

## Is there still a role for abdominal plain X-ray in acute abdomen?

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### Abstract

The imaging workup of patients with acute abdominal pain still starts with abdominal X-ray in several clinical settings and facilities. Unfortunately, conventional plain film is of limited utility if performed as a routine investigation. Abdominal radiography is valuable only in patients with suspected perforated viscus and large bowel obstruction. Ultrasound is mostly valuable in the vast majority of abdominal pain presentations, whereas computed tomography scan should be considered as second level test.

### Introduction

Approximately 10% of emergency department visits are due to acute abdominal pain, making it one of the most encountered complaints.<sup>1,3</sup>

Several studies have demonstrated that a diagnosis based solely on a patient's medical history, physical examination, and laboratory tests is not reliable enough, despite the fact that these aspects are essential parts of the workup of a patient presenting with acute abdominal pain.<sup>4</sup> Imaging workup traditionally starts with abdominal radiography series: supine and upright abdominal and erect chest radiography. Unfortunately, X-ray has limited utility in abdominal imaging. In 2011 the van Randen's group<sup>5</sup> published the results of a multicenter prospective trial. The study compared the initial diagnosis, after clinical evaluation alone, with the final diagnosis, in patients with abdominal pain presented at the ED. The primary clinical diagnosis corresponded with the final diagnosis in less than half patients. After radiographs, primary diagnosis corresponded with final diagnosis in half cases; the improvement in accuracy of plain abdominal radiography combined with clinical examination was not significant ( $P=0.14$ ). Treating physician changed primary diagnosis from initial clinical diagnosis in 11% after

plain abdominal radiography, and these changes were accurate in only 22% of the patients. This study showed that clinical diagnosis after routine plain radiographs did not change significantly the primary diagnosis based on clinical evaluation alone. The Authors concluded that plain radiography should be omitted from routine diagnostic workup. The American College of Radiology, The Royal College of Radiologists and the Italian Society of Radiology, published indications for abdominal radiography that include only suspicion of perforated viscus or bowel obstruction.<sup>6-8</sup>

### Detection of free air

The identification of a small amount of free intra-abdominal gas remains one of the most significant signs in medicine. Advocates of conventional radiography state that plain abdominal X-ray should be the first diagnostic modality used in suspicion of a perforated viscus. With a well done radiographic technique it is possible to detect small quantities of free gas, but a great experience is necessary. In Baker's study,<sup>9</sup> plain radiography demonstrated pneumoperitoneum in only 51% of the patients with documented visceral perforation. Van Randen<sup>5</sup> found a sensitivity of plain radiographs for perforated viscus of only 15%. Furthermore, when in reports of 1980s plain radiographs typically revealed free intraperitoneal air originated from perforated peptic ulcers (59-69%) or colonic diverticulitis (37-46%), in recent years an increase of small bowel and colon perforation and a decline in the incidence of gastroduodenal perforation has seen, as the Kumar's study evidenced in 2012.<sup>10</sup> If abdominal X-ray evidences a massive pneumoperitoneum other imaging are unnecessary. If plain radiography delineates minimal pneumoperitoneum and the clinical is not clear an additional computed tomography (CT) scan is often needed to adopt the specific operative strategy.

### Bowel obstruction

Clinical findings in bowel obstruction include crampy abdominal pain, distension, increased bowel sounds and vomiting.

The results of a prospective study published in 1998<sup>4</sup> evidenced that the combination of that variables has low sensitivity. Furthermore history and clinical examination are neither sufficiently sensitive nor specific to determine a coexistent ischemia. This uncertainty has led to the widespread use of imaging, above all to detect complication.

If there is a suspect of bowel obstruction the diagnostic evaluation should focus on the following goals: distinguishing mechanical obstruction from ileus; determining the etiolo-

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gy of the obstruction; discriminating from partial to complete obstruction; and discriminating from simple to strangulating obstruction. X-ray has conventionally been used as the first step in the diagnostic imaging evaluation of a patient with suspected bowel obstruction.<sup>11</sup> The diagnostic accuracy of plain radiographs is low varying from 55 to 80%. The diagnosis relies on two primary findings: dilated loops and air-fluid levels. Their evidence is correlated with the severity of obstruction (partial or complete) and with the time of onset until X-ray is performed; an abdominal X-ray obtained just after the onset of the obstruction may not yet evidence dilated bowel proximal to the obstruction and may not yet evidence the absence of gas distal to the obstruction. Already the presence of more than two air-fluid level, air-fluid levels wider than 2.5 cm, and air-fluid levels differing more than 5 mm from one another in the same small-bowel loop, have reported to be sensitive and specific to differentiate high-grade of small bowel obstruction from low grade.<sup>12</sup> The sensitivity of the plain films is high when there is a high grade bowel obstruction, in this case X-ray is as sensitive as CT (86 vs 82%).<sup>13</sup> Unfortunately the number of symptomatic patients encountered with either low grade or no obstruction is considerably greater than the number of patients with a high-grade partial or complete bowel obstruction. In patients for whom clinical suspect of an intestinal obstruction is high and abdominal radiographs are insufficient to confidently confirm diagnosis or to reasonably assess the severity of obstruction, additional diagnostic imaging becomes necessary.

## Conclusions

The routinely use of abdominal X-ray as the first assessment after clinical examination in abdominal pain is striking considering the low diagnostic yield of this imaging test.<sup>14</sup> However, performing abdominal CT in all patients presenting to the ED complaining for abdominal pain is an insane way, and it could be considered the Waterloo of the emergency system, indeed. So, is there still a role for abdominal plain X-ray in acute abdomen? The choice of imaging test is part of the strategy.<sup>15</sup> After clinical evaluation, only in the suspect of perforation or bowel obstruction a plain radiography should be performed, while in different contexts it is of poor value.

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