

Ministry of Health

Kuwait Institute of Medical Specialization

Curriculum For Clinical Radiology Training Program

2014-2015

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Adapted from the web sites of:

Faculty of Radiology, Royal College of Surgeons in Ireland.

A FORMAL CURRICULUM FOR SPECIALIST TRAINING IN RADIOLOGY

Basic Premise

1.1 Radiology is defined as the specialty encompassing all aspects of medical imaging that yields information regarding anatomical, physiological and pathological status of disease. It includes those interventional techniques necessary for diagnosis, as well as minimally invasive therapy, which fall under the remit of departments of clinical radiology.

1.2 The Faculty of Radiologists of the Royal College of Surgeons in Ireland is the statutory body responsible for training of Radiologists and for certifying their competence for registration and hereby reaffirms that right.

1.3 It is a basic tenet of the training programme that the patient's interest supersedes all other considerations, particularly self-interest, and that at all times the trainee acts with professionalism, integrity and an ethical principle of patient care. Effective communication skills are crucial to this process as well as an ability to act as part of a clinical care team.

1.4 A Radiologist requires a high level of expertise in the following areas:

1.4.1 Basic Sciences:

- The physical basis of image formation, including all those techniques used in radiology departments
- Quality control
- Radiation protection and its current legislation
- Radiation physics
- Radiobiology
- Anatomy, physiology and techniques referring to radiological procedures
- Pharmacology and the administration of contrast media
- Basic computer science, molecular biology and biochemistry

1.4.2 Pathological Sciences

A knowledge of pathology and pathophysiology relating to diagnostic and interventional radiology

1.4.3 Current Clinical Practice

A knowledge of current practice as related to clinical radiology is needed as well as a commitment to continuing medical education (CME). Collaboration with clinical colleagues can be either through formal case conferences or informal discussion

1.4.4 Clinical Radiology

An expert knowledge of current clinical radiology practice is required including:

- Organ or system-based specialties specifically cardiac, chest, dental, otolaryngology, abdominal (gastrointestinal and genitourinary), mammography, musculoskeletal, neurology, obstetric and vascular radiology, encompassing all of the imaging modalities: conventional x-rays, contrast studies, angiography, ultrasound, computed tomography (CT), magnetic resonance imaging (MR), and nuclear medicine including positron emission tomography (PET), where applicable.
- Age based specialties e.g. pediatrics
- Common interventional procedures
- On call in emergency situations

1.4.5 Medicolegal Practice

1.4.6 Research

Comprising a knowledge of scientific method necessary for evaluating research publications and promoting personal research

1.4.7 Clinical Audit

Including a review of uncertainty and error.

1.4.8 Administration and Management:

An understanding of management of a department of radiology involving multiple craft personnel groups as well as expensive equipment, and interaction with professional managerial staff

1.5 All training will take place in departments fully accredited by the Faculty and reviewed in the regular Faculty assessment and visits process

1.6 Trainees entering the specialty will have at least two years of satisfactory clinical experience, in this case normally comprising as a minimum the intern year and one other full year of satisfactory clinical experience.

1.7 The period of training is for four years of certified general professional training, and at least one further year of specialist training, comprising five years in total.

1.8 Trainees will be formally examined as follows:

The Primary examination for the Fellowship of the Faculty of Radiologists is held at the end of the first year. The Final examination for the Fellowship is held after not less than three years of certified training in a radiology post. Specific details regarding the examination entry requirements are available in the document Training Programme in Diagnostic Radiology (September 2002) and its appendix, available from the Faculty, RCSI.

1.9 Trainees will maintain a record of their training in specifically designed logbooks in digital format using a web-based system, as part of an overall training portfolio.

Syllabus for the First Year of Training:

2.1 The first year of training is aimed at preparing the trainee for the Primary Examination, taken in May of the first year.

This comprises an introductory course on basic sciences relevant to clinical radiology including Physics, Radiological Anatomy and Radiological Techniques/Radiography.

