



Study of Role of Ultrasonography & Plain Radiography for The Diagnosis of Pneumoperitoneum

KEYWORDS

Ultrasonography, Radiography, Pneumoperitoneum.

Dr Aruna Pawar

(MBBS, MD in Radiodiagnosis)
Professor, Department of Radiology,
Shree Vasantrya Naik Government
Medical College, (SNVNGMC),
Yavatmal

Dr Suhas D Alone

(BVsc & AH, MVsc Medicine),
Assistant Commissioner
Government Veterinary,
Minipolyclinic, Ghatangi (Dist-
Yavatmal)

Dr Nilesh Agrawal

Assistant Superintendent,
Government Medical College &
Hospital, Nagpur

ABSTRACT Objective: To study & evaluate role of plain radiography & ultrasonography in the detection of pneumoperitoneum.

Methods: A total of 72 patients with suspected hollow viscus perforation were studied. All patients underwent ultrasonography, upright chest radiography and left lateral decubitus abdominal radiography examination. The sensitivity, specificity, positive and negative predictive value, and accuracy of upright chest and abdominal radiography were compared with that of abdominal ultrasonography.

Results: Sixty eight patients underwent laparotomy; 66 patients had hollow viscus perforations, (if we include four patients who had perforated appendicitis) and two had acute cholecystitis. In the diagnosis of pneumoperitoneum, ultrasonography had improved sensitivity (90 versus 75 percent), negative predictive value (36 versus 18 percent), and accuracy (88 versus 74 percent), and similar specificity (both 50 percent), and positive predictive value (95 versus 93 percent) compared with plain radiography.

Conclusion: Ultrasonography is more sensitive than plain radiography in the diagnosis of pneumoperitoneum.

INTRODUCTION

Pneumoperitoneum results most commonly from a perforated hollow viscus. Plain radiography of the chest is a standard method for the detection of pneumoperitoneum [1,2], and this can be helpful in 55-85 percent of patients with hollow organ perforation[3,4], many patients with an acute abdomen or trauma are too sick to stand for erect chest radiographic examination[5,6]. Alternatively, left lateral decubitus radiography of the abdomen can be used. Although computed tomography (CT) is superior to erect chest radiography in demonstrating free intra-peritoneal air, however CT is expensive and generates more radiation than plain radiography [7].

Ultrasonography has emerged as an alternative initial diagnostic procedure in patients with an acute abdomen [8-10]. The aim of this study was to compare ultrasonography with plain radiography in the detection of pneumoperitoneum.

METHODOLOGY

Over the period of 2 years, 72 patients with suspected hollow viscus perforation were admitted to the surgical department in our teaching hospital in central India. There were 48 males and 24 females, mean age 50 years, range 20-75 years. After detailed history and physical examination, erect chest X-ray was performed. A left lateral decubitus abdominal film was taken if the chest radiograph failed to reveal free sub-phrenic air. After complete radiographic examination, the patient was sent for ultrasound of the abdomen.

Abdominal ultrasonography was performed over the epigastric area (supine position) followed by the highest point of the right hypochondrium (left lateral position). The results of the ultrasonography were classified as either positive or normal. Ultrasonographic evidence of pneumoperi-

toneum was sought as echogenic lines or spots [11].

The decision to operate was based on either the presence of peritonitis depending on clinical examination, or the presence of pneumoperitoneum on either ultrasonography or plain radiography. Patients without free air were observed in hospital, additional pan- endoscopy or CT was performed to search for the diagnosis. Operative findings related to ultrasonography or radiography were recorded. The sensitivity, specificity, positive and negative predictive value, the accuracy of ultrasonography were recorded and compared with those obtained from plain radiography.

Approval for the present study was taken from the Institutional Ethics Committee & all the patients gave written consent to participate in the study.

RESULTS

Ultrasonography was performed in all 72 patients. The ultrasonographic findings are shown in table 1. There were 60-patients with the ultrasonographic finding of free air, 12-patients had no free air (4-normal scan, and 8-patients with abnormal scan but no free air).

