

## A study on the use of abdominal X-ray in an emergency department

SY Choi, TW Wong, CC Lau, E Liang, YK Fu, J Khoo

**Objective:** 1) To study the current use of abdominal X-rays (AXR) in our emergency department (ED). 2) To evaluate the clinical predictors for positive AXR findings. **Methods:** During the 40 days study period, all patients who had taken abdominal X-rays were included. The attending doctor filled in a questionnaire on demographic data, clinical features and outcome. The three radiologists who participated in this study reported the films and consultant emergency physicians then commented on the appropriateness of the request. The clinical features, which were predictive of positive radiological findings, were sorted out using univariate analysis. **Results:** 64 patients were included in the 40 days study period. The rate for AXR request was 3.4 per 1000 patients. The most common presenting complaints were abdominal pain (85.9%) and constipation (45.3%). The most frequent clinical findings were abdominal distension (35.9%) and hyperactive bowel sound (31.3%). Only two of the clinical features, including vomiting and rebound tenderness, were found to have significant correlation with positive X-ray findings. Most of the AXR requests and interpretations by ED doctors were considered to be appropriate. (*Hong Kong j.emerg.med.* 2002;9:30-33)

**Keywords:** Abdominal X-ray, predictor, utilization, yields

### Introduction

In our daily practice in the emergency department (ED), we often come across patients with abdominal pain and other gastrointestinal complaints. Abdominal radiography (AXR) is one of the most readily available investigations in the emergency department. However, plain abdominal X-ray has its limitation in the diagnosis

of abdominal complaints because of its low sensitivity and specificity. It has been said that plain AXR has been over-utilized for patients with abdominal pain.<sup>1</sup> In order to improve the yield of abdominal radiography, our present pattern of AXR usage in ED was studied.

### Objectives

1. To study the current use of AXR in our emergency department.
2. To evaluate the clinical predictors for positive AXR findings.

### Methods

In this prospective study, all patients who attended our emergency department in the period from 1 March to 10 April 1997, requiring AXR films, were included. The attending doctor would fill in a questionnaire together with the ordinary X-ray request form.

Correspondence to:

Wong Tai Wai, FRCS(Edin), FHKCEM, FHKAM(Emergency Medicine)

**Pamela Youde Nethersole Eastern Hospital**, Accident & Emergency Department, 3 Lok Man Road, Chaiwan, Hong Kong

Email: cclau@ha.org.hk

Choi Sing Yim, MBChB, FRCS(Ed)

Lau Chor Chiu, MRCP(UK), FHKCEM, FHKAM(Emergency Medicine)

**Pamela Youde Nethersole Eastern Hospital**, Department of Radiology, 3 Lok Man Road, Chaiwan, Hong Kong

Eisen Liang, FRCR, FRANZCR, FHKCR

Fu Yiu Kai, MBBS, FRCR, FHKCR

Jennifer Khoo, MBBS, FRCR, FHKCR

The questionnaire included questions concerning the patient's history and physical findings. The reasons for the request, the types of film ordered, and the patient's outcomes in ED were also recorded. The history part included previous abdominal surgery, pre-existing carcinoma, intra-abdominal carcinoma, presence of abdominal pain, vomiting, diarrhoea, constipation (bowel not opened for more than 3 days), ingestion of foreign body, and history of blunt abdominal trauma. For the physical findings, the attending doctor had to note down the presence of abdominal distension, hyperactive bowel sound, percussion tenderness, rebound tenderness, faecal impaction (after per rectal examination), any mass felt, jaundice, the total absence of bowel sound, or any abnormal finding elsewhere (such as supraclavicular lymph node). All the films were reported by the three radiologists who participated in this study. Reports were classified as normal, incidental findings or positive. The radiologists would also state whether they agreed with the interpretation made by the ED doctor. Consultant emergency physicians then commented on the appropriateness of the X-ray request according to the clinical situation.

The SPSS computer package was used for data analysis. A univariate analysis was performed to determine the association between clinical features and positive X-ray findings.

## Results

Out of the 18,749 patients attending our emergency department within the 40 days study period, 64 patients had AXR performed. The rate for AXR requests was 3.4 per 1000 patients. The mean age was 59.7 year, ranging from 2 to 96 year. The male to female ratio was 1:1.

The presenting complaints were summarized in Table 1. Abdominal pain and constipation were the most frequent presenting features. Vomiting, diarrhoea, history of previous abdominal surgery, foreign body ingestion and abdominal trauma were present in only a minority of the cases.

Table 2 summarized the findings of physical examination. 23 (35.9%) patients had abdominal distension and 20 (31.3%) patients had hyperactive bowel sounds. Peritoneal signs like percussion tenderness or rebound tenderness were detected in eleven (17.2%) and five (7.8%) patients. Interestingly, abnormal findings elsewhere were detected in 59 (92.2%) of the patients.

