Plain abdomen radiographs: the right view?

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Background **Plain abdomen radiographs (PAR) have limited use in the setting of the emergency department. We conducted this study to look at the appropriateness of requests and its utilization in our emergency department.**

Methodology **We conducted a retrospective analysis of scanned emergency department notes between the period of December 2005 and February 2006 (3 months). Those cases with PAR requested by an emergency department doctor were recruited in this study. The documented history, examination, and provisional diagnosis in the case notes were reviewed to look at the appropriateness of the indications for requests.**

Results **Only 67% (50 of 75) of the requests were appropriate according to the Royal College of Radiologists guidelines with bowel obstruction/paralytic ileus, renal colic and foreign body ingestion being the common presentations. Thirty three percent (25 of 75) (95% confidence interval: 24–45) of the requests were inappropriate and could have been avoided by referring to the aforementioned guidelines.**

Conclusion **We recommend implementing strict local protocols and guidelines for requesting PAR to reduce inappropriate requests. We also recommend staff education and awareness programs for reducing the over-utilizing of PAR.** ***European Journal of Emergency Medicine*** **16:267–270 © 2009 Wolters Kluwer Health | Lippincott Williams & Wilkins.**

European Journal of Emergency Medicine 2009, **16:**267–270

Keywords: abdomen, diagnosis, radiographs, utilization

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Received 2 October 2008 **Accepted** 11 November 2008

Introduction

The use of plain abdomen radiographs (PAR) as part of the routine investigative profile to diagnose acute abdominal pain is still widely advocated at various levels of medical practice and has become ingrained in our system of management [1]. There are many occasions where it is unlikely to provide any useful information. The advent of newer, more sensitive and specific modalities of investigations have reduced the spectrum of indications for which PAR are used in this day and age.

In addition, irrational use of PAR places a financial burden on the institution, as well as increases the patients' exposure to radiation and its effects. A typical effective dose of a plain abdomen film is 0.7 mSv (equal to one time exposure to 4 months of natural background radiation) and is equivalent to 35 chest radiographs [2]. There is an estimated cancer risk of one death, or two cases per 140 000 films, because of radiation from a PAR [3]. The average cost of one PAR is £30–40 [2].

Earlier retrospective and prospective studies have concluded that 77–78% of PAR requested were normal, increasing to 84% if unsuspected and unrelated findings were taken into account [4,5]. Further studies concluded that there is a need to determine specific indications for requesting PAR in the emergency department, which can effectively help to reduce numbers by at least 50% [6,7].

Our study was aimed at determining our unit's practice of requesting PAR and ways in which inappropriate requests can be reduced.

Materials and methods

The study was conducted in the emergency department of a district general hospital. It was a retrospective database analysis. Scanned emergency department notes of 113 consecutive patients were studied, who had PAR requested between December 2005 and February 2006 (3 months). These PAR were requested under the two emergency medicine consultants and were obtained using the locally prevalent computerized radiology picture archiving system. Only those radiographs requested by staff working in the emergency department were considered relevant.

The guidelines for indications referred to were those mentioned in the Royal College of Radiologist, London's publication: *Making the best use of a department of clinical radiology – Guidelines for Doctors*. 5th ed. [2]. Locally relevant guidelines were also incorporated (Table 1).

0969-9546 © 2009 Wolters Kluwer Health | Lippincott Williams & Wilkins DOI: 10.1097/MEJ.0b013e328323d6e5

Table 1 Guidelines for requesting PAR in the emergency department

Clinical/diagnostic problem	Recommendation (grade)[a]
Abdominal complaints	
Acute abdomen pain: suspected perforation or obstruction – indicated supine PAR/erect PAR/erect CXR can be used in varying circumstances	B
Acute large bowel obstruction – indicated may suggest diagnosis and suggest likely level	B
Acute exacerbation of inflammatory bowel disease of colon – indicated often sufficient to determine disease severity and extent	B
Acute pancreatitis – indicated presents as nonspecific/vague abdomen pain – needed to exclude other causes	C
Chronic pancreatitis – indicated to show calcification (calcified duct stones), limited value in exclusion	B
Constipation – indicated only in specific circumstances may be useful in geriatric and psychiatric specialties to see the extent of faecal impaction	B
Trauma: blunt/stab injury – indicated supine PAR and erect CXR	B
Palpable mass – indicated only in specific circumstances rarely of value	C
Acute abdomen pain warranting hospital admission/surgical consult – indicated PAR and erect CXR may be used, local protocol negates this guideline[b]	B
Acute gastrointestinal bleeding: haematemesis/malaena – not indicated	B
Biliary disease (e.g. gallstones, post-cholecystectomy pain) – not indicated only shows 10% of gallstones	C
Genitourinary complaints	
Microscopic/macroscopic haematuria – indicated useful to evaluate upper tracts in young patients, best in combination with USG	B
Renal calculi without acute colic – indicated adequate to detect 80% of calculi, USG for urate calculi	B
Suspected renal/ureteric calculi – indicated only in specific circumstances where radiation/contrast medium contraindicated, e.g., pregnancy, allergy	B
Urinary tract infection in adults – indicated only in specific circumstances, cases of infection not settling with antibiotics; one proven episode in males and proven recurrence in females	B
Renal failure – indicated USG is preferred, PAR helps to show USG undetectable calculi	B
Obstetrics/gynaecological complaints	
Lost intra uterine contraceptive device – indicated only in specific circumstances only if contraceptive device not seen in uterus with USG	C
Swallowed FB – adults and paediatric	
Smooth and small FB, e.g., coin – indicated only in specific circumstances if not lodged at cricopharyngeus muscle and has not passed in 6 days (still might need radiographs for legal reasons)	B
Sharp/potentially poisonous, e.g., battery – indicated most FB that pass oesophagus will pass through smoothly, danger of leakage	B
Paediatric complaints	
Blunt abdomen trauma – indicated in specific circumstances only if major trauma with physical signs, not for use in minor trauma	B
Gastrointestinal bleed (per rectum) – indicated only in specific circumstances, only if suspecting necrotising enterocolitis	C
Acute abdomen pain – indicated only in specific circumstances rarely of value, avoid before considering USG	C
Constipation – indicated only in specific circumstances may be useful only in intractable constipation	C

