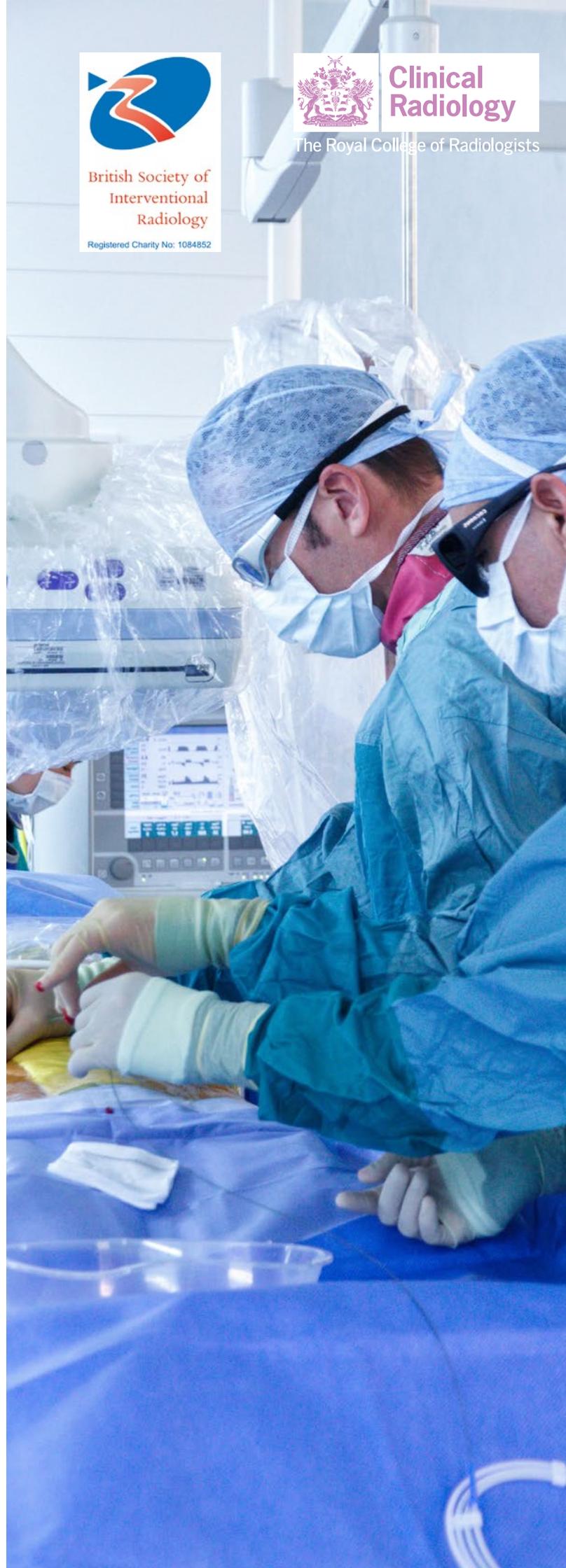


Provision of interventional radiology services Second edition

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Foreword

Interventional radiology (IR), using innovative, evolving and often complex techniques, has revolutionised patient care in a wide range of diseases. It has produced major improvements in safe, patient-focused care demonstrating cost-effectiveness in numerous conditions and utilising imaging guidance at its heart. IR is increasingly recognised as a vital component of hospital medicine, providing lifesaving care, both in and out of hours (OOH), and became a separate subspecialty of radiology in 2010. The purpose of this document is to inform service providers, clinicians and commissioning bodies of the requirements for the provision of a safe and sustainable IR service.

Many surgical procedures have been replaced or enhanced by the provision of IR services, as well as allowing new treatments for patients that were not previously feasible. The provision of IR services, however, remains variable with many hospitals having limited or, in some instances, no direct access to IR services. This is particularly true OOH with a recent survey of units by NHS Improvement demonstrating that only 45% of units are able to provide comprehensive OOH IR care, potentially putting many patients at risk. The principal causative factor is insufficient numbers of trained interventional radiologists, a fact that needs to be urgently addressed. This document demonstrates the range of services offered by interventional radiologists and sets out the core requirements for the provision of an IR service both in district general hospitals (DGH) and tertiary or teaching hospitals, advising on how services may be set up collaboratively within regions to offer the highest quality of care to all patients, both in and OOH. This document should be used in conjunction with documents referenced here on IR published by The Royal College of Radiologists (RCR) and NHS Improvement and standards documents published by the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) and the Society of Interventional Radiology (SIR).

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Working group and consultation

We would like to recognise the Safety and Quality Committee of the BSIR, Dr Phil Haslam and Dr Trevor Cleveland for their time and assistance in helping to develop this second edition of *Provision of Interventional Radiology Services*, which updates the first edition published in 2011.

The document was made available for consultation to and comments from BSIR members for one month from 20 July to 20 August 2018. It has been subsequently revised in consultation with members of the BSIR, the Interventional Radiology Committee and the Faculty of Clinical Radiology of the RCR.

The document will be revised in September 2022.

