



Emergency Medicine Physician Ordering of Abdominal Radiographs for Acute, Non Traumatic, Abdominal Pain

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Abstract

Introduction: The purpose of this study was to document, classify, and analyze the rationale behind the use of abdominal radiography (AXR) by Emergency Department physicians (EDMDs) in the setting of acute non-traumatic abdominal pain.

Methods: A prospective observational cohort study of EDMDs in the diagnostic evaluation of patients with acute, non-traumatic abdominal pain for whom AXR was requested. Prospectively acquired data included the experience level of the EDMD, the provisional diagnosis prior to AXR, the likely impact of the results on the decision to order further imaging, and the EDMDs' estimate of the likelihood of having a positive finding on AXR.

Results: Results from 169 patients were included. The most common provisional diagnoses provided at the time of ordering the AXR were obstruction (43%), constipation (14.8%), perforation (8.3%), non-specific abdominal pain (6.5%), renal colic (3.6%) and other (18.9%). The reason for ordering the AXR was to establish the provisional diagnosis (44.4%), to exclude a more serious diagnosis (33.1%) and other (20.7%). Overall 70.4% of AXRs were interpreted as normal, 23 (13.6%) of the studies were read as positive with 78% of these being positive for small bowel obstruction. An additional 27 (16%) studies were equivocal. In 40% of patients with an AXR, no CT was obtained later.

Conclusion: Physicians' pretest probability of a positive finding was found to increase the likelihood of a positive AXR. By limiting the use of AXR to specific diagnoses and guided by the physician's own determination of likelihood of positive results, imaging resources might be able to be used more efficiently, decreasing patient's length of stay, radiation exposure, and technician's and physician's time.

Keywords: Non-traumatic; Radiation; Abdominal pain.

Introduction

Acute non-traumatic abdominal pain is one of the most common complaints among patients presenting to the emergency department (ED) [1]. The differential is wide and ranges from self-limited causes to life-threatening emergencies [2]. To help in diagnosis, emergency physicians (EPs) often utilize a wide arsenal of diagnostic testing [3]. Part of this imaging repertoire includes abdominal radiography (AXR). The use of AXR has evolved from part of the routine workup for undifferentiated abdominal pain to a more limited use in a smaller number of provisional diagnoses [4]. However, AXR remains the initial modality used in many occasions [5]. Studies have shown variability in the ordering rates of imaging studies among different groups of providers but no outcome differences have been demonstrated [6,7].

Nearly 30 years ago, Eisenberg et al. [8] challenged the use of AXR, showing more than half of those ordered could be eliminated without missing clinically important findings. AXR use has been challenged in

view of the widespread availability of computed tomography (CT) in the ED [9]. One of the studies further challenging the use of AXR, published in 2008 by Kellow et al. [10], concluded that if imaging was deemed indicated on clinical grounds, with the exception of catheter placement, more definitive imaging should be requested. The authors concluded, "There no longer remains a role for abdominal radiography in non-trauma emergency room patients" [10]. As supporting evidence, the authors found a high incidence (81%) of positive CT and ultrasound findings in patients whose radiographs were interpreted as normal or non-specific [10].

Should AXR be completely eliminated from the diagnostic battery of the EP? In Kellow's study, 58% of cases with a normal AXR (20% of patients) did not undergo further imaging [10]. If the AXR is completely eliminated, and CT scans are instead ordered for this group, there would be a large increase in the amount of radiation and cost in the evaluation of this group of patients [11].

The purpose of this study was to document, classify, and analyze the rationale behind the use of abdominal radiography by EPs in the setting of acute non-traumatic abdominal pain. We aimed to determine the reason for ordering abdominal radiographs in the ED

and to determine the accuracy in assessing the likelihood of a positive result in patients presenting with acute non-traumatic abdominal pain. The optimization of radiograph utilization is of importance, as it contributes to the reduction of health care costs and the reduction of potential harm due to radiation exposure.

