How we manage radiation protection in our country
Royal College of Radiologists

iRefer: Making the best use of clinical radiology

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The Royal College of Radiologists (RCR) has produced the radiology referral guidelines *iRefer: Making the best use of clinical radiology (formerly Making the Best Use of a Department of Clinical Radiology)*[1] for over 20 years. The current edition, the seventh, which is online (free for NHS professionals in the UK) was published in 2011 and available in hard copy and as an app (Figure 1) (2012). The methodology is based on the AGREE instrument[2] and accredited by NICE Evidence.[3] The aim is to recommend the most appropriate investigation to address a clinical question or scenario, leading to accurate diagnosis with the minimum of radiation or intervention and the most cost-effective use of resources. Recommended radiological investigations are an accepted part of medical practice justified at ICRP level 2[4] in terms of clear clinical benefits to the patient, which should far outweigh the small radiation risks.

Under Article 6 of Directive 97/43/EURATOM,[5] Member States shall ensure that recommendations concerning referral criteria for medical exposure, including radiation doses, are available to the prescribers of medical exposure. This information is required in order to justify exposures in a proper way and to identify the best procedure for the desired outcome. Under *The Ionising Radiation (Medical Exposure) Regulations 2000 (IR(ME)R 2000,*[6] [as part of the duties of the employer, the employer should establish recommendations concerning referral criteria for medical exposures, including radiation doses, and shall ensure that these are available to the referrer.

RCR *iRefer* guideline development

The development of the *iRefer* guidelines has evolved over its seven editions to incorporate a more evidence-based approach. Split into 12 sections, the full resource consists of over 300 fully searchable guidelines designed to assist the clinician in selecting the most appropriate investigation for a given diagnostic or imaging problem.

Each section sets out the clinical scenario, including clinical red flags (see Figure 2), and lists relevant procedures with an indication of the associated radiation dose. For each procedure, there is a recommendation on its appropriateness (together with the grade). Finally, an explanatory comment is included when required to clarify the circumstances in which the procedure should be used.

The recommendations used are:

1. Indicated. Investigations most likely to contribute to the clinical diagnosis and management.

2. Specialised investigation. Specialised investigations are frequently complex, time-consuming or resource intensive, and will usually only be undertaken after discussion with the radiologist or according to locally agreed protocols.

3. Indicated only in specific circumstances. Non-routine investigations, usually only undertaken if a clinician provides cogent reasons or if the radiologist believes the examination represents an appropriate means of furthering the diagnosis and management of the patient. With certain clinical problems which may resolve with time, it may be correct to defer investigation.

4. Not indicated. Investigations for which the proposed rationale is no longer appropriate. Recommendations are graded according to evidence levels.[7,8] The highest level of evidence and the relevance/applicability of the evidence to the clinical problem have been used to determine the grade of recommendation. In many instances, a grade B or C reflects the supporting evidence base rather than the importance of these recommendations to the clinical problem addressed.

These grades used, based on the quality of evidence, are as follows:

[A] Any of the following
- » High-quality diagnostic studies in which a new test is independently and blindly compared with a reference standard in an appropriate spectrum of patients
- » Systematic review and meta-analyses of such high-quality studies
- » Diagnostic clinical practice guidelines/clinical decision rules validated in a test set

[B] Any of the following
- » Studies with a blind and independent comparison of the new test with the reference standard in a set of non-consecutive patients or confined to a narrow spectrum of patients
- » Studies in which the reference standard was not applied to all patients
- » Systematic reviews of such studies
- » Diagnostic clinical practice guidelines/clinical decision rules not validated in a test set

[C] Any of the following
- » Studies in which the reference standard was not objective
- » Studies in which the comparison of the new test with the reference standard was not blind or independent
- » Studies in which positive and negative test results were verified using different reference standards
- » Studies using an inappropriate set of patients
- » Expert opinion.

In these referral guidelines, the doses have been grouped into broad bands to help the referrer understand the order of magnitude of radiation dose of the various investigations (Table 1). Figure 3, adapted from Hart *et al*,[9] shows the value of awareness of radiation dose in the UK.