In addition the trainee will be introduced to and begin to acquire some of the practical skills central to the practice of clinical radiology.

Lectures are provided by visiting tutors from the faculty, RCSI as per the schedule from August to May.

Ultrasound Practical, IR Skills and Emergency Radiology Courses are also provided.

2.2 At the end of the first year, the trainee will be expected to have mastered the basic sciences as above, be familiar with the concepts of the multiple imaging modalities used for diagnosis and intervention, as well as their role in general patient care, and understand the

responsibility of the radiologist to the patient. The trainee will become competent in the use of contrast agents and drugs, their indications and contraindications, and how to manage adverse reactions. The trainee will be competent in cardiopulmonary resuscitation. The trainee will have attained basic competence in all imaging modalities and techniques and have developed basic reporting skills.

Basic Sciences Course

2.3 Physics

The syllabus includes:

- Physics of radiation
- Image production in basic radiography
- Physics of Contrast agents
- Physics of Fluoroscopy, Ultrasound, CT, MR and Nuclear Medicine
- Radiobiology
- Radiation protection
- Quality Control
- Digital Imaging

2.4 Radiological Anatomy

The syllabus aims towards a high level of expertise in knowledge of regional anatomy relevant to practice for each body system: It is envisaged that trainees will have a firm grasp of normal anatomical variants.

- Thorax, including heart, lungs and chest wall
- Abdomen including the gastrointestinal system, liver, pancreas and biliary tract
- Pelvis including the genitourinary system
- Musculoskeletal system including skeletal development
- Brain
- Head & Neck including skull base, face and teeth
- Vascular including arterial, venous and lymphatic systems
- Breast
- Normal foetal radiology

2.5 Radiological procedures and radiography

The syllabus aims to a high level of knowledge in the key radiological and radiographic techniques relevant to a systems and age based practice.

- Gastrointestinal examinations
- Genitourinary system techniques
- Arthrography
- Arteriography, venography, lymphography
- Basic interventional procedures: biopsy, abscess drainage, nephrostomy, angioplasty
- Catheters, needles, guide wires
- Contrast agents
- Other pharmacological agents e.g. sedatives, muscle relaxants
- Procedures in Paediatric radiology
- Procedures in pregnant patients
- Procedures in critically ill patients
- Procedures in the breast e.g. needle localisation, ductography, biopsy
- General radiography comprising the routine, accessory and supplementary examinations needed to cover the anatomy of the skeleton and contrast examinations. These should include positioning, centering and exposure factors.

Clinical Radiology Activity

2.6 These activities parallel the Basic Science course throughout the first year. Individual departments will differ but rotations within departments allow the trainee to spend time in all relevant areas. In addition the trainee will participate fully in the clinical radiology activity of the department to acquire a good knowledge of best radiological practice. They will actively participate in the clinicoradiological meetings, internal departmental meetings, journal clubs, grand rounds etc. Activities below which are considered optional objectives in first year are considered to be core objectives in subsequent training years, reflecting the reiterative revisiting inherent in this longitudinally integrated spiral curriculum.

2.7 Clinical activity will include a minimum of two sessions per week devoted to reporting. This should be performed under the supervision of a recognized trainer. This will include as core:

- All of the procedures performed by the trainee
- Trauma radiographs
- In and out patient radiography
- Some selective reporting of referrals from general practitioners

Optional activities include

- Reporting of special procedures performed by the trainee
- Reporting of ultrasound, radionuclide, CT and MRI examinations overseen by the trainee

2.8 At the end of the first year, the trainee should be in a position to pass the Primary FFR RCSI examination, currently held in the second week of May in the first year. A formal annual summative review of each trainee will have been carried out by the KIMS Faculty during this year, as well as less formal appraisals on a regular basis by the trainee's local co-ordinator (including formative assessment and feedback). The aim of the appraisal is to verify the trainee's experience and competence gained during the preceding year and to review progress and professional development. Any deficiencies in expected knowledge should be identified. The assessment is formalised by jointly completing the assessment form between trainee and assessors.

