Partial or Complete Circular Duodenectomy With Highly Selective Vagotomy for Severe Obstructing Duodenal Ulcer Disease

An Initial Experience

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Objective: To evaluate partial and complete circular duodenectomy combined with highly selective vagotomy (HSV) for relief of gastric retention.

Design: A retrospective, case-comparison study.

Setting: University hospital referral center.

Patients: Eighteen patients with severe obstructing duodenal ulcer disease defined by failure of a saline load test and endoscopic narrowing of the gastric outlet to 5 mm or less.

Methods: In patients with severe obstructing ulcer the diseased duodenal segment was excised with electrocautery (partial excision, 10 patients; complete excision, 8 patients). An HSV was then done. Postoperative fasting gastric residuum measurement and measurement of the emptying of liquids and solids was done at 3 months and patients were weighed at 3 and 12 months.

Results: No patient experienced postoperative gastric retention or required reoperation in a 2-year follow up. The early emptying of liquid (20 minutes) in complete circular duodenectomy plus HSV was more rapid than in normal subjects and duodenal ulcer patients. The emptying of solids was slightly delayed in partial duodenectomy plus HSV compared with duodenal ulcer patients but not with normal controls. The emptying of solids in duodenal ulcer patients was more rapid than in normal controls. Weight gain was excellent at 3 and 12 months.

Conclusion: Partial duodenectomy and complete circular duodenectomy plus HSV are more efficacious than alternative nonresective procedures in restoring gastric emptying to near normal and restoring weight in patients with obstructing duodenal ulcer.

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PATIENTS AND METHODS

Eighteen consecutive patients with severe obstructing duodenal ulcer disease were studied. Severe obstructing disease was defined by: (1) the retention of 200 mL or more of a 750 mL saline load 1 hour following its instillation into the stomach; and (2) the endoscopic findings of narrowing of the gastric outlet to 5 mm or less such that visualization of the duodenum beyond was not possible. The extent of the scarring found at operation determined whether a PD and HSV (n = 10) or CCD and HSV (n = 8) would be required (Figure 1 and Figure 2). The findings at operation of a badly scarred duodenum and enlarged thickened stomach were particularly informative. The boundaries of the scarred area were marked with silk stay sutures and the resection done exclusively with the use of electrocauterity (Figure 3). In 2 instances the ulceration was found at operation to be within the pyloric channel and not the duodenum. These cases were treated with truncal vagotomy and Billroth I hemigastrectomy and are not part of this study.

Following resection of the diseased duodenum a finger was inserted through the pylorus, which could be readily palpated. The duodenum was reconstructed transverse to the lumen using interrupted figure-8 full-thickness sutures with an absorbable synthetic monofilament. The nasogastric tube was then situated across the suture line and left in place for 72 hours. The time required for the duodenectomy ranged from 20 to 90 minutes. In no instance was it necessary to ligate the gastroduodenal artery or transfuse blood. An HSV was then done. A group of patients presenting with obstruction who failed the saline load test but did not have evidence of mechanical obstruction on endoscopy were treated by HSV alone (n = 10).

Three months postoperatively, gastric emptying studies of solids was evaluated using technetium Tc99–diethylenetriamine pentaacetic acid–labeled microcapsules (1-2 mm) as a solid particle mixed in 300 mL of a rice gruel (protein 20 calories, carbohydrates 150 calories) meal. The initial appearance of the radiolabel into the duodenum (lag duration) and complete disappearance from the stomach (emptying time) were monitored by an external gamma counter.9,10 The gastric emptying of liquids was evaluated after an overnight fast using a double-sampling technique (modified George test).11 A 750-mL liquid cereal meal (protein 2.56 g, carbohydrates 38.93 g, fat 0.91 g) was instilled into the stomach, after the residuum had been aspirated, through a radioopaque gastric tube. The tube had been inserted under fluoroscopic control into the most dependent portion of the stomach. Samples of the gastric contents were aspirated at regular intervals and the concentrations of phenol red determined. The liquid emptying studies required insertion of a nasogastric tube, at which time the fasting gastric residuum was measured (Table 1).

The liquid-gastric emptying was obtained by 50% emptying and determined postcibal at 20 minutes, 40 minutes, and 60 minutes (Table 2). For the 2-phase model analysis, the solid emptying curves were divided into a lag period and an emptying period. These parameters were considered to provide a comprehensive analysis of the possible relation between motility and emptying for the entire postcibal period. Data were analysed using the Student unpaired t test.

Figure 1. Partial duodenectomy and highly selective vagotomy. P indicates level of pylorus.

Figure 2. Complete circular duodenectomy and highly selective vagotomy. P indicates level of pylorus.

COMMENT

There has been an increased effort to perform nonresective procedures for the complications of duodenal ulcer disease, which still may require operation for their ameliora-
Severe obstruction is such a complication and it continues to be a problem in Taiwan. Previous efforts to alleviate the obstruction were by dilation and nonresection procedures of the obstructed segment. Forceful dilation of the strictured duodenum had a high failure and ulcer recurrence rate. Injury to the duodenum also occurred. In particular, these procedures are noted to produce marked delayed gastric emptying in approximately 40% of patients (Table 3). Both gastric resection and markedly delayed gastric emptying prevent adequate nutrition and weight gain in patients who have already suffered weight loss because of obstruction.

The duodenum is thought to be the site of an important inhibitory control mechanism of gastric emptying. We postulate that the loss or impairment of this control mechanism is responsible for the more rapid emptying of liquids (early phase) and solids (lag duration) in the patients who had CCD. An HSV was done in both PD and CCD and therefore was probably not responsible for this difference.

