

Combined laparoscopic-endoscopic method using an omental plug for therapy of gastroduodenal ulcer perforation

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Background: Laparoscopic techniques have been proposed as an alternative to open surgery for therapy of peptic ulcer perforation. They provide better postoperative comfort and absence of parietal complications, but leakage occurs in 5% of cases. We describe a new method combining laparoscopy and endoluminal endoscopy, designed to ensure complete closure of the perforation.

Methods: Six patients with anterior ulcer perforations (4 duodenal, 2 gastric) underwent a concomitant laparoscopy and endoluminal endoscopy with closure of the orifice by an omental plug attracted into the digestive tract.

Results: All perforations were sealed. The mean operating time was 72 minutes. The mean hospital stay was 5.5 days. There was no morbidity and no mortality. At the 30-day evaluation all ulcers but one (due to *Helicobacter pylori* persistence) were healed.

Conclusions: This method is safe and effective. Its advantages compared with open surgery or laparoscopic patching as well as its cost-effectiveness should be studied in prospective randomized trials.

Despite profound modifications of the natural history of ulcer disease with the advent of therapies directed against *Helicobacter pylori*,¹ the management of peptic gastroduodenal ulcer perforation remains mainly surgical. As an alternative to open surgery, considered as the "gold standard,"² a laparoscopic approach was first described in 1990 by Mouret et al.³ Several laparoscopic techniques have

been reported; omental patch repair with³ or without fibrin spraying,⁴ patching of the ligamentum teres hepatis,⁵ or sealing with gelatin sponge and fibrin.⁶ We present here a new technique, combining endocavitary with endoluminal endoscopy, that allows precise ulcer localization, tight closure of the perforation under double visual control, as well as diagnosis of *H. pylori* infection, which in turn allows elimination of the cause of the ulcer.

PATIENTS AND METHODS

From May 1997 to March 1998 six patients (3 men, 3 women; mean age 43.8 years, range 23 to 71 years) were included in this prospective study. All patients gave written informed consent. The study was approved by our institutional research committee. The inclusion criterion was the clinical suspicion of peptic ulcer perforation (acute abdominal pain and signs of peritoneal inflammation, combined with previous ulcer history or existence of risk factors) with mandatory need for surgical exploration. The absence of free air under the diaphragm did not exclude the diagnosis. Patients suffering from associated gastrointestinal bleeding, severe respiratory insufficiency, or hemodynamic instability were not considered for the study. Relevant data concerning the patients and the ulcer descriptions are given in Table 1.

The operative method was as follows: After creation of a pneumoperitoneum using carbon dioxide, three trocars were inserted: two 10 mm subumbilical and upper left quadrant trocars and one 5 mm trocar in the right upper quadrant at the level of the midclavicular line. During surgical exploration, esophagogastroduodenoscopy was performed (Olympus Q 20; Olympus Optical Co., Hamburg, Germany). A foreign body forceps (Alligator type, GIP type 821460) was introduced via the flexible endoscope through the perforation orifice into the abdominal cavity to grasp an omental plug, approximately 5 cm long, held over the site with an operating forceps (Fig. 1). The epiploic tissue was pulled through the orifice into the duodenum or stomach for about 3 to 4 cm and maintained in this position with the forceps. The surgeon proceeded to fix the plug with one or two Vicryl stitches (polyglactin 910; Ethicon, Norderstedt, Germany) on the ulcer edges by intracorporeal knot tying. The plug was then released (Fig. 2). An "airtightness test" was performed: after maximal air insufflation within the gut lumen and laparoscopic water irrigation of the sutured operative site, no air bubbles were noted in the vicinity of the perforation. After this maneuver, 5 biopsy specimens were taken in the gastric antrum and body for histopathologic evaluation and performance of a rapid urease test. In case of a gastric ulcer, 10 additional biopsy specimens from around the ulcer edges were obtained. Finally, abundant lavage of the abdominal cavity was performed. All patients received intravenous omeprazole 40 mg tid as well as intravenous antibiotics (amoxicillin and clavulanic acid). *H. pylori* infection was treated with a triple-drug regimen (omeprazole 20 mg bid, clarithromycin 250 mg bid, and metronidazole 500 mg bid for 7 days, followed by a 30-day course

Received September 5, 1997. For revision March 6, 1998. Accepted May 28, 1998.

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Presented, in part, at the annual meeting of The American Society for Gastrointestinal Endoscopy, May 17-20, 1998, New Orleans, Louisiana.

