

# Diagnostic value of Plain Abdominal Radiograph, Ultrasonography and Clinical impression of the surgeon in acute peritonitis.

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## ABSTRACT

**Background:** Exact pre-operative diagnosis of peritonitis remains challenging despite proper history taking and clinical examination, as well as advancement in new imaging techniques. The objective of this study was to highlight the diagnostic value of radiological investigations and clinical impression of the surgeon in acute peritonitis. **Methods:** We enrolled 50 patients with clinical features suggestive of acute peritonitis, which required surgery, were included. Evaluation of patients was done by detailed history, clinical examination, plain abdominal radiography, ultrasonography examination and final diagnosis on surgery after stabilizing the patient. Pre-operative diagnosis based on history, clinical examination and radiological investigations was compared with the operative diagnosis based on the operative findings. **Results:** The age of these patients varied from 5 years to 73 years with the mean age of 40.7 years. The commonest cause of acute peritonitis was perforated duodenal ulcer. Based upon history and examination accurate diagnosis of acute peritonitis with its underlying cause could be made in 94% of patients. Accurate diagnosis of perforated duodenal ulcer peritonitis could be made in 92.59% of cases based on history and clinical findings. Clinically acute appendicitis and perforated appendix was diagnosed with the clinical accuracy of 91.66%. On plain abdominal X-ray in standing position free gas under the right dome of the diaphragm was seen in 64% of the cases. The left lateral decubitus X-ray revealed free gas in peritoneal cavity in 70% cases. In our study with the help of ultrasonography of the abdomen we were able to diagnose 85.71% cases of acute appendicitis and 75% of perforated appendix. Free fluid in the peritoneal cavity on ultrasound of the abdomen was present in 70% of patients. **Conclusion:** In majority of cases of acute peritonitis, clinical impression of the surgeon plays a vital role in reaching the diagnosis if detailed history and meticulous clinical examination is carried out. However detailed history and meticulous clinical examination and radiological investigations may not be a foolproof diagnostic in all cases of peritonitis and the particular issue is settled on laparotomy.

**Key Words:** Acute peritonitis, Plain Abdominal Radiograph, Ultrasonography

## INTRODUCTION

Peritonitis persists to be one of the major abdominal emergencies encountered by surgeons. The diagnosis of the peritonitis always calls for a refined history taking and a comprehensive physical examination. Peritonitis is mainly a clinical diagnosis. Imaging diagnostic aids have an important role in establishing the diagnosis of acute peritonitis. The intent of an imaging modality as a diagnostic aid in acute peritonitis is to look for the presence of surgical disease. The imaging modality should be fast, non-invasive, easily available, accurate and cost-effective in diagnosing peritonitis.<sup>[1]</sup> Routinely done additional radiological investigations encompass plain abdominal radiography and ultrasonography.

These radiological investigations should be done to investigate a specific cause of peritonitis and not as a substitute for clinical diagnosis. Exact pre-operative diagnosis of peritonitis remains challenging despite proper history taking and clinical examination, as well as advancement in new imaging techniques.<sup>[1-2]</sup>

## MATERIALS AND METHODS

This study was carried out at Dr. Rajendra Prasad Government Medical College Kangra at Tanda Himachal Pradesh on 50 patients of all ages and both sexes with clinical features suggestive of acute peritonitis, which required surgery, were included. Evaluation of patients was done by detailed history, clinical examination, plain abdominal radiography, ultrasonography examination and final diagnosis on surgery after stabilizing the patient.

A detailed history of the patient was taken and the signs and symptoms were recorded along with a variety of information such as: pain – duration of pain, mode of onset of pain, site of pain, character of pain, radiation or shifting of pain, aggravating or relieving factors; vomiting –frequency of vomiting,

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amount, colour and content; bowels – constipated, normal, diarrhoea. In addition personal and family history of the patient was recorded. A general physical examination was done and special emphasis was paid on the abdominal examination recording the contour of the abdomen, movement with respiration, shifting liver dullness, tenderness, guarding/rigidity, rebound tenderness, bowel sounds (normal/increased/decreased/absent).

