

Diagnostic Accuracy of Different Radiological Investigations in the Diagnosis of Perforated Duodenal Ulcer

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Abstract

Background; Perforated duodenal ulcer (PDU) is a common surgical emergency that is associated with high mortality and morbidity. Early diagnosis and prompt surgical treatment is required to prevent grave complications.

Objective; The study was designed to evaluate the diagnostic accuracy of different radiological investigations in the diagnosis of perforated duodenal ulcer.

Methods; A prospective study of 185 pts with PDU at al kindy teaching hospital, Baghdad, Iraq from June 2008-august 2010. patients were examined clinically and investigated by blood test, chest x ray, plain X ray of the abdomen. Ultrasonography (U/S) and CT scanning done for those patients with negative X- ray finding. Resuscitation by intravenous fluid and antibiotic done. Explorative laparotomy done for all patients, repair of perforation done by simple omental patch. Data regarding radiological, ultrasonographic and CT finding and operative finding were recorded.

Results: The study of 185 pts with proven perforated DU revealed 162 (87.5%) male and 23 (12.5%) female with age ranging from 22-70 yrs ,the average was 38 years.

Crescentic shape air under diaphragm was seen in chest or abdominal plain X ray in 121 (65.4%) pts and negative in 64 (34.6%) pts. For those 64 pts, a positive finding of free air or fluid was seen by U/S in 16 (25%) pts and positive CT finding was seen in 62 (96.9%) pts.

The operative finding in those 64 pts were; a small perforation less than 0.5 cm in 24 pts, completely or partially sealed perforation in 19 pts, severe edema and narrowing of the pylorus in 15 pts and perforation larger than 1 cm but with little peritoneal soiling was seen in 6 pts.

Conclusions: Pneumoperitonium was detected radiologically in 65% of pts of perforated DU. CT scan was found to be superior to U/S study for the diagnosis in pts with negative X-ray finding. For pts with perforated DU Conservative treatment can be adopted in pts with negative radiological findings.

Keywords: perforated DU, air under diaphragm, radiological investigations in perforated DU.

Introduction

Peptic ulcer disease (PUD) represents a worldwide health problem because of its high morbidity, mortality and economic loss¹. In the United States, approximately 5 million adults suffer annually from peptic ulcer disease and 500,000 new cases with 4 million recurrences are reported each year^{2,3}. Globally, the incidence of peptic ulcer disease has fallen in recent years⁴. Despite this and recent advances in both diagnosis and management of peptic ulcer disease, namely the improvement in endoscopic facilities, eradication of *H. pylori* and the introduction of the proton pump inhibitors, complications such as peptic ulcer perforation remain a substantial healthcare problem. This may be due to an increase in the risk factors for peptic ulcer complications^{1,4} peptic ulcer disease and its complications remains a frequent clinical problem in our environment predominantly affecting young males not known to suffer from PUD. Simple closure with omental patch followed by *Helicobacter pylori* eradication was effective with excellent results in majority of pts despite patients' late presentation in our country. Peptic ulcer perforation is a serious complication which affects

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almost 2-10% of peptic ulcer patients on the average^{5,6} Peptic ulcer perforation presents with an overall mortality of 10%⁷ although some authors report ranges between 1.3% and 20%^{8,9}. the most important factor in preventing the post operative morbidity and mortality in pts with PDU is the time factor, so that the shorter the interval between diagnosis and initiation of surgical treatment the less complication rate. A successful outcome could be obtained by prompt recognition of the diagnosis, aggressive resuscitation and early institution of surgical management. The pattern of perforated PUD has been reported to vary from one geographical area to another depending on the prevailing socio-demographic and environmental factors¹⁰. In the developing world, the patient population is young with male predominance, patients present late, and there is a strong association with smoking¹¹. In the west, the patients tend to be elderly and there is a high incidence of ulcerogenic drug ingestion¹². The diagnosis of perforated DU poses a diagnostic challenge in most of cases. The spillage of duodenal or gastric contents into peritoneal cavity causing abdominal pain, shock, peritonitis, marked tenderness and decreased liver dullness offers little difficulty in diagnosis of perforations¹³. The presence of free gas under the diaphragm (pneumoperitonium) on plain abdominal erect X-

ray is diagnostic in 75% of the cases¹⁴. The most common cause is a perforation of the abdominal viscus—most commonly, a perforated ulcer, although a pneumoperitoneum may occur as a result of perforation of any part of the bowel. Likewise, not every bowel perforation results in a pneumoperitoneum; some perforations seal over, allowing little gas to escape. Plain film abdominal radiographs are helpful if free air is seen, however 30-50 percent of cases of perforated ulcers do not show free air. Ultrasonography or CT can be useful to detect intraperitoneal free fluid or air if the diagnosis is uncertain. Since the first description of surgery for acute perforated peptic ulcer disease, many techniques have been recommended. The recent advances in antiulcer therapy have shown that simple closure of perforation with omental patch followed by eradication of *H. Pylori* is a simple and safe option in many centers and have changed the old trend of truncal vagotomy and drainage procedures¹⁵.

