulmonary angiography
- drainage of pleural space collections under image guidance

Core experience

- observation of image-guided biopsies of lesions within the thorax
- familiarity with the applications of the following techniques:
 - MRI
 - angiography

Optional experience

- supervising and reporting MRI
- angiography
- bronchial stenting

3.2.2.15 Uroradiology

Core knowledge

- knowledge of urinary tract anatomy and clinical practice relevant to clinical radiology
- knowledge of the manifestations of urological disease as demonstrated on conventional radiography, US, CT and MRI
- familiarity with the current application of radionuclide investigations for imaging the following:
 - renal structure
 - renal function
 - vesico-ureteric reflux
- awareness of the application of angiography and vascular interventional techniques

Core skills

- reporting plain radiographs performed to show urinary tract disease
- performing and reporting the following contrast studies:
 - intravenous urogram
 - retrograde pyelo-ureterography
 - loopogram
 - nephrostogram
 - ascending urethrogram
 - micturating cysto-urethrogram
- performing and reporting transabdominal US to image the urinary tract
- supervising and reporting CT of the urinary tract
- reporting radionuclide investigations of the urinary tract in the following areas:
 - kidney
 - renal function
 - vesico-ureteric reflux
- performing nephrostomies

Core experience

- observation of percutaneous ureteric stent placement
- observation of endorectal US
- performing image-guided renal biopsy under US and CT guidance
- MRI applied to the urinary tract
- experience of angiography and vascular interventional techniques
- experience of antegrade pyelo-ureterography

Optional experience

- urodynamics
- percutaneous nephrolithotomy
- lithotripsy

3.2.2.16 Vascular and vascular intervention

Core knowledge

- knowledge of vascular anatomy and clinical practice relevant to clinical radiology
- familiarity with the indications, contraindications, pre-procedure preparation (including informed consent), sedation and anaesthetic regimens, patient monitoring during procedures, procedural techniques and post-procedure patient care

- familiarity with procedure and post-procedure complications and their management
- familiarity with the appropriate applications of the following techniques:
 - US (including Doppler)
 - digital subtraction techniques
 - intra-arterial angiography
 - CT and CT angiography
 - MRI and MR angiography

Core skills – imaging

- reporting plain radiographs relevant to cardiovascular disease
- femoral artery puncture techniques and the introduction of guide wires and catheters into the arterial system
- venous puncture techniques both central and peripheral and the introduction of guide wires and catheters into the venous system
- performing and reporting the following procedures:
 - lower limb angiography
 - arch aortography
 - abdominal aortography
 - lower limb venography (contrast or US)
- performing the following techniques:
 - US (including Doppler), venous and arterial
 - digital subtraction angiography
- supervising and reporting CT examinations of the vascular system including image manipulation
- supervising and reporting MRI examinations of the vascular system including image manipulation

Optional experience – imaging

- selective angiography (e.g., hepatic, renal, visceral)
- pulmonary angiography
- alternative arterial access (e.g., brachial, axillary puncture)
- upper limb venography
- portal venography
- pelvic venography via femoral approach
- superior vena cavography
- inferior vena cavography

Optional experience – interventional

- angioplasty and stenting techniques
- embolisation
- thrombolysis
- caval filter insertion
- central venous access

The core training objectives for the technique-based subspecialties CT (3.2.2.17), MRI (3.2.2.18), radionuclide radiology (3.2.2.19) and US (3.2.2.20) are listed below for reference, although they have been incorporated into the system-based modules for the purpose of this document and the trainee portfolio. Core training objectives for interventional radiology (3.2.2.21) are listed below but are also incorporated into the system-based modules.

