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ORIGINAL ARTICLE

# Impact of abdominal radiography on surgical approach among patients with acute abdomen attending emergency ward

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## Abstract

**Introduction:** Abdominal radiography is an important method for acute abdomen cases and it is usually used to determine surgical approaches. This study was performed to determine the effect of abdominal radiography in the surgical approach among patients with acute abdomen attending the emergency ward of Rasool-Akram Hospital.

**Methods:** In this comparative cross-sectional study, 147 consecutive patients with acute abdomen attending the emergency ward of Rasool-Akram Hospital were enrolled. The effect of abdominal radiography on surgical approach was assessed in them.The collected data were analyzed in SPSS software (version 13) using independent t-test and Fisher'sexact test. The significance level for all tests was considered less than 0.05.

**Results:** In this study, radiography was effective on surgical approach in 63.3% of cases and it proposed peritonitis in 68% of cases. The impact was associated with lower age (P=0.0001), shorter surgery duration (P=0.003), and male sex (P=0.0001).

**Conclusions:** According to the results, it may be concluded that clinical assessment has a pivotal role for diagnosis of peritonitis, and if it is positive, no additional procedure is required whereby the operation should be carried out. Abdominal radiography should be used for cases with equivocal results in clinical assessment.

**Key Words:** Abdomen, Acute; Peritonitis; Radiography, Abdominal

## Introduction

Assessment of the emergency ward patients with acute abdominal pain is usually important and difficult. Various factors can hinder the presentation or prevent from correct diagnosis, with subsequent complications. Clinicians must consider differential diagnosis, especially for those with life-threatening conditions to limit morbidity and mortality. Acute abdomen is a common emergency condition need of surgery. It may be due to acute appendicitis, acute cholecystitis, acute pancreatitis, acute diverticulitis, acute ulcerative colitis, peritonitis, intestinal obstruction, perforated peptic ulcers, trauma, acute hepatitis, dissecting aneurysm, ovarian cyst complication, or ectopic pregnancy. Prompt diagnosis and surgery would result in better prognosis (1-4).

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In this regard, one frequent test is abdominal radiography which is performed in all cases (5). However, it should be remembered that additional tests should be avoided to save the time (6). In 1972, the abdominal radiography was the only feasible diagnostic imaging modality ordered for half of the patients. In 1992, plain abdominal radiography was ordered in 30% of all patients. Nonetheless, in case it has limited efficacy and high costs and if exposure to radiation is not recommended , abdominal radiography should be assessed twice to save the time with lower mortality (7, 8). This study was performed to determine the effect of abdominal radiography on surgical approach in patients with acute abdomen who attended the emergency ward.

## Methods

In this comparative, cross-sectional study, 147 consecutive patients with acute abdomen attending the emergency ward of Rasool-Akram Hospital were enrolled. Age, gender and duration of operation were recorded using a checklist. The inclusion criterion was presence of peritonitis in clinical assessment. The exclusion criteria were age older than 80 years, heart failure (EF < 40%), inability to take two step upstairs, trauma patients with laparotomy at first 24 hours, BMI>35, and chemotherapy for active cancer. The informed consent form was attained. The ethical committee code was IR.IUMS.rec.1394.9211245005.

The radiographies were reported initially by the resident of the admitting team, special note being made of the value of the abdominal radiographies over the combination of supine abdominal radiographies and the chest radiograph. On the basis of information obtained from the abdominal radiographies alone, no changes in the patient's management were recorded. Also, a consultant radiologist reported the same radiographies at a later date. The preoperative graphies were in sitting and standing position of the abdomen and the standing position of the chest. The effect of abdominal radiography on surgical approach in patients were assessed and divided according to age and gender or type and duration of operation. The preoperative factors were signs of intestinal or colon obstruction, volvulus sign, pneumatosis intestinalis, closed loop signs, PUD history with presence of free air, and lack of psoas shadow. Data analysis was performed by SPSS (version 13.0) software [Statistical Procedures for Social Sciences; Chicago, Illinois, USA]. Fisher Exact and Independent-Sample T tests were used and were considered statistically significant at P values less than 0.05.

## Results

Mean age was 46.6 ± 15.6 years and 79.5% were male. The mean duration of operation was 85.8 ± 36.8 minutes and the mean hospital stay was 5.6 ± 1.2 days. The graphy affected the type of operation in 63.3% and it showed peritonitis in 68% of cases.

As shown in Tables 1 and 2, the effect was related to lower age (P=0.0001), shorter surgery duration (P=0.003), and male sex (P=0.0001). However, it was not related to hospital stay (P=0.829). The graphy presenting peritonitis was not related to other factors understudy except for the male gender (P >0.05). Sensitivity, specificity, positive predictive value, and negative predictive value were respectively 81%, 30%, 89%, 17% for free air and PUD (Table 5) and 86%, 50%, 81%, 60% for volvulus (Table 6).