Although surgery is normally the correct treatment for perforated duodenal ulcer, the whole patient and the comorbidity need to be taken into account. Perforations may seal themselves by adherence to liver, gallbladder, or omentum. The aim of this study is to evaluate the diagnostic accuracy of different radiological investigation for the diagnosis of PUD.

Methods

This is a prospective study of 185 pts with PDU who attend for emergency dept at al-kindy teaching hospital, Baghdad from period June 2008-august 2010.

The diagnosis of PDU was based on clinical finding of classic symptoms and signs of sudden sever abdominal (epigastric) pain with generalized tenderness and rebound tenderness with board like rigidity. The diagnosis supported by history of chronic dyspeptic symptoms, previous endoscopic finding of DU, with history of long-term ingestion of steroid or NSAID. Causes of pneumoperitoneum other than PDU (recent surgery, recent peritoneal dialysis) were excluded.

For all pts with high clinical index of suspicion of perforated DU, chest radiograph PA view was taken in erect position to demonstrate presence of free intraperitoneal air. if this reveal no pneumoperitoneum, another left lateral decubitus CXR done with another plain abdomen radiograph.

For those with no radiological finding of pneumoperitoneum on a plain film, Ultrasonographic examination of the abdomen done to demonstrate free intraperitoneal fluid or air.

If the diagnosis of perforation is not supported by the presence of pneumoperitoneum by X ray or the presence of fluids/ or air on U/S, then CT scan was done to confirm the diagnosis in those pts.

Blood samples were aspirated from all pts to assess hemoglobin level, blood urea, blood sugar and serum electrolyte (Na^+ , K^+ , Ca^{++}).

Data were collected by regarding the demographic information the radiological ultrasonography and operative finding by special proforma.

After preliminary resuscitation with IV fluid in form of crystalloid solution from 0.5 to 2 liters according to the general conditions of the pts and hydration state. Correction of electrolyte if present. Nasogastric tube inserted to all pts preoperatively. Foleys catheter inserted when indicated.

Preoperative antimicrobial therapy given in form of third generation cephalosporin in the form of cefotaxime 1 gm 12 hourly intravenously and metronidazole 500 mg intravenously 8 hourly was used in all cases.

Written consents were taken from all pts. Explorative laparotomy done for all pts through midline incision.

Finally the diagnosis was confirmed by the operative finding of duodenal perforation.

Identification of the site, size and nature of the perforation done, closure of the perforation was done with omental patch (grahams omentopexy) using 2/0 absorbable suture. Peritoneal wash done by using 1-3 liters of warmed saline. 2 tube drain were inserted, 1st near the site of repair and second in the pelvis. Wound closed in layers.

The data were analyzed by computer using Minitab statistical software version 14

P value of <0.05 was considered statistically significant

Results

One hundred eighty five pts included in this study with proven PDU, 162 (87.5 %) male and 23 (12.5 %) female, male to female ratio was 7;1. The mean age was 38 years, ranging from 22-70 years.

PDU was noted to occur most commonly at the age group of 30-40 yrs and less frequently at other age group. Frequency of presentation in different age group are shown in table 1.

Operative finding	No. of pts
Small perforation(less than 0.5 cm)	24
Completely or partially sealed perforation	19
Sever edema and narrowing of pylorus	15
Perforation >1cm with little soiling	6

Table 1: Distribution of pts with perforated DU according to the different age groups

Age group	No. of pts	% of pts
20-30 yrs	36	19.4
30-40yrs	71	38.3
40-50yrs	43	23.2
50-60yrs	27	14.5
60-70yrs	18	9.7

In our study a crescent shape free air under diaphragm on chest X-ray PA view, lateral decubitus chest radiograph and plain abdomen radiograph was seen in 121 (65.4 %) pts mainly on right side in 84 pts (69.4%) and sometimes on both sides in 37 (30.5%) pts which was clearly distinct the gastric gas shadow on the left side preoperatively in pts with proven perforated DU. In other 64 (34.6%) pts there was no radiological signs (pneumoperitonium) seen in chest or plain abdomen radiography.

For those 64 pts with negative radiographic findings , an abdominal ultrasonography done to detect any free fluid or air in the peritoneal cavity. Ultrasonographic finding in form of free peritoneal fluid was seen in 16 (25%) pts out of 64 pts

CT scan positive finding in form of free fluid or air in the peritoneal cavity was seen in 62(96.9%) pts out of 64 pts as shown in table 2.