Methods

This was a prospective observational cohort study of EPs in the diagnostic evaluation of patients with acute, non-traumatic abdominal pain for whom abdominal radiographs were requested as part of routine clinical practice. The study was approved by the hospital Institutional Review Board (Protocol # 2009-P-000104/9).

The primary participant population was EPs at various levels of training requesting abdominal radiographs for the evaluation of non-traumatic abdominal pain on eligible patients, which were limited to non-pregnant patients over 17 years of age. This observational cohort study of EPs was performed in an urban, tertiary care ED with an annual ED visit volume of 55,000.

The primary data was collected by live-interview of the ordering physician by a trained research assistant after an AXR order was placed. The physician responses were captured on a paper procedure card and data transferred to a spreadsheet. This prospectively acquired data included the experience level of the ordering physician, patient identifiers for medical record review, the provisional diagnosis prior to abdominal radiography, the likely impact of the radiographic results on the decision to order further imaging, and the referring physician’s best estimate of the likelihood of having a positive finding on the radiograph. If subsequent CT imaging was obtained in the ED, the referring physician was asked to record the new provisional diagnosis and the likelihood of a positive result with this more sophisticated imaging modality. Descriptive statistics are included where relevant.

Results

Data were collected between September 2009 and October 2010. Results from 169 patients with completed forms were included. Patient age ranged between 19 and 96 years old, with an average age of 54 years. 62.7% of the patients were female.

The training level for the EP ordering the abdominal radiographs was as follows. For 64 of the patients, the physician was a PGY1 (37.9%), PGY2 for 32 patients (18.9%), PGY3 for 19 patients (11.2%), PGY4 or higher for 3 patients (1.8%), and at attending level for 51 (30.2%).

The most common provisional diagnoses provided at the time of ordering the abdominal radiographs were obstruction for 72 patients (43%), constipation for 25 (14.8%), perforation for 14 (8.3%), non-specific abdominal pain for 11 (6.5%), renal colic in 6 (3.6%), other in 32 (18.9%), and the rest as listed on Table 1.

Disease	No. of Patients	Percentage
Obstruction	72	42.6%
Perforation	14	8.3%
Renal Colic	6	3.6%
Appendicitis	0	0.0%

Diverticulitis	0	0.0%
Pancreatitis	3	1.8%
Gallbladder disease	0	0.0%
Gastroenteritis	1	0.6%
Peptic Ulcer Disease	1	0.6%
Adynamic ileus	1	0.6%
Gastrointestinal Bleeding	2	1.2%
Diarrhea	1	0.6%
Constipation	25	14.8%
Nonspecific abdominal pain	11	6.5%
Other	32	18.9%
Total	169	

Table 1: Provisional (clinical) Diagnosis

The reason for ordering the abdominal x-ray was to establish the provisional diagnosis in 75 of the cases (44.4%), to exclude a more serious diagnosis in 56 (33.1%), and other in 38 (22.5%), which included responses such as requested by consulting service or PCP, tracking foreign body, and others.

Likelihood of positive findings on AXR

The physicians rated the likelihood of having a positive abdominal film as very unlikely in 21 (12.4%), unlikely in 44 (26%), equivocal in 45 (26.6%), likely in 43 (25.4%), and very likely in 16 (9.5%). AXR were ordered in 65 patients (38%) even though the estimated likelihood of a positive result was deemed as unlikely or very unlikely.

Of the radiographs deemed very unlikely to have a positive result, 4.8% [1] were abnormal and 9.5% [2] were equivocal. Of those unlikely, 9.1% [4] were abnormal and 11.4% [5] were equivocal. Of those equivocal, 8.9% [4] were abnormal and 15.6% [7] were equivocal.