Assuming the trainee is in good standing, the trainee now will progress to the second year. If the trainee has not passed the primary examination, then he will not be allowed to progress to the second year.

Primary FFR RCSI Examination

- 2 sittings per year (May & September)
- The exam is composed of:
 - a) **MCQ**
 - i) Physics
 - ii) Radiological Anatomy
 - iii) Techniques / Radiography
 - b) **Viva**
 - i) Physics
 - ii) Radiological Anatomy
 - iii) Techniques / Radiography
 - c) **Film Viewing:** Identification of labeled structures
- Pass Mark 60% (at least 50% in all parts & 70% in film viewing).
- The September examination is held only in Dublin.

Syllabus for Subsequent Years of Training (Second, Third and Fourth)

3.1 During these years trainees will receive practice-based structured training to allow satisfactory experience and experiential learning in all constituent areas of clinical radiology, including systems-based, modality-based and age-based disciplines. This is achieved by a mixture of didactic and practical training as well as a strong core of self-directed learning. While individual departments structures will dictate specific rotations, the following time course over the 3-year period is suggested as a guideline (it is not meant to be prescriptive and allows for 44 weeks of training per year in light of annual and study leave for the trainee). In line with the spiral design, the trainees will receive increasing responsibilities as they progress through the stages of Bloom's taxonomy from base knowledge to evaluation.

- Musculoskeletal radiology and trauma :17 weeks
- Thorax including cardiac imaging :17 weeks
- Abdominal imaging :34 weeks (equivalent to 17 weeks Gastrointestinal imaging & 17 weeks Genitourinary imaging)
- Neuroradiology :14 weeks
- Vascular imaging: 12 weeks
- Paediatric imaging :12 weeks
- Head and neck imaging including dental :10 weeks
- Basic interventional techniques: 8 weeks
- Breast imaging: 6 weeks

Implicit within this are concepts of disease based imaging e.g. in oncology and modality based imaging e.g. radionuclide imaging. The order of rotations is left to individual departments.

Weekly tutorial sessions are provided by visiting faculty from the RCSI. Sessions on Practice Based Learning, tutorials, and seminars are provided by KIMS faculty.

Final FFR RCSI

2 sittings in November and April of 4th year

MCQ

Rapid Reporting

Long Cases

Vivas

3.2 It is clearly recognized that individual departments will, because of their makeup, differ from each other in how their trainees' needs are met in this respect. For the purposes of elucidating the curriculum, this document concentrates on the organ based imaging classification. Certainly considerable overlap will occur between modality and organ based training but implicit in this flexibility is an understanding that the trainee will receive training in all of the core objectives and most of the optional objectives during their training time.

3.3 It is not intended that specific numbers of cases will be dictated in the syllabus as being appropriate to the level of training achieved. This process has been tried in other jurisdictions with little success. It has indeed proved easier to specify numbers of cases when dictating programmes for Continuing Medical Education (CME) for post fellowship radiologists. Obviously, this situation will evolve as the years and practice develops but individual trainee log books will be used to monitor their progress in given areas.

3.4 On call rostering for out of hours work is a crucial part of this process and while individual departments will have their own arrangements, a formalised rota should in principle include all trainees from the second year as well as subsequent years.

3.5 Trainees in Radiology will develop knowledge of the radiological signs and techniques in line with the criteria outlined below.

It is expected that the trainee will be able to offer advice regarding appropriate examinations in given clinical scenarios and be up to date with knowledge of current radiation protection legislation. They will be capable of reporting plain radiographs as part of the normal working of a Radiology Department including participation in a hot reporting system. In light of development in information technology the trainee will be competent at reviewing images displayed on workstations as well as being capable of image manipulation and post processing.

The trainee will be capable of performing routine radiologic procedures during the normal working day, and performing and reporting out of hours investigations corresponding with the level of training. Trainees will develop expertise at the organization and presentation at departmental clinico-radiological meetings.