1. Executive summary

Interventional radiology (IR) procedures are minimally invasive, often targeted treatments performed under imaging guidance and they play a vital role in both elective and emergency patient care.

IR procedures can replace many open and laparoscopic surgical procedures and are less invasive, reducing morbidity and mortality and allowing more rapid recovery.

IR encompasses a large range of procedures and techniques and some hospital sites will not be able to offer all types of treatment.

Access to a robust 24/7 IR cover should be a priority for all acute hospitals. Hospital units that undertake acute medical and surgical care should have access to IR services, particularly haemorrhage control and drainage of sepsis (for example nephrostomy) either onsite or by formal arrangement to transfer the patient to a site where the service is available. Transfer procedures and policies must be developed to detail transfer arrangements between hospital trusts for emergency IR cases. Specific consideration should be given to the transfer of unstable bleeding patients as IR is lifesaving in this situation. Transfer direct to an available staffed unit with appropriate levels of support from critical care and acute services, not affected by 100% bed occupancy risk, under a nominated defined clinician located near to the IR department should be considered. Safe, appropriate timescales are required to transfer patients between trusts. It is recommended that transfer should occur within 30 minutes of the clinical decision for IR treatment.

Reconfigurations to individual services should ensure that a continuity of access to IR services is maintained in a safe manner for patients. This is paramount for emergency care, which includes acute admissions as well as inpatient emergencies such as post-op haemorrhage, sepsis and gastrointestinal (GI) bleeding.

Services consisting of six or more interventional radiologists will usually be able to provide an effective and sustainable service, and networks or units should aim for a rota with a minimum frequency of 1:6. Units covering populations of more than one million will require rota frequencies of 1:8 or greater. Some networks will be able to provide separate vascular and non-vascular rotas.

Larger, busier units will have daily emergency lists, as for acute surgery and trauma services.

IR nurses and radiographers provide vital specialist skills to the interventional radiology team. Safe and sustainable support for IR services will require adequate radiographer and nursing resources to allow similar rota frequencies to the interventional radiologists' rota for 24/7 cover.

There is significant variation in the provision of IR nursing support, particularly for OOH procedures. A minimum recommendation for patient safety is the provision of one trained staff member experienced in the procedures and equipment and another member of staff (healthcare assistant or other) to act as runner for equipment. If sedation is required there needs to be a trained member of staff whose sole duty is to provide monitoring and observation of the patient. If a trained scrub nurse is required then a second trained staff member is needed if sedation is required.¹ The second edition guidelines on sedation, analgesia and anaesthesia in the radiology department were published in June 2018.²

Interventional radiologists play an increasingly clinical role with more direct clinical referrals from primary and secondary healthcare. Job plans should incorporate all aspects of IR activity, including the requirements to provide outpatient clinics and inpatient clinical

support as outlined in *Job planning for interventional radiology* published in April 2018.³ Interventional radiologists should be listed on the hospital e-referral system to ensure appropriate clinical treatment choices for patients.

Patients expect the procedure and their treatment to be explained by the clinician competent in carrying them out. Interventional radiologists have the primary responsibility of ensuring that patients have sufficient information to give their fully informed consent for an IR procedure. The establishment of IR outpatient clinics is essential to facilitate appropriately informed treatment decisions, under the Montgomery ruling,⁴ and allow for follow-up after treatment.

In some interventions, such as percutaneous tumour ablation, the interventional radiologist may be the only nominated responsible clinician for the patient's care and should be the primary admitting consultant. However, other models of care exist, such as shared care, where both names should appear above the bed. IR outcome data should ideally be collected for all IR procedures; this is especially important for interventional oncology procedures, where data should be collected via the trust's routine cancer outcome measure systems. Administrative support is essential for this process. Submission of clinical outcomes for IR is best supported by a systematic process and submission to national IR registries should be mandatory.

2. Interventional radiology – the specialty

IR procedures are image-guided surgical treatments that are minimally invasive with rapid recovery, often performed on a day-case basis. A wide range of procedures are included, such as treatment of obstructed kidneys, the emergency management of active haemorrhage, the treatment and palliation of cancer (both primary and metastatic disease), stroke prevention and clot retrieval in acute stroke.

IR procedures often replace open and laparoscopic surgical procedures as they are less invasive, reduce morbidity and mortality, and allow more rapid patient recovery and hospital discharge. Over 90% of procedures are undertaken through pinhole incisions of around 2–3 mm, and most procedures are performed under local anaesthesia, often allowing same-day discharge from hospital.

IR has expanded to play a vital role in both elective and emergency treatment. The examples below are by no means exhaustive but illustrate the breadth of treatments available.

Vascular disease – interventional radiologists are integral to the provision of endovascular aneurysm repair, angioplasty and stenting for the treatment of peripheral and aortic vascular disease.

Haemorrhage control – IR allows rapid control of haemorrhage by embolisation or stent grafting without the morbidity of an open surgical procedure. IR now plays a vital role in trauma and GI bleeding pathways.⁵ The 2015 NCEPOD report recommends that patients with any acute GI bleed should be admitted to hospitals with 24/7 access to on-site IR.⁶

Renal medicine and dialysis support – elective and emergency support is increasingly becoming a component of many IR units to provide support for complex dialysis access, fistuloplasty, fistula thrombectomy and renal artery stenting.

