National audit of appropriate imaging

D. Remedios a,*, K. Drinkwater b, R. Warwick c On behalf of the Clinical Radiology Audit Committee (CRAC), The Royal College of Radiologists, London

a Department of Clinical Radiology, Northwick Park Hospital, Harrow, HA1 3UJ, UK
b The Royal College of Radiologists, London, UK
c Department of Clinical Radiology, Buckinghamshire Healthcare NHS Trust, UK

AIMS: To audit the availability of imaging referral guidelines; vetting by radiologists of GP-initiated CT and MRI requests; and the achievement of appropriate imaging using retrospective assessment as a surrogate.

MATERIALS AND METHODS: A web-based questionnaire was distributed to imaging departments in the UK seeking awareness of guideline availability; the percentage of consecutive general practitioner (GP)-requested computed tomography (CT) and magnetic resonance imaging (MRI) investigations that showed evidence of vetting; and the percentage of procedures where retrospective assessment showed the investigation to be appropriate according to imaging referral guidelines.

RESULTS: Replies were received from 88 departments covering 1700 of 2700 (63%) consultant radiologists practising in the UK. Regarding the availability of guidelines, approximately a third of respondents were not aware of guidelines being available to all radiologists and radiographers. The 68% level of availability (58/88 departments) is well below the standard of 100%. In keeping with the target of 95%, vetting of CT requests was shown in 1815/1890 (96%) and MRI in 1181/1250 (95%). Appropriateness of CT examinations was shown in 1746/1870 (93%) and MRI in 1154/1215 (95%), well above the target of 90%. The most common reason for an inappropriate investigation for both MRI and CT was the inability to affect patient management.

CONCLUSIONS: Although awareness of referral guidelines availability was limited at 68%, well below the 100% standard, the meticulous vetting of requests (shown in 95–96%) with the amendment or return of inappropriate requests (9–12%) enables a high level of appropriate imaging (93–95%) for GP-requested CT and MRI, thus making the best use of clinical radiology.

© 2014 The Royal College of Radiologists. Published by Elsevier Ltd. All rights reserved.
Use of imaging referral guidelines has been shown to improve appropriateness of imaging, reducing numbers of examinations typically by 20%. Diagnostic radiology in USA accounts for almost as much radiation per capita as natural background causes (15% in 1980 rising to 48% in 2006). In the UK, although there has been a 23% increase in 10 years, diagnostic radiology still only accounts for <20% of the per caput dose. Given similar standards of healthcare but with half the percentage gross domestic product (GDP) expenditure than in the USA, the lower UK per caput dose is achieved largely through the appropriate use of clinical radiology.

Imaging referral guidelines with dose information are required to be available under the European Medical Directive 2013/59 Euratom and the UK Ionizing Radiology (Medical Exposures) Regulations 2000 (IRMER). The Royal College of Radiologists (RCR) has published referral guidelines for over 20 years principally to guide GPs and non-specialist clinicians. Other referral guidelines are available through the American College of Radiology, Canadian Association of Radiologists, French Society of Radiology, and Government of Western Australia.

Making referral guidelines available is the responsibility of healthcare employers and is an essential part of clinical governance. It is acknowledged that not every guideline can be implemented immediately on publication, but mechanisms should be in place to ensure that practice is reviewed against the guideline recommendations and the reasons for any differences assessed and, where appropriate, addressed.

Imaging referral guidelines such as iRefer: Making the best use of clinical radiology (guidelines) inform decisions not as a protocol and work best as part of clinico-radiological dialogue. IRMER impose a responsibility on imaging departments to ensure that all exposures to ionizing radiation are justified. Guidelines assist ICRP (International Commission on Radiological Protection) level 2 justification when ionizing radiation examinations are used, and especially, for high-dose procedures such as CT. Vetting of MRI examinations is equally important to ensure good medical practice and cost-effectiveness, particularly in the early days of commissioning from primary care where sustainability is essential. Furthermore the detection of unsuspected incidental findings, estimated at 2–69% may lead to further wasteful use of imaging. It is accepted that in individual cases there may be deviation from the indicated investigation due to the patient’s age, comorbidity, or to non-availability of an investigation locally. Encouragement and improvement may be achieved by a variety of means including patient-specific reminders to referrers in workflow, continuing medical education, training, and clinical audit with feedback. The value and need for clinical audit to monitor justification has been set out in the Euratom Directive, and IRMER, reiterated in Europe globally through the International Atomic Energy Agency in its campaign for “Awareness, Appropriateness and Audit” and the need for monitoring has been highlighted in the International Basic Safety Standards.