3.2.2.17 Computed tomography

Core

- knowledge of the technical aspects of performing CT, including the use of contrast media
- knowledge of cross-sectional anatomy as demonstrated by CT
- practical experience in supervision including vetting requests, determining protocols, the examination, and post-processing and reporting of the examination in the following anatomical sites:
 - brain
 - head and neck
 - chest
 - abdomen and pelvis
 - musculoskeletal
 - vascular
- experience in performing CT-guided procedures, e.g., biopsy and drainage
- familiarity with the application of CT venography and angiography
- familiarity with post-image acquisition processing

n.b.: these examinations may be performed during a system-based attachment (e.g., neuroradiology) or during a CT attachment.

3.2.2.18 Magnetic resonance imaging

Core

- understanding of current advice regarding the safety aspects of MRI
- knowledge of the basic physical principles of MRI, including the use of contrast media
- knowledge of the cross-sectional anatomy in orthogonal planes, and the appearance of normal structures on different pulse sequences
- experience in supervision including vetting requests, determining protocols, the examination, and post-processing and reporting of the examination in the following anatomical sites:
 - brain
 - head and neck
 - chest
 - abdomen and pelvis
 - musculoskeletal (e.g., hips, knees, shoulders, and extremities)
- experience of the application of magnetic resonance angiography and venography
- familiarity with post-image acquisition processing

n.b.: this experience may have been gained during a system-based attachment (e.g., musculoskeletal) or during a MRI attachment.

3.2.2.19 Radionuclide radiology

Core

- secure knowledge of the relevant aspects of current legislation regarding the administration of radiopharmaceuticals
- knowledge of the technical aspects of radionuclide radiology relevant to optimising image quality
- knowledge of the radiopharmaceuticals currently available for the purposes of imaging organs and locating inflammatory collections, tumours and sites of haemorrhage
- knowledge of the relevant patient preparation, precautions (including drug effects), and complications of the more commonly performed radionuclide investigations

- knowledge and understanding of the principles and indications of the more commonly performed radionuclide investigations and how these relate to other imaging techniques, in particular knowledge of the radionuclide investigations in the following topic areas:
 - cardiology
 - endocrinology
 - gastroenterology and hepato-biliary disease
 - haematology
 - infection
 - lung disease
 - nephro-urology
 - nervous system
 - oncology
 - paediatrics
 - skeletal disorders
- understanding the significance of normal and abnormal results
- knowledge of the strengths and weaknesses of radionuclide investigations compared to other imaging modalities
- experience in supervision and reporting of radionuclide investigations

Optional

- familiarity with the practical application of positron emission tomography
- n.b.: ideally the training in radionuclide radiology should take place during a radionuclide imaging attachment, but it may occur in part or wholly during one or more system-based attachments.

3.2.2.20 Ultrasound

Core

- knowledge of the technical aspects of US relevant to optimising image quality
- knowledge of the cross-sectional anatomy as visualised on US
- experience in performing and reporting transabdominal US examination of structures in the following anatomical areas:
 - general abdomen (including vessels)
 - pelvis (non-obstetric)
 - small parts (scrotum, thyroid, neck structures)
 - upper abdomen (including lower chest)
- experience of performing Doppler US imaging (e.g., leg veins, portal vein, carotid artery)
- performing US of the breast
- experience in US of the musculoskeletal system
- performing US-guided interventional procedures (e.g., biopsy and drainage)

Optional

- obstetric US
- performing transcranial paediatric US

3.2.2.21 Interventional radiology

Core

- familiarity with the equipment and techniques used in vascular, biliary, and renal interventional techniques
- familiarity with the indications, contraindications, pre-procedure preparation including informed consent, patient monitoring during the procedure and post-procedure patient care

- familiarity with procedure and post-procedure complications and their management
- performing nephrostomies
- US-guided interventional procedures (e.g., biopsy and drainage)
- CT-guided interventional procedures (e.g., biopsy and drainage)

Optional

- angioplasty and stenting techniques
- observation of the spectrum of interventional procedures currently performed in the following systems:
 - vascular system (including neurovascular)
 - urinary system
 - biliary system
 - GI system
 - musculoskeletal system
- experience of MRI-guided interventional procedures