Venous access – IRs are central to the provision of complex venous access, including tunnelled lines and port insertions for chemotherapy, dialysis and long-term therapies, for example in cystic fibrosis patients.

Interventional oncology – ablative procedures such as radiofrequency ablation, cryotherapy, microwave ablation and irreversible electroporation, and embolisation procedures such as transarterial chemoembolisation (TACE) and selective internal radiotherapy (SIRT) provide minimally invasive targeted treatment options for patients with solid tumours. In addition, treatment of obstructive lesions of both vascular and non-vascular systems can provide invaluable palliation for patients with advanced disease.

GI and hepatobiliary disease – Interventional radiologists provide palliation of obstruction due to tumours at many sites, including upper and lower GI disease and bowel and biliary tree, as well as direct access to the gut to provide nutrition as an alternative to parenteral nutrition.

Obstetrics and gynaecology – IR is used to prevent and treat life-threatening postpartum haemorrhage (PPH). NHS trusts should have access to IR for obstetric cases where PPH is likely, and protocols for the management of PPH and use of IR should be in place locally. Uterine artery embolisation is an established and highly cost-effective treatment for symptomatic fibroids.⁷ Interventional radiologists also provide essential treatment for symptomatic women with debilitating pelvic congestion syndrome.

Uro-intervention – IR is used in acute and chronic treatment of ureteric obstruction from stone disease and tumours to prevent renal damage. Prostate artery embolisation (PAE) for the treatment of benign prostatic hypertrophy has recently received NICE approval.⁸

Paediatric intervention – IR is central to the safe and effective provision of acute and elective services to children. Children's services often lag behind equivalent adult services with potential delays and poorer outcomes for children.

Neuro-intervention – IR has been central to the treatment of intracranial haemorrhage, aneurysms, tumours and stroke prevention (carotid intervention) for many years. More recently the acute treatment of stroke with mechanical thrombectomy has been shown to significantly improve disability-free survival and quality of life.^{9,10} Interventional radiologists are in an ideal position, with catheter and guidewire skillsets, to help provide this service with appropriate additional neuro-interventional training and support. It is now a priority for the NHS to deliver access to this service.¹⁰

Other conditions – with the established benefits of image-guided surgery in providing safe and effective care for patients, IR is being used more often. These techniques are also being used to treat failing transplants (liver, pancreas and kidney) and acute and chronic bowel ischaemia and to manage vascular malformations.

3. Interventional radiology units

IR encompasses a large range of procedures and techniques and some hospital sites will not be able to offer all types of treatment.

IR units should clearly define the procedures they undertake both within working hours and OOH to ensure that patient access to appropriate treatment may be maintained. Formal pathways are required for the hub-and-spoke arrangements between hospitals to transfer acute patients requiring emergency IR within 30 minutes of the decision to treat.

The development of robust 24/7 access to interventional radiology cover should be a priority for all acute hospitals. The British Society of Interventional Radiology (BSIR) has worked with the Department of Health (DH) and the NHS England sustainable improvement team (previously NHS IQ) to detail the availability of 24/7 IR services in NHS England.^{11,12} This has documented substantial variation in the UK to access common, potentially lifesaving, IR procedures.

The most frequent IR procedures undertaken as an emergency are arterial embolisation to arrest haemorrhage and nephrostomy placement to relieve obstructed kidneys and avoid renal failure. All IR specialists should be able to carry out these core procedures, for which hospital trust boards should prioritise cover. Less commonly performed complex interventional procedures may need to be provided by a formal hub-and-spoke arrangement with a neighbouring trust. This arrangement should not impede the development of cover for the more common procedures locally.

Hospital units that undertake acute medical and surgical care should have access to IR services, particularly haemorrhage control and nephrostomy drainage, either on-site or by formal arrangement to transfer the patient to a site where the service is available in a safe and timely manner.

Some procedures occur sufficiently infrequently or are sufficiently complex that it is not appropriate that all units provide them. Guidance on optimising training opportunities for low-volume procedures is given in *Best practice in interventional radiology*.¹¹ For units covering a small population it may be better to develop a formal network with a neighbouring unit and put in place a formal policy to permit prompt transfer.

It is essential for good medical care and patient safety that formal written pathways and policies are established for interhospital patient transfer. These should be agreed by all parties (hospital management, clinicians and the IRs) and should be disseminated to all local clinical colleagues. There should be a clear referral pathway and precise details of transfer protocol, timescales and the agreed procedures covered by the units. Where services are commissioned, commissioners should be informed and ensure appropriate pathways are established for local and regional services.

Reconfigurations to individual services should ensure that a continuity of access to IR services, particularly for emergency care, is maintained.

The number of IRs within a unit is clearly a key factor in determining the approach to developing a safe and sustainable rota. The following guidance should be applied.