3.5.1 Abdominal (Gastrointestinal tract, liver, pancreas, spleen and urinary tract)

3.5.1.1 Gastrointestinal tract, liver, pancreas and spleen

Core Knowledge

- Knowledge of gastrointestinal 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), ultrasound, 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 gastrointestinal disease

Performing and reporting the following contrast examinations:

- Swallow and meal examinations, including assessment of oesophageal motility
- Small bowel studies
- Colonic evaluation by enema and/ or CT colonography techniques

Performing and reporting transabdominal ultrasound of the gastrointestinal system and abdominal viscera

Supervising and reporting computed tomography of the abdomen

Performing:

- Ultrasound-guided biopsy and drainage
- Computed tomography-guided biopsy and drainage

Core Experience

Performing and reporting the following contrast medium studies:

- Cholangiography (T-tube)
- Sinography
- Stomagraphy

GI video studies

Experience of the manifestations of abdominal disease on MRI

3.5.1.1 Gastrointestinal tract, liver, pancreas and spleen (contd.)

Core Experience

Experience of the current application of radionuclide investigations to the gastrointestinal tract in the following areas:

- Liver

- Biliary system
- Gastrointestinal bleeding (including Meckel's diverticulum)
- Abscess localisation

Experience of the application of angiography and vascular interventional techniques to this subspecialty

Experience of the relevant application of the following interventional procedures:

- Percutaneous abscess drainage
- Percutaneous biliary drainage and stenting
- Percutaneous cholecystostomy
- Embolization in acute GI bleeding
- Percutaneous gastrostomy
- Porto-systemic decompression procedures (TIPSS)
- Interventional oncologic procedures (TACE, RFA)

Optional Experience

Observation of colonoscopy, ERCP, balloon dilatation of the oesophagus/ stent insertion and other diagnostic and therapeutic endoscopic techniques

Endoluminal ultrasound (including endoscopic ultrasound)

Balloon dilatation of the oesophagus/ stent insertion

Familiarity with performance and interpretation of the following contrast studies:

- Proctogram
- Pouchogram

3.5.1 Abdominal (Gastrointestinal tract, liver, pancreas, spleen and urinary tract)

3.5.1.2 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, ultrasound, CT and MR

Familiarity with the current application of radionuclide investigations for imaging the following:

- Kidney
- 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 ultrasound to image the urinary tract

Supervising and reporting computed tomography of the urinary tract

Reporting radionuclide investigations of the urinary tract in the following areas:

- Kidney
- Renal function
- Vesico-ureteric reflux

Performing nephrostomies

3.5.1.2 Uroradiology (contd.)

Core Experience

Observation of percutaneous ureteric stent placement

Endorectal ultrasound

Performing image-guided transrectal biopsy under US and CT guidance

Magnetic resonance imaging applied to the urinary tract

Experience of angiography and vascular interventional techniques

- Experience of antegrade pyelo-ureterography

Optional Experience

- Urodynamics
- Percutaneous nephrolithotomy
- Lithotripsy

3.5.2 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 speciality (e.g. ultrasound, magnetic resonance imaging and radionuclide radiology)

Core Skills

- Mammographic reporting of common breast disease

Core Experience

- Participating 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

3.5.3 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
 - Magnetic resonance imaging
 - Cardiac computed tomography including CT coronary angiography
 - Conventional angiography

Core Skills

- Reporting plain radiographs performed to show cardiac disease

Optional Experience

- Supervising and reporting radionuclide investigations, computed tomography and/or magnetic resonance imaging performed to show cardiac disease

- Experience in echocardiography (including transoesophageal)

- Performing/observing coronary angiography and other cardiac angiographic and interventional procedures.