3.2.3 The trainee will also attain an appropriate level of knowledge in:

- clinical conditions in which radiology has a role in diagnosis and/or treatment
- applied pathology and physiology where it contributes to a better understanding of radiological signs and methods of investigation
- those aspects of clinical medicine and pathology which are essential to the safe and effective conduct of interventional procedures
- current trends and recent advances in clinical radiology
- medical ethics
- statistics and research methods
- communication (breaking bad news, consent, communication with colleagues, etc.)
- the legal and ethical framework within which radiology and general healthcare provision operates

3.2.4 The trainee will develop skills, as part of his/her general professional development, in:

- teaching
- clinical audit
 - clinical effectiveness
 - clinical risk management including discrepancy review
 - quality standards
- research
- management (see Section 3.2.4.1)
- health informatics (See Section 3.2.4.2)

Some of these aspects of training will require attendance at in-house and/or external meetings and courses at appropriate periods during training.

3.2.4.1 The following management skills should be acquired:

- contextual awareness, understanding the bigger picture and developing an ability to operate effectively at all appropriate levels in the NHS
- strategic thinking
- functional and operational skills, and knowledge of the day-to-day operation of radiology departments and other health care units
- clinical governance including clinical effectiveness, quality assurance and clinical risk management
- human resources/people management, team building, complaints procedures, professional development

3.2.4.2 Health informatics

The trainee should:

- develop core skills in information technology, especially the ability to perform basic word-processing, and to access computerised medical databases, electronic mail systems and the internet
- keep abreast of developments in information management relevant to radiology departments
- strive for best practice in patient record keeping and the transfer of clinical data and images
- comply with the Acts and Directives concerning data protection in clinical practice, and when using patient data for research, audit or teaching
- understand the principles and practice of evidence-based medicine
- understand how clinical information is used in clinical governance

3.2.5 The trainee should develop the following personal attributes as part of his/her general professional development:

- self-awareness
- time management
- teamwork
- handling uncertainty
- skill in communicating with patients
- skill in communicating with colleagues

3.2.6 At the end of the fourth year the trainee should:

- have substantial experience of interpreting and reporting plain radiographs in all subspecialties
- have acquired experience of performing and reporting all core procedures as defined in Sections 3.2.2.5–3.2.2.21
- be able to advise clinicians on appropriate imaging strategies for the investigation of routinely encountered clinical situations (e.g., jaundice)
- be able to perform and give a provisional interpretation of standard emergency imaging procedures
- have attempted the Final FRCR Examination
- have formulated a preference for their subspecialty training in the fifth year (see Section 4.1)

3.2.7 There will be annual reviews of all trainees as outlined in Section 2.9. These will aim to:

- verify experience and competence gained during the preceding year by reviewing the in-training assessments
- ensure that set targets have been met
- review clinical, technical and general professional development (listed in Sections 3.2.2–3.2.5)

The use of the trainee portfolio (Section 2.8) and standardised log books (Section 2.4.5) will facilitate this review and help the review panel to:

- identify any deficiencies in expected knowledge, practical skills or experience so that these may be remedied in the ensuing year
- set targets for the forthcoming year
- offer career guidance and counselling as appropriate.

The review of in-training assessments should be formalised and completed jointly by the trainee and reviewers with a copy of the review result being sent to the regional postgraduate medical dean and the regional postgraduate education adviser.

3.2.8 The possible outcome of the annual (RITA) review process will be:

- **Progress** into the next year of training (RITA C form completed).
- **Conditional progress** into the next year of training (RITA D form completed). 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** (RITA E form completed). If the trainee is so far short of the objectives of their previous year of training such as to prevent them continuing into the next year of training, directed training is recommended to achieve those objectives. The precise course of action will be formulated by the group undertaking the assessment and will depend on the individual situation, but will range from the trainee having to repeat their training in the areas judged to be severely deficient, to the recommendation that the trainee's contract is not renewed. This will only happen in exceptional circumstances, and only after consultation between the head of training, College tutor, regional postgraduate education adviser and regional postgraduate dean.

