Abdominal radiograph requesting in the setting of acute abdominal pain: temporal trends and appropriateness of requesting

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ABSTRACT

INTRODUCTION The biannual turnover of house surgeons has long been dreaded by paramedical staff because of fears of increased workloads generated by 'untrained' junior doctors. The aim of this study was to address this issue by examining both the quantity and quality of requests made for emergency abdominal radiographs made by 'experienced' house surgeons during the month of July and by the 'novices' during August.

PATIENTS AND METHODS All adult patients undergoing abdominal radiography (AXR) following admission as emergencies via the surgical directorate with abdominal signs were identified prospectively. The reports of the AXRs were reviewed to determine the total number of requests and the number of positive findings for the two groups. In addition, the hand-written request forms were recovered to determine the suitability of the requests according to nationally-accepted guidelines produced by the Royal College of Radiologists (RCR).

RESULTS During the study period, a total of 252 radiographs were performed consisting of 98 in July and 154 in August. The number of unreported films in each month were similar at 11 (11.2%) and 16 (10.4%), respectively, leaving 87 reported radiographs in July and 138 in August. There was no difference in the number of radiographs with positive findings (excluding degenerative spinal disease) for July ($n = 19$; 22%) and August ($n = 33$; 24%). Of the 225 reported films, RCR guidelines were followed in only 73 (32%) of 225 cases. When guidelines were adhered to, positive findings were identified in 56 (76.7%) of 73 cases whereas when guidelines were not followed positive findings were seen in only 13/139 (8.9%) of AXRs.

CONCLUSIONS We have demonstrated that the popular myth of the 'August syndrome' is unsubstantiated at least using the surrogate marker of abdominal radiograph requests. The worrying finding of a high number of unacceptable indications for the performance of abdominal radiographs deserves urgent attention both in terms of its financial implications and with regards reducing radiation exposure. A programme of education is proposed to emphasise the RCR guidelines with re-audit to assess adherence to the guidelines.

KEYWORDS

Abdominal radiograph – Guidelines – Acute abdominal pain

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The month of August traditionally marks the transition between student and medical practitioner. The newly qualified preregistration house officer (PRHO) approaches this milestone with enthusiasm, excitement and a healthy quota of trepidation. Naturally, senior colleagues and allied healthcare professionals endeavour to allay fears by recanting tales of missed diagnoses, of ludicrous requests and referrals, and of escalating mortality rates. This has led to the description of an 'August Syndrome' to describe this period – but does such a phenomenon really exist?

PRHOs are generally the first doctors to approach patients and are responsible for obtaining a clinical history and arrang-

ing baseline investigations including radiographic requests. The plain abdominal radiograph (AXR) is an investigation commonly requested by PRHOs for patients presenting on the surgical emergency intake with acute-onset abdominal pain.

Despite their wide-spread request, there is much debate within the literature as to the relevance of the investigation.^{1–6} Lee, in a review of 277 patients suffering from 5 common acute abdominal conditions, found useful radiological features in 48% of cases, whilst in a second assessment of 249 patients with various types of abdominal pain, he found AXRs to be helpful in 42% of cases.¹ As a result, he recommended AXRs for all cases of abdominal pain.

However, not all investigators are in agreement. In a paper from 1980, de Lacey *et al.*² reported on 100 consecutive AXRs performed following referral to the accident and emergency department with abdominal pain. They suggested that whilst radiographic evaluation was indicated in 95% of patients, less than half of the AXR requests were justified.² Eisenberg and colleagues⁵ studied 1780 patients who had undergone AXR following presentation with acute abdominal pain. Of these, only 179 (10%) were found to have any positive findings in the radiological report.³ Stower *et al.*⁴ reviewed 97 patients with abdominal pain and found that whilst abnormalities were identified in 66% of cases, the AXR altered clinical diagnosis in 7 cases and patient management in only 4 instances. Campbell and Gunn⁵ reviewed 5080 patients with acute abdominal pain and found that suspected appendicitis, non-specific abdominal pain and urinary tract infections, conditions with no specific radiological findings, accounted for 48% of conditions and 32% of AXRs. They concluded that 'indiscriminate use of films is likely to be wasteful in terms of normal results and possibly misleading in showing abnormalities that are coincidental'.