**Table 1: Comparison of graphies according to mean age, hospital stay, and operation duration**

| Effect for Surgery | | Mean±SD |
|---|---|---|
| Age | Positive | 42.6±12.66 |
| | Negative | 53.4±17.90 |
| Surgery Duration | Positive | 78.9±34.71 |
| | Negative | 97.5±37.75 |
| Hospital Stay | Positive | 5.5±0.92 |
| | Negative | 5.6±1.61 |

**Table 2: Comparison of graphies frequency according to gender**

| Gender | | Effect for Surgery | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| Gender | Male | 86 (73.5%) | 31 (26.5%) | 117 (100.0%) |
| | Female | 7 (23.3%) | 23 (76.7%) | 30 (100.0%) |
| Total | | 93 (63.3%) | 54 (36.7%) | 147 (100.0%) |

**Table 3: Comparison of graphies frequency for peritonitis according to gender**

| Gender | | Benefit | | Total |
|---|---|---|---|---|
| | | Positive | Negative | |
| Gender | Male | 93 (79.5%) | 24 (20.5%) | 117 (100.0%) |
| | Female | 7 (23.3%) | 23 (76.7%) | 30 (100.0%) |
| Total | | 100 (63.3%) | 47 (32.0%) | 147 (100.0%) |

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**Table 4: .Frequency of free air level in the graphies**

| Diagnosis | Free air level N(%) | Without free air level N(%) |
|---|---|---|
| Ulcerated PUD | 61 (81%) | 14 (19%) |
| Perforated Appendicitis | 8 (36%) | 14 (64%) |
| Volvulus | 4 (26.7%) | 11 (73.3%) |
| Intestinal Perforation | 19 (95%) | 1 (5%) |
| Negative laparotomy | 0 | 10 (100%) |

**Table 5: Free air level and PUD results**

| Test | Disease+ | Disease- |
|---|---|---|
| Test+ | 61 | 7 |
| Test- | 14 | 3 |

**Table 6: Volvulus results**

| Test | Disease+ | Disease- |
|---|---|---|
| Test+ | 13 | 3 |
| Test- | 2 | 3 |

## Discussion

Regarding the emergency situation of peritonitis, it is both useful and necessary to have prompt diagnosis and operation and to avoid unnecessary procedures. This study was performed to determine the effect of abdominal radiography on surgical approach and type of disease in patients with acute abdomen attending the emergency ward. It showed an effect of 63% with peritonitis diagnosis in 68% of cases. Lower age, male gender, and shorter operation were related factors.

Sandrasegaran et al (6) reported that type and duration of operation were related to applicability of radiography for intestinal obstruction which is not in congruence with our results. Zeina et al retrospectively reviewed the records of patients referring to the emergency department with acute abdominal pain during a 6-month period. Of 573 patients, 52% underwent abdominal radiography. Findings were normal in 88%, non-specific in 7.3%, and abnormal in 4.7% of cases. For those with normal results, no further imaging was ordered for 43% (114/264). Of the 57% (150/264) who had follow-up imaging, 65% (98/150) showed abnormal findings. In 3%of the patients, abdominal radiography identified bowel perforations and obstructions, and treatment was provided without the need for further radiologic examination. They concluded that use of plain abdominal radiography is still common despite the high rate of false positive results. Efforts are needed to decrease the indiscriminate use of radiography in patients presenting with abdominal symptoms (7).

Cartwright et al (8) compared various imaging methods for acute abdomen maintaining that these methods are confirmatory for initial diagnosis by clinical and laboratory assessment. The American college of radiology guideline reported that ultrasonography is usually useful for upper abdomen pain. It also showed that standing abdominal graphies would reveal less than 1 ml and lateral decubitus would demonstrate 5 to 10 ml of air. These graphies are usually used for perforated duodenal ulcer with 75% positive rate of free air level and for further results, the laparotomy should be performed (9). Grassi et al (10) reported that 75.4% of perforation cases are diagnosed by radiography and in 85%, the preoperative diagnosis is clear. However, we had lower diagnostic ability in our study, possibly because of the imaging technique. The underlying cause is only clinical experience without statistical support however.

Abdominal radiography should be used for cases with equivocal results in clinical assessment. Compared to transit imaging, the plain abdominal radiography would have some advantages. It would help simple examination processes, reduce costs, and have less radiation exposure. In the study by Sreedharan et al (11), 76 % abdominal radiographies were reported as normal, 12 % were non-specific, and 12 % were abnormal as for 108 patients. Of those patients, 25 % of the abdominal radiographies did not meet indications listed in the Diagnostic Imaging Pathways published by the Western Australia Department of Health and were found not to benefit patient care. Of the 19 doctors who completed the survey, only 16 % were aware of any clinical guidelines for imaging in this context. They recommended that guidelines should be followed when ordering imaging for patients with acute abdominal pain to minimize unnecessary patient radiation exposure, to avoid delays in diagnosis, to yield definitive patient management, to reduce costs, and therefore to increase efficiency in emergency department.

Ashindoitiang et al (12) studied 100 patients with acute abdominal conditions. Twenty-four percent of the patients had intestinal obstruction, 20% perforated typhoid enteritis; gunshot injuries and generalized peritonitis each occurred in 13%, blunt abdominal trauma in 12%, while 8% and 10% had acute appendicitis and perforated peptic ulcer disease respectively. Of the 100 patients, 54% had plain abdominal radiographs that showed

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positive diagnostic features. Plain abdominal radiograph showed high sensitivity in patients with intestinal obstruction 100% and perforated peptic ulcer 90% but was less sensitive in patients with perforated typhoid, acute appendicitis, blunt abdominal trauma, and generalized peritonitis. They concluded that abdominal radiographs are useful when appropriate criteria are followed in requesting for the investigation. Abdominal radiographies have low specificity and it is very cost-beneficial to decrease unimportant tests for peritonitis diagnosis.

## Conclusions

According to the obtained results, it may be concluded that clinical assessment has a pivotal role for diagnosis of peritonitis and if it is positive, no additional procedure is required whereby the operation can be performed. Abdominal radiography should be used for cases with equivocal results in clinical assessment.

## Authors' Contribution

Patient operation by dr Mostafa hoseini; Data collection by dr Khashyar Sanjari; Research of references and same article by dr Alireza Negahi; Data analysis by dr Nahid Nafissi; Primary revision by dr Seyed Hamzah Mousavie.

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