3.5.4 Chest

Core Knowledge

- Knowledge of respiratory anatomy and clinical practice relevant to clinical radiology
- Knowledge of the manifestations of thoracic disease as demonstrated by conventional radiography and CT (including CT Pulmonary angiography)
- Knowledge of the application of radionuclide investigations to chest pathology with particular reference to radionuclide lung scintigrams.
- Knowledge of the application, risks and contraindications of the technique of image-guided biopsy of chest lesions

Core Skills

- Reporting of plain radiographs performed to show chest disease
- Supervising and reporting radionuclide lung scintigrams
- Supervising and reporting computed tomography of the chest, 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:
 - Magnetic resonance imaging
 - Angiography

Optional Experience

- Supervising and reporting magnetic resonance imaging
- Angiography (including thoracic aortic stent-grafting)
- Bronchography
- Bronchial stenting

3.5.5 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, ultrasound, CT and MRI.
- Awareness of the application of ultrasound 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, sialography and dacrocystography)
- Performing and reporting ultrasound of the neck (including the thyroid, parathyroid and salivary glands)
- Supervising and reporting computed tomography of the head and neck for ENT problems.
- Supervising and reporting computed tomography for orbital problems
- Supervising and reporting magnetic resonance imaging in 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 ultrasound of the eye
- Supervising and reporting computed tomography and magnetic resonance imaging of congenital anomalies of the ear
- Reporting radionuclide parathyroid investigations

3.5.6 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 ultrasound.

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 computed tomography of the musculoskeletal system
- Supervising and reporting magnetic resonance imaging of the musculoskeletal system
- Performing and reporting ultrasound of the musculoskeletal system
- Supervising CT and MR 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

3.5.7 Neuroradiology

Core Knowledge

- Knowledge of neuroanatomy and clinical practice relevant to neuroradiology
- Knowledge of the manifestations of CNS disease as demonstrated on conventional radiography, CT, MRI, myelography 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 MR angiography in neuroradiology

Core Skills

- Reporting plain radiographs in the investigation of neurological disorders
- Supervising and reporting cranial and spinal computed tomography
- Supervising and reporting cranial and spinal magnetic resonance imaging

Core Experience

- Observation and reporting of cerebral angiograms
- Observation of carotid ultrasound including Doppler
- Experience in MR angiography and CT angiography to image the cerebral vascular system

Optional Experience

- Performing and reporting cerebral angiograms
- Performing and reporting myelograms
- Performing and reporting transcranial ultrasound
- Observation of interventional neuroradiological procedures
- Observation of magnetic resonance spectroscopy
- Experience of functional brain imaging techniques (radionuclide and MRI)

3.5.8 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 fetal anatomy during gestation and the imaging appearances of fetal abnormality
- Awareness of the applications of angiography and vascular interventional techniques
- Awareness of the applications of magnetic resonance imaging in gynaecological disorders and obstetrics

Core Skills

- Reporting plain radiographs performed to show obstetric and gynaecological disorders
- Performing and reporting transabdominal and endovaginal ultrasound in gynaecological disorders and obstetrics
- Supervising and reporting computed tomography in gynaecological disorders
- Supervising and reporting magnetic resonance imaging in gynaecological disorders

Core Experience

- Performing and reporting hysterosalpingography
- Performing and reporting transabdominal endovaginal ultrasound in obstetrics

Optional Experience

- Supervising and reporting magnetic resonance imaging in obstetric applications (e.g. assessing pelvic dimensions)
- Observation of fetal MRI
- Observation of angiography and vascular interventional techniques in gynaecological disease

3.5.9 Oncology

Core Knowledge

- Knowledge of clinical practice relevant to clinical radiology

- Familiarity with tumour staging nomenclature

- Familiarity with the application of ultrasound, radionuclide investigations, computed tomography and magnetic resonance imaging, angiography and interventional techniques in oncological staging, management and monitoring the response of tumours to therapy

- Familiarity with the radiological manifestations of complications which may occur in tumour management

- Familiarity with the role of Interventional oncologic procedures (TACE, RFA)

Core Skills

- Reporting plain radiographs performed to assess tumours

- Performing and reporting ultrasound, 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

Optional Experience

- Familiarity with the practical application and appropriate use of PET imaging in tumour staging and management

3.5.10 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, ultrasound, contrast studies, CT, MRI and radionuclide investigations.

