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Gastric Electrical Stimulation: A Report of Two Cases

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Abstract
Gastroparesis refractory to prokinetic agents poses a major challenge to the physician and patient, alike. In the past 5 years, electrical methods to treat gastroparesis have emerged from animal and human experiments to a potentially valuable tool in clinical gastroenterology. One of these methods, known as gastric electrical stimulation (GES), is being increasingly used in specialized centres worldwide, but had never been tried in Ireland. We describe here our experience with the first two implantations of gastric neurostimulators performed in Ireland and the outcome with these 2 patients. Our results at 6 months show reduction in symptoms and improvement in quality of life, which is encouraging and should prompt further evaluation of GES for patients with gastroparesis refractory to medical therapy.

Introduction
Gastroparesis can be defined as a disturbance in gastric motility, resulting in delayed emptying of a solid, liquid or mixed meal. The predominant symptoms are nausea, vomiting, abdominal pain, early satiety, bloating and anorexia. Diabetes Mellitus is the commonest cause of gastroparesis, although other known causes include gastric surgery, viral infections, systemic sclerosis, Parkinsonâ s disease and drugs such as anticholinergics and dopaminergic agents.

Though rare, chronic diabetic gastroparesis poses a major challenge to both diabetologist and gastroenterologist, especially when symptoms are persistent and severe, do not respond to prokinetic agents such as domperidone, metoclopromide, erythromycin (a motilin agonist) and cisapride and impact on the patientâ s nutrition and diabetic control. Restrictions on the prescription of cisapride due to its potential cardiotoxicity have compounded matters further.

Gastric Electrical Stimulation(GES), though still regarded by many as experimental, has emerged in recent years as a therapeutic tool in cases of prokinetic-refractory gastroparesis. Three different types have emerged-gastric electrical pacing, neural electrical gastric stimulation, and high-frequency gastric electrical stimulation. The first two types have been mainly experimental, with the latter type, high-frequency GES, showing more promise and described in this report. Numerous clinical trials[1,2,3] have demonstrated favourable results of high-frequency GES in chronic, refractory gastroparesis, but we have had no experience of this novel therapy in Ireland up to now. We have overseen the first two implantations of a gastric electrical stimulator in Ireland, and describe here the procedure, its rationale, our experience and results.

Basis of Gastric Electrical Stimulation (GES)
Gastric myoelectrical activity originates from an area along the greater curvature of the stomach, the â pacemakerâ area, which consists of specialized cells known as the interstitial cells of Cajal (ICC). The motility-generating structures of the gastric wall, which comprises the ICC and the gastric musculature, are integrated to produce a peristaltic wave, initiated by a synchronized electrical signal, which traverses the entire stomach in an orderly aborad fashion. Thus, an external electrical stimulus delivered to the gastric wall may influence the electrical activity of any one or all of these structures, which are commonly dysfunctional in gastroparesis. The theoretical consequence is therefore a modification of contractility, and, ultimately, function.

One approach that has emerged uses a high frequency stimulus, and is the one used in our patients. However, with high-frequency GES, gastric motility and gastric emptying are not restored, but strangely enough, there are marked effects on symptoms, especially nausea and vomiting.[3] This is thought to be due to a modulation of afferent neural activity,[4] thereby, influencing symptom perception and also possibly influencing the central control of nausea and vomiting.

Methods

Figure 1

Two patients were identified as suitable for GES. Patient 1 was a 23 year old male with type 1 diabetes mellitus for 16 years.

He had repeated admissions since 2000 with intractable vomiting secondary to gastroparesis unresponsive to prokinetics. Patient 2 was a 60 year old female, referred from another University Teaching Hospital, where she was repeatedly admitted with severe gastroparesis over the past 2 years. Her isotope gastric emptying test showed delayed gastric emptying.

The GES system consisted of 2 electrodes implanted to the gastric wall and a neurostimulator (Enterra, Medtronic) inserted subcutaneously (see Figure 1). The procedure was performed by a cardiothoracic surgeon.

Table 1: Number of days spent in hospital in 2003 and 2004. spent in hospital by Patient 1 in 2003 and 2004 Neurostimulator inserted February

	Pre- stimulator	***Post-stimulator***
	Feb 8	Mar 0
	Mar 9	Ap 18
	Apr 18	May 12
	May 0	Jun 0
	Jun 0	Jul 0
	Jul 0	Aug 15
	Aug 14	Sep 14
	Sep 10	Oct 12
	Oct 15	Nov 0
	Nov 30	Dec 0
	Dec 12	Jan 9
	Jan 0	Feb 0
	Feb 0	Mar 16
Total number of days	116	87

After 6 months, both patients reported improvement in symptoms as assessed by a patient diary. Daily episodes of nausea and vomiting were markedly reduced. Table 1 shows hospital admissions for Patient 1. More limited data available from Patient 2, who was being managed in another tertiary centre, is shown as 6 months pre and post gastric stimulator insertion in Table 2.

Table 2: Number of days spent in hospital by Patient 2 Neurostimulator inserted February

	Pre- stimulator	***Post-stimulator***
	Sep 21	Mar 12
	Oct 31	Apr 0
	Nov 30	May 0
	Dec 16	Jun 0
	Jan 0	Jul 0
	Feb 11	Aug 15
Total no of days	109	27

The hospital readmission rate however did not seem to be markedly affected for patient 1, although patient 2 had no hospitalization for 4 months (see Figure 2), suggesting that the rate of acute attacks may not be influenced in a major way. Further long-term follow-up should elucidate this.

Figure 2: Days spent in hospital from September 2003 to August 2004

Conclusions

Our experience with GES, though limited and preliminary, has, so far, been encouraging. At the time of stimulator insertion here, only about 15 had been implanted in the UK. Studies have shown that at least 75% of diabetic gastroparesis patients can expect a significant improvement in weekly vomiting frequency and quality of life,[3] which is so markedly impaired in this category of patients.[5] Global experience with GES is still at an early stage, and future refinements in the technology should pave the way for more effective systems.

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