Erect chest radiography in the setting of the acute abdomen: essential tool or an unnecessary waste of resources?

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ABSTRACT

INTRODUCTION It has been suggested that changes to the training schemes of junior doctors and the increased pressure on emergency departments to manage their patients within a limited time might increase the number of unnecessary investigations performed on emergency admission patients. This, in turn, may lead to an increased number of investigations with normal results. In this study we try to analyse the role of the chest X-ray (CXR) as a diagnostic tool in patients presenting with acute abdominal pain.

PATIENTS AND METHODS A retrospective study was performed of the request forms and results of all chest radiography performed on patients admitted on the emergency surgical intake with acute abdominal pain through utilisation of the prospectively maintained electronic radiology database. The indications were compared to the guidelines published by the Royal College of Radiologists (RCR) which have been adopted as the standard of care.

RESULTS A total of 334 chest X-rays were identified of which only 23 (7%) had new findings. Four (1%) patients had free gas under the diaphragm. Of the CXRs, 258 (77%) were reported normal whilst 53 (16%) had old changes which were described in their hospital records and previous radiographs. Of the CXRs with new findings, only 20 were clinically significant and, of these, four (1%) were surgically significant.

CONCLUSIONS The majority of CXRs performed on emergency surgical admissions with abdominal pain are unnecessary. By obtaining a clear history, performing a thorough clinical examination and following the RCR guidelines most of the CXRs could be avoided. This would lead to less radiation exposure, reduce delays to diagnosis, and provide significant financial savings.

KEYWORDS

Chest radiograph – Acute abdomen

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Patients admitted as an emergency with abdominal pain often undergo two standard imaging studies in the acute setting, namely an erect chest and supine abdominal radiograph. The indications for the erect chest radiograph (CXR) are first to exclude free gas under the diaphragm as a result of a perforated viscus, and second to attempt to exclude an intrathoracic condition as a cause for the abdominal symptoms.

The Royal College of Radiologists (RCR) recommends a CXR be performed when there is a suspected visceral perforation, to exclude air under the diaphragm. This does not supersede a thorough clinical examination and should not be done routinely for patients with abdominal pain.¹

Although the cost of a CXR is relatively small at approximately £20 per film, the fact that acute abdominal pain accounts for 50% of all emergency surgical admissions²

means that the overall costs for this investigation are significant. Furthermore, although the radiation exposure of a CXR is low at 0.2 mGy,⁵ all unnecessary radiation should be avoided. In addition, from a clinical perspective, requesting investigations which are unlikely to be of any benefit in obtaining the diagnosis simply delays the commencement of treatment.

The aim of this study was to address this issue by examining both the quantity and quality of requests made for emergency chest radiographs in patient presenting with abdominal symptoms.

Patients and Methods

A retrospective study was performed to identify all patients admitted on the emergency intake of a single surgeon with

Table 1 The Royal College of Radiologists guidelines on requesting a CXR in patients presenting with abdominal pain

- To detect the presence of free gas from a perforated viscus
- To rule out a chest infection in elderly patients with upper abdominal pain

acute abdominal pain during a 12-month period. From this cohort, adult patients undergoing chest radiography (CXR) at the time of admission were identified.

The prospectively maintained radiology department database was then analysed to obtain details of the indications for the CXR and the result of the CXR as determined by a consultant radiologist. CXRs with positive findings were identified and divided into new and old findings by comparison with previous clinical and radiological data. CXRs were then evaluated as to whether or not they were surgically relevant.

The indications for the CXR were also compared to nationally-accepted guidelines produced by the Royal College of Radiologists, to assess the appropriateness of the requests (Table 1).¹

Results

During the period of the study, 515 patients with acute abdominal pain were admitted under the care of a single general surgical consultant at a district general hospital. Of these admissions, 334 (65%) had an erect CXR performed at the time of admission.

Of those in whom a CXR was performed, only 23 of 334 (7%) had new findings identified by the reporting radiologist and 20 of these 23 had findings which were clinically significant. The commonest radiological diagnosis on CXR

was consolidation or atelectasis which was seen in 16 of 334 (5%) and the other 4 of 334 (1%) had free air under the diaphragm. Therefore, only four had signs indicative of intra-abdominal disease on their CXR. In two of these cases, free gas was visible on the plain abdominal radiograph (AXR). The pathology was duodenal perforation in three cases and perforated sigmoid diverticular disease in the fourth case. The remaining three patients with a positive finding were reported as having non-caseating granulomas in the lungs.

Of the 16 patients with consolidation or atelectasis reported on their CXR, none had any associated gastrointestinal condition identified during the index admission and the primary pathology was believed to be a respiratory one with referred pain to the upper abdomen.

Of those with no new findings on their CXR, in 258 of 334 (77%) cases the radiograph was reported as being normal; in 53 of 334 (16%) cases, old changes which were identified on previous radiographs were reported. These old radiological findings included chronic obstructive airways disease, cardiomegaly and hiatus hernia.

When the indications for the CXR were assessed in the 334 cases in which a radiograph was performed, the usual indication on the request form was to exclude a perforation (321/334; 96%) and in only 13 of 334 (3%) cases were respiratory signs noted on the CXR request form. None of the 13 patients with clinical signs of consolidation/atelectasis had gastrointestinal pathology identified during the course of their admission.