Radiological examination was conducted in all cases with plain abdominal X-ray film in erect position, to detect the presence of gas under the dome of the diaphragm, small or large bowel fluid levels, localized ileus, appendiceal fecolith, and pancreatic calcifications and a left lateral decubitus radiograph of the abdomen for the presence of pneumoperitoneum. All patients underwent an abdominal ultrasonographic examination of the whole abdomen, with screening of the hepatorenal recess, paracolic gutters, rectouterine pouch, biliary tract, gallbladder, liver, spleen, pancreas, small intestine, large intestine and intra-abdominal fluid collections.

Pre-operative diagnosis based on history, clinical examination and radiological investigations was compared with the operative diagnosis based on the operative findings.

## RESULTS

The age of these patients varied from 5 years to 73 years with the mean age of 40.7 years. The maximum (26%) patients of acute peritonitis presented in the age group of 41 to 50 years. Second peak was seen in the age group of 31 to 40 years i.e. 8 cases (16%). There were only 2 cases (4%) in the age group of 0 to 10 years. There was 1 case (2%) in the age group of 71 to 80 years. Out of the total of 50 cases 40 cases (80%) were males and 10 cases (20%) were females. There was male preponderance with the male to female ratio of 4:1.

On the basis of the history and physical findings of these 50 patients clinical impression of diffuse peritonitis was made in 43 cases and of localized peritonitis was made in 7 cases with underlying cause of perforated duodenal ulcer in 27 cases (54%) followed by acute appendicitis in 7 cases (14%), perforated appendix in 4 cases (8%), penetrating trauma abdomen with acute peritonitis in 4 cases (8%), blunt trauma abdomen with acute peritonitis in 3 cases (6%), acute intestinal obstruction with gangrene of gut in 3 cases (6%) and enteric perforation in 2 cases (4%) [Figure 1].

On plain abdominal X-ray in standing position free gas under the right dome of the diaphragm was seen in 32 cases (64%). Fluid levels were seen in 9 cases (18%). Localized ileus was seen in 7 cases (14%). X-rays did not show any abnormality in 7 cases (14%). Faecolith was seen in 1 case (2%). The left lateral decubitus X-ray revealed free gas in peritoneal cavity in 35 cases (70%). In 15 cases (30%) free gas was absent [Table 1].

Out of the 27 cases with clinical impression of perforated duodenal ulcer free gas was detected in 24 cases (88.89%) on plain abdominal X-rays and in 26 cases (96.30%) left lateral decubitus films respectively. Out of the 5 cases of perforated appendix none showed gas in standing position but 1 case had free gas on left lateral decubitus film and 4 cases did not show any abnormality in the left lateral decubitus film. 1 case (20%) of perforated appendix had faecolith, 2 cases (40%) had localized ileus and another 2 cases (40%) had fluid levels in the plain abdominal film. All 4 cases of penetrating trauma abdomen showed free gas on plain abdominal X-rays and left lateral decubitus films. Out of 3 cases of clinical impression of blunt trauma abdomen 2 cases (66.66%) showed free gas on plain abdominal X-ray and all 3 cases had free gas on left lateral decubitus film. 2 cases of enteric perforation showed free gas on both plain abdominal X-rays and left lateral decubitus films in both cases. Clinical impression of acute appendicitis was made in 7 cases out of these 4 cases (57.71%) had localized ileus, 3 cases (42.86%) were without abnormality on plain abdominal X-ray. All seven cases of acute appendicitis had normal left lateral decubitus films. 2 cases with clinical impression of acute intestinal obstruction with gangrene of gut clinically had multiple fluid levels in their plain abdominal films and had normal left lateral decubitus films [Table 1].

On ultrasound abdomen 35 cases (70%) had free fluid, 10 cases (20%) were having normal study. 6 cases (12%) had sonological features of acute appendicitis. Perforated appendix was diagnosed in 3 cases (6%). Haemoperitoneum was seen in 2 cases (4%).

