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The relationship between computed tomography findings and the locations of perforated peptic ulcers: it may provide better information for gastrointestinal surgeons

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PPU;
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CT

Abstract

BACKGROUND: Computed tomography (CT) plays an important role in diagnosing gastrointestinal perforation. This study explored the relationship between CT findings and the locations of perforated peptic ulcers (PPUs), which may help further surgical planning.

METHODS: During a 34-month period, 175 patients had CT scans. We categorized those 175 patients into 2 groups: patients with and without a PPU at a difficult ulcer site for a laparoscopic approach. Both clinical data and the CT images were reviewed and analyzed.

RESULTS: Based on the univariate analysis results, we conducted multivariate analyses of 3 factors: age, American Society of Anesthesiologists classification of 3 or more, and positive lesser sac image findings. The positive lesser sac findings in CT were the only independent factor that was correlated to the PPU site.

CONCLUSIONS: Positive lesser sac CT findings may help to predict PPUs in sites where a laparoscopic approach might be difficult. Our study re-evaluates the additional value of CT scanning in diagnosing PPU, and the results may assist with surgical planning in clinical practice.

Peptic ulcers are a common and worldwide disease. However, with the introduction of the proton pump inhibitor and eradication therapy for *Helicobacter pylori*, the incidence has decreased.[1,2] Although there have been improvements in medication and gastrointestinal endoscopy,

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peptic ulcer disease is still sometimes complicated by emergent conditions, such as acute upper gastrointestinal hemorrhage or perforation, and prompt interventions are necessary. Upper gastrointestinal hemorrhage can be mostly treated by interventional endoscopy, but perforated peptic ulcer (PPU) is still one of the most common surgical emergencies. PPU is associated with high patient mortality and morbidity,[1,3,4] particularly for patients with high surgical risks and underlying comorbidities.[5] The preoperative diagnosis, surgical management, and postoperative care are, therefore, important for clinicians to provide the best clinical results for these endangered patient groups.[6]

In addition to clinical presentation and physical examination, radiologic evidence is also critical for diagnosing PPU. Pneumoperitoneum is the most important diagnostic image indicator for the disease. The most classical diagnostic radiologic evidence is subphrenic free air in an upright chest x-ray (CXR) or the left decubitus view of an abdominal x-ray, although neither sensitivity nor specificity is satisfactory.[4,7] Because of the improvements in and convenience of computed tomography (CT) in recent years, CT scanning has been used more frequently to diagnose PPU. In addition to identifying extraluminal air and peritoneal fluid, CT scans can also differentiate PPUs from other peritonitis entities with good consistency between peer radiologists.[8–10]

After PPU is diagnosed, prompt surgical treatment is still the mainstream,[6] even with evolving surgical techniques. Laparoscopy with primary repair has been proposed and recommended for select patients. Laparoscopy inarguably provides equal treatment efforts and greater postoperative comfort to patients.[11] As with any laparoscopic procedure, conversion from laparoscopy to laparotomy may occur. Although a number of reasons for these conversions have been proposed, the location of the perforation site (eg, posterior) is one such reason.[12,13]

In this study, we focused on PPU patients and explored the relationship between the CT findings and anatomic PPU sites, which may possibly provide additional information for later surgical planning. Moreover, we also explored whether upright CXR can provide additional information for diagnosis, although CT scan is thought to provide more information than x-ray.[14]

Patients and Methods

Form September 2010 to July 2013 (a 34-month period), 300 patients were admitted for trauma and emergency surgery service caused by gastrointestinal perforation at the Linkou branch of Chang Gung Memorial Hospital (CGMH). After approval by the CGMH Institutional Review Board, clinical information was then extracted from the CGMH Acute Abdomen Database. CGMH in Linkou is a tertiary transfer center, and we included both transferred patients and patients who went to our hospital for first aid. All the patients in our study underwent surgical management at our hospital. Our main purpose was to determine the relationship between the PPU locations and radiologic findings. In terms of laparoscopic feasibility, we defined ulcer solely based on lesser curvature or on posterior gastric wall as PPU with "difficult ulcer site (DUS)" (Fig. 1).

We intended to evaluate radiologic studies and, therefore, excluded transferred patients without any radiologic images (n = 23) uploaded in the hospital information system. We also excluded patients with any underlying diseases with ascites as a sign, including cirrhosis of the liver, cancerous carcinomatosis, or end-stage renal disease with peritoneal dialysis (n = 10), in addition to patients with iatrogenic or foreign body–related gastroduodenal perforation (n = 9), initial presentation with upper gastrointestinal bleeding with concurrent PPU (n = 7), PPU with previous gastrectomy and gastrojejunostomy (n = 8), and an additional 11 patients in the database (3 patients diagnosed by left decubitus abdominal x-ray, 5 who had not undergone surgery, and 3 with incomplete registered data). A PPU diagnosis was confirmed in 232 patients, who were then enrolled for statistical analysis: 57 patients were diagnosed with PPU only by upright CXR, and 175 were diagnosed by CT scan with or without upright CXR (some even with upright CXR positive finding; Fig. 2).

We first compared the patients (with upright CXR performed) with and without positive upright CXRs (77 vs 31, respectively, 108 total) to determine the clinical implications, particularly regarding the PPU locations. The patients' demographic and laboratory data (initial data, surgical risk), surgical conditions (ulcer location, surgical procedure, etc), and outcomes were all compared. We then further analyzed the patients with CT scans, who were grouped according to the PPU location (DUS or not, 20 vs 155, respectively, total 175). All CT scans covered the complete abdominal region with or without intravenous contrast medium (137 vs 37,

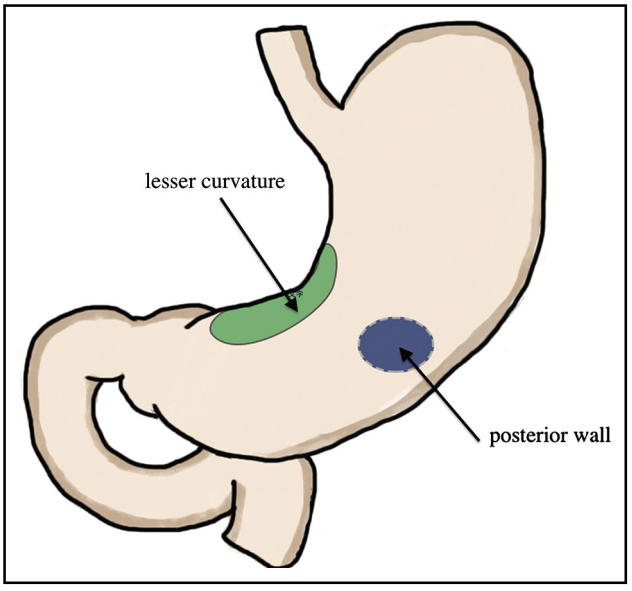

Figure 1 Difficult ulcer sites.