Archives of Emergency Medicine, 1990, 7, 241–245

Reducing the use of plain abdominal radiographs in an emergency department

G. A. JELINEK & N. D. G. BANHAM

Department of Emergency Medicine, Fremantle Hospital, Fremantle, Western Australia

SUMMARY

Plain abdominal radiographs are ordered frequently in emergency departments. Previous studies have shown that these radiographs are often requested inappropriately with little likelihood of producing useful information. This study shows that the overall number can be reduced significantly, with little risk to patients, when clear guide-lines are applied.

INTRODUCTION

The plain abdominal radiograph (PAR) is frequently used to assist diagnosis in the emergency department. Several studies have suggested that it is used excessively, and often inappropriately.

In a retrospective series of 100 consecutive cases, de Lacey *et al.*, (1980) showed that 78% of PARs were negative. A prospective study of 100 cases by McCook *et al.* (1982) showed very similar results, with 77% of films normal, increasing to 84% if unsuspected and unrelated findings were taken into account.

Other reports concur that PARs requested without specific indications are likely to be negative. Hayward *et al.* (1984) and Greene (1986) concluded that there is a need to determine specific indications for PARs. Greene further suggested that the numbers may be reduced by at least 50% if his recommendations for the appropriate use of PARs in the emergency department were followed.

This study was planned with the aim of reducing the number of PARs requested in the Fremantle Hospital emergency department by applying clear guide-lines, and to determine whether such a reduction would affect the number of positive findings.

Correspondence: Dr. G. A. Jelinek. Department of Emergency Medicine, Fremantle Hospital, PO Box 480, Fremantle, Western Australia 6160

METHOD

A PAR at Fremantle Hospital is a single supine abdominal film from the diaphragms to the hernial orifices. An erect film may be requested in addition; if it is not possible to perform an erect film, a lateral decubitus film is taken.

For the first 6 months of this study, no attempt was made to alter the pattern of requesting PARs and the medical staff were unaware of the study.

For the second 6 months, guide-lines were issued for requesting PARs, and medical staff were required to check with a consultant or registrar before such a request. Authorization was granted if the suspected condition fell into one of the categories in Table 1. These categories were chosen by the authors after a review of the literature and discussion concerning their own clinical practice.

The radiology secretary recorded the total number of PARs in the 12 months. The clerical staff in Radiology were asked to return a photocopy of all request forms for PARs performed to the Emergency Department. One author (G.A.J.) checked the radiologist's report of all those returned and coded the forms.

Radiographs were classified 'appropriate' if the history and examination recorded on the request form led to a clinical diagnosis of one of the conditions in Table 1, and 'inappropriate' if they did not.

Abdominal ultrasonography was advised for investigation of suspected biliary tract disease or abdominal aortic aneurysm.

RESULTS

In all, 328 of 699 (47%) request forms and reports were returned in the first 6 months, and 175 of 334 (52%) in the second. The results are recorded in Table 2. In the first 6 months, 699 PARs were performed. This fell to 334 in the second 6 months, a drop of over 50%.

Approximately half of all PARs in the first 6 months were considered inappropriate, falling to about one third in the second half of the study.

The percentage of positive findings rose from 12% to 17% from the first to second 6 months, but of those films appropriately ordered the percentage of positive findings changed little (25% to 26%).

Table 3 illustrates some of the conditions for which PAR's were requested inappropriately. Although some of these conditions are occasionally associated with suggestive radiographic findings, these findings rarely alter management.

Table 1. Appropriate conditions for requesting a PAR.

Bowel obstruction or paralytic ileus
Pneumoperitoneum
Renal/ureteric/bladder calculus
Ingested foreign body
Penetrating injury

Table 2. Analysis of PAR's in the Emergency Department over 12 months.

	First 6 months	Second 6 months
Total	699	334
Appropriate	51%	67%
Inappropriate	49%	33%
Positive findings	12%	17%
Positive findings (of those appropriately ordered)	25%	26%

Table 3. Conditions for which a PAR was requested inappropriately.