- *Services with fewer than four interventional radiologists* should liaise with neighbouring units to develop a model of care that will permit robust IR rotas.
- *Services with between four and six interventional radiologists* may be able to provide an on-call rota depending on the intensity of activity. Most services in this range should consider networking with neighbouring units to ensure a more robust long-term service.
- *Services consisting of six or more interventional radiologists* will usually be able to provide a robust 24/7 service that is compliant with the European Working Time Directive (EWTD) or equivalent. For populations greater than 1 million a 1:8 rota may be more sustainable.

There is a significant shortage of interventional radiologists in the UK, with almost half (45%) of the services in England not currently able to provide either local or networked OOH access to IR. There remain a large number of unfilled IR consultant posts in the UK due to a shortage of suitably trained candidates and early retirements. Data from the 2018 RCR workforce census document suggest an approximate need for 379 consultants in IR to achieve a rota of 1:6 (Table 1). Expansion of the number of trainees in IR is, therefore, urgently required as a continued shortfall will be damaging to both elective and emergency patient care.¹³

A skilled and robust workforce is also essential for the delivery of a 24/7 mechanical thrombectomy service for large-vessel occlusion stroke, which is a highly effective but very time-dependent treatment.

Table 1: Workforce required for IR 24/7 cover as a 1:6 rota

Region	Number of trusts/health boards	Consultant radiologists with PRIMARY interest in IR (WTE)	Consultant radiologists with SECONDARY interest in IR (WTE)	Total IR consultants (WTE)	Additional IRs required to provide 1:6 on call rota in each trust/health board*	% IR shortfall
East Midlands	8	35	5	40	14	27%
East of England	16	41	4	46	41	48%
London	23	122	8	130	37	22%
North East	8	18	4	22	23	51%
North West	26	62	21	83	62	43%
South Central	8	43	4	47	13	22%
South East	12	43	2	45	23	34%
South West	17	50	8	58	36	38%
West Midlands	16	53	7	60	30	33%
Yorkshire and the Humber	14	44	1	45	41	47%
England total	148	511	63	574	320	36%
Northern Ireland	5	16	4	19	17	47%
Scotland	12	39	4	43	29	40%
Wales	7	19	5	24	13	35%
UK total	172	585	76	661	379	36%

*This estimate assumes that the 22 trusts/health boards, which do not employ any consultant IRs have formal arrangements with other trusts to provide IR services i.e. it is assumed that the shortfall of IRs for these trusts/health boards is zero, not six.

4. Interventional radiology facilities

IR units place many implantable devices including arterial stents, venous access devices and inferior vena cava (IVC) filters. Insertion of these devices requires a sterile environment and such procedures are increasingly undertaken in clean-air environments.

Specific guidance produced by a joint working group led by the Medicines and Health Products Regulatory Agency (MHRA) is available detailing the requirements for facilities to support endovascular aneurysm repair, including theatre-quality air exchange, a fixed, high-quality angiographic X-ray system, anaesthetic facilities and an appropriate stock of consumables. These facilities may be optimally provided within a hybrid imaging system where a high-quality fixed angiographic suite is installed within a sterile environment. Using mobile C-arms in an operating theatre is not an adequate substitute.¹⁴

Access to non-invasive imaging using ultrasound (US), computed tomography (CT) and magnetic resonance (MR) is essential for planning non-vascular and vascular IR procedures. US is essential to IR procedures and should be routinely available within the IR suite.

IR is developing rapidly and there are now a number of dedicated image-guided surgical procedures where the interventional radiologist is the primary clinician responsible for the patient episode. To ensure patient safety and administer the highest quality of care, these patients should be admitted under a named interventional radiologist or in partnership with a clinical specialist where junior cover can be appropriately shared. IR consultants should be available to advise on clinical management and should take shared (or where appropriate sole) responsibility for the hospital episode.

Interventional radiologists therefore need to have the appropriate admission rights at their trust and have access to inpatient and day-case beds as the primary named clinician. For the majority of elective care this means access to day-case facilities, which will often be within the IR/radiology department. This allows for appropriate tariff reimbursement and the opportunity to deliver more cost-effective care.

IR procedures are becoming more complex, difficult and painful, and are being performed on patients with increasingly complex medical needs. Routine anaesthetic support should be available in IR units for elective and emergency cases as required.

5. Interventional radiology teams

IR requires an extended team of healthcare professionals beyond interventional radiologists. This includes the referring clinical teams, anaesthetists, interventional nurses, interventional radiographers and healthcare assistants. Effective team working with shared responsibilities is essential if the team is to deliver co-ordinated care with task interdependency and the best patient outcomes.

Interventional radiologists have a responsibility to lead and work within teams that encourage and accept participation from all team members. All team members must understand their individual roles but be prepared to work flexibly to ensure successful outcomes.