Out of 27 cases with clinical impression of perforated duodenal ulcer 22 cases (81.48%) had free fluid on the ultrasound abdomen and 5 cases (18.52%) had normal study. Out of the 7 cases of acute appendicitis 6 cases (85.71%) were diagnosed acute appendicitis based upon the findings of ultrasonography, one case showed free fluid in the right iliac fossa and 1 case (14.29%) had normal study. All 5 cases with clinical impression of perforated

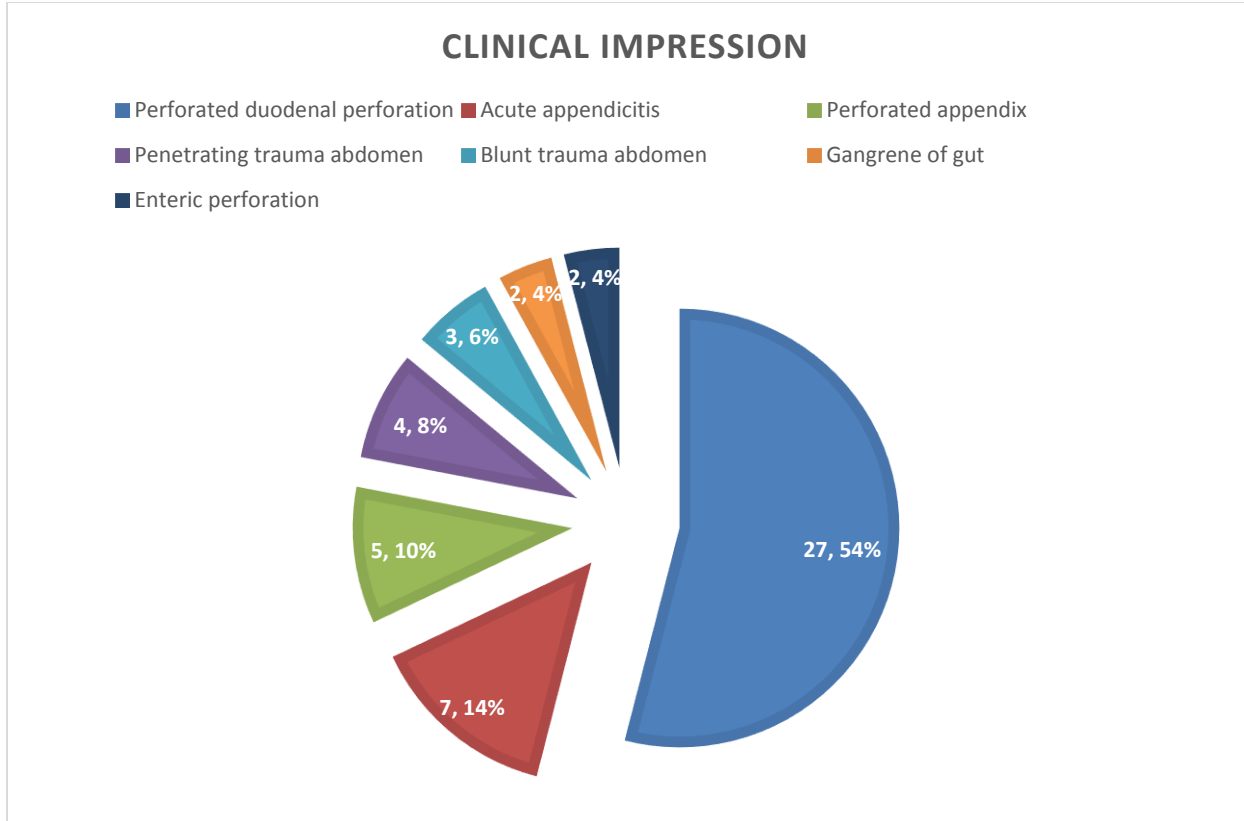


Figure 1: Clinical Impression

appendix had free fluid and 2 cases (40%) were diagnosed as perforated appendix on ultrasound abdomen and one case was diagnosed acute appendicitis. Out of the 4 cases of penetrating trauma abdomen 2 cases had free fluid and haemoperitoneum and 2 cases had normal study. All three cases of

clinically diagnosed blunt trauma abdomen showed free fluid and no solid visceral injury. 2 cases of acute intestinal obstruction with gangrene of gut clinically had normal ultrasound study. Clinically diagnosed 2 cases of enteric perforation showed free fluid in both cases on ultrasound abdomen [Table 2].