Materials and methods

The standards adopted for this audit are based partly on legislation and partly on expert consensus by the RCR Clinical Radiology Audit Committee (CRAC). Three standards based on the audit principles of structure, process, and outcome were used: (1) imaging referral guidelines with dose information should be available to all justifying practitioners (radiologists and radiographers to whom the task of justification has been delegated). As this is a mandatory duty under IRMER, the target is 100%; (2) all requests for CT and MRI from GPs should be vetted individually or through an agreed protocol. To take into account emergency referrals, the target is 95%; (3) compliance with guidelines, where applicable, should be demonstrated for GP-requested CT and MRI examinations (excluding subsequent investigations, usually for problem-solving, initiated at the recommendation of a radiologist). To take into account individual patient needs and contraindications (e.g., pacemakers) the target is set at 90%.

Although the aspirational standard of 100% is applicable to the element governed by legislation viz. the availability of guidelines, a realistic target of 95% was used for evidence of vetting to allow for emergency cases where vetting would result in delay. The lower figure of 90% for guideline compliance allows for the expected deviation from generic justification when applying individual justification at ICRP level 3.

A questionnaire requesting anonymized data was devised by the RCR CRAC and distributed through a web-based questionnaire (SurveyMonkey™ Palo Alto, California, USA; www.surveymonkey.com) to all UK departments of radiology (See Supplementary Material Appendix A). Departmental audit leads were invited by e-mail to participate, using addresses held by the RCR Audit Committee. Participants were asked to state whether guidelines were available locally (Standard 1). Participants were then requested to collect data through local radiology information and picture archiving systems (RIS-PACS) from at least 30 consecutive CT and 30 consecutive MRI examinations referred by GPs. For each examination record was be made for: the presence/absence of documented vetting OR justification at ICRP level 1, 2, or 3.

A question was asked to help identify reasons for good practice/difficulties included: size and type of hospital; an estimate of percentage of returned, unjustified GP requests for CT and MRI; an estimate of percentage of examinations in which the technique has been changed; the number of CT and MRI units in department; the number of radiologists in department; and the availability of local protocols.
Results

Response rate

Replies were received from 88 departments covering 1700 of 2700 (63%) consultant radiologists practising in the UK. Geographically, responses were roughly in proportion to the population of the four countries of the UK (Fig 1).

Regarding the availability of guidelines, approximately a third of respondents were not aware of guidelines being available to all radiologists and radiographers. The 68% level of availability (58/88 departments) is well below the standard of 100%. Half of respondents reported the use of print copy locally.

In keeping with the target of 95%, vetting of CT requests was shown in 1815/1890 (96%) and MRI in 1181/1250 (95%). The majority of departments are within the upper and lower control limits indicating common cause for variation (i.e., approaching normal distribution) with few low outliers (Figs 2–3).

Appropriateness of CT examinations was shown in 1746/1870 (93%) and MRI in 1154/1215 (95%), well above the target of 90%. In the funnel plot, the majority of departments are within the upper and lower control limits indicating common cause for variation (i.e., approaching normal distribution) with few low outliers (Figs 4–6). Analysis of the 7–8% inappropriate investigations showed that CT was often not the best investigation. The most common reason for an inappropriate investigation for both MRI and CT was the inability to affect patient management (Fig 7).

Additional information to clarify difficulties and identify solutions included: estimates of the numbers of CT and MRI examinations performed or not performed by departments at GPs’ request (Fig 8). The percentage of CT requests not performed (12%) was a third higher than for MRI (9%); estimates of the numbers of CT and MRI examinations performed by departments at GPs’ requests (Fig 9). Most departments perform fewer than 25 GP-requested CT examinations per week (75%) and/or fewer than 25 MRI examinations per week (70%); availability of tools to help with vetting and justification (Fig 10). Patient pathways were commonly available (in over two-thirds of departments)

but designated time for vetting was infrequent (less than a third); initiatives in place for improving appropriateness (Fig 11). The most common initiatives were feedback through clinic–radiological meetings, and education of medical students and junior doctors; support for tools of appropriate imaging (Fig 12). Training and educational initiatives other than computer-aided learning had the greatest support followed by feedback at meetings. Provision of guidelines through electronic requesting systems had more support than standalone clinical decision support systems.