The importance of effective team working cannot be overemphasised and is reflected in the recent guidance on team briefs and the WHO radiology safety checklist. Every member of the team contributes to patient safety, and adoption of the methodology, including the RCR/National Patient Safety Agency (NPSA) safe surgery checklists, is strongly recommended.¹⁵⁻¹⁷

Interventional radiographers possess skills for ensuring the best-quality images are obtained with the minimum patient dose and have detailed knowledge of safe and appropriate use of ionising radiation as well as interventional equipment and procedures. They provide a vital team element for the safe provision of services both in and OOH, and experienced personnel are essential in a functioning unit.

Interventional nurses possess the skills of a theatre/recovery nurse with a detailed knowledge of the equipment and procedures performed within IR. These staff play a vital role in ensuring safe and successful procedures, in both the elective and emergency settings.

Approximately one-third of patients requiring vascular and non-vascular intervention present as emergency cases and therefore both interventional nurse and radiographer rotas are required for 24/7 services.¹

Although general anaesthesia is sometimes required, image-guided surgical IR procedures are commonly carried out with conscious patients, who may be sedated. While individual models may vary between units, a minimum requirement for patient safety is the provision of one member of staff who is experienced in the procedure and equipment providing direct scrubbed assistance. Sedation and monitoring of the patient should be provided by a separate member of staff. This does not need to be a member of the radiology staff, but the individual should have competency in sedation and monitoring.²

Access to clinical nurse specialists (CNS) is an important development to help support the IR staff, who frequently have no junior doctor support. Healthcare assistants (HCA) with appropriate training and education can also provide support for IR activity. However, such HCA support cannot replace the skillset provided by registered nurses, the absence of whom might determine or limit the type of procedure that an individual department can safely perform.

6. The role of the interventional radiologist

IR is a subspecialty within clinical radiology where radiologists undergo additional specialist training, outlined in the IR curriculum, to perform image-guided therapies and procedures.

Diagnostic radiology (DR) remains a vital core element of IR, but IR practice is significantly different to DR. IR places additional clinical responsibilities on the interventional radiologist for pre-intervention assessment, outpatient clinics, consent, ward activities and follow-up. The support and resources recommended in this document apply equally to all types of radiologists providing image-guided therapies and procedures.

Most interventional radiologists work within a team of colleagues to provide an IR service to a hospital or number of hospital units. Those working within both DGH and teaching hospitals play a vital role in the support of a range of services across the hospital, including acute medical, obstetric and surgical specialties.

Interventional radiologists are required to maintain their skills through continuing professional development, which should be supported by their employing NHS trust. IR practice varies significantly between individual units. Job plans are decided by local negotiation, but careful consideration should be made of the following themes.

- Job planning should take account of all IR activity as direct clinical care (DCC), including sufficient flexibility to support day-time emergency and urgent cases.
-

- There is no fixed ratio of interventional to diagnostic activity due to variations in the services supported. Most IR staff will have a component of diagnostic activity in their job plan and this should help support their IR activity, such as CT scanning.
- Interventional radiologists have an increasingly important role to play in the provision of on-call services. Time for on-call activity must be included in job plans as part of the programmed activity (PA) calculation during job planning. Many interventional radiologists are providing a first on-call service with limited support from junior staff and are both the first contact and responsible clinician for delivery of care. It is important that rotas are sustainable. Larger units should have daily emergency lists to avoid compromising routine sessions.

All treatment options available should be discussed with patients (Montgomery ruling), and IR procedures are increasingly playing a pivotal role. Interventional radiologists possess the required skills and knowledge to help patients make appropriate treatment decisions. The primary responsibility to ensure that patients have sufficient information to make treatment decisions lies with the interventional radiologist. Patients need sufficient time to reflect before and after they decide, and patient information leaflets are an important method of supporting the consent process. The BSIR produces a wide range of patient information leaflets, which are available at www.bsir.org and www.bsir-qi.com

Interventional radiologists also have responsibility for undertaking the clinical assessment, review and appropriate further management of patients in both outpatient and ward settings. Job planning must take account of this as DCC activity.

The establishment of IR clinics with appropriate support staff, within an appropriate environment, is required to facilitate consent and treatment decisions. Clinics can be run jointly with other specialties.

In addition to the physical resources of space and support personnel, DCC time and flexibility should be made available in job plans to support IR activity. In a survey of interventional radiology clinic activity across the UK, 50% of interventional radiologists who responded had IR clinics in place.

IR clinics and ward activity allow interventional radiologists to review patients post-procedure and to document procedural outcomes and complications to ensure clinical effectiveness and patient safety. Patients should have access to IR services post-procedure for advice on and to deal with any complications. Trusts should ensure that processes are in place to ensure safe practice. Cases should be reviewed within morbidity and mortality meetings and audit and relevant information made available for individual appraisal.¹⁸ CNS staff provide essential support.

Guidance for quality improvement and standards of practice for individual procedures are available from CIRSE (www.cirse.org).

Outcome follow-up beyond the immediate peri-intervention period is invaluable in demonstrating the true efficacy of a procedure and complication profile of an individual's practice. Trusts should support interventional radiologists to submit data into national databases and registries in a systematic process. This ensures patient safety and clinical effectiveness to improve and modify interventional practice within the UK.

Follow-up may be delegated to another clinical group with specialist expertise in specific instances where there is an agreed process for outcome documentation and feedback to the IR staff.