In the light of concern regarding over-requesting of radiological examinations, a Royal College of Radiologists' (RCR) working party was established in 1976 to promote more effective use of diagnostic radiology services. The pilot stage for the assessment of AXR requesting was performed at the University Hospital of Wales in Cardiff.⁶ The study determined the findings of AXRs in relation to clinical findings and also the surgeon's management plans should an AXR not be available. Of 100 patients reviewed, abnormalities were identified in 17 patients and the AXR altered management in 10% of cases. On the basis of the pilot, a multicentre study was initiated, the findings of which contributed to a set of guidelines covering the most frequently requested radiological investigations. The guidelines were first published in 1988⁷ as a journal article and were subsequently collated into a handbook *Making the best of a Department of Clinical Radiology*,⁸ which was first published in 1990. The handbook is currently in its fifth edition, and is widely distributed to junior doctors throughout the UK. An electronic version is also provided and should be available on all NHS Trust intranets. It was believed that adherence to such guidelines would produce the dual benefits of a reduction of patient-radiation exposure and financial savings in the form of: (i) decreased number of radiographs performed; (ii) decreased radiographer/radiologist time; and (iii) reduced ancillary expenses such as pregnancy tests prior to AXR.

The aims of this study were 2-fold. First, to compare the quantity and quality of requests for AXRs made by 'experienced' house surgeons at the end of their PRHO training during the month of July, and 'novices' at the beginning of

their house jobs during August. Second, to determine the acceptability of PRHO requests for AXRs according to RCR guidelines, and to look at the number of positive findings identified from radiological reports in both the acceptable and non-acceptable referral groups.

Patients and Methods

All adult patients admitted as emergencies with abdominal pain during the months of July and August were identified through review of the emergency unit admissions ward book on a daily basis. A note was made in each case of the admission diagnosis. Patient details were then cross-referenced against the radiology department computer to obtain validated reports for all patients on whom an AXR had been performed. AXRs were classified according to whether the report noted a significant finding, no significant finding or were not reported.

The acceptability of the AXR requests in relation to the RCR guidelines (Table 1) was assessed by inspection of the original hand-written request forms. The identification of the presence or absence of significant radiological findings on the AXR was compared for the two groups in relation to whether the request was suitable or not.

The findings of the July and August groups were compared using the Chi-squared test as were the findings of the AXR reports in relation to suitability of request.

Table 1 Acceptable and unacceptable indications for the performance of abdominal radiographs

ACCEPTABLE

- Bowel obstruction
- Visceral perforation
- Acute inflammatory bowel disease
- Abdominal trauma
- Haematuria
- Renal calculus/renal colic
- Refractory constipation in geriatric patients

NOT ACCEPTABLE

- Acute gastrointestinal bleeding
- Palpable mass
- Gallstones
- Pancreatitis
- Appendicitis
- Urinary tract infections
- Constipation (other than in cases of refractory constipation in the elderly)
- Non-specific abdominal pain

Figure 1 Comparison of number and quality of AXR requests in July and August.

Results

During the period of the study, 278 patients were admitted with abdominal pain of whom 252 had an AXR performed for diagnostic purposes. Patients not undergoing AXR had no radiograph because a surgical registrar had been called to review the patient and decided it was not necessary either because it was not clinically indicated ($n = 18$) or because the patient was determined to require an operation regardless of the AXR result ($n = 8$).

The mean patient age at presentation was 52.9 years (range, 16–95 years) and the group consisted of 161 males and 91 females.

The number and quality of AXR findings for the months of July and August are illustrated in Figure 1. AXRs were performed in 98/110 (89.1%) of emergency admission in July and 154/168 (91.7%) in August. During July, the 98 AXRs undertaken yielded: 19 significant findings; 68 were reported as showing no significant findings; and 11 were unreported. By comparison, in August, the 154 AXRs performed yielded: 33 significant findings; 105 AXRs showed no radiological findings; and 16 were unreported. The yield of AXR in terms of positive findings was 19% and 21% for July and August, respectively. There was no statistical difference in the proportions of patients in the significant findings, no significant findings or unreported groups between July and August.