The radiologists reported that 23 (35.9%) films were normal. Eighteen (28.1%) of the AXR were positive and contributed to the diagnosis. (Table 3) The most common diagnosis was intestinal obstruction. Out of the various clinical features, only vomiting ( $P=0.0039$ ) and rebound tenderness ( $P=0.0218$ ) had statistically significant correlation with positive X-ray findings. 16 (25%) showed incidental findings, such as collapsed lumbar vertebrae, enlarged cardiac shadow, etc. 7 (10.9%) showed loaded colon. In most of the cases (82.3%), the radiologists agreed with the interpretations made by the ED doctors. In our series, 35 (54%) of the requests included both the erect and supine

**Table 1.** Clinical presentations.

Clinical presentations	No.	Percentage
Abdominal pain	55	85.9%
Constipation >3 days	29	45.3%
Previous abdominal surgery	24	38.1%
Vomiting	19	29.7%
Diarrhoea	3	4.7%
Foreign body ingestion	3	4.7%
Abdominal injury	1	1.6%

**Table 2.** Physical findings.

Physical examinations	No.	Percentage
Abdominal distension	23	35.9%
Hyperactive bowel sound	20	31.3%
Percussion tenderness	11	17.2%
Faecal impaction	6	9.4%
Rebound tenderness	5	7.8%
Abdominal mass	2	3.1%
No bowel sound	1	1.6%
Jaundice	1	1.6%
Abnormal finding elsewhere	59	92.2%

**Table 3.** Radiologist report.

X-ray findings	No.	Percentage
Normal	23	35.9%
Incidental findings	16	25%
Positive and Contributed to diagnosis	18	28.1%
--Intestinal obstruction	12	18.8%
--Stones	2	3.1%
Loaded colon	7	10.9%
<b>Radiologist</b> agreed with the ED interpretation		82.3%

abdominal films. Twenty-three (35.9%) cases had supine films only and the rest (9.4%) had erect films only. Consultant emergency physicians considered 89% of the requests to be appropriate.

Twenty-seven patients (42.2%) were admitted and 8 (12.5%) patients were referred to the specialists. Over 40% (26) of patients were discharged without further follow-up and only 2 (3.1%) patients were discharged with follow-up.

## Discussion

In our study, 28.1% of the AXR were positive. The yield was higher than a UK study,<sup>1</sup> where plain film radiology was performed in 55% of patients with abdominal pain in the ED, but only 10.4% was diagnostic. They suggest that plain film should be confined to patients with suspected gastrointestinal obstruction, perforation or ischemia, unexplained peritonism or renal colic. In another study,<sup>2</sup> the authors point out that in patients with acute abdominal pain, routine abdominal X-ray has little value if the provisional diagnosis is appendicitis, urinary infection, or nonspecific abdominal pain, due to its high false positive rate. In our series, 25 % of the AXR showed incidental findings, which were not helpful in making a diagnosis.

In accordance with traditional teaching, most of our requests included both supine and erect films (54%). This is currently not recommended. Since most of the abnormal findings will be shown up in the supine

films, an additional erect film will not give extra clue to the diagnosis.<sup>3,4</sup> On the other hand, an erect chest film can give extra information on the presence of intraperitoneal free gas and the position of the diaphragm. An American study has shown that the supine abdominal film and the erect chest film could diagnose normality or abnormality in 98% of patients.<sup>4</sup> The elimination of the erect abdominal view from the routine series could result in financial savings, decreased radiation exposure and a more efficient use of technician time, without significant loss of diagnostic information.

In our study, only vomiting and rebound tenderness are significantly correlated with positive AXR findings. This is most likely due to our small sample size. In a European study, the clinical features with the highest sensitivity were distended abdomen, increased bowel sounds, history of constipation, previous abdominal surgery, age over 50 and vomiting.<sup>5</sup> In another large scale study involving 1,780 patients, it was also demonstrated that 53% of the X-rays would not have been done if radiography was limited to patients with moderate to severe abdominal pain, or if there was high suspicion of bowel obstruction, renal calculi, trauma, ischemia or gallstones.<sup>6</sup> Another paediatric study also demonstrated similar percentage of film order reduction (48%) if AXR was requested in patients with as least one of the following features: prior abdominal surgery, foreign body ingestion, abnormal bowel sounds, abdominal distension or peritoneal signs.<sup>7</sup>

Besides plain abdominal films, ultrasonography also has its role in the diagnosis for abdominal pain. Studies have shown that USG is helpful in the diagnosis of cholecystitis, diverticulitis, bowel obstruction and even appendicitis.<sup>8</sup> It is particularly useful in female patients with mid to lower abdominal pain because of the possibility of gynaecological causes. However, USG is highly operator dependent. Thus, its yield and accuracy are variable.

## Conclusion

Although plain abdominal radiography has its limitations in the diagnosis of acute abdominal

conditions, its yield can be improved by focusing on patients with high yield criteria. In terms of clinical features, vomiting and rebound tenderness are most predictive of positive AXR.

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