Time for guidelines in diagnostic imaging?

The increasing costs of health care in a modern developed country consume a high percentage of its economy's resources. In 2006, total spending for this sector in the UK represented 9.4% of the gross domestic product. This was substantially greater than 2001, when 7.1% of the gross domestic product was devoted to health (Griffin, 2007). The growth in expenditure is in part a result of the health requirements of an ageing population with inherent chronic medical conditions. Coupled with this, however, is the ever-emerging new and costly medical technologies that are available to diagnose and treat disease and the public expectation that health authorities will fund the provision of these services.

Diagnostic imaging has seen a tremendous increase in use over a similar period of time. Bhargavan and Sunshine (2005) suggested that the workload within this speciality is increasing at approximately 8% per annum. This can largely be attributed to an increase in requests for using modern technology, initially computed tomography and more recently magnetic resonance imaging.

The reasons for the reliance on diagnostic imaging are varied: from the view that it is now an extension of history and examination (and unfortunately, in some cases a substitution), to patients' expectation of some form of investigation when presenting with a medical complaint, to fear of missing an important diagnosis and of subsequent medicolegal retribution. However, the fallibility of diagnostic imaging is often under appreciated, especially the risk of false positive or negative results.

Furthermore, the choice of the most appropriate investigation as well as the sequence of tests in a particular clinical scenario is sometimes bewildering for the clinician. The physician can be faced with a veritable maze of options through which he/she has to navigate to achieve a differential diagnosis. The culmination of these factors has led to the recognition that up to one third of all diagnostic imaging may be partially or totally inappropriate (Picano, 2004).

Radiation dose

In parallel to the rise of diagnostic imaging is the increase in the exposure of the general community to ionizing radiation. It is estimated that the biological effect of natural sources of radiation amounts to an average of 2.2 mSv/yr. The total yearly dose is approximately 2.7 mSv/yr. A UK review demonstrated that the main source of artificial radiation was diagnostic imaging, predominantly the use of computed tomography. The rise in the use of computed tomography led to an increase of 10% in annual exposure from medical irradiation, compared to a review completed some 4 years earlier (Hughes et al, 2005).

The quantifiable effects of a higher radiation exposure on the community as a whole are uncertain at present and we may not observe the results for many years to come. Nevertheless, despite the debate over the degree of risk posed by medical irradiation, it is the responsibility of all medical practitioners to ensure that the ALARA (as low as reasonably achievable) principle is followed. The lack of understanding by health professionals as to common sources of ionizing radiation adds to the inappropriate exposure of patients. A survey of medical practitioners of all grades concluded that 'most doctors have no idea as to the amount of radiation received by patients undergoing commonly requested investigations' (Shiralkar et al, 2003).

What are the solutions?

Are there effective solutions to tackle the issue of 'inappropriate medical imaging'? The first step would be to achieve a consensus agreement as to what constitutes 'appropriate imaging'. Only then can measures be implemented to address the problem. An idea advocated by Picano (2004) is the concept of a 'radiological prescribing licence' for practitioners. Penalty points could be given for an inappropriate imaging request. After accumulating a certain threshold of points the doctor would have to attend a remedial course to improve his/her referral practices.

Another solution advocated in the United States is the prior approval of a 'radiology benefits management' company for complex diagnostic imaging modalities. In Australia, referral to magnetic resonance imaging is restricted to medical and surgical specialists, who by implication become gatekeepers to appropriate imaging. An alternative, which would also provide education and feedback, is to better use the consultative role of the radiologist before referral. This role has often been neglected by radiologists and underused by referrers. Armed with an appropriate clinical history and a pre-test probability of disease an appropriate imaging test and protocol can be agreed upon. The radiologist would also scrutinize all referrals and provide advice and guidance as to the most appropriate test in a particular clinical situation. All of these methods have inherent flaws, from the practical issue of administrating the first policy, to weakening of the doctor–patient relationship, to likely prolonged waiting times and cost. There is also the probability that in a private service environment, the gatekeeper consultative role of the radiologist may conflict with his/her economic interests.