It is essential that sufficient time is included within job plans to ensure that these duties can be undertaken.

Interventional radiologists support a wide range of clinical services and departments and therefore it will not be possible for interventional radiologists to regularly attend every specialty multidisciplinary team meeting (MDTM) that refers patients to the service. MDTMs of specialties that make regular referral and treatment decisions should be attended. In many units this will include vascular, renal/urology, hepatobiliary, vascular anomalies and oncology meetings. Flexibility within job plans should be available to allow attendance at those MDTMs with irregular referral to IR, to ensure appropriate access to an IR opinion and management when required.

7. Training

There is an urgent need to significantly increase the workforce within IR in the UK and train more interventional radiologists for the future within the new subspecialty framework of the RCR. Women make up a large part of the UK medical workforce and are vastly underrepresented in this subspecialty. Encouraging more women to take up IR as a career is a key priority for the RCR and BSIR.¹⁹ In addition to ensuring high quality of training for all future interventional radiologists, in training centres should have sufficient time and resources to ensure adequate supervision of training as well as sufficient workload and case mix to provide exposure to a range of procedures. The BSIR and the RCR propose that local IR training programme directors (TPDs) should be appointed to oversee the training requirements of trainees interested in IR from year 1 of radiology training. Specific dedicated time should be identified in job plans for trainers to ensure the provision of high-quality training programmes in IR (Appendix 1).

8. Registries, audit and quality improvement

Interventional radiologists, like all medical practitioners, have a duty to monitor and improve the quality of their work by regular audit of their practice.

Registries offer a systematic way to monitor outcomes against peers, and submission of IR data to appropriate registries should be mandatory. Within interventional oncology, primary cancer treatment data (eg for tumour ablation) should be entered into the already existing specialty cancer databases.

The BSIR is developing, as part of its core strategy, database registries to support developments in IR and obtain outcome data for its members and to support the production of quality standards in IR. A number of index procedures for the different areas of IR will be developed, where data entry will be mandated.

The BSIR has previously produced a number of quality standards and has published reports based on registries of specific areas of IR practice, such as iliac angioplasty and stent insertion (BIAS),²⁰ biliary drainage (BDSR),²¹ nephrostomy insertion²² and selective internal radiotherapy (SIRT). In addition, there are several quality standards that have been published for guidance by NICE, the RCR, CIRSE and SIR that units and operators should be aware of when assessing their practice.

Interventional radiologists working within units that contribute to the NHS abdominal aortic aneurysm screening programme (England) must submit the results of their endovascular aneurysm repair procedures to the National Vascular Registry (NVR).²³

Although the submission of data to registries is time-consuming, it is a vital component of assessing and developing interventional procedures to ensure they are relevant, safe and cost-effective for the modern NHS practice. Registry submission also allows assessment of an individual and the trust performance data and is essential for appraisal and revalidation. Trusts should give appropriate administrative support to interventional radiologists to facilitate this data entry and ensure it is accurate and comprehensive.

The BSIR has developed a quality improvement (BSIR-QI) programme for IR units that focuses on four key areas: scope of services, providing good-quality care, patient focus and service improvement.

The BSIR-QI programme (www.bsir-qi.com) offers units the opportunity to self-assess against specific criteria and can be used for accreditation purposes. Participating IR centres are required to submit an electronic application accompanied by supporting evidence for peer review. The unit is awarded exemplary status when the defined objectives are met.

9. Specialty areas

IR provides treatments across a great number of specialist areas. It is not possible to detail all such areas in this document. We have highlighted four important areas: vascular disease, interventional oncology, paediatric intervention and renal intervention (Appendix 2).

10. Patient information

Patient information leaflets for common IR procedures are available on the websites of BSIR (www.bsir.org), CIRSE (www.cirse.org) and SIR (www.sirweb.org).

11. Conclusion

We have demonstrated the pivotal role that IR plays in the delivery of modern healthcare. The clinical and economic advantages provided through increased use of these non-invasive image-guided surgical treatments are undisputed and it is vital that their development continues. This requires appropriately trained medical, nursing and radiographic staff as well as appropriate imaging facilities and high-quality interventional X-ray rooms. In addition to providing elective care for a wide range of patients, the need for emergency IR services is widely recognised in the management of trauma, vascular disease and sepsis and for the control of haemorrhage. Alongside ongoing service reconfigurations, an increase in the number of trained interventional radiologists and interventional nurses and radiographers is required if safe and sustainable OOH services are to be established and maintained. The increasing clinical role played by IR staff requires changes in the way that these highly specialised doctors are trained and this needs to be reflected in the way that job plans are developed. IR is a subspecialty of clinical radiology where DR underpins image-guided surgery. IR image-guided surgery requires the appropriate clinical time for ward work, outpatient clinics and access to day-case beds in line with other surgical specialties.

This is also the case for the interventional nurses and radiographers whose skills are vital to ensuring the safe delivery of care for patients undergoing interventional procedures. The delivery of high-quality interventional care is paramount and the need for further development of national registries and systemic analysis of outcome data has also been stressed.

