Increasing emphasis on appropriateness of x-ray imaging as a major element of patient dose reduction programmes

Hugh Wilkins Medical Physics Department, Royal Devon and Exeter Hospital, UK

Drivers to reduce patient dose from x-rays

Doses from medical exposures are by far the largest source of artificial radiation dose to the world's population. Use of CT and interventional procedures has greatly increased in recent years[1,2]. These are relatively high dose procedures and as a result patient doses have risen substantially; in some countries average doses from radiological imaging now exceed doses from background radiation[3,4].

Appropriate use of x-ray imaging provides huge benefit to healthcare. However there is growing recognition that many x-ray procedures are inappropriate, and the associated radiation doses thus unjustified[4,5,6]. An estimated 25% (at least) of CT scans are not clinically warranted[7].

Justification of medical exposures to radiation

ICRP continues to regard the principles of radiological protection:

justification, *optimisation and dose limitation*

as being fundamental for the system of protection[8].
Justification requires there to be a net benefit from the use of radiation and applies at three levels for medical exposures[9]. There are concerns about current efficacy of justification in the medical field[10].

1. In level 1 justification, the use of radiation in medicine in general is accepted as doing more good than harm - this is taken for granted.
2. Level 2 applies to a specified procedure for a specified purpose (e.g. chest radiography for patients with relevant symptoms). Referral/appropriateness criteria correspond to level 2 justification.
3. At the third level justification applies to individual patients. The draft EC Basic Safety Standards[11] require that all individual medical exposures shall be justified in advance, with both referrer and practitioner involved in the justification process. In the UK IRMER[12] R6 applies to justification of individual medical exposures.

Bonn Call for Action: … Justification, Awareness …

The *Bonn Call-for-Action* IAEA-WHO joint position statement[13] highlights ten main actions and related sub-actions identified as essential for the strengthening of radiation protection in medicine.

Action 1: ***Enhance implementation of the justification principle***

a) Introduce and apply 'the 3 A's':
awareness, ***appropriateness*** *and audit*
b) Develop harmonized evidence-based criteria to strengthen appropriateness of clinical imaging …
c) Implement clinical imaging referral guidelines globally …
d) Strengthen application of clinical audit in relation to justification
e) Introduce clinical imaging IT tools, e.g. decision support systems
f) Develop medical exposure justification criteria for asymptomatic populations and individuals (e.g. screening, health surveillance)

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Considerations influencing X-ray referral decisions

Clinical context:
"Will x-ray imaging affect patient management?"; Clinical urgency; 24/7 patient healthcare needs (7 day working, weekends, night-time); Referrer experience, clinical skills and confidence; Clinical suspicion; Prior expectation of disease; Predictive value of test; Prevalence of suspected disease; Junior doctors instructed to request x-rays; Opinion cf evidence; Customary practice; Protocol (e.g. screening CXR for all in-patients); Patient demand / expectation; Self-referrals; Defensive medicine; **Radiation risk**; Risk of not imaging; Co-existent pathology (e.g. impaired renal function affecting contrast toleration); Anatomical margins; Needs of other patients; …

Availability of imaging (X-ray, alternative modalities):
Equipment and staff; Referral process (ease, robustness, electronic, paper-based, restricted access to some examinations, justification/authorisation procedures); Timeliness of imaging procedures (waiting time, time slots, procedure time, reporting time); Reporting arrangements; …

Referrer knowledge and access to support systems:
Up-to-date knowledge of evidence-based strategies for patient condition; Junior doctor access to consultant support (3 a.m. phone call to boss?); Culture may inhibit juniors from asking why x-rays are needed; Access to radiologist; Availability of referral guidelines; Possibly limited understanding of radiation dose and risk; Batched tests, with "just in case" requests which may become redundant but not cancelled; …

Financial / Organisational context:
Cost of imaging; Financial incentives; Who pays, where does the money go?; Budgets; Targets; Waiting times; Will imaging delay discharge?; Audit of justification process; …

Developments with potential to assist referrers

Referral Guidelines for imaging
RCR *iRefer* (*Making the best use of clinical radiology services*) [UK]
ACR *Appropriateness Criteria* [USA]
SFR *Guide du bon usage des examens d'imagerie médicale* [France]
CAR *Diagnostic Imaging Referral Guidelines* [Canada]
Australia: *Diagnostic Imaging Pathways* [Western Australia]
A number of countries have guidelines based on one or more of the above
EC-ESR Referral Guideline Initiative [Europe]
IAEA-WHO Appropriateness Criteria aims: *Global standards within a local context*

Clinical Decision Support Systems
Systems which collate up-to-date evidence-based guidance for clinicians from systematic reviews of the literature will play an increasing role in healthcare. In the digital age there is potential to integrate clinical decision support with electronic referral systems.

Choosing Wisely **(ABIM Foundation)**
Choosing Wisely[14] is an initiative *to help physicians and patients engage in conversations to reduce overuse of tests and procedures, and support physician efforts to help patients make smart and effective care choices.* More than 50 specialty societies are each contributing lists of '*Five things Physicians and Patients should question'.* Imaging procedures using ionising radiation comprise 28% of this evolving list.

Conclusions

There is considerable potential to develop x-ray referral and justification practice. Radiation risk is one of many influences on decisions to refer. Initiatives underway contribute to radiation safety, clinician support, patient engagement and better use of scarce healthcare resources.