Table 1: Clinical impression and Plain abdominal X-rays

Clinical impression (n)	Plain abdominal X-ray (standing)					Plain abdominal X-ray (Lateral Decubitus)	
	Free gas	Normal	Fluid levels	Localized ileus	Faecolith	Free gas	Normal
Perforated duodenal ulcer (27)	24	3	5	-	-	25	2
Acute appendicitis (7)	-	3	-	4	-	-	7
Perforated appendix (5)	-	-	2	2	1	1	4
Penetrating trauma abdomen (4)	4	-	-	-	-	4	-
Blunt trauma abdomen (3)	2	1	-	-	-	3	-
Gangrene of gut (2)	-	-	2	-	-	-	2
Enteric perforation (2)	2	-	-	1	-	2	-

The final operative diagnosis of the 50 patients, of our study was perforated duodenal ulcer in 25 cases (50%), acute appendicitis in 7 cases (14%) and perforated appendix in 4 cases (8%). In penetrating trauma abdomen with acute peritonitis out of 4 cases

(8%), three cases had perforated hollow viscus injury and one with no visceral injury. In blunt trauma abdomen with acute peritonitis two cases had ileal perforation and one case had duodenal perforation in the 2nd and 3rd part on the lateral aspect. Enteric

perforation was seen in 3 cases (6%). Diagnosis of acute intestinal obstruction with gangrene of small gut was made in 2 cases (4%). Gastric perforation was seen in 1 case (2%) and 1 case (2%) was with meckel's perforation.

## DISCUSSION

Peritonitis requires prompt clinical and diagnostic evaluation of the patient to establish a correct diagnosis and cause of peritonitis in order to plan a

definitive management. Clinical acumen of the surgeon plays a pivotal role in deciding the diagnostic interventions to be carried out and saving the vital time before undertaking definitive management. However, despite the advances in the understanding of the disease processes, experience of the surgeons, several progresses in the diagnostic equipments and with the introduction of newer antibiotics the mortality rate has not reached the null state.

**Table 2:** Clinical impression and Ultrasound abdomen

Clinical impression(n)	Ultrasound abdomen				
	Free Fluid	Normal Study	Acute appendicitis	Perforated appendix	Haemoperitoneum
Perforated duodenal ulcer (27)	22	5	-	-	-
Acute appendicitis (7)	1	1	5	-	-
Perforated appendix (5)	5	-	1	3	-
Penetrating trauma abdomen (4)	2	2	-	-	2
Blunt trauma abdomen (3)	3	-	-	-	-
Gangrene of gut (2)	-	2	-	-	-
Enteric perforation (2)	2	-	-	-	-

Out of the 50 patients of acute peritonitis, maximum patients (66%) were in the age group of 21 to 60 years which are the most productive years of life, followed by teenagers (14%) and school going age (4%). One case was above 70 years of age. The average age of presentation was 40.7 years in this study. Our findings are in comparison to the study conducted by Memon et al<sup>[3]</sup> and Gupta & Kaushik<sup>[4]</sup> where the average age of the patient was 46.50 and 40.63 years respectively.

Majority of the patients in this study were males (80%) with a male to female ratio of 4:1. Similar male preponderance was found in the study by Shyam Gupta & Rajan Gupta<sup>[5]</sup> where the overall male to female ratio was 3.25:1. Results of the studies by Dawson<sup>[6]</sup>, Gupta & Kaushik<sup>[4]</sup> and Memon et al<sup>[3]</sup> also reveal that there is male preponderance in acute peritonitis.

