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Hybrid imaging guidance on legislative, reporting and training aspects

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Foreword

The introduction of hybrid imaging (positron emission tomography-computed tomography [PET-CT] and single photon emission computed tomography-computed tomography [SPECT-CT]) into the clinical domain at the start of the 21st century has resulted in unprecedented growth and revolutionised the imaging world. More recently positron emission tomography-magnetic resonance imaging (PET-MRI) has emerged as a powerful adjunct but has yet to translate into routine clinical practice. This guidance document, prepared for the Intercollegiate Standing Committee on Nuclear Medicine (ICSCNM) by members of The Royal College of Radiologists (RCR), the Royal College of Physicians (RCP) and The British Nuclear Medicine Society (BNMS), comprises an up-to-date summary of important legislative, reporting and training aspects related to hybrid imaging. The ICSCNM wish to particularly thank the lead author, Dr Clare Beadsmoore (RCR), and Dr John Buscombe (RCP) and Professor Sobhan Vinjamuri (BNMS) who helped co-ordinate the development of this collaborative document.

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Introduction

Use of the hybrid technique of PET-CT is rapidly increasing, particularly in oncology but also in other areas such as neurology and cardiology. Anatomical imaging has been widely used to detect disease and monitor its response to treatment but this has its limitations, with anatomical manifestations often lagging behind functional changes. With the advent of hybrid imaging techniques such as PET-CT, it is possible to look beyond morphology to evaluate the functional aspects of the pathology and this has proven to be more sensitive and specific in detecting disease. PET-CT has become an established modality with a pivotal role in oncology imaging.

There has been a significant increase in the provision of PET-CT imaging across the UK with a threefold increase from 2008 to 2014, in part due to NHS England commissioned national contracts, supported by validated evidence on the technique's usefulness, which has been summarised in *Evidence-based indications for the use of PET-CT in the UK 2016*, produced by The Royal College of Radiologists (RCR), the Royal College of Physicians of London (RCP), the Royal College of Physicians and Surgeons of Glasgow, the Royal College of Physicians of Edinburgh, the British Nuclear Medicine Society (BNMS) and the Administration of Radioactive Substances Advisory Committee (ARSAC) and a commentary in *Clinical Radiology*.^{1,2}

From 2014 onwards, this increase has continued at approximately 15% year on year with PET-CT becoming the only imaging service in England to be nationally procured under the auspices of the Specialised Commissioning Board. Similar strategic developments in Scotland and Wales have led to an increase in availability of the technique with fixed-site installations in Glasgow, Edinburgh, Aberdeen, Dundee and Cardiff. Despite all of these positive steps, the UK still under uses PET-CT, performing approximately 1,250 studies per million population, 58% below the Western European average.³

Conventional gamma camera nuclear medicine imaging is now often being replaced by hybrid combined nuclear and anatomical imaging. Volumetric functional information from SPECT combined with the anatomical information from CT is a growth area in many general nuclear medicine departments, many of which are replacing conventional gamma cameras with SPECT-CT devices, recognising the increased specificity and sensitivity that hybrid imaging provides over each modality individually.

With the additional complexities of the introduction of new tracers, new applications for PET-CT, the expansion of SPECT-CT and the introduction of new hybrid imaging combinations such as PET-MRI, the increased use of hybrid imaging in clinical pathways seems set to continue to increase for the foreseeable future. This poses considerable challenges in developing and maintaining a workforce with the competences required for hybrid study interpretation, particularly when 23% of UK radionuclide radiologists are expected to retire by 2019.⁴

The purpose of this document is to provide advice for Fellows and members, reporters and commissioners, trainees and established consultants, in training and maintaining competence in complex hybrid imaging techniques and the associated legislative requirements.

Legislative aspects

The administration of radioisotope labelled tracers may only take place following justification by an Administration of Radioactive Substances Advisory Committee (ARSAC) certificate-holder, employed by the host trust/organisation (NHS trust, university or private hospital). Under the Ionising Radiation (Medical Exposures) Regulations (IR(ME)R), the ARSAC certificate holder acts as practitioner and will normally advise the employer of the appropriate training requirements and scope of entitlement of individuals who wish to report hybrid imaging procedures under their certificate.⁵ Each ARSAC certificate is site, tracer and indication specific although some indications are broad, for example, fluorodeoxyglucose (FDG) for whole-body tumour imaging. Additions to certificates to include new serials for tracers and techniques not already included in the certificate of the ARSAC certificate holder will require evidence of appropriate training and experience whatever their background.