Analysis of the presence of AXR findings in relation to suitability of request are shown in Table 2. The results indicate that only 32% of requests were compliant with RCR guidelines. Further analysis of the compliant requests revealed that 56 of 73 reported films (76.7%) showed significant findings, whereas when the guidelines were not followed only 13 of 139 (9.4%) of AXRs demonstrated significant findings. The difference between the two groups was statistically significant ($P < 0.05$). Had the guidelines been adhered to, positive radiological findings would have been identified in

Figure 2 Comparison of rates of significant and no significant findings in reports for patients with acceptable and unacceptable requests.

24.9% of cases. There was no difference in guideline adherence between July and August doctors.

Of the 13 patients in the 'not acceptable' indication group who had positive radiological findings, 4 were in the non-specific pain group and consisted of 1 case of small bowel obstruction, 2 of ureteric calculi and 1 incidental calcified aortic aneurysm. When the indication for AXR was gallstones ($n = 36$), radio-opaque stones were seen in 2 cases, and in 2 of 16 cases where pancreatitis was suspected, pancreatic calcification was identified (both patients were known to have chronic pancreatitis). One patient with a

Table 2 Comparison of findings in patients with indications deemed acceptable or unacceptable according to RCR guidelines

Indication	Significant finding	No significant finding
ACCEPTABLE	$n = 56$	$n = 17$
Bowel obstruction	28	5
Renal calculus/renal colic	16	6
Visceral perforation	8	4
Inflammatory bowel disease	4	2
NOT ACCEPTABLE	$n = 13$	$n = 139$
Gallstones	2	34
Appendicitis	3	33
Non-specific abdominal pain	4	25
Diverticulitis	1	17
Pancreatitis	2	14
Gastrointestinal bleed	0	8
Abdominal mass	1	6
Aortic aneurysm	0	2

pre-AXR diagnosis of diverticulitis was found to have a ureteric calculus; three patients with possible appendicitis had a single loop of dilated bowel in the right iliac fossa indicative of local ileus and in the patient in whom an AXR was requested for an abdominal mass, a right iliac fossa mass was identified on AXR and this required further characterisation by means of CT. Overall, for the 'not acceptable' group, the AXR provided useful information in 5 cases (1 small bowel obstruction, 1 aortic aneurysm and 3 ureteric calculi); however, on review of the patient notes, it was evident that senior surgeons had detected the bowel obstruction and the aneurysm clinically and that 2 of the 3 patients with ureteric calculi had haematuria noted on urine dipstick although this was not indicated on the request form.

In total, therefore, AXRs provided clinically useful information in 27% of cases, with variation from 5/152 (3.3%) for indications that were not acceptable to RCR guidelines to 56/73 (76.7%) if guidelines were adhered to ($P < 0.05$).

Discussion

The primary finding was that there was no evidence of a radiological 'August syndrome'. Although more request were made in August than in July, this was primarily due to a heavier workload and not over-enthusiastic requesting. The proportion of positive findings, no findings and unreported films were almost identical for the 2 months studied as was the validity of requesting based on indication for AXR.

Unfortunately, despite the fact that the RCR guidelines were conceived in Cardiff, they were not routinely applied when AXRs are requested by junior staff. Only 32% of performed AXRs were indicated according to the RCR guidelines. The validity of the guidelines is shown by the fact that when a thorough clinical assessment and appropriate request is made, the yield of AXR is high at 76.7% whereas if the request is inappropriate the positive findings are low at 3.3%.