In our study of 50 patients of acute peritonitis 82% patients were of acute generalized peritonitis and 18% patients were of localized peritonitis. The commonest cause of acute peritonitis was perforated duodenal ulcer in (50%) followed by acute appendicitis in 7 cases (14%), perforated appendix in 4 cases (8%), penetrating trauma abdomen with acute peritonitis in 4 cases (8%), blunt trauma abdomen with acute peritonitis in 3 cases (6%), acute intestinal obstruction with gangrene of gut in 2 cases (4%), enteric perforation in 3 cases (6%), gastric perforation 1 case (2%) and perforated meckel's diverticulitis 1 case (2%). Duodenal ulcer perforation

was the leading cause of acute peritonitis in our study. Gupta & Kaushik<sup>[4]</sup> and Shyam Gupta & Rajan Gupta<sup>[5]</sup> have also reported similar findings [Table 3]. Based upon history and examination accurate diagnosis of acute peritonitis with its underlying cause could be made in 47 (94%) of patients. Flasar & Goldberg<sup>[7]</sup> had also documented that based merely on history and clinical examination diagnosis can be reached most of times.

Based upon history and clinical examination the diagnosis of perforated duodenal ulcer peritonitis was made in 27 cases but finally on laparotomy duodenal ulcer perforation was present in 25 cases (92.59%). Two cases of clinically duodenal ulcer perforation turned out to be gastric ulcer perforation and appendicular perforation each. Out of 5 cases of clinically diagnosed perforated appendix, four had appendicular perforation and one was of meckels perforation. Clinically acute appendicitis and perforated appendix was diagnosed with the clinical accuracy of 91.66%. Flasar & Goldberg<sup>[7]</sup> have also found the diagnostic accuracy of acute appendicitis to be approaching 95% and many other authors have found that the diagnosis can be reached on the basis of history and physical examination alone in many instances.

Out of 50 cases of acute peritonitis, 41 cases were due to gut perforation due to one or the other underlying cause. Pneumoperitoneum was picked up by plain abdominal standing X-ray in 34 cases and in 35 cases in left lateral decubitus, thereby indicating

that left lateral decubitus radiograph is more sensitive to detect pneumoperitoneum [Table 4]. In two cases of perforated duodenal ulcer, pneumoperitoneum could not be detected in X-rays which is in comparison to the studies of Woodring & Heiser<sup>[8]</sup>

who have also reported that lateral chest radiographs had free gas in 98% of the cases and are most sensitive. Similarly Chen et al<sup>[9]</sup> found that incorporating left lateral decubitus film may further improve the sensitivity to detect pneumoperitoneum.

**Table 3:** Clinical impression and operative diagnosis

Clinical impression(n=50)	Operative diagnosis (n=50)
Perforated duodenal ulcer (27)	Perforated duodenal ulcer (25)
Acute appendicitis (7)	Acute appendicitis (7)
Perforated appendix (5)	Perforated appendix (4)
Penetrating trauma abdomen (4)	Penetrating trauma abdomen (4)
	(jejunal, ileal, sigmoid and rectal perforation)
Blunt trauma abdomen (3)	Blunt trauma abdomen (3)
	(duodenal and ileal perforation)
Gangrene of gut (2)	Gangrene of gut (2)
Enteric perforation (2)	Enteric perforation (3)
	Gastric Perforation (1)
	Perforated meckel's (1)

**Table 4:** Operative diagnosis and Abdominal radiography

Operative diagnosis	Plain X-ray abdomen standing (Free gas)	Percentage	Left lateral decubitus (Free gas)	Percentage
Perforated duodenal ulcer (25)	23	92%	23	100%
Perforated appendix (4)	Nil	Nil	-	-
Penetrating trauma abdomen (4) (jejunal, ileal, sigmoid and rectal perforation)	4	100%	4	100%
Blunt trauma abdomen (3) (duodenal and ileal perforation)	2	66.66%	3	100%
Enteric perforation (3)	3	100%	3	100%
Gastric Perforation (1)	1	100%	1	100%
Perforated meckel's (1)	1	100%	1	100%
<b>Total n=41</b>	<b>34</b>	<b>82.92%</b>	<b>35</b>	<b>85.36%</b>

Free peritoneal gas was not seen on X-rays in all patients of perforated appendix. This was probably because perforation was not at the base of the appendix and caecum was loaded with faecal matter. Prassannan et al<sup>[10]</sup> has reported that plain abdominal films are useful in 4.8% of cases of appendicitis.