The CT component of a hybrid imaging study is justified under IR(ME)R and similarly this justification can only be performed by a practitioner with appropriate training and experience.

Usually both components of a hybrid imaging study will be justified by the same practitioner although in complex cases it is possible that some hybrid studies will require a separate practitioner for the nuclear medicine and cross-sectional components of the study.

Formal training routes for nuclear medicine training and ARSAC certification

There is global variability in training and accreditation for hybrid image reporting.⁶ There is overlap between the disciplines of PET-CT and SPECT-CT, with the anatomical component common to both. Thus once training and competence has been achieved in the anatomical component of one of these modalities, this would be skill transferable to the other modality in respect of the same body part. As such this document will discuss the various aspects of PET-CT in more detail than SPECT-CT.

There are three structured routes for an imaging specialist to acquire the necessary education and skills for ARSAC certification.

1. A nuclear medicine physician with a Certificate of Completion of Training (CCT) in nuclear medicine has comprehensive education and training in diagnostic and therapeutic aspects of nuclear medicine to satisfy requirements for a diagnostic ARSAC certificate for all procedures included in Appendix I (Parts A and B) and a therapy certificate for procedures included in Appendix I (Part C) of the *ARSAC Notes for guidance on the clinical administration of radiopharmaceuticals and use of sealed radioactive sources*.⁷
2. A dual-accredited radiologist has comprehensive training in all aspects of radiology and nuclear medicine, with a CCT in clinical radiology and a Certificate of Eligibility for Specialist Registration – Combined Programme (CESR-CP) in nuclear medicine. These individuals will satisfy the requirements for ARSAC certification in the same way as a nuclear medicine physician.
3. A radionuclide radiologist with a CCT in clinical radiology has specialty training to satisfy the requirements for a diagnostic ARSAC certificate for imaging procedures included in Appendix I (Part A) from the ARSAC Notes for Guidance.⁷ Additional training in PET-CT may be required to satisfy the requirements for diagnostic serials for FDG PET-CT and those in Appendix I (Part B).⁷

Formal training routes for cross-sectional imaging

Radiologists, including radionuclide radiologists and dual-accredited radiologists, will have received comprehensive training in all aspects of cross-sectional imaging (CT and MRI) to the standard deemed necessary by the RCR to pass the FRCR examination and achieve a CCT in clinical radiology.⁸

Nuclear medicine specialists who train on the 2014 curriculum will have trained in core radiology and completed the FRCR examination prior to obtaining the Postgraduate Diploma in Nuclear Medicine and completing nuclear medicine training.⁹

Nuclear medicine specialists who trained on the 2010 specialty training curriculum will have also received training in the CT component of PET-CT and can apply these skills to the CT component of SPECT-CT reporting.¹⁰

Nuclear medicine physicians who trained prior to 2010, before the introduction of hybrid imaging, will generally need additional training in cross-sectional imaging to enable accurate interpretation of hybrid studies.

Alternative training for reporters of hybrid studies

For those wishing to train in hybrid imaging outside of the three formal pathways described above, training requirements will differ depending on the imaging specialist's previous background.

Whenever learning a new technique, training needs to be undertaken to ensure understanding of the science underpinning the physics, instrumentation, radiopharmacy, legislation and pathophysiology of the conditions being considered.

Experience may be developed gradually through exposure, but specific additional appropriate training is frequently required to develop further competence. The following section of this document uses PET-CT training as an example but the same principles should be applied to other hybrid techniques.

Reporters will need to collate a portfolio of evidence which may be made up from a combination of the following.

- A log of experience in interpretation of individual examinations, specifying whether each is an archived case, a solo read scan or a dual read study with an experienced reporter, ideally with reflective commentary. As a rough guide, 600 cases is considered likely to provide a sound basis for preparation to allow independent reporting for FDG PET-CT by those experienced in other aspects of nuclear medicine.
- Attendance at a recognised course such as that provided by European Association of Nuclear Medicine (EANM) PET-CT school (a month-long course) followed by providing mentored first reports in an audited framework.
- Formal attachment at a PET-CT training centre.
- A blend of learning techniques such as e-learning, direct supervision and providing first reports in an audited framework.¹¹

Individuals who are already trained in FDG PET-CT and who wish to develop additional experience in emerging aspects such as the introduction of new tracers may follow similar training pathways with suggested mentored review of 50–100 cases in an audited framework.

