



## Highly selective vagotomy and gastrojejunostomy in the treatment of peptic ulcer induced gastric outlet obstruction

### Supraselektivna vagotomija i gastrojejunostomija u lečenju stenozе pilorusnog kanala uzrokovane peptičkim ulkusom

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#### Abstract

**Background/Aim.** The incidence of peptic ulcer-induced gastric outlet obstruction is constantly declining. The aim of this study was to present our results in the treatment of gastric outlet obstruction with highly selective vagotomy and gastrojejunostomy. **Methods.** This retrospective clinical study included 13 patients with peptic ulcer – induced gastric outlet obstruction operated with highly selective vagotomy and gastrojejunostomy. A 3-year follow-up was conducted including clinical interview and upper gastrointestinal endoscopy on 1 and 3 years after the surgery. **Results.** The most common preoperative symptom was vomiting (in 92.3% of patients). The mean preoperative body mass index was  $16.3 \pm 3.1$  kg/m<sup>2</sup>, with 9 patients classified preoperatively as underweight. There were no intraoperative complications, nor mortality. At a 3-year follow-up there was no ulcer recurrence. Delayed gastric emptying was present in 1, bile reflux in 2, and erosive gastritis in 1 patient. Two patients suffered from mild “dumping” syndrome. **Conclusion.** Highly selective vagotomy combined with gastrojejunostomy is a safe and easily feasible surgical solution of gastric outlet obstruction induced by peptic ulcer. Good functional results and low rate of complications can be expected at a long-term follow-up.

#### Key words:

peptic ulcer; pyloric stenosis; vagotomy, proximal gastric; digestive system surgical procedures; treatment outcome.

#### Apstrakt

**Uvod/Cilj.** Incidencija stenozе pilorusnog kanala uzrokovane peptičkim ulkusom u stalnom je padu. Cilj ove studije bio je da prikaže naše rezultate u hirurškom lečenju stenozе pilorusnog kanala supraselektivnom vagotomijom i gastrojejunostomijom. **Metode.** Retrospektivnom studijom bilo je obuhvaćeno 13 bolesnika sa stenozom pilorusnog kanala uzrokovanom peptičkim ulkusom kod kojih je učinjena supraselektivna vagotomija i gastrojejunostomija. Sprovedeno je trogodišnje praćenje, koje se sastojalo od kliničkog ispitivanja i endoskopije gornjeg dela digestivnog trakta, jednu i tri godine nakon operacije. **Rezultati.** Najčešći preoperativni simptom bilo je povraćanje, kod 92,3% bolesnika. Srednja vrednost preoperativnog indeksa telesne mase bila je  $16,3 \pm 3,1$  kg/m<sup>2</sup>, pri čemu je 9 bolesnika preoperativno klasifikovano kao pothranjeno. Nije bilo intraoperativnih komplikacija ili mortaliteta. Nakon trogodišnjeg praćenja nije bilo rekurentnih ulkusa. Odloženo gastričko pražnjenje uočeno je kod jednog, bilijarni refluks kod dva, a erozivni gastritis kod jednog bolesnika. Kod dva bolesnika bili su prisutni simptomi “dumping” sindroma. **Zaključak.** Supraselektivna vagotomija kombinovana sa gastrojejunostomijom je bezbedna hirurška procedura i dobro rešenje za bolesnike sa stenozom pilorusnog kanala uzrokovanom peptičkim ulkusom. U dugoročnom praćenju mogu se očekivati dobri funkcionalni rezultati i niska incidencija kasnih komplikacija.

#### Ključne reči:

želudac, ulkus; pilorus, stenozа; vagotomija, proksimalna, gastrička; hirurgija digestivnog sistema, procedure; lečenje, ishod.

#### Introduction

From the historical point of view, surgery for peptic ulcer disease (PUD) used to be a cornerstone of general surgery. Much that once was, now has changed. The role of sur-

gery, and especially elective one, in the treatment of PUD is declining, and currently is reserved for the complications of PUD, such as bleeding, perforation and gastric outlet obstruction (GOO)<sup>1</sup>. This shift of treatment paradigm has been influenced by improvement in antisecretory medications,

knowledge of *Helicobacter pylori* (HP) role in pathophysiology and treatment of PUD, and introduction of endoscopic therapeutic approach<sup>2</sup>. HP eradication combined with proton pump inhibitors is now mainstay therapy for PUD.