4 Subspecialty Training

4.1 Overview

Subspecialty training will normally be undertaken in the fifth year but may be undertaken in a modular fashion during the fourth and fifth years of training. Subspecialty training contains elements of choice to reflect the requirements of the trainee. These include:

- continued training in core competencies to a higher professional level;
- development of one or more subspecialty interests;
- further training in a single subspecialty, which may, with the agreement of both the RCR and the regional postgraduate medical dean, continue into a sixth year of training.

It is envisaged that for subspecialty rotations there will be a minimum commitment of six sessions per week to subspecialty training. It will sometimes be appropriate to link system-based expertise with technique-based expertise. Whether or not it is possible or advisable for this subspecialty training to be undertaken in the base training centre, elsewhere in the UK, or abroad, should be decided on the basis of:

- previous assessment of progress;
- trainee aspirations;
- local availability and suitability of specialist rotations;
- the necessary agreements (see Sections 4.6.1 and 4.6.2).

A few well-qualified trainees may identify their chosen subspecialty at an early stage in their training. In such circumstances, focussed individualised training programmes may be created to allow flexibility in training opportunities while providing the total experience outlined in this document and the relevant subspecialty curriculum (see Glossary).

4.2 The elements of general professional development, as outlined in Sections 3.2.3 – 3.2.5, will also be pursued during subspecialty training to a level sufficient to demonstrate professional competence.

4.3 Annual reviews, as defined in Sections 2.9, 3.2.7 and 3.2.8, will continue during subspecialty training with an emphasis on guidance as to future career choices. Accurate log books will continue to be essential in documenting the progress of the trainee towards the completion of her/his training, and the award of a CCST.

4.4 The curricula for selected subspecialties are provided on the RCR website. In general terms trainees are expected to acquire the elements identified below (see specific subspecialty curricula for more details).

- Detailed knowledge of current theoretical and practical developments in their chosen subspecialty (or subspecialties).
- Development of clinical knowledge relevant to their chosen subspecialty (or subspecialties). This could take the form of attending clinics/ward rounds.
- Extensive directly observed, or unobserved but supervised, practical experience in their chosen subspecialty (or subspecialties).
- Full utilisation of study allowance (currently equivalent to one session per week with a maximum of 30 days in a year) to pursue research projects within their chosen subspecialty (or subspecialties) and to strive to see this work through to publication. Trainees should be assiduous in attending and presenting such work at appropriate meetings.
- Understanding of clinical audit and risk management, and its application to their chosen subspecialty (or subspecialties).
- Documentation of the extent of all relevant training in their portfolio and log book of all relevant experience.

- 4.5 Where the desired subspecialty training cannot be provided on-site, the RCR recommends that training schemes should make every effort to assist the trainee to obtain an attachment or fellowship at another institution if this is appropriate to his/her career needs. It is recognised that this will require consultation and agreement between the head of training, the regional postgraduate education adviser, the regional postgraduate dean, the clinical director of the department to which the trainee is attached and where relevant, the head of the subspecialty training or fellowship. Other forms of attachment, such as a day- or week-release, may provide a suitable alternative for some trainees.
- 4.6 Training centres must identify a named trainer responsible for each subspecialty in which training is offered.
- 4.6.1 Trainers should assess the trainee's aptitude for his/her chosen subspecialty at the earliest opportunity. The trainer, together with the College tutor and head of training should advise those trainees unlikely to succeed within that particular subspecialty as soon as this becomes apparent. Trainees are advised to discuss their chosen subspecialty (or subspecialties) with suitable mentors before embarking on such training.
- 4.6.2 Apart from the annual review (see Sections 2.9, 3.2.7 and 3.2.8), continuing competence assessment of the trainee by the trainer will be required in order to focus the development of radiological skills.

