| Study | Population | Intervention | Results | Validity/Conclusion |
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| **Abell et al, 2003**<br>**Study type**:<br>Crossover RCT.<br><br>**Objective:**<br>To investigate the efficacy of gastric electrical stimulation (GES) for the treatment of gastroparesis unresponsive to standard medical therapy.<br><br>**Primary outcome: of phase I (RCT):**<br>Difference in vomiting frequency with stimulation OFF vs. ON.<br>**Secondary outcomes:**<br>Patient preference, QoL, upper GI symptoms, gastric emptying, and adverse events.<br><br>**N of patients:**<br>N=33<br>**Blinding:**<br>Double-blind for 2 months.<br><br>**Follow-up:**<br>2 months RCT, followed by 10 months nonrandomized open- label.<br><br>**ITT analysis:**<br>Yes for phase I. | **Inclusion criteria:**<br>1. More than 7 episodes of vomiting per week. 2. Delayed gastric emptying (>10% at 4 hours, or >60% at 2 hours). 3. Symptoms of gastroparesis longer than 12 months, 3.Unresponsive or intolerant to 2 of 3 classes of prokinetic and antiemetic drugs.<br>**Exclusion criteria:**<br>1. Documented intestinal pseudo-obstruction, prior gastric surgery, vagotomy, organ transplantation, primary swallowing disorders, chemical dependency, pregnancy, psychogenic vomiting, medical instability, or high surgical risk.<br>**Patient Characteristics:**<br>Mean age 38.9 years (range 19-65), 72.7% females, mean BMI 23.8 $kg/m^2$, mean duration of GP symptoms 6.3 years (range 1-28 y), median weekly vomiting episodes17.3, vomiting and nausea severity scores 3.3 and 3.5 respectively. 78% retention at 2 hours, 34% at 4 hours. 76% were receiving antiemetics, 85% prokinetics, 15% were on enteral feeding tubes, and 27% on total parenteral nutrition. The etiology of the gastroparesis was diabetes in 51.5% and idiopathic in 48.5% of the subjects. | The study was conducted in 11centers in the US, Canada, and Europe.<br>All patients underwent implantation of the GES system laparoscopically or via laparotomy.<br>**Phase I of the study:**<br>Patients were randomized to stimulation either ON or OFF which stared after recovery from surgery (mean 5.6±3.3 days). At the end of the first month, the neurostimulator was programmed to the opposite mode for one month.<br>**Phase II of the study:**<br>At the end of the crossover period, the device was programmed ON for all patients for 11 additional open-label months.<br>Patients were evaluated at baseline, and at 1, 2, 6, and 12 months.<br>All patients were required to record daily vomiting episodes in a 28-day diary for diabetic patients, and 2-week diary for idiopathic gastroparesis. Gastric retension was evaluated after a solid meal at baseline, and at 6 and 12 months using a standardized scintigraphy method and a low-fat test meal. QoL was assessed at baseline and at 1, 2, 6, and 12 months using SF-36 Health Status Survey questionnaire. | **Phase I results**<br><br>**OFF mode** / **ON mode** / **P value**<br>**All patients**<br>WVF* 13.5 (5.5-24.4) / 6.8 (3.9-16.5) / <0.05<br>TSS** 13.9 ± 1.1 / 12.5 ± 1.0<br>**Diabetic patients**<br>WVF* 12.8 (5.5-24.4) / 6.0 (3.0-14.8) / =0.16<br>TSS** 13.2 ± 1.7 / 11.3 ± 1.5 / NS<br>**Idiopathic patients**<br>WVF* 13.8 (5.4-27.8) / 12.8 (4.0-20.3) / =0.16<br>TSS** 14.8 ± 1.3 / 13.8 ± 1.4 / NS<br>* Weekly vomiting frequency: median (Interquartile range)<br>** Total symptom score: mean (standard deviation)<br><br>According to the data presented to FDA the vomiting episodes /week at was 47.6+52.6 at baseline, 23.0±35.5 in the ON mode and 29.0±38.2 in the OFF mode (difference between OFF-ON was 6.0±22.4 (non-significant)<br>Median 26.3 at baseline, 12.0 ON, and 14.0 OFF difference 2.0 (NS)<br><br>**Phase II results:**<br>*6 and 12 months results compared to baseline**<br>**baseline** / **6 months** / **12 months**<br>**All patients** n=33 / n=27 / n=24<br>WVF 17.3 (11.8-45.5) / 2.6 (0.6-12.0) / 4.8 (0.1-7.6)<br>TSS 16.8 ± 0.9 / 11.1 ± 1.3 / 11.4 ± 1.3<br>**Diabetic** n=17 / n=13 / n=11<br>WVF 13.4 (8.8-55.6) / 2.6 (0.9-12.5) / 4.9 (0.1-7.4)<br>TSS 16.8 ± 1.2 / 10.7 ± 1.7 / 9.2 ± 1.5<br>**Idiopathic** n=16 / n=14 / n=13<br>WVF 26.8 (13.0-38.4) / 3.0 (0.2-13.8) / 4.5 (2.5-7.0)<br>TSS 16.9 ± 1.3 / 11.6 ± 1.9 / 13.2 ± 2.0<br>* p<0.05 at 6 and 12 months vs. baseline for all comparisons<br>(It is to be noted that the follow-up rate was lower in the study data provided to the FDA (25 at 6 month and 15 at 12 months)<br><br>Adverse events necessitating removal of the device:<br>N (%)<br>Infection of the neurotransmitter pocket 2 (6%)<br>Lead perforation of the stomach 1 (3%)<br>Pulse generator erosion through skin 1 (3%)<br>Pulse generator migration requiring surgical intervention to reposition occurred in one patient. | The study was a double-blind, multicenter cross-over, RCT. However, it had several disadvantages: It was a very small study originally planned to enroll 80 patients but was stopped after enrolling only 33 patients. All patients were highly symptomatic, GES was not compared to other therapies, and patients were kept on their medications and parenteral nutrition during the study. The study lacked a washout period between stages of the study. This makes it hard to determine whether the improvement in symptoms was actually due to the treatment or just a placebo effect of the therapy.<br>The results for phase I of the study showed a significant decrease in WVF (and not for TSS) in all patients but not in the diabetic or idiopathic groups.<br>It is to be noted that the published outcome data differ from that presented to the FDA. |