Core Skills

- Reporting radiographs performed in the investigation of paediatric disorders including trauma
- Identification of suspected non accidental injury
- Performing and reporting ultrasound in the paediatric age group in the following areas:
 - Transabdominal
 - Transcranial
 - Paediatric hip ultrasound
- Performing and reporting routine fluoroscopic procedures in the paediatric age group, particularly:
 - Contrast studies of the urinary tract
 - Contrast studies of the gastrointestinal system
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- Prioritisation, protocoling, supervising and reporting computed tomography and magnetic resonance imaging and radionuclide investigations in the paediatric age group
- Special requirements for radiation safety and contrast material dosage for the paediatric population
- Principles of sedation in paediatric radiology

Optional Experience

- The practical management of the following paediatric emergencies:
 - Meconium ileus
 - Intussusception

3.5.11 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 regimes, patient monitoring during procedures and post-procedure patient care

- Familiarity with procedure and post-procedure complications and their management

- Familiarity with the appropriate applications of the following techniques:
 - Ultrasound (including Doppler)
 - Intravenous digital subtraction angiography
 - Intra-arterial angiography
 - Computed tomography and CT angiography
 - Magnetic resonance imaging 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 ultrasound)

- Performing the following techniques:
 - Ultrasound (including Doppler), venous and arterial
 - Intravenous digital subtraction angiography

- Supervising and reporting CT examinations of the vascular system (CTA) including image manipulation

- Supervising and reporting MRI examinations of the vascular system (MRA) 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

Core Experience - Interventional

- Femoral angioplasty
- Iliac angioplasty
- Renal angioplasty
- Embolisation
- Thrombolysis
- Stenting
- Caval filter insertion

For the purposes of this document, we have used a systems based module; there is of course considerable overlap between this and technique based subspecialty areas. These are reflected below.

3.5.12 Computed Tomography

Core

- Knowledge of the technical aspects of performing computed tomography (CT), including the use of contrast media.

- Knowledge of cross-sectional anatomy as visualised on computed tomography

- 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 computed tomography-guided procedures, e.g. biopsy and drainage

- Familiarity with the application of CT angiography

- Familiarity with post image acquisition processing

NB: These examinations may be performed during a system-based attachment, e.g. neuroradiology, or during a computed tomography attachment.

3.5.13 Magnetic Resonance

Core

- Understanding of current advice regarding the safety aspects of magnetic resonance imaging (MRI)

- Knowledge of the basic physical principles of magnetic resonance imaging, 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 MR angiography and venography

- Familiarity with post image acquisition processing

NB: This experience may have been gained during a system-based attachment, or during a magnetic resonance attachment.

3.5.14 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 modalities, 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 PET imaging

NB: Ideally the training in radionuclide radiology should take place during a radionuclide imaging attachment, but it may occur in part or wholly during a system-based attachment.

3.5.15 Ultrasound

Core

- Knowledge of the technical aspects of ultrasound relevant to optimising image quality

- Knowledge of the cross-sectional anatomy as visualised on ultrasound

- Experience in performing and reporting transabdominal ultrasound examination of structures in the following anatomical areas:
 - General abdomen (including vessels)
 - Obstetric
 - Pelvis (non-obstetric)
 - Small parts (scrotum, thyroid, neck structures)
 - Upper abdomen (including lower chest)

- Experience of performing Doppler ultrasound imaging (e.g. leg veins, portal vein, carotid artery)

- Performing ultrasound of the breast

- Performing transcranial paediatric ultrasound

- Experience in ultrasound of the musculoskeletal system

- Performing ultrasound-guided interventional procedures (e.g biopsy and drainage)

3.5.16 **Interventional**

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
- Performing nephrostomies
- Ultrasound-guided interventional procedures (e.g. biopsy and drainage)

Optional

- Performing femoral angioplasty
- Performing iliac angioplasty
- Observation of the spectrum of interventional procedures currently performed in the following systems:
 - Vascular system (including neurovascular)
 - Urinary system
 - Biliary system
 - Gastrointestinal system
 - Musculoskeletal system
- Experience of MR - guided interventional procedures

3.5.17 General Professional Development

The Trainee will continue to develop expertise in relation to current clinical practice as it relates to radiology, applied pathology, physiology and molecular biology as they relate to the practice of radiology and statistical and research methods.