There are many good reasons not to perform AXRs indiscriminately. First, a radiological finding when requests are inappropriate may provide a radiological answer, however, this may be incidental to the presenting complaint and thus may delay the diagnosis of the cause for the pain which necessitated hospital admission. Despite being a relatively cheap investigation at around £20 per film, the exclusion of a large volume of unnecessary AXRs on an annual basis could lead to large financial savings. In addition to the cost of the film itself, all females of reproductive age require a pregnancy test prior to AXR, and there is also the cost in salary and time for the radiographer performing the examination and the radiologist reading the films. When the guidelines were first introduced, it was calculated that strict adherence to guidelines on a national basis could lead to savings to the NHS of £50–60 million per year.⁹

One other area of concern is radiation exposure. It has been estimated that nearly 90% of radiation exposure in the UK is due to diagnostic radiology.¹⁰ Figures from the National Radiation Protection Board (NRPB) show that whilst AXRs represent only 2.93% of radiological requests in the UK, these requests account for 4.42% of radiation exposure.¹¹ The NRPB has estimated that 1 AXR is equivalent to 30 chest radiographs or 6–9 months of background radiation.¹² Furthermore, there is a small but definite risk of cancer with radiation exposure. It has been calculated that medical radiation contributes a 1% risk to fatal cancers; however, this is in the context of a 25% risk in the general population,¹³ and thus all attempts should be made to minimise this risk. This fact must be considered even more carefully now that computed tomography (CT) is being requested more widely by surgeons as doses of radiation are considerably higher for this means of radiological investigation. Requests for abdominal CT constitute 0.72% of radiological requests but account for 15.4% of medical radiation exposure in the UK.¹¹

The negative AXR, when the clinical history appears appropriate, is sometimes also of clinical benefit, for example, in cases of suspected/established peptic ulcer disease when a perforation is being questioned. On other occasions, the negative AXR does not exclude the surgeon's diagnosis, and may lead to the request for further investigations if immediate surgery is not indicated. Studies of the role of CT in the investigation of suspected bowel obstruction have shown that CT identifies findings not revealed on AXR and also gives details of the level of obstruction and sometimes the aetiology of the obstruction and the presence of strangulation.¹⁴ Likewise, patients for whom an AXR is not indicated may be appropriately investigated using other radiological imaging modalities, the correct choice for each condition being listed in the RCR guidelines. Thus, for aneurysms and gallstones, ultrasound would be appropriate; for masses and pancreatic pathology, CT; and for bleeding, endoscopic evaluation is the first-line investigation.

Surprisingly, despite its wide-spread use in surgical admission units, there have been relatively few attempts to look at the effects of RCR guidelines on AXR requesting. A recent paper by Anyanwu and Moalypour¹⁵ assessed the use of AXR in 224 patients referred to the accident and emergency department with acute abdominal pain. They noted that whilst AXRs were being limited to 55.8% of patients with abdominal pain, only 10.4% of AXRs performed were diagnostic and there was still inappropriate requesting of AXRs in the majority of patients (> 60%) with non-specific abdominal pain.¹⁵ By adhering to guidelines, only 20.5% of their patients would have required an AXR.

Although not formally assessed in the study, the most frequently encountered reasons given for requesting an AXR 'outside of guidelines' was insistence by the admitting consultant that all patients with abdominal pain should have an

AXR performed and lack of familiarity with the guidelines. Some surgeons claim that a normal AXR is clinically useful. However, if a patient presents with pain and has no findings on AXR, it is probably unwise to claim that the patient has no cause for the pain. In such cases, clinical examination, routine haematological and biochemical investigations and appropriate radiological test requesting is probably more appropriate than reliance upon negative AXR findings. Education of all grades of surgeons is required in order for this situation to be resolved.

Conclusions

This study has shown no evidence of an 'August syndrome' at least from the radiological perspective. A disappointing finding of the study was that 68% of AXR requests were inappropriate according to the RCR guidelines, although when the guidelines are appropriately applied, the yield of AXRs was high.

Adherence to the RCR guidelines will lead to a reduced radiation exposure for patients and significant financial savings both direct and indirect. For this to occur, surgeons must be reminded of the guidelines and the importance of following their advice. PRHOs must be accurate in obtaining histories and, in cases of doubt, a more senior surgeon should review the patient early in the hospital course rather than simply requesting a standard package of investigations to include an AXR.

We plan to conduct an education programme based upon the RCR guidelines and then re-audit the results.

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