Negotiating the risks of computed tomography in primary care

INTRODUCTION

Computed tomography (CT) is one of the most frequently used imaging modalities. Over 5 million scans were performed in the UK in 2017/2018, a 6.9% increase from 2016/2017. One in ten scans performed for initial cancer investigations were referred directly from GPs.[1] Versatility of scanners, an ageing population, patient knowledge, and improved access are some factors that have led to an increase in demand; however, there is regional variation in direct-access radiology for GPs in the UK.[1] When GPs have direct access to cancer investigations, they diagnose cancer in a similar proportion of patients to specialists with the same test.[2] The risks of ionising radiation from CT conflict with the demand for earlier cancer diagnosis creating a risk/benefit dilemma. GPs who frequently refer to CT may come under pressure from commissioners for their use of radiology, but if slow to refer they may be criticised for late diagnoses following repeat patient attendances.[3]

This piece aims to improve understanding of the risks of ionising radiation and who is responsible for them.

EFFECTS OF RADIATION

Effects of ionising radiation are divided into deterministic and stochastic. Deterministic effects are the cause-and-effect relationship between the amount of radiation absorbed and the likelihood of an event occurring. A minimum dose must be absorbed before a deterministic event can occur, for example, skin erythema can occur from 2 Gy. Stochastic effects occur by chance with any exposure to radiation, potentially increasing the chances of a carcinogenic event. Public Health England (PHE) estimates that the average UK adult is exposed to 2.7 mSv of background radiation a year. The average UK CT chest scan exposes the patient to a radiation dose of 6.6 mSv.[4] The linear no-threshold hypothesis (LNTH) of radiation carcinogenesis was established using data provided by the Life Span Study (LSS) of initial non-fatal victims of the Hiroshima and Nagasaki atomic bombs. Calculations based on the LNTH have traditionally been used to inform international radiation regulations. Emerging evidence suggests that the LNTH is not accurate when extrapolated to larger populations.[5] As there is very little evidence on the long-term effects of lower-dose exposures to radiation it is difficult to estimate the risk associated with a medical exposure. Public Health England has created a table comparing the exposure associated with radiological examinations and everyday activities to inform discussions with patients (Table 1).[4] The Clinical Imaging Board (CIB) has developed posters for patients to explain the risks of ionising radiation (https://www.rcr.ac.uk/sites/default/files/clinical-imaging-board-patient-information-poster-ct-scans.pdf). Posters are displayed in radiology departments, but it may be useful if they were also displayed in GP waiting rooms.

REGULATIONS IN RADIATION PROTECTION

Exposures to ionising radiation are subject to the Ionising Radiation (Medical Exposure) Regulations 2017 (IR(ME)R).[6] IR(ME)R have established the 'As Low As Reasonably Achievable' (ALARA) and 'As Low As Reasonably Practicable' (ALARP) principles.[6] These principles require operators to ensure radiation doses are as low as possible while maintaining high image quality. Low-dose scanning techniques are constantly being refined and improved. Scan parameters are selected by operators ensuring exposure to radiation is limited to the area justified.

IR(ME)R identify four groups responsible for protecting patients from exposure to ionising radiation: employer (radiology department), referrer (clinician requesting exposure), practitioner (usually radiologist), and operator (usually radiographer). Employers are responsible for providing patients with information relating to risk/benefit of exposure. Practitioners are responsible for the justification of referrals. Justification is based on clinical information provided by referrers, ensuring that the use of ionising radiation is beneficial and correct imaging techniques are used to optimise exposure. IR(ME)R detail that clinical information provided must include any relevant symptoms or diagnosed conditions.[3,6]

If requests do not justify the radiation exposure, GPs should be guided by radiologists to more appropriate imaging or non-imaging methods to answer the clinical question.[7] However, communication between radiology services and primary care varies nationally. Locally, an email advice line is utilised. Electronic healthcare platforms alongside direct communication have been shown to enable all clinicians to deliver better patient service.[8] Implementation of such systems at national scale would require input and financial support on a clinical commissioning group level.