Nowadays, GOO will occur in approximately 6–8% of PUD patients<sup>3,4</sup>. GOO is usually accompanied with severe gastric distension and stasis which raises gastric pH, and will in return lead to increased gastrin and acid secretion, the example of “vicious cycle”<sup>4</sup>. Therefore, the goals of treatment should be to ensure gastric emptying and to diminish gastric acid secretion. Gastric emptying could be accomplished by endoscopic dilatations of pyloric stricture or by several surgical procedures, such as pyloroplasty, gastrojejunostomy or antrectomy<sup>5</sup>. Gastric acid secretion regulation on the other hand, can be achieved by employing acid suppressing medications, or surgically, by some form of vagotomy procedure. Highly selective vagotomy (HSV) had a major part in the treatment of PUD historically, although there are less and less recent reports which would enlighten the role of HSV nowadays. The rationale for HSV is in fact that this procedure should minimize gastric acid secretion, and preserve normal gastric emptying.

The aim of this study was to present our experience with HSV and concomitant gastrojejunostomy in the treatment of PUD – induced GOO.

## Methods

The study was conducted in the Department of Esophago-gastric Surgery, the First Surgical University Clinic, Clinical Center of Serbia, Faculty of Medicine, University, of Belgrade. The study was approved by Hospitals Board and Ethics Committee. It was designed as retrospective clinical study. We included 13 consecutive patients in whom HSV and gastrojejunostomy were performed due to GOO caused by PUD in the period from January 2004 till December 2010.

Microsoft Excel data base was created and it included the following: demographic data, upper gastrointestinal endoscopy data preoperatively and postoperatively, results of preoperative upper gastrointestinal endoscopic biopsy, and the data related to surgical procedure and postoperative course.

Two consecutive upper gastrointestinal endoscopies with biopsies were obligatory before surgery. This was performed in order to exclude malignancy, and HP infection evaluation.

Nasogastric tube was placed in all patients preoperatively, in order to prevent vomiting and aspiration of gastric contents.

Exclusion criteria were prior gastric surgery and GOO caused by malignancy. We excluded also the patients in

whom postoperative upper gastrointestinal endoscopy was not performed.

A patient was placed in supine position, in a reverse Trendelenburg. Operation was performed using proximal median laparotomy. Sternal retractor usage was obligatory. After retracting the left lobe of the liver, the lesser sac of omentum was exposed. We used to begin dissection after identifying the anterior aspect of Latarjet’s nerve, after which careful dissection was carried out from the level of angular incisure proximally towards phrenoesophageal ligament. Harmonic scalpel proved to be a useful tool in performing fine and precise dissection. The anterior trunk of the vagus nerve next to the lesser curve of the stomach was pulled laterally with a tape. After reaching the phrenoesophageal ligament complete encroaching of the esophagus was performed in order to divide all the anterior and posterior vagal braches. Then dissection was carried out towards the lesser curve, this time ligating the branches of the posterior vagal trunk, and the vagotomy procedure was finished with ligation of the most proximal branch of the posterior Latarjet’s nerve. Serosal layers on the posterior and anterior aspects of the lesser curve were approximated with interrupted sutures. Gastrojejunostomy was performed on the posterior wall of the stomach trough the mesocolon of the transversal colon. It is performed in two layers with continuous sutures, approximately 20–30 cm from the ligament of Treitz. In all the patients we performed reconstruction of the angle of His by two or three interrupted sutures.

All patients underwent regular yearly check-ups including clinical interview, upper gastrointestinal endoscopy one and three years after the surgery. Data regarding medication usage after the surgery were also collected. Follow-up using upper gastrointestinal endoscopy data included the following features: erosions or ulcer formation, the presence of corporal liquid “pool“ as a marker for delayed emptying, inspection of the strictured pyloric chanel, the presence of bile and obligatory biopsies of gastric mucosa.

All the data are expressed as means with standard deviations. Descriptive statistics is presented. Due to the limited number of patients, we did not perform comparative statistics.

## Results

Overall 13 patients met the inclusion criteria. There were 10 men and 3 women. The mean age of patients was  $67 \pm 17$  years. The mean duration of preoperative symptoms was  $26 \pm 9$  months. Vomiting was the leading symptom in the great majority of the patients; 6 of them had pain in the upper abdomen (Table 1), and 3 were presented with aspira-

**Table 1**  
**Preoperative symptoms of the study participants**

Symptom	Patients n (%)
Vomiting	12 (92.3)
Pain in the upper abdomen	6 (46.2)
Heartburn	7 (53.8)
Dyspepsia	8 (66.6)
Cough	3 (23.1)

tion pneumonia. The mean body mass index (BMI) was  $16.3 \pm 3.1 \text{ kg/m}^2$ , and 9 (69.2%) patients were classified as underweight with BMI less than  $18.5 \text{ kg/m}^2$ .