CXR, chest X-ray; FB, foreign bodies; PAR, plain abdomen radiograph; USG, ultrasonography.
[a]Grades of recommendation based on the system developed by the US Department of Health and Human Services, Agency for Health Care Policy and Research (US Department of Health and Human Services, Agency for Health Care Policy and Research. Acute pain management. The agency, Rockville, Maryland, USA 1993).
[b]Local protocol prevalent at Shrewsbury and emergency department of Telford Hospital National Health Service Trust.
Adapted with permission (Royal College of Radiologist [2]).

The cases were compared with the indications given in the guidelines, on the basis of documented symptoms, signs and provisional diagnosis, and the results were collated and then analysed using SPSS software (version 16, SPSS, Chicago, Illinois, USA).

Results

Of the 113 case notes analysed, nine were lost to errors in scanning and two did not have radiographs at all. A further 27 cases (26%) were requested by different specialties in the emergency department, and hence were excluded. The breakdown of these 27 cases was as follows:

Seventeen: requested by the surgical senior house officer (SHO);
Six: requested by the medical SHO;
Three: requested by urology house officer;
One: paediatric resuscitation call.

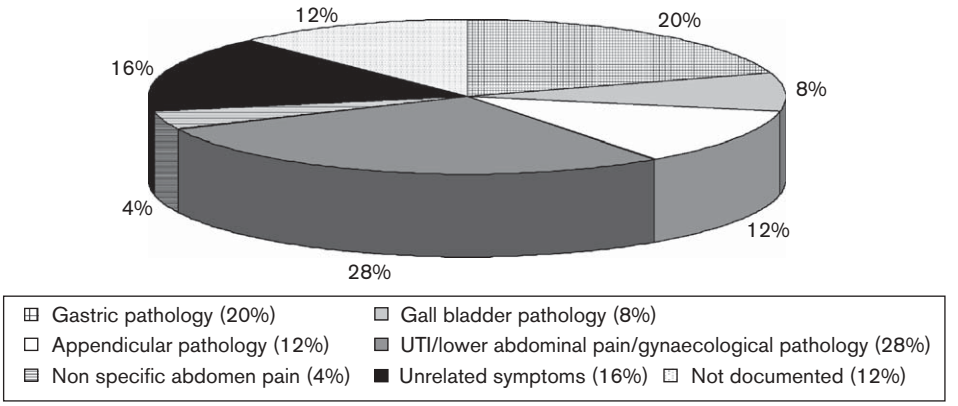
Of the 75 cases fitting the case criteria, the male and female percentage distribution was 56 (42 of 75) and 44 (33 of 75), respectively. The average age was 44.7 years (range: 10 months to 95 years).

Thirty three percent (25 of 75) (95% confidence interval: 24–45) of the patients' presenting complaints and working diagnoses, as mentioned by the attending doctor, did not meet the recommended indications. The patterns of presentation of these cases were varied and difficult to categorize; however, an attempt had been made to do the same and the following broad groups have been found:

(1) Gastric pathology, for example, gastritis, gastro-enteritis, upper gastrointestinal bleed, hiatus hernia (five of 25);
(2) Gall bladder pathology, for example, cholecystitis, cholelithiasis (two of 25);
(3) Appendicular pathology, for example, appendicitis (three of 25);
(4) Genitourinary pathology, for example, urinary tract infections/gynaecological symptoms (seven of 25);
(5) Nonspecific abdomen pain (one of 25);
(6) Unrelated symptoms, for example, asthma, pneumonia, panic attack (four of 25);
(7) Not documented (three of 25).