MANAGING 'INCIDENTALOMAS'

Improvements in image quality and better access to radiology while aiding diagnosis of disease has led to a significant growth in the number of incidental findings or 'incidentalomas'.[9] Incidentalomas are defined as abnormalities detected on scanning that were not the primary reason for referral. These include, but are not limited to: pulmonary, adrenal, and pancreatic nodules, and renal, splenic, and liver cysts. Often follow-up imaging is warranted by CT or another modality to determine any clinical significance of the incidentaloma. National incidentaloma follow-up guidelines for clinical use have not been established in the UK, leading to a variation in how and which

Table 1. Comparison of doses from sources of exposure

Source of exposure	Dose, mSv
Dental X-ray	0.005
100 g of Brazil nuts	0.01
Chest X-ray	0.014
Transatlantic flight	0.08
Nuclear power station worker average annual occupational exposure (2010)	0.18
UK annual average radon dose	1.3
CT scan of the head	1.4
UK average annual radiation dose	2.7
US average annual radiation dose	6.2
CT scan of the chest	6.6
Average annual radon dose to people in Cornwall	6.9
CT scan of the whole spine	10
Annual exposure limit for nuclear industry employees	20
Level at which changes in blood cells can be readily observed	100
Acute radiation effects including nausea and a reduction in white blood cell	1000
Dose of radiation that would kill about half of those receiving it in a month	5000

Source: Public Health England.[4] Reproduced under the Open Government Licence v3.0.

incidental findings are investigated. Booth *et al* demonstrated that GPs are unsure as to what follow-up is necessary.[9] This variation has potentially negative implications on the standard of care that patients receive. Explaining these incidental findings to patients can be difficult: national guidelines could aid all clinicians in determining what requires further investigation and help GPs in their discussions with the patient about these incidental findings and their potential significance. An incidental cancer diagnosis could be of clinical benefit or could represent overdiagnosis.[10]

CLINICAL CAPACITY

Radiology capacity has not increased in line with service demand. Scanner availability and radiographers needed to operate the scanners[11] can limit clinical capacity. Attempts to address this have been made by introducing 7-day working and extended working days, but shortages of radiographers and increasing emergency and inpatient demands have negated any improvements in the delivery of outpatient services. The second issue lies in the provision of radiology reports. There has been a worsening of reporting turnaround as demands on all modalities have increased, particularly for cross-sectional imaging, while a national shortage of radiologists has occurred.[12] Reporting workload may be reduced by using advanced-practice radiographers, with postgraduate accreditation to ensure the standard of radiology is not negatively affected.[12] This issue surrounding capacity may deter GPs from referral, and radiology services need to be more explicit on the estimated wait for appointments and reports to enable the appropriate management of patient and clinician expectations.

CONCLUSION

Repeat attendances from patients who want imaging investigations may be seen as a 'waste' of clinical time. With an expanding workload over a smaller cohort of GPs it is understandable that requesting a CT scan provides one solution. The uncertain harm of ionising radiation is a risk that GPs, as referrers, should be conscious of but ultimately it is the role of practitioners and operators to justify and minimise exposure.[6] Some focus must be moved to educating patients on the risks of radiation exposure and the 'false reassurance' that imaging can offer. This is encouraged by IR(ME)R.[6] GPs could use posters in waiting rooms and display the conversion table as suggested by PHE to make the radiation risks more relatable (Table 1). Enabling patients to make an informed decision could be an effective way of reducing the number of investigations carried out and dissipating the potential consequences of investigating or not.

Improvements in the communication between radiology and primary care are required.[7,8] Discussion around imaging modalities rather than rejection without explanation may improve the standard of referrals and therefore reduce the time spent vetting and protocoling imaging requests. Guidelines on the follow-up of incidental findings would help ensure a higher standard of consistent patient care.

A joint approach between radiology and primary care would enable the optimum quality of care to be delivered to every patient.[7]

KEY POINTS

- Radiologists/radiographers are responsible for the justification and limitation of exposure to ionising radiation;
- accurate and detailed clinical information optimises and limits the radiation exposure to patients;
- patient education on the potential risks of ionising radiation may share the risk burden with referring clinicians; and
- improved communication between referrers and radiology will improve patient care.

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