The radiology request form: a guide for the foundation year doctor

Introduction

The walk to the radiology department with a paper or electronic request in mind may make the junior doctor apprehensive. This scenario may begin on a busy ward round during which multiple requests for imaging are made. By the time one patient plan has been documented, a correct request form found and the notes frantically arranged to an up-to-date entry point, your team have moved on. You may then receive a secondary history for the initial request while simultaneously writing a new set of notes. Invariably you are left asking 'What should I write on the form?', 'How much do I write?', 'Do I arrange it now or later?', 'Can we all go to the department and get this investigation organized?', echoing distant memories of your first week as a new trainee.

An understanding of common imaging modalities can facilitate the organization of imaging investigations for your patients. In general clinicians rely upon imaging to provide additional information to confirm or exclude a diagnosis, define the anatomy, extent and functional status of a disease process and monitor its progression. This article explores the steps needed to successfully present an imaging request to the radiologist.

The guidelines *Making the Best Use of Clinical Radiology Services* (Royal College of Radiologists, 2007) state that in the UK 20% of all radiographic investigations have no clinical justification. Now in their sixth edition and available in paperback and online formats, the concise tool assists clinicians and the increasing number of allied health professionals requesting imaging to implement the right test in a variety of clinical problems. Developed to adhere to the Ionising Radiation (Medical Exposure) Regulations (2000) the guidelines emphasize the justification of requests in an attempt to limit the ionizing radiation dose to patients (*Table 1*). Responsibility for justification of an exposure lies with a radiological practitioner. This is usually the radiologist, who may only justify an exposure if sufficient relevant clinical information has been provided on the request form.

Dr Allan Andi *is Specialist Registrar in Radiology at St Thomas' Hospitals, London SE1 9RT and* **Dr David Howlett** *is Consultant Radiologist in the Department of Radiology, Eastbourne District General Hospital, East Sussex Hospitals NHS Trust*

Correspondence to: Dr A Andi

Planning investigations

During investigative planning of a patient you should routinely ask yourself five questions:

1. Has the investigation been already performed?
2. Is the investigation needed immediately or can it wait?
3. Is this the best investigation of choice?
4. Have I fully explained the clinical problem on the request form?
5. How will this investigation influence my patient's management?

Appraisal of such information will yield important clinical information, establish a firm basis to discuss your investigation and lead to appropriate imaging. If doubt exists concerning the most suitable imaging modality consult the radiologist at the earliest opportunity.

A common scenario encountered is the untimely presentation of a relevant and justified request. This usually arises because of failings in prioritization. A good method is to assemble all your requests in a morning and visit the radiology department to discuss each request with the consultant. A duty radiologist (sometimes a specialist registrar) may be available to serve as the first port of call for advice and case reviews, but examinations may be discussed with any member of the radiology team. If regular sub-speciality requests are being made try and obtain and familiarize yourself with the specific consultant's timetable so you are aware of his/her schedule and can therefore plan your discussion and the timing of investigations.

The importance of previous imaging and reports cannot be over-emphasized as all too frequently patients are transferred with imaging on a CD-ROM and no supporting report. Forward planning can avoid reduplication of imaging and unnecessary ionizing radiation exposure to the patient.

An increasing number of hospitals are now using software-based request forms. The use of electronic requesting has the advantage of permitting abnormal findings or incomplete requests to be directly returned to the issuing clinician. However,

Table 1. Typical effective doses from diagnostic medical exposure

Diagnostic procedure	Equivalent no. of chest X-rays	Equivalent period of background radiation (approximate)
Limbs and joints (excluding hip)	<0.5	<1.5 days
Chest (posterior-anterior)	1	3 days
Pelvis	35	4 months
Abdomen	35	4 months
Lumbar spine	50	5 months
Intravenous urography	120	14 months
Barium enema	360	3.2 years
Computed tomography of the head	100	10 months
Computed tomography of the chest	400	3.6 years
Computed tomography of the abdomen and pelvis	500	4.5 years

Modified from Hart and Wall (2002)

urgent requests may not necessarily be brought to the immediate attention of the radiologist. Therefore, meeting the radiologist facilitates discussion, explanation and clarification of the clinical question.

Imaging modalities

Ultrasound

High frequency sound waves generated from a transducer in a probe applied to the skin are reflected back by the tissues to produce a gray-scale ultrasound image. The characteristics of the image depend on the reflecting and absorbing properties of the tissue. Therefore regions appearing bright – hyperechoic (e.g. gallstones) – are highly reflective while regions appearing dark – hypoechoic (e.g. water) – are highly transmissible.

When requesting an ultrasound it is useful to be aware of the indications, advantages and limitations. Common indications include characterization of the morphology and texture of solid and fluid-filled visceral organs, delineating muscle and tendon, vascular flow assessment with respect to occlusion and guidance assistance during biopsy and drainage procedures. It is a real time, cost-effective, cross-sectional modality and more importantly non-ionizing to the patient. However, imaging is highly operator dependent with quality significantly limited in the obese.

Barium and water-soluble studies

Contrast media are so named to create an artificial contrast between an organ and surrounding tissue otherwise indistinguishable on a plain radiograph. Typically the organs in question are tubular such as bowel, urinary tract or vessels. All media are based upon suspensions containing elements of high atomic number and exist as non-water-soluble and water-soluble agents.