Of those deemed likely to have a positive result, 23.2% [10] were abnormal and an equal number were equivocal. Of those deemed very likely to have a positive result, 25% had a conclusive finding. This is summarized in Table 2. Overall 70.4% of AXRs were interpreted as normal, 23 (13.6%) of the studies were read as positive with 78% of these being positive for small bowel obstruction. An additional 27 (16%) studies were equivocal.

	Pre-test very unlikely	Pre-test unlikely	Pre-test equivocal	Pre-test likely	Pre-test very likely
positive	1	4	4	10	4
equivocal	2	5	7	10	3
negative	18	35	34	23	9

Table 2: Table positive findings by pre-test likelihood.

Strategies

Of the 169 patients enrolled, physicians stated for 53 (31.4%) that a CT would be ordered if the x-ray result was negative. Of these, in 52.8% it was to establish a diagnosis and in 43.4% to exclude more serious diagnoses.

If the abdominal films were negative, the plan was to treat symptoms and discharge in 45 patients (26.6%), to order a CT in 53 (31.4%), and other in 70 (41.4%).

If the x-ray had a positive result [38.5% (65)], the plan was to order a CT with the goal of establishing a provisional diagnosis in 46.2% and excluding a more serious diagnosis in 38.5% of the cases.

In 14 patients (8.3%), the strategy was to order a CT scan regardless of abdominal x-ray result. A CT was not ordered in 68 patients (40%).

Discussion

Even though the most common provisional diagnosis made before ordering abdominal radiographs was bowel obstruction (43%), abdominal radiographs were ordered when considering other diagnosis such as constipation (14.8%), abdominal pain NOS (6.5%), and even GI bleeding, which were unlikely to be answered by a AXR. AXR were also ordered when considering perforation, where a CXR might serve the goal of diagnosis better and with less radiation. The elimination of AXR for conditions where it is not diagnostic or where it can be substituted for a lower radiation study may improve the benefit and yield of positive AXR.

A recent study from Australia found 76% of AXR in their patient population to be normal, they reference the Western Australia Department of Health Diagnostic Imaging Pathways as a way to reduce the use of AXR and estimate a 25% reduction in use in their patients if the guidelines were applied [12,13]. Similar or greater reductions would have been achieved in our patient population by eliminating diagnoses where AXR is unlikely to yield any information and by substituting CXR for AXR when perforation is being ruled out.

If the provider thought findings were likely or very likely, there were positive findings in 47% and 44%, compared to 14%, 21%, and 24% in those deemed very unlikely, unlikely, or equivocal. This results show physician clinical judgment despite level of training might serve to guide which patients are more likely to have findings on AXR and which are more likely to have a diagnosis from an AXR.

At the time of ordering, in 27% of cases, physicians considered treating symptoms and discharging patient with a negative AXR. In 40% of patients, whom physicians considered important to obtain imaging in the form of an AXR, no CT was obtained later. If the recommendations made by Kellow et al. [10] were followed – to begin with a more definitive study if imaging is indicated – there would have been a significant increase in the number of CT scans ordered.

Limitations

Although the survey provided the option to elaborate on the rationale for ordering imaging studies, the survey format limited responses to the options provided.

The study was limited to only ED data and does not reflect either inpatient or outpatient abdominal imaging utilization. The data were collected at a single institution, and therefore the results may not be generalizable to other institutions or regions.

Conclusion

Our study indicates that abdominal radiographs are still used as a diagnostic tool by the EP. Even though a CT scan was ordered in a significant number of patients presenting with acute, non-traumatic abdominal pain, a diagnosis was determined by radiography in 14%. Physicians' pre-test probability of having a positive finding was found to increase the likelihood of a positive AXR.

By limiting the use of AXR to specific diagnoses, such as bowel obstruction or foreign body where a diagnostic finding is more likely to be obtained, and guided by the physician's own determination of likelihood of positive results without completely eliminating it as a diagnostic modality, imaging resources might be used more efficiently, decreasing patient's length of stay, radiation exposure, and technician's and physician's time.

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