

# Stent treatment of perforated duodenal ulcer – physiology and clinical aspects

Akademisk avhandling:

Som för avläggande av Medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentlig försvaras i hörsal Arvid Carlsson, Medicinargatan 3, Göteborg, fredagen den 23:e april 2021, klockan 13:00

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## Avhandlingen baseras på följande delarbeten

- I. **Arroyo Vázquez JA**, Henning C, Park PO, Bergström M. Bacterial colonization of the stomach and duodenum in a Swedish population with and without proton pump inhibitor treatment. **JGH Open. 2019 Oct 1;4(3): 405-409.**
- II. **Arroyo Vázquez JA**, Sjöberg M, Henning C, Bergström M, Park PO. Gastric bacterial colonization with relation to PPI consumption and gastric pH, in a Swedish population. In **Manuscript.**
- III. **Arroyo Vázquez JA**, Bergström M, Bligh S, McMahon BP, Park PO. Exploring pyloric dynamics in stenting using a distensibility technique. **Neurogastroenterol Motil. 2018 Dec; 30(12).**
- IV. **Arroyo Vázquez JA**, Khodakaram K, Bergström M, Park PO. Stent treatment or surgical closure for perforated duodenal ulcers: a prospective randomized study. **Surg Endosc. 2020 Nov 30.** [Epub ahead of print].

**SAHLGRENSKA AKADEMIN**  
**INSTITUTIONEN FÖR KLINISKA VETENSKAPER**



# Stent treatment of perforated duodenal ulcer – physiology and clinical aspects

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## Background

The incidence of perforated duodenal ulcer is decreasing but still constitutes a life-threatening complication to peptic ulcer disease. Abdominal contamination from gastric or duodenal content occurs during perforations. Gastric content is normally sterile due to its low pH, but the widespread use of PPI might affect gastric bacterial flora. Gold standard treatment is sutured surgical closure, open or laparoscopic. Treatment with a covered stent has proven useful in cases of esophageal perforations. The same treatment strategy might be an option in selected cases with duodenal perforation. Stents placed over the pylorus might influence pyloric motility leading to stent migration. The aim of this thesis was to investigate the use of a covered stent to treat perforated duodenal ulcers including aspects on pyloric physiology and gastric bacterial colonization.

## Methods

*Paper I & II:* Gastric and duodenal bacterial colonization was investigated taking swab samples from the mucosa for culturing during, clinical outpatient gastroscopies. PPI consumption was recorded. In paper II gastric pH was measured from gastric aspirate and bacterial growth was quantified.

*Paper III:* Pyloric physiology was studied in an animal model using the EndoFLIP™ probe, mimicking a stent placed in the pylorus. Pyloric cross sectional area and pressure was recorded.

*Paper IV:* Randomized clinical trial, patients presenting with signs of upper gastrointestinal perforation and free air on a CT scan were included and randomized to surgical closure or stent treatment. Laparoscopy was performed in all patients to verify the diagnosis.

## Results

*Paper I:* 103 patients were analyzed. Gastric and duodenal bacterial colonization was more common in patients on continuous PPI treatment ( $p < 0,0001$ ). Dominating bacterial species were of oropharyngeal origin, most common were *Streptococcus salivarius* & *mitis*.

*Paper II:* 107 patients were analyzed. Abundant bacterial growth ( $>10^4$  CFU/ml) occurred in 16% in the stomach and 12% in the duodenum, significantly more in patients with PPI treatment ( $p < 0,0001$ ). Patients with abundant growth showed high gastric pH and old age.

*Paper III:* When pylorus is stepwise dilated, it changes activity from acting as an opening and closing sphincter to a propulsion pump. At full distention, pyloric motility disappears. Pyloric opening and emptying is stimulated by food.

*Paper IV:* 43 patients were included, 28 had a verified perforated duodenal ulcer, 15 randomized to surgical closure and 13 to stent treatment. Morbidity was 42% overall, 6 patients in each group had a complication of Clavien-Dindo grade 2-4 (n.s.). Mortality was 4% (n=1). For all patients, time from onset to intervention  $>12$ h correlated with complications Clavien-Dindo grade 3-5.

## Conclusion

Bacterial flora found in the stomach and/or duodenum is mainly of oropharyngeal origin, more frequently occurring in patients with ongoing PPI treatment. Individuals with high gastric pH are more at risk for abundant gastric and/or duodenal bacterial colonization. Stent design influences pyloric motility, through pyloric distention, and seems to be of importance to avoid stent related complications. Stent treatment of perforated duodenal ulcer seems to be as safe and effective as surgical closure.

**Keywords:** Stent, Gastroscopy, Perforated duodenal ulcer, Proton Pump inhibitor, gastric bacterial flora, Gastric pH, Pylorus, EndoFLIP™, Pyloric motility.

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