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5 Glossary of Terms

A training programme/training scheme

A training programme/scheme which provides a comprehensive 5-year training programme matching the requirements of the specialist training curriculum. The training programme may be delivered by a single or a number of departments of clinical radiology. Training programmes/schemes are accredited for training on a 4-yearly cycle by the Training Accreditation Committee of the RCR.

A training department

A department of clinical radiology which is part of an accredited training programme/scheme. The training department may contribute to one or more parts of the curriculum.

Certificate of Completion of Specialist Training (CCST)

This certificate is issued by the Specialist Training Authority on the recommendation of the RCR after: (i) satisfactory completion of each of the 5 years of the curriculum within a training scheme(s) accredited by the RCR; and (ii) admission to the Fellowship of the RCR following success in the Final FRCR Examination. In time the new Postgraduate Medical Education and Training Board (PMETB), which will assume the functions of the Specialist Training Authority, will redefine the CCST and institute a Certificate of Completion of Training (CCT).

Record of in-training assessment (RITA) Forms

The RITA form provides a record of the annual review at which specialist registrar's progress through specialist training is evaluated.

Fellowship appointment

An attachment, usually of 6–12 months, spent in a specialist unit, which may be away from the main training centre, designed to provide particular experience in one (or more) radiological subspecialties.

Head of training scheme

In each training scheme there will be one clearly identifiable person who has overall responsibility for the training programme. This should be a separate post from that of clinical director to avoid potential conflict of interest, but may on occasion be the same individual where this arrangement can be shown to be advantageous to the scheme as a whole. In all circumstances the line of accountability must be clearly understood by all.

Regional postgraduate education adviser

This post is jointly appointed and approved by the RCR and the regional postgraduate medical dean. The holder is accountable to the Warden. He/she is primarily responsible for ensuring that the RCR's aims in regard to postgraduate education are adopted throughout the Region. He/she is normally chairman of the regional radiology training committee.

College tutor

This is a locally appointed consultant who is responsible for supervising the needs of individual trainees. There will be at least one College tutor in each training hospital.

Focussed individualised training (FIT)

A small number of trainees may benefit from identifying their individual subspecialty area at an early stage in their training. They have to be able to provide evidence to their local training scheme of their aptitude for their chosen subspecialty (e.g., a paediatrician wishing to become a paediatric radiologist). Training could then be delivered with that aim in mind. The principal difference would be that one rotation through their chosen subspecialty would be covered early on in their training and studied in a part-time fashion for the rest of their first 4 years. They would return to their chosen subspecialty in their fifth year. The same total curriculum as laid out in this document would be covered. The total length of training and the proposed date of their CCST would remain unchanged. Such flexibility is very much in line with the concept of 'Individualised Training Profiles' encouraged by regional postgraduate deans and has now been approved by the Specialist Training Authority.

6 References

- 1 Department of Health (1993) *Hospital Doctors: Training for the Future (The Calman Report)*. Report of the Working Group on Specialist training for Hospital Doctors. London: Health Publications Unit
- 2 The Royal College of Radiologists (2001) *First Examination for the Fellowship in Clinical Radiology: Examination Syllabus*. London: The Royal College of Radiologists
- 3 The Royal College of Radiologists (2004) *Final Examination for the Fellowship in Clinical Radiology: Examination Syllabus*. London: The Royal College of Radiologists
- 4 The Royal College of Radiologists (2001) *Regulations for Training in Clinical Oncology and Clinical Radiology*. London: The Royal College of Radiologists
- 5 The Royal College of Radiologists (2004) *Regulations for the Examinations for the Fellowship of the Royal College of Radiologists in Clinical Radiology*. London: The Royal College of Radiologists
- 6 The Royal College of Radiologists (2003) *Training Accreditation in Clinical Radiology: Guidance Notes for Training Schemes*. London: The Royal College of Radiologists
- 7 The Royal College of Radiologists (2004) *Curricula for Subspecialty Training*

Readers are advised that the latest versions of these RCR documents will become available on the RCR website (www.rcr.ac.uk).

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