Haematemesis
Peptic ulceration
Renal carbuncle
Appendicitis
Pancreatitis
Giardiasis
Gastroenteritis
Ascites
Constipation
Chronic left iliac fossa pain
Anxiety
Vaginal discharge
Back pain
Diarrhoea
Hiatus hernia
Renal contusion
Lymphoma
Gastric erosions
Fractured rib

The presence of a faecolith in suspected appendicitis is an example. Such conditions were considered inappropriate indications.

DISCUSSION

The Emergency Department at Fremantle Hospital has some 82 000 occasions of service annually. In the first 6 months of this study, there were 699 PARs requested. In the second 6 months, after the implementation of guide-lines, there were less than 350, a reduction of over 50%. Although the overall number of radiographs dropped by half, a third of those ordered in the second half of the study were still inappropriate. It seems there were also fewer appropriate PARs in this period. Why this should occur is difficult to understand, but it appears that the drop in

overall numbers was not simply by chance, as the monthly numbers during the first 6 months were fairly constant, as they were during the second 6 months but at about half the previous rate. Perhaps doctors, being aware of the study were less likely to request radiography even in cases previously considered appropriate, such as renal colic, where they were able to avoid such a request by using alternative investigations, such as intravenous urography or ultrasound.

Several papers have indicated that positive findings are very unlikely to be detected on inappropriately ordered PARs. This study confirms that view. In the first 6 months, there were seven positive findings in those radiographs which were requested inappropriately. Three were unsuspected, asymptomatic gallstones. There was one unsuspected renal stone, one abdominal soft tissue mass, and 2 unsuspected bowel obstructions. On scrutiny of the notes in the latter four cases, failure to make the diagnosis clinically prior to abdominal radiography resulted from deficiencies in history or examination.

In the second 6 months none of the inappropriately requested radiographs had positive findings.

Although the total number of positive findings fell in the second 6 months, it is important to note that the proportion of positive findings found in those PARs requested appropriately remained unchanged at about a quarter. This would indicate that the drop in total numbers of PAR's did not result in a failure to detect positive findings. It could be argued that a radiograph which does not detect positive findings is of value in excluding certain conditions, and therefore a judgement of whether a PAR is of value simply by whether it detects positive findings is not valid. We concur with this view but feel that the exclusion of those conditions in Table 1, if they are suspected clinically, is quite appropriate, but in other conditions, such as those in Table 3, a PAR is of little value.

There are several advantages in reducing the number of inappropriately ordered PARs in the Emergency Department. Selective use of abdominal radiography is time efficient, uses limited staff to the best advantage and maintains the enthusiasm of the staff concerned. In a busy emergency department, delays produced by unnecessary radiography limit the attention available for other patients. At night particularly, radiology department staff rightly resent performing films with little likelihood of producing useful information. More easily quantified is the financial benefit one could expect. The Medicare rebate for a PAR at the time of the study was A$39·50. Reducing the number of these radiographs by over 700 annually produces a saving of over $27 650. Although this calculation is of course not entirely valid in a hospital setting, it does indicate that substantial savings may be made. Stewart *et al.* (1985) have estimated a cancer risk of one death, or two cases per 140 000 films, due to radiation from a PAR. Moreover, many patients have PARs performed on several occasions. Lowering the number of PARs reduces this risk.

It is possible to further reduce the number of PARs. When a pneumoperitoneum is suspected, Miller *et al.* (1971) argue that a well penetrated erect chest film is more appropriate. In suspected ureteric colic Roth *et al.* (1985) conclude that the PAR provides no diagnostic information that cannot be obtained by history, examination and urinalysis. If further investigation is required then excretary

urography is the correct investigation. Management decisions are rarely made on the basis of PAR alone in acute ureteric colic and therefore it is illogical to submit the patient to a PAR when this is undertaken as a preliminary film before a contrast study. Although there was a large reduction in the number of inappropriate PARs there remain a number which may be reduced further with better selection on clinical grounds and closer supervision.

ACKNOWLEDGEMENTS

We would like to thank Nicole Jenner and Shirley Stubber for their assistance in copying and returning the request forms, and Elaine Sillery and Lee Jelinek for preparing the manuscript.

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