Based on final diagnoses, and excluding pericolic abscesses, a further eight patients had a perforated viscus with free peritoneal gas as a cause for their emergency admission including two perforated ulcers and six colonic perforations. These findings were confirmed on computed tomography (CT) prior to laparotomy in six cases and in two cases was there evidence of gas on the AXR. In the remaining three patients with signs on the CXR but no respiratory signs on clinical examination, the final clinical diagnosis was acute cholecystitis and the atelectasis seen on CXR was believed to be secondary to pain.

Discussion

The primary finding of this study is that the vast majority of CXRs performed in patients admitted on emergency surgical intakes with acute abdominal pain could be avoided. Only four of 321 (1.2%) patients in whom a CXR was requested to 'exclude perforation' had evidence of gas under the diaphragm. Overall, 12 of 334 patients had a visceral perforation with free intraperitoneal gas identified during their admission of which two cases were identified on AXR alone, two on both AXR and CXR and in two cases the gas was seen on CXR alone. In the remaining six cases,

Figure 1 Classification of the patients based on their chest X-ray (CXR) findings.

no gas was identified on plain radiography and the diagnosis was confirmed by CT/laparotomy. Thus, in only two cases did the CXR indicate the underlying diagnosis. All 12 of these patients had a suspected diagnosis of visceral perforation.

The most commonly identified new pathologies on the CXRs performed were respiratory and were seen in 19 of 334 (5.7%) undergoing a CXR or 19 of 515 (3.7%) admissions with abdominal pain. Of these patients, 16 had an acute respiratory pathology for which clinical findings were also present. Other studies have also evaluated the need for CXRs in patients with abdominal pain. Tsalkidis *et al.*⁴ reviewed the records of 1731 paediatric patients admitted with acute abdominal pain and 51 were found to have non-abdominal causes for their pain, representing 3.1% of the total.

In our experience, the requesting of CXRs is often attributed to pressure by senior colleagues with trainees stating 'the consultant insists'. Some trainees admit to quoting a clinical suspicion of perforation on the request form as they are aware that this is an appropriate indication for a CXR regardless of whether or not it is truly suspected based on clinical findings. Another justification is that a surgical patient may need an operation. However, if the patient has no clinical signs and no relevant history, there is no indication for a CXR.¹ Even for patients with a history of cardiorespiratory disease, if there is an archived film and if there are no clinical signs or significant clinical changes since the previous radiology, a repeat CXR is not indicated.

It has been suggested that increased pressure on emergency departments to manage their patients within a limited time might increase the number of unnecessary investigations performed as juniors are pressured triage patients. It is, therefore, necessary that these doctors are educated in the importance of following RCR guidelines.¹ If CXRs were not performed unless there were unexpected clinical signs on examination of the cardiovascular or respiratory systems during the surgical admission process, the vast majority of CXRs in this series would have been avoided. This was also the conclusion of a study of 1584 children with abdominal pain in whom pneumonia was identified in 30 (1.89%), all of whom had respiratory signs.⁵ In only two cases (0.13%) would the diagnosis of pneumonia been missed on initial presentation had a CXR not been performed.

In the current study, in the two cases in which the diagnosis of visceral perforation was identified on CXR but not AXR, it is unlikely that either patient would have suffered from not performing the CXR examination as, in both cases, there were clinical signs of peritonism. There is now accumulating evidence that a CT scan should be performed as the first-line radiological investigation in a stable patient in whom a visceral perforation is suspected as it is more sensitive and allows identification of the source and pathology responsible for the perforation.⁶

There are three distinct benefits from not performing radiological investigations. First is the avoidance of radiation exposure. Although the radiation exposure from a CXR is small, it is avoidable. The second factor is to reduce waste of resources.

The cost of a CXR is small but given the large number of unnecessary CXRs, the cumulative cost is significant. When the RCR first published guidelines for requesting radiographs, it was predicted the NHS could save £50–60 million per year. The costs saved by reducing CXR requesting include all the indirect costs such as the salary of the radiographer taking the film, pregnancy tests of female patients and the costs of the radiologist interpreting and reporting the films. In this series, respiratory symptoms were elicited in only 13 patients; thus, the CXR could have been avoided in 321 of 334 (96.1%) of those in which they were requested. Finally, the time wasted in requesting and processing the CXR might be better used in requesting other more suitable investigations.

The findings in this study complement those of a previous paper looking at the appropriateness of abdominal radiograph requests.⁷ A reduction in AXR requests would increase the potential advantages of adherence to RCR guidelines.

The main limitation of our study is, being retrospective, that data may not have been adequately documented, in particular in relation to respiratory findings within the clinical notes. As not all our patients with abdominal pain underwent a CXR, it is feasible that some of those who did not have an X-ray may have had positive findings had one been performed. However, it is presumed that the decision not to request one was based on the absence of clinical findings on examination of the chest and no indication for a CXR based on RCR guidelines.

Conclusions

This study has demonstrated that the majority of CXRs performed on patients admitted on a surgical intake with abdominal pain are not necessary and should be avoided. Furthermore, in the small numbers in whom free gas was identified, clinical findings were also present and thus the value of a CXR even in this setting is questionable. Stricter adherence to the RCR guidelines would significantly reduce the financial, radiation and time resources currently being wasted.

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