



Adventures in GI Motility: Reminders of the Complications of Gastric Electrical Stimulator Implantation

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Abstract

Background: Treatment of drug-refractory gastroparesis (GP) may include gastric electrical stimulation (GES) accompanied by Pyloroplasty. This approach has been shown to improve gastric emptying and reduce symptoms up to 80%. One must be aware of the important although rare complication of perforation of the gastric leads through the gastric mucosa into the lumen during long-term follow up of the GES patients.

Case Report: Two recent cases represent the significant recurrence of symptoms in GP patients, while interrogation of the GES system did not display abnormal readings of any parameters, with special focus on potential changes of the impedance, representing resistance between the electrodes, implanted 1 cm apart. Upon further evaluation via upper endoscopy, it was confirmed that there was perforation of electrodes through the gastric mucosa into the gastric lumen in both patients requiring surgical intervention to remove the electrodes and stimulator.

Conclusion: Impedance does not necessarily change to abnormal values when perforation of electrodes through the gastric mucosa occurs in patients with GES devices, suggesting that impedance may not serve as a predictor of luminal perforation. However, worsening symptom control does seem to correlate with perforation of electrodes.

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Keywords: Gastroparesis; Gastric electrical stimulation; Pyloroplasty; Complications; Perforation

Abbreviations

GES: Gastric Electrical Stimulation; GP: Gastroparesis

Introduction

Gastroparesis is a disease where there is a delay in gastric emptying causing symptoms of nausea, vomiting, early satiety, bloating and epigastric discomfort in the absence of evidence of mechanical obstruction in the upper GI tract. Treatment options begin with modification of diet, glycemic control (if patient is diabetic), however pharmacologic agents may also be used such as antiemetics and prokinetics. It is estimated that up to 30% of patients will develop drug-refractory gastroparesis and surgical intervention with implantation of electrical stimulation may then be considered [1-3]. Gastric electrical stimulation (GES), to address control of nausea via a centrally mediated pathway, is combined with Pyloroplasty, which improves and often normalizes the rate of gastric emptying. This new approach results in an approximately 80% reduction in symptoms during follow-up of these (Figure 1 and 2) patients [4-6]. One must be aware of the important although infrequent complication of luminal penetration of the gastric electrodes through the gastric wall into the lumen, from their original site of being sutured in the smooth muscle of the stomach. Interrogation of the neurostimulator to check programmed parameters, values, battery status and electrode impedance is performed at each follow up visit, and the integrity of GES system is confirmed when impedance are in a normal ranges between 200 Ω and 800 Ω . If the resistance between electrodes becomes greater than 800 Ω , it suggests that there is a problem such as dislodgement of electrode from gastric smooth muscle [7]. In this report, we will present two cases where perforation through the gastric mucosal wall into the gastric lumen was encountered during follow up of patients undergoing GES for drug-refractory gastroparesis.

Case Presentation

Our first patient is a 32-year-old Caucasian woman with a medical history of diabetes mellitus

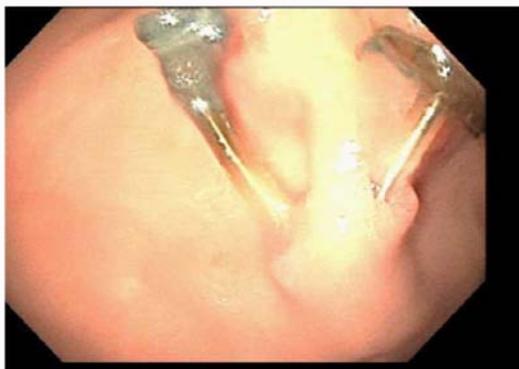


Figure 1: Two gastric electrodes penetrating gastric mucosa at the junction of gastric body and antrum.



Figure 2: Gastric electrodes penetrating through mucosa at the junction of the gastric body and antrum.

type 1 who had simultaneously undergone robotic gastric stimulator placement and pyloroplasty for drug-refractory gastroparesis 18 months ago. GP symptoms were improved for a while, however, she recently returned to our clinic for re-evaluation due to recurrence of symptoms. Upon interrogation of the GES device, impedance value was within normal limits of 331 Ω , which was similar to the last, reading values of 430 Ω . The other parameters of the pulse generator, current and voltage were in the settings that were placed at the previous visit. Patient did not complain about any electric shocks or other sensations, suggesting misplacement of one or two electrodes. Due to the steadily progressive exacerbation of GP symptoms, the decision was made to perform an upper endoscopy for further evaluation and 2 gastric electrodes from the gastric electrical stimulation system were visualized at the junction of the gastric body and antrum penetrating out of the gastric mucosa into the gastric lumen (Figure 1). Patient underwent surgery a week later to have the gastric electrical stimulator removed. Our second patient is a 39-year-old Caucasian woman with a history of cerebral palsy, who had undergone gastric electrical stimulation placement 9 years ago for treatment of drug refractory idiopathic gastroparesis. Similar to our previous patient, she was re-evaluated due to recurrence of some symptoms and during evaluation the pulse generator was interrogated and was found to have the same settings programmed during the past visits. Our records indicated that the baseline impedance value was 570 Ω in the operating room after the surgery, and it was followed by 599 Ω and 576 Ω readings at follow up visits. Interesting the interrogation at the last clinical visit documented the same resistance of 576 Ω . Again, the decision was made to perform upper endoscopy. She was found to have gastric stimulation electrodes penetrating

through the mucosa at the junction of the gastric body and antrum (Figure 2). She subsequently underwent surgery for removal of the GES system, without further complications.

Discussion

Gastric Electrical Stimulation (GES) involves surgical implantation of the gastric neurostimulator where two leads are sutured into the muscularis propria of the stomach at 9 cm and 10 cm from pylorus along the greater curvature and connected by 35 cm long leads to the pulse generator that is implanted subcutaneously in either the left or right upper quadrant of the abdominal wall [1,2]. At the time of surgical implantation, intraoperative endoscopy is performed to confirm that the electrodes are situated intramuscularly and not visible or penetrating through the mucosa. After implantation, the device is interrogated and a baseline default setting of parameters is set in place, which may be changed during follow up examinations based on symptom status. The most common complication is infection of the pulse generator site (incidence of 5% to 6%), however it is important to recognize that penetration through the gastric mucosa is also a potential complication occurring over time [2]. We recently encountered two patients, whose electrodes had eroded through the gastric mucosa. This situation potentially creates an environment where infection can take place within the gastric muscle and subsequently be transmitted through the leads to the gastric stimulator pocket resulting in further complications for the patient. Of important note, the parameter of impedance did not change to abnormal values in these patients, suggesting that impedance is not a good indicator for predicting this serious complication. In the setting of deterioration of GP symptoms, perhaps the documentation of unchanged, identical impedance obtained at different visits, could suggest dislodgment of the electrodes or the possibility of technical complications. Gradual or sometimes acute worsening of symptom control does seem to correlate better with this complication of electrode penetration. Therefore, we believe that the diagnosis of such outcome is best established by performing exploratory endoscopy, and the removal of the GES system is then the next step.

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