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0016-5107/98/\$5.00 + 0 37/69/92073

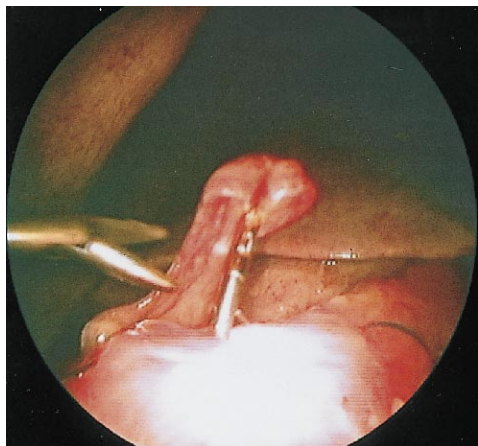


Figure 1. Laparoscopic view in a patient with a perforated bulbar ulcer. The omental plug is grasped with the foreign body forceps through the perforation (patient 2).

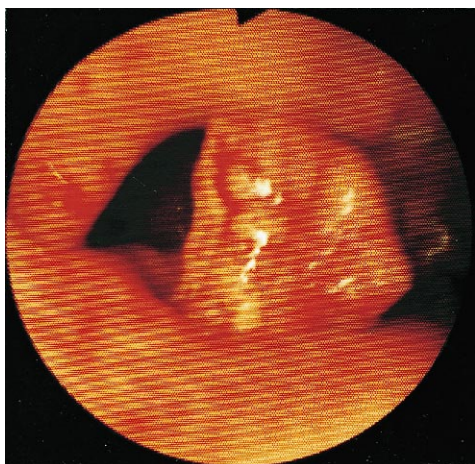


Figure 2. Endoscopic view of the omental plug immediately after release from the foreign body forceps (patient 4).

of omeprazole 20 mg bid). Two patients underwent follow-up endoscopy 8 and 10 days after laparoscopy; endoscopy was performed 4 to 6 weeks after perforation closure in all patients.

RESULTS

There were 4 duodenal and 2 gastric ulcer perforations (Table 1), all of which were on anterior surfaces. The mean diameter of the perforation orifice was 10 mm (range 4 to 20 mm). *H. pylori* infection was diagnosed in all cases of duodenal ulcer, whereas it was absent in the 2 patients with gastric ulcers. One of the latter (patient 4) had undergone chemotherapy and high-dose corticosteroid therapy. Four patients regularly received nonsteroidal anti-inflammatory drugs. All patients had signs of diffuse peritonitis. The mean operating time was 72 minutes (range 45 to 90 minutes). The only techni-

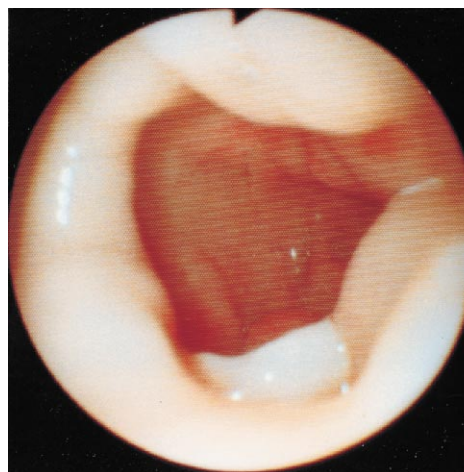


Figure 3. Endoscopic view 8 days after perforation closure. A fibrinoid scar is visible at the bottom of the figure immediately distal to the pylorus (patient 2).

cal difficulty encountered was due to left liver lobe hypertrophy in one case (patient 5) partially masking the duodenum. This prolonged the operating time by 20 minutes. Conversion to laparotomy was not necessary in any case. The postoperative courses of the patients were uneventful. The mean postoperative analgesic dosage per patient consisted of 45 mg morphine subcutaneously (7.5 mg qid; range 7.5 mg to 120 mg per patient). The nasogastric tube was removed after a mean of 33 hours (range 14 to 38 hours). Patients resumed oral intake after 2.2 days (range 36 to 62 hours). The mean hospital stay was 5.5 days (range 3 to 10 days). There was no 30-day mortality. Two patients underwent early postoperative endoscopy (day 8 and 10). These showed complete disappearance of the omental plug (Fig. 3). At endoscopy performed 1 month after surgery, all ulcers except one had disappeared. In this patient, persistent *H. pylori* gastritis was diagnosed and successfully treated by a second, modified, triple regimen with subsequent ulcer healing at endoscopic evaluation performed 2 months later.

During the study period a 45-year-old man underwent combined laparoscopy-endoscopy for suspicion of a peptic ulcer perforation. The largely perforated ulcer was difficult to locate on the anterior face of the subcardial region. Gastroscope disclosed an elevated ulcer crater, the appearance of which raised a suspicion of carcinoma; therefore the procedure was converted to laparotomy with ulcer excision and suturing. The histologic diagnosis was an adenocarcinoma and the patient underwent gastrectomy 3 weeks later.

