

## The role of plain radiographs in patients with acute abdominal pain at the ED

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## INTRODUCTION

- ✦ In the United States, 119.2 million people visited ED in 2006, of which 8.1 million people (6.8%) sought help for **abdominal pain**
- ✦ Imaging workup generally starts with **acute abdominal series (supine and upright abdominal and upright chest radiograph)**
- ✦ American College of Radiology considers **abdominal radiographs** equally appropriate as **unenhanced CT and ultrasound**. Only **CT** with iv contrast is considered more appropriate

## INTRODUCTION

- ✦ Despite these recommendations, some evidence shows **diagnostic value and clinical utility** of plain radiography in acute abdominal pain **are limited**.
- ✦ Only in suspecting with **urinary tract calculi 、 perforation 、 bowel obstruction 、 radio-opaque GI foreign bodies** ,plain radiographs are presumably diagnostic

## DESIGN AND ELIGIBILITY

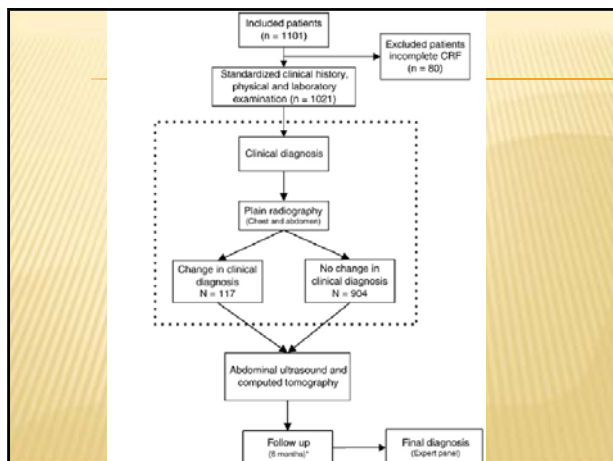
- ✦ Inclusion: patients with acute abdominal pain, for more than 2 hours and less than 5 days
- ✦ Exclusion: discharge by treating physician without any diagnostic imaging, <18 y/o, pregnant women, blunt or penetrating trauma, hemorrhagic shock

## DESIGN AND ELIGIBILITY

- ✦ patients were evaluated by treating physicians at the ED, who were **surgical or emergency medicine residents**
- ✦ Diagnoses were selected from a list of potential diagnoses

## IMAGE EVALUATION

- ✦ All patients underwent **supine abdominal and upright chest radiography**.
- ✦ Plain **radiographs were evaluated by treating physicians** at the ED → new diagnosis and level of confidence were provided by the physician
- ✦ patients also underwent **ultrasonography and CT** after radiography
- ✦ After **6 months of follow-up**, **final diagnosis** was assigned by an **independent expert panel**



## ANALYSIS

- ✗ We recorded: **proportion of changes** in primary diagnosis **between clinical assessment only and after plain radiographs** , **accuracy of changes** , **corresponding change in level of confidence- if diagnoses did not change**
- ✗ **sensitivity and positive predictive value** were calculated for **bowel obstruction, perforated viscus, and urinary tract stones**

## RESULTS

- ✗ mean age of the 1021 patients was 47 years (range, 19-94 years), and male to female ratio was 456 to 565 (44%:56%).
- ✗ Patients had been evaluated at the ED by **surgical residents (74%) and emergency medicine residents (26%)** with mean experience of 25 months

| Diagnosis                                                    | Clinical evaluation |      | After plain radiography |      | Final |      |
|--------------------------------------------------------------|---------------------|------|-------------------------|------|-------|------|
|                                                              | n                   | %    | n                       | %    | n     | %    |
| Appendicitis                                                 | 422                 | 41.3 | 402                     | 39.4 | 284   | 27.8 |
| Diverticulitis                                               | 126                 | 12.3 | 118                     | 11.6 | 118   | 11.6 |
| Gastrointestinal nonurgent                                   | 80                  | 7.8  | 87                      | 8.5  | 56    | 5.5  |
| Bowel obstruction                                            | 72                  | 7.1  | 82                      | 8.0  | 68    | 6.7  |
| Hepatic, pancreatic and biliary disorders (HPB) <sup>a</sup> | 65                  | 6.4  | 64                      | 6.3  | 43    | 4.2  |
| Cholecystitis                                                | 62                  | 6.1  | 57                      | 5.6  | 52    | 5.1  |
| Pancreatitis                                                 | 28                  | 2.7  | 27                      | 2.6  | 28    | 2.7  |
| Nonspecific abdominal pain                                   | 27                  | 2.6  | 30                      | 2.9  | 183   | 17.9 |
| Gynecologic disorder urgent                                  | 24                  | 2.4  | 28                      | 2.7  | 27    | 2.6  |
| Urinary tract disorder urgent                                | 21                  | 2.1  | 21                      | 2.1  | 17    | 1.7  |
| Urinary tract stones <sup>b</sup>                            | 21                  | 2.1  | 26                      | 2.5  | 25    | 2.4  |
| Perforated viscus                                            | 18                  | 1.8  | 15                      | 1.5  | 13    | 1.3  |
| Abscess                                                      | 18                  | 1.8  | 18                      | 1.8  | 14    | 1.4  |
| Gynecologic disorder nonurgent                               | 11                  | 1.1  | 11                      | 1.1  | 9     | 0.9  |
| Peritonitis <sup>c</sup>                                     | 6                   | 0.6  | 9                       | 0.9  | 3     | 0.3  |
| Inflammatory bowel disorder                                  | 5                   | 0.5  | 6                       | 0.6  | 30    | 2.9  |
| Hernia <sup>d</sup>                                          | 4                   | 0.4  | 4                       | 0.4  | 2     | 0.2  |
| Bleeding                                                     | 4                   | 0.4  | 4                       | 0.4  | 9     | 0.9  |
| Bowel ischemia                                               | 3                   | 0.3  | 7                       | 0.7  | 12    | 1.2  |
| Other <sup>e</sup>                                           | 2                   | 0.2  | 3                       | 0.3  | 12    | 1.2  |
| Pneumonia                                                    | 1                   | 0.1  | 1                       | 0.1  | 11    | 1.1  |
| Malignancy                                                   | 1                   | 0.1  | 1                       | 0.1  | 5     | 0.5  |
|                                                              | 1021                | 100  | 1021                    | 100  | 1021  | 100  |