The trainee will also continue to develop a high level of expertise in teaching, clinical audit and departmental management. This will include clinical governance and risk management, and also issues relating to human resources within the Radiology Department. The trainee will also maintain a high level of continuing general professional development.

The trainee will maintain a high level of expertise in terms of Advanced Cardiac Life Support (ACLS) in which they must be regularly certified according to local practice.

It is envisaged that training in these areas will be given by experts in these areas, either by inviting speakers in to the courses or alternatively attending externally organized seminars in these areas.

3.5.18 Other Modules

The trainee will be given instruction in Communication Skills, which are a key part of the essential attributes of a well-trained radiologist. Trainees will also be given modular training in report writing. Trainees will also be expected to take a full role in management of their clinical departments and it is expected that Clinical Directors will appoint specialist registrar trainees to management committees in their respective departments.

3.5.19 Assessments

Summative / Continuous

Annual trainee summative assessments will be carried out by the KIMS Faculty on a formal basis as well as more frequent and less formal local formative appraisals as specified in relation to the first training year as outlined in 2.8 above. These assessments are in addition to ongoing workplace based assessments on a daily basis. The aim of the appraisal is to verify the trainees experience and competence gained during the preceding year and to review progress and professional development. Any deficiencies in expected knowledge should be identified. The assessment is formalised by jointly completing the assessment form between trainee and assessors.

Subjects assessed include:

- Radiological Skills
- Syllabus Content
- Knowledge
- Basic Science
- Clinical
- Health Outcomes
- Management

Postgraduate Activities

- Teaching
- Audit
- Research (Posters and Presentations)
- Presentation Skills
- Personal Qualities
- Communication
- Time Management
- Reliability
- Self-Motivation
- Leadership
- Self-Awareness
- Observed Professional Relationships
- Senior Colleagues
- Junior Colleagues
- Patients

Formative

Primary FFR RCSI Examination

2 sittings per year in May & September.

a. **MCQ**

- i. Physics
- ii. Radiological Anatomy
- iii. Techniques / Radiography

b. **Viva**

- i. Physics
- ii. Radiological Anatomy
- iii. Techniques / Radiography

c. **Film Viewing:** Identification of labeled structures

- Pass Mark 60% (at least 50% in all parts & 70% in film viewing).

Final FFR RCSI

2 sittings in November and April of 4th year

Exam Comprises of:

MCQ

Rapid Reporting

Long Cases

Vivas

3.5.21 Future Developments

Trainees are expected to develop a high level of expertise in information technology, as it applies to word processing, digital dictation techniques (including voice recognition) database creation and maintenance, lecture and other research presentation, email and internet. They should also be aware of information technology systems used for patient record keeping and transfer of clinical data and strive for best practice in use and maintenance of these systems, complying with legislation regarding patient confidentiality and freedom of information.

3.5.22 Final Statement

By the end of the formal four year training process, the trainee should have a broad experience of interpreting and reporting radiographs in all specialist areas whether they be hard or soft copy. They should have acquired the expertise needed to perform and report the core procedures outlined above. It is intended that the radiologist be a key player in clinical decision making and have developed communication skills to copper fasten this role in relation to consultation with clinical colleagues and most importantly with patients.

It is intended that the trained radiologist be a rounded individual with a high level of integrity, who maintains an active interest in research, teaching and clinical audit as dictated above and keeps abreast of new developments in information technology and clinical radiology.