In most of the patients with acute peritonitis free fluid in the peritoneal cavity is the most consistent sonological finding on ultrasound of the abdomen. In our study ultrasonography of abdomen was done in all the 50 patients of acute peritonitis and free fluid in the peritoneal cavity was the most consistent finding and was seen in 70% of the cases and rest of the cases had findings of acute appendicitis, perforated appendix and haemoperitoneum. In perforated duodenal ulcer peritonitis ultrasound is not diagnostic investigation but it helps in the diagnosis by excluding other causes of peritonitis viz acute pancreatitis, acute cholecystitis, pelvic inflammatory disease, torsion of ovary, ruptured ectopic etc. In total, ultrasonography was positive in 80% of the

cases of acute peritonitis. Similar trends were found in the study by Chen & Fang.<sup>[11]</sup> In their study they found free fluid in 78.57% of patients as the most consistent finding and accurately diagnosed peritonitis by ultrasonography in 83.3% of cases.

In our study with the help of ultrasonography of the abdomen we were able to diagnose 6 out of 7 (85.71%) cases of acute appendicitis, which is in comparison to the findings of Puylaert<sup>[11]</sup> and Terasawa et al.<sup>[12]</sup> Correct prediction of perforated appendix by ultrasonography was done in 75% of cases which is slightly less than the findings of Puylaert<sup>[11]</sup> who was able to predict perforation in 85% of the cases. This may be due to the fact that the sonological findings are operator dependent.

All the cases of blunt trauma abdomen were diagnosed to have free fluid in the peritoneal cavity without any solid visceral injury on abdominal ultrasonography in our study indicating gut perforation and no solid visceral injury. The sonological findings in the light of clinical findings



further helped in the diagnosis of traumatic gut perforation. MaGahan and Richards<sup>[13]</sup> have also found that sonographic findings in abdominal trauma patients have to be correlated with the physical findings to decide the management plan accordingly. Acute peritonitis has been and will remain a challenging problem that presents to the surgeon with a wide choice of differential diagnosis. In the initial evaluation, the surgeon assesses the site and duration of abdominal pain tenderness guarding and rebound tenderness, as well as other variables of the medical and physical examination to establish the most likely clinical impression. Clinical impression acts as a road map for further radiological investigations such as plain abdominal films or ultrasonography of the abdomen to establish an accurate diagnosis. In majority of the patients accurate diagnosis is reached upon with proper history, physical examination, X-ray abdomen and ultrasonography, however sometimes final diagnosis may be astonishing on exploratory laparotomy as has been rightly stated that abdomen is a Pandora box.

## CONCLUSION

In majority of cases of acute peritonitis clinical impression of the surgeon plays a vital role in reaching the diagnosis if detailed history and meticulous clinical examination is carried out. Plain X-ray abdomen in the standing position and the left lateral decubitus film has an important role and further confirms our clinical impression in perforation peritonitis but are not of much help in appendicitis and perforated appendix. Ultrasound abdomen may not be able to establish the cause of gut perforation but definitely helps at reaching the diagnosis by excluding other causes of acute abdomen viz, acute cholecystitis, acute pancreatitis, pelvic inflammatory disease, ovarian torsion, ruptured ectopic pregnancy etc; in acute appendicitis ultrasound has a definitive role. However detailed history and meticulous clinical examination and radiological investigations may not be a foolproof diagnostic in cent percent cases of peritonitis and issue is settled on laparotomy; hence exploratory laparotomy appears to be the final court of appeal.

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