Educating referring doctors

Educating referrers at the time of referral as to the appropriateness (or not) of the selected imaging modality may be a solution. Clinical decision support systems (CDSS) have been used for the prescription of drugs or drug dosing (White and Mungall, 1991), as reminders for overdue preventative health tasks (Burack and Gimotty, 2003), as algorithms in clinical scenarios (e.g. deep vein thrombosis prophylaxis) (Durieux et al, 2000) and as critiques for existing health-care orders. It has been shown that these systems have improved practitioner performance and patient outcomes (Garg et al, 2005).

Similar systems have become ubiquitous in industry, commerce and tertiary education. However, despite the success, implementation of these CDSS has been slow. The barriers include failure of clinicians to use CDSS, poor usability and integration into practitioner workflow, or non-acceptance of the recommendations.

The identification of these obstacles has led to recommendations to promote the successful integration of CDSS into medical practice. An effective CDSS tool must be clinically relevant, delivered in real time at the point of referral, fit into the user's normal workflow, be accessible and simple to use, provide alternatives and evidence for recommendations, provide a mechanism for feedback and be able to be readily amended when new evidence is available (Bates et al, 2003). Several paper-based guidelines for diagnostic imaging have been produced (Lau, 2001; Royal College of Radiologists, 2003). Because of their method of publication they are inherently difficult to keep current, with long intervals between editions and resultant outdated information.

Guidelines for diagnostic imaging

A number of online computer-based CDSS tools have been developed for diagnostic imaging with these considerations in mind. The American College of Radiology appropriateness criteria (www.aapmr.org/hpl/pracguide/pmrprac/acr_appropriateness.htm) are based on a scale where a high number for a particular diagnostic imaging modality indicates that it is strongly recommended in the investigation of that particular clinical scenario.

Another CDSS tool is diagnostic imaging pathways (www.imagingpathways.health.wa.gov.au/). This is a suite of 120 clinical scenarios with a flow chart algorithm which details initial diagnostic imaging techniques, as well as the sequence of investigations recommended in a given clinical circumstance. Both products are extensively researched, with systematic evidence and consensus opinions sought before publication of guidelines. The broad objectives of both applications are to reduce the incidence of inappropriate diagnostic imaging, improve diagnostic yield, minimize potential patient harm, encourage the effective use of scarce resources and provide a means of education for potential referrers to diagnostic imaging.

Decision making

Evidence suggests that computer-based CDSS has a profound effect on clinical decision making and adherence to guidelines in daily practice. Increasingly, in modern medicine routine haematology, biochemistry and microbiological studies are ordered electronically. Studies have clearly demonstrated rationalized ordering and cost effectiveness when a CDSS is incorporated at the time the practitioner is requesting such investigations (Wijk et al, 2001; Poley et al, 2007). However, evidence of such benefits of CDSS in diagnostic imaging is scant, although initial studies are encouraging (Bairstow et al, 2006). Further work is needed to address this issue.

As with electronic ordering of pathology in conjunction with a CDSS, future computer-based guidelines in diagnostic imaging may wish to incorporate such a feature. This would provide an opportunity to select rational evidence- and consensus-based investigations and provides an efficient means of ordering such tests at the same time. The goals of these interventions are to improve patient outcome and provide a sustainable diagnostic imaging service well into the future. BJHM

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KEY POINTS

- Diagnostic imaging services are growing exponentially.
- There is evidence that a significant proportion of imaging examinations are partially or totally inappropriate.
- Referring clinicians need tools for education and guidance about the appropriateness of imaging examinations.
- Clinical decision support systems are available for diagnostic imaging and aim to reduce inappropriate imaging, improve diagnostic yield, minimize potential patient harm and improve the effective allocation of scarce health-care resources.