Do guidelines work?

There is evidence that justification is lacking for many radiological procedures and that the number of such procedures may be reduced by use of referral guidelines. Justification when using guidelines can reduce the number of examinations by 20%,[10,11] with the potential for a 44% reduction.

The RCR carried out a national audit of appropriate imaging in 2013, assessing the basic organisation and process for justification using a sample of CT and MRI examinations requested from primary care. Findings showed that:
- » Imaging referral guidance available in only two-thirds of UK radiology departments
- » Meticulous vetting/justification of 95–96% of exams requested by GPs – within standard of 95%
- » Appropriateness of imaging in 92–93% of exams requested by GPs – within standard of 90%.

Guidelines help referring practitioners, radiology practitioners, health organisations and, most importantly, patients. Continuous quality improvement methods will influence referral patterns.

Table 1. Band classification of the typical doses of ionising radiation from common imaging procedures

Symbol	Typical effective dose (mSv)*	Examples	Lifetime additional risk of fatal cancer/ exam
0	0	US; MRI	0
☢	<1	CXR; XR limb, pelvis, lumbar spine; mammography	<1:20,000
☢☢	1–5	IVU; NM (eg, bone); CT head and neck	1: 20,000–1:4,000
☢☢☢	5.1–10	CT chest or abdomen; NM (eg, cardiac)	1: 4,000–1: 2,000
☢☢☢☢	>10	Extensive CT studies, some NM studies (eg, some PET-CT)	> 1: 2,000

*The average annual background dose in most parts of Europe falls within the 1–5 mSv range (☢☢). Cancer risks from radiation vary considerably with age and sex with higher risks in infants and females. Cancer risk indicated in this table is averaged for adults. This should be taken in the context of the considerably higher 1 in 3 average lifetime risk for cancer and must be balanced against the benefit of the investigation.

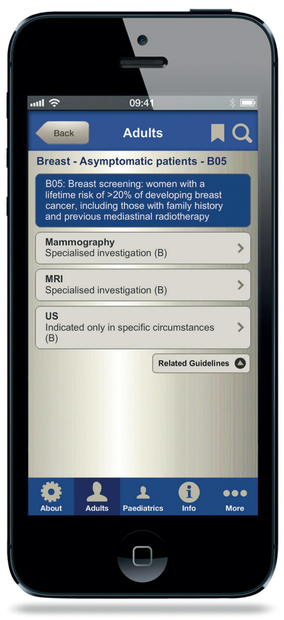

Figure 1: *iRefer* is available for both smartphones and tablets. Advice for the screening of asymptomatic patients is covered in *iRefer*.

Figure 2: Recommendations for imaging for acute back pain with red flag features from *iRefer*[1]. The clinical red flags help clinicians to select the correct imaging referral guideline to follow.

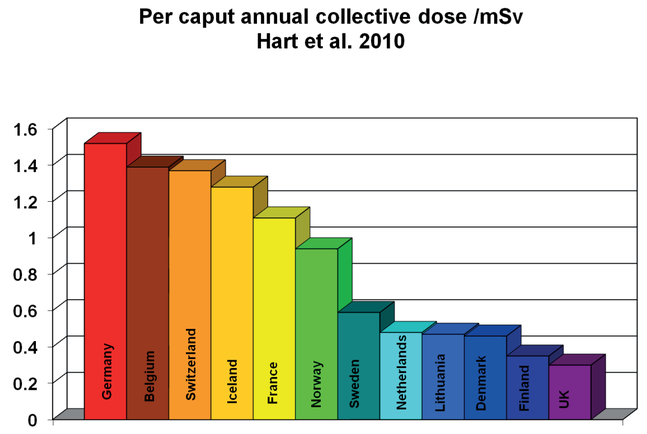

Figure 3. Per caput annual collective effective dose from diagnostic medical exposures in Europe[9]. Awareness of radiation dose may result in lower doses in the UK.

Poster References:

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