DISCUSSION

The potential advantages of laparoscopic over open surgery for peptic ulcer perforation have been

Table 1.
Characteristics of the patients treated by combined laparoscopic-endoscopic technique for ulcer perforation

Patient No.	Gender/age (yr)	Ulcer history	NSAID intake	Time interval (hr)*	Ulcer location	Orifice size	<i>H. pylori</i>
1	M/42	Yes	Yes	4	Bulb	4 mm	Positive
2	F/36	No	Yes	5	Bulb	10 mm	Positive
3	F/71	No	Yes	15	Bulb	10 mm	Positive
4	M/23	No	No	10	Corpus	6 mm	Negative
5	M/48	No	No	6	Bulb	10 mm	Positive
6	F/43	No	Yes	12	Antrum	20 mm	Negative

NSAID, Nonsteroidal anti-inflammatory drugs.

*Time elapsed from onset of acute pain and beginning of the operation.

evaluated in several recent studies.⁶⁻¹¹ It is worth noting that only one randomized prospective trial has been conducted thus far.¹⁰ All authors consistently reported the absence of hernias and eviscerations and better postoperative patient comfort, that is, a lower need for analgesics.^{6-8,10} However, no study reported a significantly shorter hospital stay and most investigators reported a prolonged operating time^{6-8,10} compared with open surgery. Furthermore, a certain number of leaks have been reported, resulting in reinterventions in 2% to 10% of patients.^{6,9-11} Lastly, the mortality rate of 2% to 5% has not been reduced compared with open surgery.^{10,11}

We present here the modification of a combined laparoscopic-endoscopic approach to perforated peptic ulcer, as first proposed by Mouiel and Kathkouda⁴ in 1991 and alluded to, without clinical data, by Périssat et al.¹² in 1992. It should be noted that a preoperative (diagnostic) endoscopy is contraindicated if a perforation is suspected. We think that intraoperative gastroscopy is a useful adjunct to laparoscopy for several reasons. Endoscopy visualizes the ulcer, allowing detection of multiple lesions and—in case of gastric ulcer—detection of a neoplasia by inspection and by obtaining biopsy specimens. The latter is shown by one patient in our series who underwent operation for perforation and was found to have gastric adenocarcinoma. In addition, this intraluminal endoscopy easily locates the ulcer, thus avoiding a prolonged laparoscopic search. This circumstance led to conversion to open laparotomy in 6 of 69 cases of ulcer perforation in a recent report by Navez et al.¹³

Most importantly, the endoscopic maneuver allows optimal sealing of the perforation by exact filling of the orifice with omental tissue and stabilization of the omentum under direct vision while the surgeon performs fixation. Unlike most investigators,^{4,6,11} we do not just apply an omental patch over the perforation site, but pull a plug into the

digestive tract. This has been briefly described by Karanjia et al.¹⁴ using a nasogastric tube inserted “blindly” by the anesthetist and removed 1 week later. We preferred to accomplish this procedure under direct visual control and thereby avoid the need for an indwelling tube for several days. We also favor the use of an omental plug rather than the ligamentum teres hepatis as proposed by Costalat and Alquier.⁵ The omentum is easy to mobilize and better suited to this purpose because of its physiologic sealing properties by tissue adhesion and rich vascularization that hastens tissue healing. The mechanisms underlying these effects seem to be local secretion of anti-inflammatory, angiogenic, and collagen-synthesizing mediators.¹⁵ The results of our study compare favorably with most other trials of laparoscopic therapy in terms of operation time (72 minutes versus 113 minutes for Lau et al.¹⁰ or 80 minutes for Druart et al.¹¹), but open repair still seems to be slightly more rapid (57 minutes for Lau et al.). The hospital stay of 5.5 days in our series is comparable with that for laparoscopic and open surgery in the experience of Lau et al.¹⁰ (5 days each), but shorter than that of Druart et al.¹¹ (9.3 days). Our study also confirms the low need for postoperative analgesics. Gastroscopy also reliably diagnoses *H. pylori* infection by means of the rapid urease test and biopsies. This microorganism has recently been shown to play a causative role in ulcer perforation^{16,17} and its eradication is of crucial importance for prevention of ulcer recurrence.^{1,17}

The limitations of the combined laparoscopic-endoscopic approach are higher cost, the need for the presence of an experienced endoscopist, as well as the difficulties in cases of posterior or very large ulcer perforations which are generally considered to be contraindications to laparoscopic therapy.¹¹ Furthermore, experimental data have raised a concern about induction of septic shock by capnoperitoneum in cases of longstanding peritonitis (more than 12 hours).¹⁸ The absence of complications and

mortality with perforations as large as 20 mm in diameter seems encouraging; nevertheless possible selection bias as well as the small number of patients make it difficult to draw firm conclusions. There is a theoretic risk of duodenal obstruction by the plug or omental necrosis; in our limited experience this has not occurred thus far, and the early follow-up endoscopies documented complete disappearance of the plug. Further development of this technique might include endoluminal clipping or stitching to stabilize the plug.^{19,20}

Whether the laparoscopic approach is of any substantial benefit to patients with ulcer perforations compared with open surgery remains uncertain^{7,9} and there is a clear need for randomized comparative trials. We propose our combined laparoscopic-endoscopic method using an omental plug as a safe and effective alternative to other laparoscopic techniques.

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