Table2: Negative and positive finding of different diagnostic tools.

Investigation	No. of pts	posit ive	negativ e	% of positiv e
Ultrasonograph y	64	16	48	25
CT scan	64	62	2	96.9

The operative finding in those 64 pts with negative X-ray and sonographic finding are listed in table3

Table3: The operative findings of 64 pts with no findings on Xray and U/S.

Discussion

PDU is a serious complication of DU with potential risk of serious complications. The mortality and morbidity is directly related to delay in diagnosis and treatment, Therefore, early diagnosis and prompt (urgent) treatment is required to avoid complications.

Current study demonstrated that positive radiological sign of pneumoperitonium found in 65% of pts with proven diagnosis of PDU. This result was in agreement with results reported from western countries (50% , 70%)^{16,17} . Other authors reported a figure of 75%¹⁴ . When there is no gas under diaphragm on x-ray, the attention must be directed toward other diagnostic method to confirm or exclude the provisional clinical diagnosis of PDU.

In our study there was 35% of pts with no radiological evidence of PDU this may be attributed to small sized perforation or sealing off the perforation by omentum ,liver or gallbladder , sever oedema and narrowing of the pylorus and in some pts, although there was a perforation more than 1 cm in size , there is little or no peritoneal soiling, as proved by operative findings . These findings may explain absence of radiological or ultrasonographic signs of perforation.

In case of perforated PUD ulcer, free intraperitoneal gas is less likely to be seen if the time interval between the perforation and radiological examination in short.

In our study U/S showed a positive finding in form of free fluid or gas in the peritoneal cavity in 16 pts(25%) of those with negative finding in plain chest or abdominal radiograph. Abdominal ultrasonography has also been found to be superior to plan radiographs in the diagnosis of free intra-peritoneal air¹⁸.

Some studies have reported sensitivities greater than that of plain abdominal radiography in the diagnosis of a pneumoperitonium¹⁹ . Compared with plain radiography, US examination also has the advantage of depicting other changes, such as free abdominal fluid and inflammatory masses²⁰ .

Baker SR et al concluded that CT can depict as little as 5 cm of cubic free air in the peritoneum²¹ . In a supine position, anteriorly placed gas can generally be differentiated from gas within the bowel. With any perforation, an outpouring of inflammatory fluid of varying quantities can be observed within the peritoneum.The amount depends on the site of perforation. This fluid is again readily detected with CT. The cause of the perforation can sometimes be diagnosed. Such perforations may be associated with a carcinoma, diverticulitis, or appendicitis.^{21,22} .

In the present study, perforated duodenal ulcer disease were found to be most common in the fourth decade of life and tended to affect more males than females, with a male to female ratio of 7 ; 1 which is comparable

with other studies in developing countries²³. Our demographic profile is in sharp contrast to what is reported in developed countries where the majority of the patients are above 60 years and the incidence is higher in elderly females taking ulcerogenic medications²⁴. Male predominance in this age group is attributed to excessive alcohol consumption and smoking among young males which is common in our environment. Alcohol consumption and smoking have been reported to be associated with increased risk for perforated peptic ulcer. Alcohol, as a noxious agent causes gastric mucosal damage, stimulates acid secretion and increases serum gastrin levels and smoking inhibits pancreatic bicarbonate secretion, resulting in increased acidity in the duodenal bulb. It also inhibits the healing of duodenal ulcers.

In agreement with other studies^{23,25}, the diagnosis of perforated DU in this study was made from history and identification of free air under the diaphragm in plain abdominal and chest radiographs, and the diagnosis was confirmed at laparotomy. The value of the radiological investigation has been compared with other writers and with current radiological techniques; 80-90% of cases are correctly diagnosed²⁶. In case of perforated DU, free intraperitoneal gas is less likely to be seen if the time interval between the perforation and radiological examination is short²⁶. Recently abdominal ultrasonography has also been found to be superior to plain radiographs in the diagnosis of free intra-peritoneal air¹⁸. We relied on plain radiographs of the abdominal/chest to establish the diagnosis of free intra-peritoneal air which was demonstrated in 65.8% of cases.

Conclusions

Plain X-ray of the chest and abdomen yield high diagnostic accuracy rate, while CT scan was found to be superior to the U/S study for the diagnosis of perforation in pts with negative X-ray finding.

In patients with negative radiological findings, this may be attributed to small sized perforation, sealed perforation or presence of little peritoneal soiling and very localized peritonitis so that conservative treatment can be adopted in those patients with negative radiological findings.

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