Discussion

Lack of awareness of guideline availability may not be the same as non-availability of guidelines. Possible reasons for failure to reach the 100% standard of guideline availability include the fact that only 58/88 (66%) of departments have online access. Half of all departments still use paper copy. Since this audit was performed, the shortfall in online access has been addressed following recent introduction of intranet access of RCR guidelines to all National Health
Service (NHS) workers in England along the same lines as distribution in the rest of the UK.

Achieving standards for vetting (95%) and for achievement of appropriate imaging (90%) were possible even in the absence of widespread guideline availability. These figures compare well with the published figures of 80% for justification of CT in a Swedish study.22 Standards were achieved through radiologists’ meticulous vetting and, where necessary, changing of technique from the investigation requested to a more appropriate imaging method or to clinical assessment in 12% of CT requests and 9% of MRI requests. The one-third higher rate of change for CT compared with MRI requests probably reflects the awareness and need for radiation safety. This vetting process is an integral part of the clinical radiologist’s job, but in only one-third of cases is time formally allocated.

The existence of clinical or imaging pathways in over 70% of departments facilitates appropriate imaging. This basic form of clinical decision support would be usefully augmented by a computerized process, most easily through existing electronic request systems. This point reaches 75% consensus on a balanced Likert scale.

Educational and training initiatives are important and favoured by most departments with face-to-face feedback at clinico-radiological meetings (multi-disciplinary team meetings).

Differences in practice amongst departments with regard to the vetting process and in the achievement of appropriate imaging show common cause variation, i.e., differing only as expected through a normal distribution. Improvement of such practices is only achievable through a change in process. Radical improvement in the level of appropriate imaging is unlikely given the high levels achieved in the UK. However, the principles of supporting the considerable efforts of UK radiologists through electronic requesting systems, which facilitate vetting and access to guidelines, and also introduction of efficient computer-based tools for decision support in real time may lead to a faster turnaround time. Furthermore, recognition through job planning, of
time spent vetting requests will certainly help the concept of corporate responsibility for quality and safety in radiological imaging—very much part of clinical governance in healthcare.

Planning imaging facilities and commissioning of imaging procedures should take into account the following: paper copy of guidelines is still used in 50% departments; and GP-initiated CT and MRI requests are carried out in 30% and 45% of departments respectively, hampering the amendment of inappropriate requests.

Limitations of the present study include the narrow focus on GP-requested CT and MRI. Although extrapolation to other referrers seems logical, requests from GPs have particular challenges different to those from hospital doctors. Strategies for improvement in appropriate imaging will differ according to the referrer, their availability for discussion, and feedback.

Figure 8 GP-initiated CT and MRI requests: estimates of numbers performed/not performed weekly. The proportion of requests amended or not performed for CT (12%) was a third higher than for MRI (9%).

Figure 9 The number of GP-initiated CT and MRI examinations performed weekly by departments. Few departments performed more than 50 CT or MRI cases per week for GPs. Approximately a third of departments do not perform CT or do not perform MRI at GPs’ requests.

Figure 10 Additional information for improving appropriateness of imaging: availability of tools to help with vetting and justification. The frequent use of pathways for CT and MRI may help to explain the success at achieving appropriateness. (Data are from 84 responding departments.)

Figure 11 Initiatives in place for improving appropriateness of imaging: percentage of departments reporting such initiatives. Feedback in context at clinic—radiological meetings may help explain acceptance of appropriateness of imaging.

Figure 12 Support for tools of appropriate imaging. Departments expressed their level of support on a balanced five-point Likert scale.
Future studies including other imaging techniques, especially ultrasound, would provide a more representative view. Inclusion of primary-care requests from the emergency department by junior doctors would have widened the scope to include most of the intended end-users of guidelines satisfying the objective to provide guidance for the best test first. Furthermore, widening of the audit to include referrers as well as radiologists would address the need for guidelines at the point-of-care.

In conclusion, although awareness of referral guidelines availability was limited at 68%, well below the 100% standard, the meticulous vetting of requests (shown in 95–96%) with the amendment or return of inappropriate requests (9–12%) enables a high level of appropriate imaging (93–95%) for GP-requested CT and MRI, thus making the best use of clinical radiology.

Acknowledgements

This study was devised and performed by the CRAC of the RCR. The authors acknowledge the considerable work put in by participating audit leads across the UK and also the staff of the College who helped with collation, analysis, and distribution of results.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.crad.2014.05.109.

References