Gastric electrical stimulation.
Studies in patients with intractable nausea and vomiting.

AKADEMISK AVHANDLING

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av
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Avhandlingen baseras på följande arbeten:

I. **Percutaneous implantation of gastric electrodes – a novel technique applied in animals and in patients.**
Elfvin A, Andersson S, Abrahamsson H, Edebo A, Simrén M, Lönroth H.
Neurogastroenterol Motil 2007;19:103-109

II. **Temporary percutaneous gastric electrical stimulation (GES). A novel technique tested in patients with non-established indications for GES.**
Andersson S, Ringström G, Elfvin A, Simrén M, Lönroth H, Abrahamsson H
Submitted for publication.

III. **Gastric electrical stimulation for intractable vomiting in patients with chronic intestinal pseudoobstruction.**
Andersson S, Lönroth H, Simrén M, Ringström G, Elfvin A, Abrahamsson H.
Neurogastroenterol Motil 2006;18:823-830

IV. **A slow caloric drinking satiety test in patients with temporary and permanent gastric electrical stimulation.**
Andersson S, Elfvin A, Ringström G, Lönroth H, Abrahamsson H, Simrén M.
Eur J Gastroenterol Hepatol. 2010;18. Epub ahead of print.

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Gastric electrical stimulation.
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Abstract

The most severe cases of gastroparesis are refractory to drugs. In the 1990s gastric electrical stimulation (GES) was introduced for treatment of nausea and vomiting in patients with diabetic and idiopathic gastroparesis. The electrodes and neurostimulator are usually placed with laparoscopy. The mechanism behind the effect of GES is unknown, but seems not to be correlated to improvement in gastric emptying.

The aims were to develop a simple method to implant gastric electrodes percutaneously with a minimal invasive technique, to test the clinical feasibility of temporary percutaneous GES (TPGES) and to evaluate TPGES for selection for permanent GES. Furthermore, to investigate whether patients with non-approved indications for GES, e.g. post-surgical gastroparesis, functional dyspepsia and chronic intestinal pseudo-obstruction (CIP), also can benefit from this treatment. Eventually, to evaluate if increased gastric accommodation is a mechanism behind the positive effect of GES on the symptoms nausea and vomiting.

A new type of gastric electrode was constructed, for percutaneous insertion into the muscular layer of the stomach under endoscopic guidance. In initial studies in pigs and in patients, the percutaneous electrodes could easily be anchored in the gastric submucosa. The gastric EMG could be recorded in animals and patients and temporary GES decreased patients´ symptoms indicating a proper electrode position.

Totally 30 patients with drug-refractory symptoms of severe nausea and vomiting, but non-approved indications for GES (13 patients with delayed gastric emptying, 17 normal gastric emptying), were enrolled for TPGES. The mean implantation time was 14 min. and the electrodes were in place for up to 60 days. The first patients received open stimulation and the following were randomized to crossover double-blind stimulation, ON/OFF, when appropriate. Twenty out of 22 responders to TPGES received permanent GES. At last follow-up (mean 21 months) 90% were still responders.

In a separate study focusing on GES for the non-approved indication CIP, patients had a reduction of symptoms comparable to that obtained in patients with diabetic gastroparesis.

To assess gastric accommodation healthy volunteers and patients with temporary or permanent GES underwent a slow caloric drinking satiety test. The patients had significantly lower drinking capacity than the healthy subjects. There was no significant difference in drinking capacity before and during GES, or during stimulation ON vs. OFF. Improvement of symptoms during GES did not correlate with change in drinking capacity.

Conclusions: Temporary electrodes for GES can easily be implanted percutaneously under endoscopic guidance. Most patients responded to TPGES with reduction of nausea and vomiting. The method of TPGES can be used to select patients for permanent GES. Patients with chronic intestinal pseudo-obstruction, post-surgical gastroparesis and patients with severe nausea but normal gastric emptying can also benefit from treatment with GES. The improvement in symptoms of nausea and vomiting is not primarily due to improvement in gastric emptying or an increased gastric accommodation capacity.

Key words: gastric electrical stimulation, gastroparesis, gastroscopy, vomiting, gastric accommodation, drinking test, dyspepsia

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