Resection of a portion of the diseased duodenum in patients with obstruction has been previously reported. The report by Holle notes the clinical prompt return of normal gastric emptying and the technical advantage removal of the diseased tissue affords, in contrast to nonresective plastic procedures with scarred tissue.

Here we report results of both PD and CCD in treating severe obstructive disease. We find no previous reports in the literature of CCD for obstructing duodenal ulcer disease. Complete circular or sleeve duodenectomy evolved in our practice as we progressively undertook treatment of the most severe cases by this method. In the past we would have treated these patients by resective gastric surgery and bypass of the diseased duodenum (Billroth II). To our surprise we found that it was technically easier to resect the diseased portion of the duodenum than we had anticipated. We believe that this related to a meticulous approach that is confined to the scarred and relatively avascular tissue using electro-

**Table 1. Fasting Postoperative Residuum Volume**

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Postoperative Residuum, mL</th>
<th>Patient No.</th>
<th>Postoperative Residuum, mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD + HSV</td>
<td></td>
<td>CCD + HSV</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>25</td>
<td>1</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
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<td>2</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>47</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>5</td>
<td>110</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>78</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>42</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

*PD indicates partial duodenectomy; HSV, highly selective vagotomy; and CCD, complete circular duodenectomy.*
The closure of healthy pliable duodenal tissue was found to be much easier than previous attempts to close portions of scarred tissue in a plasty so as to widen the gastric outlet.

None of these procedures involved excision or division of the pylorus. It is emphasized that these procedures were not used and are not suitable for pyloric channel ulcers. The pylorus was palpated from inside the lumen prior to the closure. While at times the duodenal anastomosis was very close to the pylorus, every effort was made to avoid it in the closure. We consider this to be an important aspect in the early return to near-normal gastric emptying. These procedures differ from the Holle pyloroplasty, in which the anterior scarred duodenum is excised in conjunction with excision of a portion of the pylorus.8

The results of the gastric emptying studies are in keeping with our clinical observations. Both the PD and CCD groups were noted to have little postoperative gastric drainage and to recover quickly and easily from their operations. The emptying studies documented the clinically evident near-normal emptying of both liquids and solids by patients treated by CCD + HSV and PD + HSV. While some parameters achieved statistical significance, the changes noted were less than those reported for other procedures other than HSV. The absence of postoperative symptoms and the excellent weight gain suggest that the data is statistically but not clinically significant. We consider the excellent postoperative course and gratifying weight gain the great advantages of duodenectomies. We have now accumulated an extended experience with these procedures.

This research was supported by grant NSC 83-0412-B-016-071 from the National Science Council, Taipei, Taiwan. Reprints: Tzu-Ming Chang, MD, Division of General Surgery, Department of Surgery, Tzu-Chi Buddhist General Hospital, Hua-Lien, Taiwan, Republic of China.

### Table 2. Liquid Emptying in Normal Subjects, Patients With DU, Those With HSV, Those With PD + HSV, and Those With CCD + HSV*

<table>
<thead>
<tr>
<th>Status, min</th>
<th>Normal Subjects (n = 9)</th>
<th>DU (n = 22)</th>
<th>HSV (n = 9)</th>
<th>PD + HSV (n = 10)</th>
<th>CCD + HSV (n = 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>14.2 ± 1.5</td>
<td>16.7 ± 2.8</td>
<td>10.7 ± 1.2</td>
<td>11.0 ± 1.4</td>
<td>9.0 ± 1.2‡</td>
</tr>
<tr>
<td>40</td>
<td>17.3 ± 1.6</td>
<td>18.9 ± 1.0</td>
<td>21.9 ± 3.0</td>
<td>19.3 ± 2.0</td>
<td>18.5 ± 1.9</td>
</tr>
<tr>
<td>60</td>
<td>20.7 ± 1.6</td>
<td>23.6 ± 3.2</td>
<td>29.2 ± 3.5†</td>
<td>26.8 ± 3.4</td>
<td>26.1 ± 2.8</td>
</tr>
</tbody>
</table>

*DU indicates duodenal ulcer disease; HSV, highly selective vagotomy; PD, partial duodenectomy; and CCD, complete circular duodenectomy. All data are presented as mean ± SEM.

†P < .05, normal subjects vs those with DU, HSV, PD + HSV, and CCD + HSV.

‡P < .05, patients with DU vs HSV, PD + HSV, and CCD + HSV.

### Table 3. Solid Emptying in Normal Subjects, Patients With DU, Those With HSV, Those With PD + HSV, and Those With CCD + HSV*

<table>
<thead>
<tr>
<th>Status</th>
<th>Normal Subjects (n = 35)</th>
<th>DU (n = 20)</th>
<th>HSV (n = 10)</th>
<th>PD + HSV (n = 8)</th>
<th>CCD + HSV (n = 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lag duration, min</td>
<td>22.5 ± 2.1</td>
<td>34.4 ± 6.6</td>
<td>34.5 ± 8.8</td>
<td>42.0 ± 13.7</td>
<td>15.0 ± 6.5</td>
</tr>
<tr>
<td>Emptying time, min</td>
<td>82.5 ± 6.3</td>
<td>66.0 ± 4.7†</td>
<td>79.9 ± 16.7</td>
<td>104.1 ± 15.5‡§</td>
<td>79.8 ± 20.1</td>
</tr>
</tbody>
</table>

*DU indicates duodenal ulcer disease; HSV, highly selective vagotomy; PD, partial duodenectomy; and CCD, complete circular duodenectomy. All data are presented as mean ± SEM.

†P < .05, normal subjects vs those with DU, HSV, PD + HSV, and CCD + HSV.

‡P < .05, patients with DU vs HSV, PD + HSV, and CCD + HSV.

### REFERENCES