Table 1. Findings of abdominal ultrasonography in patients with acute abdominal pain

Finding of abdominal ultrasonography	No. of patients (n= 72)
1. Abnormal scan result	68
* Pneumoperitoneum	60
* Fluid accumulation	
- Subhepatic	54
- Pelvic	30
* Small bowel dilatation	45
2. Normal scan	4

Among the 68-patients who had surgery (depending on radiological, ultrasound, and CT finding), 60 patients were thought to have hollow viscus perforation and eight-patients to have peritonitis. A total of 62 proved to have hollow organ perforation at laparotomy, four patients had perforated appendicitis and two patients with acute cholecystitis.

Oesophago-gastroduodenoscopy on 4 patients with normal scanning and acute abdominal pain (no laparotomy) revealed peptic ulceration without perforation in three patients. Free air was detected by upright chest radiography in 48-patients, and 36 of these were found to have hollow organ perforation at operation. A further 24 patients underwent additional left lateral decubitus abdominal radiography, six were diagnosed with pneumoperitoneum, but only five patients were found to have hollow organ perforation (table 2).

Table 2: Summary of the total No. of patients submitted for plain radiography, ultrasonography and the results on laparotomy.

Method of examination	Total no. of patients submitted	Positive free air detection	Abnormal scan with no free air	Hollow viscus perforation On Lap
Ultrasound Scanning	72	60	--	66*
Upright chest radiography	12	--	8	--
Lateral decubitus abdominal radiography	72	48	--	36
	24	6	--	5

*** Including 4-patient with perforated appendicitis**

The comparison between ultrasonography with plain radiography in the detection of pneumoperitoneum is shown in table 3. In the diagnosis of pneumoperitoneum, ultrasonography had improved sensitivity (90 versus 75 percent), negative predictive value (36 versus 18 percent), and accuracy (88 versus 74 percent), and similar specificity (both 50 percent), and positive predictive value (95 versus 93 percent) compared with plain radiography.

Table 3: The comparison between ultrasonography and plain radiography in the detection of pneumoperitoneum.

	Ultrasonography	Plain radiography
Sensitivity	90%	75%
-ve predictive value	36%	18%
Accuracy	88%	74%
Specificity	50%	50%
+ve predictive value	95%	93%

DISCUSSION

Hollow viscus perforation is one of the most common surgical emergencies. The diagnosis of hollow organ perforation is usually based on the presence of free intraperitoneal air on chest or abdominal radiography. In comparison with other study, Woodring et al., find that free air is missed on upright posteroanterior chest radiographs in 20-62 percent[7], which is in this study is about 34 percent. Adding a left lateral decubitus film improves the sensitivity of the examination: in the present study we are able to

detect 6-patients with free intraperitoneal air which are not diagnosed by upright chest radiography.

It is well known that CT is the most sensitive imaging test for the detection of free intraperitoneal air [12-15]. The success rate is between 83 and 100 percent [12, 13]; however CT is more expensive and generates more radiation than plain radiography, so it is not used as an essential tool in the diagnosis of pneumoperitoneum.

In comparison with the study done by Catalano et al., ultrasonography can detect 76-90 percent of patients with pneumoperitoneum [16]. Although in this study a small number of patients were included, we demonstrate that ultrasonography is a useful alternative imaging modality for the detection of pneumoperitoneum and we are able to detect about 80 percent of patients with pneumoperitoneum.

The amount of free air produced after perforation of the lower gastrointestinal tract was usually large and both plain radiography and ultrasonography had similar accuracy in the detection of pneumoperitoneum. The amount of free air from the upper gastrointestinal tract was usually lower, and this study found that ultrasonography was superior to plain radiography in this setting. In the present study two false positive ultrasonographic examinations resulted from the finding of abnormal images on either the right hypochondrial or the epigastric scan. To prevent the echo pattern visible in the pleurodiaphragmatic recess from being misinterpreted for free air, modification of the patient position from supine to left lateral during the examination is essential because it permits confirmation of the origin of the interference echopattern [17].

Ultrasonography has the additional advantage of detecting other findings associated with pneumoperitoneum that were not found on the plain radiographs.

In conclusion, our findings prove that ultrasonography is more sensitive and accurate in the detection of pneumoperitoneum than plain radiography.

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