In preparing this document we have set out the standards and requirements for the current position of IR within a modern NHS healthcare system. We have also stated the key elements required to ensure the sustainability and future of IR services.

Approved by the British Society of Interventional Radiology

Approved by The Royal College of Radiologists Clinical Faculty Board and the RCR/IR Committee

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Appendix 1: Training

IR gained subspecialty status in 2010. Subspecialty training is over a six-year period with three years dedicated to IR. When followed as part of a prospectively approved training programme, it leads to the award of a certificate of completion of training (CCT) in clinical radiology with interventional radiology subspecialisation CCT in CR(IR). A detailed subspecialty curriculum and a description of the assessment process are available on the RCR website (www.rcr.ac.uk/IRcurriculum).

Trainees are given a general radiology national training number (NTN) in year 1 and not specific IR training numbers. BSIR and the RCR recommend that access to IR from year 1 should be overseen by dedicated IR TPDs within each training region.

Appointment to IR training for years 4–6 will be made, in most circumstances, by interview halfway through year 3 (the General Medical Council (GMC) requirement is for trainees to be given three months' notice of their rotations).

Assessment of competence and completion of training will be made based on satisfactory progression through annual review of competence progression (ARCP) with evidence from a logbook of practical experience and workplace-based assessments.

There is currently no requirement for trainees to have exposure to IR on call as part of their core training.

Exposure to IR on call should, however, form a key part of subspecialty training to ensure trainees have adequate experience of the variety of emergency procedures before they take up a consultant post. This is recommended in their sixth year of subspecialty training.

The European Board of Interventional Radiology (EBIR) examination was established in 2010. This examination was developed by CIRSE and is endorsed by the European Society of Radiology (ESR) and the European Union of Medical Specialists (UEMS) interventional radiology division.

Applicants must have completed a satisfactory period of training in IR and must undergo written and oral examinations. The European Interventional Radiology curriculum was published in January 2013 and updated in February 2017.

The UK and European Interventional Radiology curricula are similar and the BSIR encourages UK trainees to complete the EBIR examination in addition to the RCR Fellowship Examination.

Appendix 2: Specialty areas

Specialty area: vascular disease

Interventional radiologists specialise in providing imaging and intervention for patients with peripheral arterial disease. This includes treating patients with trauma, athero-occlusive disease or aneurysmal disease at multiple sites.

Interventional radiologists work within the vascular team, which includes vascular and cardiothoracic surgeons, vascular anaesthetists, diabetologists, and renal and stroke physicians.

In those patients where invasive treatment is required, decisions about surgical and/or interventional radiological treatments are best made within a formal MDT setting.

Endovascular treatment options have increased particularly for critical limb ischaemia (CLI) and no patient with CLI should ever undergo amputation without discussion in an MDT setting where there is experience of infrapopliteal intervention.

There have been significant changes to the structure of vascular services and networks in recent years. Current recommendations advocate the centralisation of all inpatient arterial surgical intervention and the provision of 24/7 access to vascular specialist intervention.

The BSIR and the RCR support the objectives of vascular centralisation in improving patient outcomes, but this does not necessarily mean all vascular activity needs to be carried out in vascular hubs. It can be delivered safely in non-arterial centres. There are significant opportunities to deliver imaging and a large proportion of elective vascular interventional procedures via networks, particularly day-case angioplasty or stenting (such as lower limb angioplasty or fistuloplasty) within local hospitals. This also helps to maintain skills for local delivery of other non-vascular IR procedures – both elective and emergency. As for all patients with vascular disease, these cases should be discussed at the MDTM and there should be agreed local network protocols for the provision of appropriate procedures and rapid patient transfer policies in the event of a complication, as currently occurs for acute vascular emergencies.

The provision of 24/7 complex vascular intervention can be more safely and effectively undertaken within larger units that can provide all the elements required for a comprehensive clinical service. This will require changes to the provision of services by some local hospitals and may require staff to work within alternative structures. Interventional radiologists form a vital part of the 24/7 care for vascular emergencies and should be key members within the specialist team and available within a formal on-call rota.

Improving patient outcomes is supported by submission to appropriate registries including the NVR.

Specialty area: interventional oncology

Interventional oncology (IO) encompasses a range of minimally invasive image-guided techniques that may complement and, in some cases, replace surgery or medical therapies to improve outcomes with reduced costs.

IO techniques can be broadly divided into those that are purely palliative, such as stenting of the superior vena cava (SVC), biliary, urological or GI tracts to relieve symptoms, or therapeutic, where image-guided surgery can be the primary curative intervention or allow increased survival with an improved quality of life. Techniques may also act as an adjunct to facilitate surgery and/or other medical therapies such as radiotherapy and chemotherapy.

Oncology patients should now have all potential therapeutic options discussed with them to allow them to make informed decisions about their care. Interventional radiologists are central to this, ideally acting within an outpatient clinic setting, and they should also be present as part of an MDT that includes medical and radiation oncologists and associated surgical specialists.