## CHANGES IN PRIMARY DIAGNOSIS

- ✗ primary clinical diagnosis corresponded with final diagnosis in 49%. After radiographs, primary diagnosis corresponded with final diagnosis in 50% → improvement in accuracy was **not significant**
- ✗ Treating physicians **changed primary diagnosis** from initial clinical diagnosis in 11%, of which 22% were accurate
- ✗ 65% of 875 patients with unchanged diagnosis before and after radiography, **level of confidence of did not change**

**Table 2** The level of confidence in patients with an unchanged diagnosis after evaluation of the plain radiographs

| Diagnoses <sup>a</sup> | Unchanged diagnosis, n <sup>b</sup> | Level of confidence increased, n (%) |      | Level of confidence decreased, n (%) |      | Level of confidence unchanged, n (%) |
|------------------------|-------------------------------------|--------------------------------------|------|--------------------------------------|------|--------------------------------------|
| Overall                | 875                                 | 182                                  | (21) | 122                                  | (14) | 571 (65)                             |
| Bowel obstruction      | 61                                  | 23                                   | (38) | 6                                    | (10) | 32 (52)                              |
| Urinary tract stones   | 17                                  | 2                                    | (12) | 4                                    | (24) | 11 (65)                              |
| Perforated viscus      | 13                                  | 6                                    | (46) | 2                                    | (15) | 5 (38)                               |

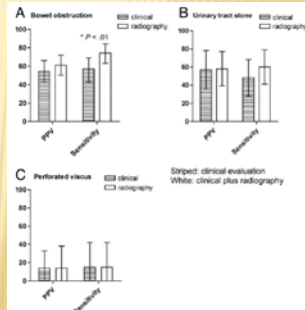
<sup>a</sup> Because the level of confidence was not recorded in all patients, only 983 patients (of which 875 had an unchanged diagnosis) were included in this analysis.

<sup>b</sup> The number of diagnoses that did not change after evaluation of plain radiographs.

## BOWEL OBSTRUCTION, PERFORATED VISCUS, AND URINARY TRACT STONES

- ✧ positive predictive value

did not differ significantly between clinical only and after radiographs for 3 diagnoses



## DISCUSSION

- ✧ This study shows clinical diagnosis after plain radiographs did not change significantly from primary diagnosis based on clinical alone.
- ✧ Only sensitivity in detecting bowel obstruction was significantly higher after plain radiographs.
- ✧ For other diagnoses (perforated viscus and urinary tract stones), radiographs have no added diagnostic value.

## DISCUSSION

- ✧ limitation: added value of plain radiography in clinically suspected for GI foreign body was not evaluated, because study included only 1 patient with a foreign body (Plain radiography may be able to show GI radioopaque
- ✧ foreign body adequately, and sensitivity of 80% is reported)

## DISCUSSION

- ✧ we did not perform upright abdominal radiography.
- ✧ For detecting bowel obstruction, multiple air-fluid levels of different heights within 1 bowel segment and an air fluid level width of more than 2.5cm are the most significant features at upright abdominal radiography

## DISCUSSION

- ✧ We were unable to evaluate specific features of bowel obstruction with supine abdominal radiograph
- ✧ evaluation of location of obstruction may be easier to detect on supine film because bowel loops are more or less at their anatomical position

## CONCLUSIONS

- ✧ Plain abdominal and chest radiographs in acute abdominal pain were shown to have limited added diagnostic value
- ✧ added value is too limited to advocate their routine use in diagnostic workup of acute abdominal pain because few diagnoses changed and the level of confidence of diagnosis was usually not affected
- ✧ Therefore, we suggest plain radiography should be omitted from routine diagnostic workup