Preoperative endoscopy revealed the presence of peptic pyloric stricture in all of the patients. Endoscope passage through the pyloric channel was not possible in all the patients. Preoperative histology based on endoscopic biopsy specimens showed the presence of HP in 6 (46.2%) patients.

There was no intrahospital mortality. In one patient postoperative pneumonia was developed, and the patient was treated successfully. There were no intraoperative complications. The mean hospital stay was  $9.4 \pm 3.1$  days. There were no readmissions in early postoperative course.

At a 6-month follow-up, one patient reported occasional nausea and vomiting. He was treated with proton pump inhibitors and prokinetics with a good symptomatic outcome. A total of 12 patients reported satisfactory results after the surgery, 9 of them reported weight gain.

Upper gastrointestinal endoscopy showed the presence of delayed gastric emptying in 2 patients. In one patient presence of erosive gastritis was notified. The presence of bile reflux was documented in 4 of the patients. Both patients with the presence of erosive gastritis and peptic ulcer were HP positive based on endoscopic biopsy and patohistology. Also, both patients were asymptomatic, and were submitted to HP eradication therapy. None of the patients was presented with recurrent ulcer.

Three years after the surgery we completed upper gastrointestinal endoscopy in 12 patients. In one patient there were endoscopic signs of delayed gastric emptying (Table 2). None of the patients were presented with peptic ulcer. In one patient erosive gastritis was found (Table 2). Pylorus recanalization was present in 3 of the patients. In 2 of the patients there was a significant amount of bile present in the stomach (Table 2). Eight patients had normal appearance of gastric mucosa on a 3-year follow-up endoscopy and were completely asymptomatic. Ten of the patients gain more than 5 kg of weight 3 years after surgery.

Two of the patients reported symptoms that could point out to mild "dumping" syndrome.

## Discussion

The focus of surgery for PUD has switched to disease complications, as a growing knowledge of patophysiology brought to light successful medicamentous treatment. GOO remains one of PUD complications in which surgery still has its role. It has been estimated that 1–2% of patients with PUD will eventually develop GOO and require surgery<sup>6</sup>.

Patients with GOO are usually malnourished, presented with severe vomiting and early satiety. Initial treatment should be placement of nasogastric tube for gastric decompression, and fluid and electrolyte resuscitation, as the majority of patients will suffer from hypokalemia, hypochloremia and metabolic alkalosis due to persistent vomiting<sup>5</sup>. This was also the case in our study. The majority of the patients had BMI less than  $20 \text{ kg/m}^2$  at the time of disease presentation, and 85% of them had electrolyte imbalance. After the initial phase in treatment, diagnostic workout should be concentrated on etiology of PUD. PUD is now the second most common cause of GOO, and malignancy is the main etiological factor<sup>7</sup>. Therefore the diagnosis should be concentrated on ruling out malignancy, which can be best accomplished by upper gastrointestinal endoscopy with biopsies. Due to intense scarification, edema and gastric stasis, endoscopic biopsy can sometimes fail to deliver the proper diagnosis, so computed tomography can be applied in order to get more precise view of the disease<sup>8</sup>. Even so, in some cases surgical exploration followed with *ex tempore* biopsies will be necessary to solve the disease etiology.

Endoscopic balloon dilatation is recommended as the primary treatment modality in patients with PUD induced GOO<sup>9</sup>. The procedure is not burdened with a high complication rate, but single dilatation is usually not enough to achieve normal gastric emptying. The success rate of endoscopic balloon dilatation is up to 50%, and these are the data from a relatively short follow-up<sup>10,11</sup>. There are no comparative studies between endoscopic dilatation and surgical treatment of GOO, which could give some better perspective upon this issue. None of the patients included in our study went through the endoscopic dilatation sessions. Explanation for this is in the fact that all the patients were presented with

**Table 2**  
Symptomatic status and endoscopic data obtained by 3-year follow-up

Endoscopic findings	Symptoms	Patients (n)	Positive for <i>Helicobacter pylori</i> infection
Delayed gastric emptying	Asymptomatic	1	-
Bile reflux	Dyspepsia, asymptomatic	2	-
Erosive gastritis	Pain in upper abdomen	1	+

long-lasting strictures, intense scarifications and severe gastric stasis.