Treatment decisions should be made within an MDT, where all treatment options can be considered with detailed knowledge of the individual patient's condition and stage of disease.

Although often highly successful, as evidenced by the BSIR UK Registry of Oesophageal Stenting (ROST) and the recently published BSIR Biliary Drainage and Stenting Registry (BDSR), the morbidity and mortality associated with the IO treatments can be high (BDSR mortality 19.8%). It is important that clinicians, operators and patients are all aware of these risks so that a fully considered risk–benefit assessment can be made with full informed consent obtained prior to treatment.

All IO practitioners should have a robust knowledge of the various IO treatment options as well as cancer staging classifications in order to optimise patient selection and treatment planning. Training in IO includes development of a thorough understanding of both physical anatomy and of imaging techniques, particularly cross-sectional imaging, in addition to specialist IR training in the use of the different vascular ablative, non-arterial ablative and other palliative techniques.

A trust's infrastructure needs to ensure that interventional radiologists operate within a team of specialist clinicians contributing to decision-making, follow-up and procedural care to ensure patient access to the highest quality of care.

Interventional radiologists are encouraged to participate in appropriate national IO registries such as the BDSR and the SIRT registry.

The supporting data for some IO techniques continue to evolve. Some of these techniques remain experimental and should be continuously evaluated in clinical trials to assess how they measure up in terms of both outcomes and cost-effectiveness compared with other surgical and medical therapies.

Specialty area: paediatric intervention

A subset of interventional radiologists specialise in diagnostic and therapeutic interventions in children. This includes diagnostic procedures such as tumour biopsy, bronchography and angiography, and therapeutic procedures such as drain or stent placement, angioplasty, sclerotherapy, feeding tube placement and central venous access. Paediatric IR provision significantly lags behind that available for adults, despite a national review of services and subsequent clinical recommendations made in 2010. The BSIR and the RCR strongly support the provision of 24/7 paediatric IR services within specialist paediatric units across the UK in parallel with robust policies within DGHs and other units without paediatric IR skills for the timely transfer of unwell children to specialist units when this is required. This aims to eliminate the current two-tier system of healthcare that currently exists between adult and paediatric services within the UK and is of particular importance in accredited trauma centres. It is no longer acceptable that specialist paediatric centres have no policy in place for the safe and timely provision of acute IR services for children in need of care.

It is recognised that establishment of comprehensive regional paediatric IR services will require an increase in formal training opportunities as well as consultant posts, with concomitant growth in paediatric-specific IR facilities and paediatric IR nursing and radiographer numbers. This requires recognition of the importance of paediatric IR services by specialist children's units, financial investment, support for existing IRs to develop some paediatric IR skills and an openness to exploring additional options for paediatric IR service delivery, such as role extension by surgeons and anaesthetists as well as nurses and radiographers.

Specialty area: renal intervention

Interventional radiologists provide essential support to renal units including tunnelled central venous catheter insertion for dialysis, fistula intervention and native renal angioplasty and stent placement.

As the population ages the number of patients undergoing dialysis will increase. Approximately 100 patients per million population start dialysis each year, of which 70 will undergo haemodialysis. The most effective and safest form of dialysis is via a surgical arteriovenous fistula. However, dialysis fistula stenosis or thrombosis occurs frequently, at a rate of about 15 per hundred fistula-years, and access to radiological intervention is critical for preserving fistula function.

Complex interventions to provide venous access for dialysis, consequent to an aging population and longer periods of dialysis, are required more frequently and are likely in the future to require an increasing proportion of IR resources.

Providing support for fistula angioplasty, intervention and central venous access is vital but has significant resource implications. It has been estimated that a minimum of two IR sessions per week are required for every 100 patients undergoing haemodialysis.

Increasing demand and changes to service provision are reflected in a high variability in access to prompt fistula intervention.

The complex nature of these interventions, and frequent patient comorbidities, mean that MDT discussion prior to any intervention is advised.

Terminology

ARCP:	annual review of competence progression
BDSR:	Biliary Drainage and Stenting Registry
BIAS:	British Society of Interventional Radiology Iliac Angioplasty and Stenting registry
BSIR:	British Society of Interventional Radiology
BSIR-QI:	British Society of Interventional Radiology Quality Improvement
CIRSE:	Cardiovascular and Interventional Radiological Society of Europe
CT:	computerised tomography
DGH:	district general hospitals
ESR:	European Society of Radiologists
EWTD:	European working time directive
GI:	gastrointestinal
HCA:	healthcare assistants
IR:	interventional radiology
IVC:	inferior vena cava
OOH:	out of hours
MHRA:	Medicines and Healthcare Products Regulatory Agency
MR:	magnetic resonance
NHSI:	National Health Service Improvement
NICE:	National Institute for Health and Care Excellence
NTN:	national training number
NVR:	National Vascular Registry
RCR:	Royal College of Radiologists
ROST:	Registry of Oesophageal Stenting
SIR:	Society of Interventional Radiologists
SIRT:	selective internal radiation therapy
UEMS:	European Union of Medical Specialists
US:	ultrasound



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