Barium sulphate is the most common non-water-soluble agent and is used to opacify the gastrointestinal tract. However, upper gastrointestinal studies carry the risk of aspiration of the inert material into the bronchial tree. In the event of such an episode, same day physiotherapy and follow-up chest radiographs are a priority in view of the risk of lung lobar or segmental collapse, consolidation and pneumonia.

Lower gastrointestinal studies using barium, for example barium enemas, are being conducted less frequently with increasing use of colonoscopy, computed tomography enema and virtual colonoscopy. In the post-surgical patient who has undergone upper or lower gastrointestinal surgery, water-soluble contrast agents may be used to check for integrity and leaks. In this scenario, where possible, a sketch of the surgical anastomosis or stoma may considerably assist interpretation of the investigation.

Computed tomography

Computed tomography (CT) revolutionized medical imaging in the 1980s and earned British inventor Sir Godfrey Hounsfield the 1979 Nobel Laureate in Medicine. He shared the prize with the South African nuclear physicist Allan Cormack who had worked along similar concepts in the 1950s. In the early days imaging the chest, abdomen and pelvis could take up to 30 minutes. In 2008 multidetector CTs are capable of imaging the entire body in less than 30 seconds, accurately demonstrating macroscopic pathology with high-resolution bone and tissue anatomy. Data may subsequently be reconstructed in a virtual three-dimensional environment and interrogated.

The imaging tool unfortunately carries ionizing risks with the potential of cancer induction. Concerns in particular are with multiple exposures in children and young adults. Patients are also at risk of contrast media reactions. The aetiology of such reactions are not fully understood, management typically involves administration of advanced life support, steroids and adrenaline. It is therefore imperative for clinicians to document a history of contrast allergy.

Contrast media have the potential to adversely affect renal function, causing nephrotoxicity particularly in elderly and dehydrated patients. Diabetics on metformin are also at risk of lactic acidosis following contrast. Therefore renal function should be scrutinized before such procedures and the drug delayed for 48 hours following the procedure (the authors advise review of local department guidelines). The radiologist will determine the necessity for contrast media administration, but knowledge that your patient is on metformin and documentation of abnormal renal function results on the request form will benefit the patient and the radiologist who will be in a better position to decide upon the advantages of contrast media.

Magnetic resonance imaging

Magnetic resonance imaging (MRI) uses a high strength magnet to apply a radiofrequency pulse to momentarily disrupt abundant hydrogen nuclei (single protons) in the patient. As the nuclei return to their original alignment in the magnetic field they emit a radiofrequency signal that is detected. The site of origin and the strength of each signal determine image generation. Therefore each slice of an MRI is effectively a map of the distribution of hydrogen nuclei excitation and relaxation throughout various tissues of the body.

The principal sequences are T1 and T2. T1-weighted images show CSF as low signal (black) and fat as high signal (white). T2-weighted images show CSF as high signal and fat as low signal. A short T1 inversion recovery (STIR) sequence may be used to suppress fat and highlight the changes of oedema (white) in soft tissues and bone. Compared to CT, MRI is particularly advantageous in that non-ionizing radiation is involved and soft tissue resolution is far superior. It is therefore the modality of choice when imaging spinal cord, brain or musculoskeletal pathology. However, MRI is contraindicated in patients with non-compatible metallic implants or devices (e.g. pacemakers), has cost-effective implications and remains a slower acquisition procedure, typically 5–30 minutes in duration. Renal and systemic effects of contrast media may also occur (usually a gadolinium-based compound) therefore prior knowledge of impaired renal function is important.

Conclusions

Clinical radiology is integral to the investigative planning and management of patients. A sound understanding of imaging modalities will serve as a proficient tool in your chosen area of future clinical practice. Useful arenas for additional learning are multidisciplinary meetings. In addition to active clinical discussion the indications and limitations of investigations are often examined. The seasoned radiologist thrives on clinical problem solving and the accuracy of a report is usually correlated to the quality of the clinical information provided. Attempt to ascertain further informa-

tion regarding your patient's imaging history, think how the study will affect your patient's management and if in doubt seek the opinion of the radiologist at the earliest opportunity. By following these often simple steps you will develop your diagnostic skills and feel confident in your imaging requests. BJHM

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Further reading

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Scally P (1999) *Oxford Core Texts: Medical Imaging.* Oxford University Press, Oxford

KEY POINTS

- Accurate request forms aid prompt investigation and patient management.
- Explain why the investigation is being conducted by providing a concise clinical history and question that will enable the radiologist to compose an accurate and specific report.
- Do not use ambiguous diagnoses such as 'rule out trauma', 'routine' and 'pre-op' as reasons to conduct an investigation. Such requests will only be returned and result in delay.
- Radiology departments routinely assess the pregnancy status of patients before ionizing investigations. It is good practice as the requesting clinician to ascertain the pregnancy status of women of child-bearing age before exposure to radiation.
- Prevent delays by clearly indicating patient transport methods, requirement for oxygen therapy and infectious status. Do not hesitate to accompany an unwell patient.
- For prompt communication always record your pager number on the request form or alternatively a senior team member's contact details if you are not on duty but have requested the investigation.
- Forward planning and organization of external images and reports can avoid reduplication of imaging.
- Multidisciplinary meetings provide a useful forum for learning indications and the limitations of investigations.