The goal of surgical treatment of PUD-induced GOO is to provide the gastric emptying, and additionally to this, to decrease gastric acid secretion. This should be ideally performed in a single procedure, with lowest morbidity and postoperative complications. Early surgical attempts were oriented towards subtotal or partial gastric resection. These procedures resulted in a very low ulcer recurrence rate, but were burdened with severe postoperative complications, such as dumping, diarrhea and weight loss. One must not forget the fact that severe scarification can lead to intraoperative problems with closure of the duodenal stump and subsequent leakage. With the introduction of vagotomy procedures, surgeons tended to less radical solutions and a place was made for pyloroplasty or gastrojejunostomy. Good functional results were obtained with a lower risk.

Vagotomy was introduced in the late 1940 by Lester Dragstedt<sup>12</sup>. This rather revolutionary procedure brought excellent results in terms of ulcer recurrence rates, but also was followed with large percentage of undesirable side effects in up to 50% of patients<sup>13</sup>. After experimental works of Griffith and Harkins<sup>14</sup> a HSV was introduced in 1969 also known as parietal cell vagotomy<sup>15</sup>. HSV divides only the nerve branches supplying corporal and fundic parts of the stomach, with the tendency to preserve normal innervation of the antral part of the stomach. Basal acid gastric secretion is reduced approximately for 85%, and stimulated secretion up to 50%<sup>16</sup>. Although effective in reducing acid secretion, HSV has been reported to have ulcer recurrence rate up to 25%. It was postulated that this was due to technical faults, and there were reports indicating that lower ulcer recurrence rates have been obtained in experienced surgical hands. Special emphasis is brought upon careful dissection of posterior vagal branches, and criminal nerve of Grasi. Donahue et al.<sup>17</sup> reported modification of HSV, extending the dissection upon recurrent vagal innervation along the right gastroepiploic vessels. Donahue<sup>18</sup> also reported the ulcer recurrence rate with this technique to be 1%. Similar results were obtained in our study. No ulcer recurrence and low rate of postprocedural side effects were noted. This could emphasize the importance of precise dissection, and the roll of experienced and specialized surgical team.

HSV was a mainstay vagotomy option in our study. Although we reported experience with limited number of patients, we have not encountered intraoperative complications with this procedure. This procedure was not time consuming, and was easily feasible in all the patients included in this report. In a 3-year follow-up we did not meet ulcer recurrence. Two patients suffered from mild dumping. Although present endoscopically in one patient delayed gastric emptying was completely asymptomatic. One patient was present with severe dyspeptic symptoms due to extensive alkaline reflux which was noted endoscopically. In three of the patients

complete recanalization of the pyloric channel occurred indicating the importance of antral innervation preservation. HP infection was verified in 46% of the patients. This is in conjunction with other study which reported similar incidence of HP infection in patients with PUD-induced GOO<sup>19</sup>.

When dissecting vagal branches for the corporal part of the stomach receptive relaxation phenomenon is interrupted and this can result in rapid liquid emptying, then in dumping syndrome. According our experience, this can be overcome by dietary measures.

One prospective study on 90 patients operated on due to PUD induced GOO, compared three groups of patients with the following randomization according to the type of treatment: HSV with lateral Jaboulay gastroduodenostomy, HSV with gastrojejunostomy or selective vagotomy with antrectomy<sup>20</sup>. Clinical outcomes were graded using the Visick classification. Patients operated with HSV and gastrojejunostomy had a statistically significantly better functional outcome than those operated with HSV and Jaboulay gastroduodenostomy, and a slightly better score than patients operated with selective vagotomy and antrectomy. The authors<sup>20</sup> concluded that HSV with gastrojejunostomy is the treatment of choice for patients with PUD-induced GOO.

### Conclusion

Gastric outlet obstruction caused by peptic ulcer disease is nowadays a rare disease. It is hard to accomplish large surgical series and obtain more data. According to our experience, highly selective vagotomy in combination with gastrojejunostomy represent a safe and easily feasible surgical solution. Follow-up data point out that good functional results were obtained with this type of procedure, especially in terms of ulcer recurrence rate, and low incidence of postoperative side effects. Highly selective vagotomy is a well-established and proven procedure, with constant decrease in the number of indications, so surgeons should guard its place in the years that come.

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