The Society of Nuclear Medicine and Molecular Imaging has developed a very useful website (*PET Professional Resource and Outreach Source: PET PROS*) which is freely available and provides extensive resources on emerging applications of PET-CT.¹² There are web-based resources which can be used to augment face-to-face learning, continuing medical education and maintenance of competence. In particular, the Society of Nuclear Medicine and Molecular Imaging provides a web-based repository of PET-CT training cases.¹³ The Christie School of Oncology provides several workshops and is developing a range of web-streamed events and King's College London is developing short courses which are aimed to be more accessible than the formal Nuclear Medicine MSc and Diploma course.^{14,15}

Who can report a hybrid imaging study?

The purpose of the imaging report in hybrid imaging is to provide a specialist, integrated interpretation of both the PET or SPECT (functional) and the CT or MR (anatomical) components of the study. Individuals reporting these studies need to be trained and competent in both functional and anatomical imaging. The imaging specialist reporting the study must also have the appropriate training to enable them to relate the imaging findings, both expected and unexpected, to the patient's current clinical symptoms and signs. This should take into account previous imaging and incorporate advice to the referring clinician on further investigation and management where appropriate.¹⁶

The functional and anatomical components of the hybrid imaging studies may be reported by a single individual who is trained and competent in both aspects of the study. In the absence of the ability to demonstrate the above competencies, collaborative double reporting is an acceptable alternative model. This may be particularly relevant in specialist areas, for example in specialist musculoskeletal (MSK) SPECT-CT imaging where a nuclear medicine physician and MSK radiologist could work together to form a collaborative double report.

Maintaining competence

All clinicians who report hybrid imaging need to demonstrate their competency through regular audit of their practice. Those reporting PET-CT studies in England are required by the NHS England PET-CT specification to participate in a 10% external audit programme and the RCR recommends that by 2018 workflow-efficient electronic peer feedback to original reporters should be facilitated through review of 5% of previous imaging as part of the normal work flow.¹⁷⁻¹⁹ This will provide useful documentary evidence of individual reporting competence for appraisal and revalidation.

Individuals should work within a co-operative team with robust clinical governance procedures in place to provide the best outcomes for patients.

Important collective and individual learning, as well as system changes, occur through learning from discrepancies meetings and quality improvement meetings and participation in these is to be encouraged.²⁰

Audit, attendance at multidisciplinary team (MDT) meetings and learning from discrepancy meetings with efficient systems in place for feedback of errors should occur in hybrid imaging, as with all imaging, and should be carried out in all imaging departments in compliance with the employer's clinical governance procedures.

For all clinicians, training is followed by annual appraisal and a five-yearly revalidation process to establish their continued fitness to practise which includes evidence of appropriate continuing professional development (CPD).

MDT meetings

Those presenting PET-CT studies at MDT meetings but who are not themselves trained to report PET-CT need to understand the indications and limitations of the technique and familiarise themselves with the necessary software. A visit to their local PET-CT centre to establish good links and to acquire the required skills is advised; opportunities for such visits should be made available on request.

There should be open lines of communication between the MDT and PET-CT reporters. Clinicians presenting PET-CT should not amend or alter a PET-CT report, unless they are a trained PET-CT reporter, and then only with feedback to the primary reporter of the examination. If doubt is raised within the MDT, for example, due to additional clinical information being made available, further discussion with the reporting clinician is advocated in the first instance to enable an addendum to be added.

There are now a number of one-day educational courses in the UK which are specifically targeted at MDT radiologists who wish to gain a fuller understanding of PET-CT.

Conclusion

Hybrid imaging is now firmly established and its use in the UK is increasing. Growing demand, along with the introduction of novel PET tracers into clinical practice, emerging non-oncological PET-CT applications, the advent of PET-MRI and increasing use of SPECT-CT result in challenging training needs for the hybrid imaging reporter. This document provides a strategic overview of training and maintenance of competence in the reporting of hybrid imaging.

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