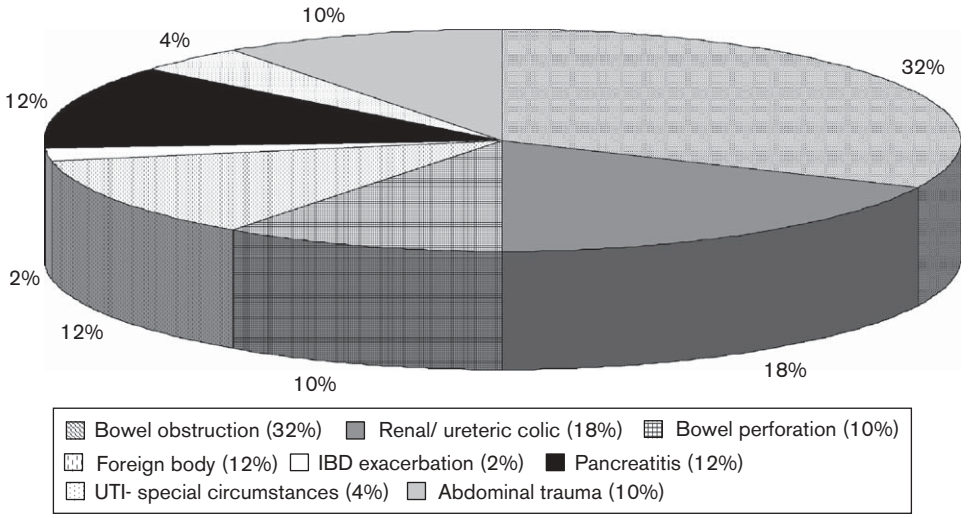
The percentage distribution of these cases was as illustrated in Fig. 1.

Fig. 1



Percentage distribution of inappropriate requests ($n=25$) of plain abdomen radiographs. UTI, urinary tract infections.

Fig. 2



Percentage distribution of appropriate requests ($n=50$) for plain abdomen radiographs. IBD, inflammatory bowel disease; UTI, urinary tract infections.

According to the published guidelines, there are very specific indications that justify requesting PAR. Of the 67% (50 of 75) cases that were justified, the percentage distribution was as in Fig. 2.

Discussion

The percentage of cases not justified in using the plain abdomen films, as found in our study, is significant enough to warrant serious rethinking of our strategies in managing such cases. Most of the inappropriate requests (33%), in our study, were for conditions where PAR would not have any positive findings. Certain conditions, such as appendicitis, may have nonspecific features visible on PAR, such as localized ileus/faecoliths; however, they too have no bearing on the ultimate management of the patient. Campbell and Gunn [8] reported that suspected appendicitis, urinary tract infections, and nonspecific abdominal pain, accounted for 32% of their PAR, and there was little value in the routine use of PAR in these conditions. This was confirmed by Anyanwu and Moalypour [9], who reported only 10.4% diagnostic PAR in their study, whereas 62% of patients with nonspecific abdominal pain underwent PAR in their study.

Bohner *et al.* [10] showed in their study that focusing on thorough history and clinical examination helped to elicit symptoms and signs, and these had a good sensitivity/specificity to safely make a provisional diagnosis of bowel

obstruction. Similar deductions can be made for other pathologies as well. By reaching an appropriate provisional diagnosis, a decision can easily be made on the appropriateness of a PAR request.

Results from our study confirmed the findings of Jelinek and Banham [11], and PAR were clearly indicated only in presentations shown in Fig. 2. They also fit the indications mentioned in the Royal College of Radiologists publication [2] and other studies [9]. Restricting the use of PAR for these specific groups of presentations can help in reducing the PAR requests significantly [9]. This can be achieved through use of locally devised or validated clinical algorithms for these conditions [10]. Displaying these algorithms as posters in the emergency department can help to increase awareness.

Many medical centers, both in UK and abroad, are conducting retrospective and prospective studies to devise guidelines of indications for requesting PAR. At the moment these studies are limited for use in pediatric cases [12,13], but a similar effort must be made to carry out well-designed prospective studies in adult patients as well. There has to be a conscious effort by emergency department staff to request PAR more judiciously. Educating the staff and making them aware of the existing guidelines, by organizing teaching sessions, poster presentations and including the Royal College guidelines in SHO induction packs, would go a long way in ensuring the same.

More access could be granted to the use of other imaging modalities out of hours, for example, ultrasonography, Doppler. The problem in this case would be ensuring the presence of trained staff that can perform and interpret these tests, either radiographers or doctors. Should implementation of these measures be undertaken, a step-by-step approach would ensure that the process was smooth.

Doctors from other specialties, requesting PAR in the emergency department, should also be involved in the aforementioned measures to curb over-requesting. Interdepartmental teaching sessions and presentations can once again help in increasing staff awareness. There should be an increasing communication between various departments in the hospital to ensure that the latest developments and guidelines are well circulated. This avoids discrepancies in requests by different departments and ensures that the evidence-based medicine is followed.

Conclusion

PAR are a valuable investigative tool, with very specific indications. Injudicious use can place a huge financial burden and radiation risk on the system. We recommend measures to reduce the number of requests by focusing on specific presentations, for which they are indicated, and implementing educational and awareness drives. Larger prospectively designed studies are required to gauge the effect of such a change.

Acknowledgements

The authors thank the staff at the radiology department of Royal Shrewsbury Hospital for their help in organizing this study. This study was self-supported and no major contributions received. No conflicts of interest.

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