Assessing Skin Sympathetic Nerve Activity and Cardiac Effects in Patients with Gastric Electrical Stimulation

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Background:

Gastric Electrical Stimulation (GES) is a therapy for gastroparesis patients, alleviating symptoms like nausea, vomiting, and poor gastric emptying. The therapeutic impact of GES is believed to stem from changes in autonomic nerve activity, particularly parasympathetic activity via the vagal nerves. This study examines skin sympathetic nerve activity (SKNA) to assess autonomic nerve bursts, investigating the effects of GES on nerve activity and cardiac function.

Methods:

SKNA signals were recorded from 48 patients at three locations: left side of the neck (SKNA1), right side of the neck (SKNA2), and via ECG Lead 1 across the chest (SKNA3). Signals were band pass filtered (500 Hz to 1000 Hz) to eliminate ECG and muscle artifacts and highlight nerve activity. Using Labchart software, the absolute value integral (iSKNA) was calculated for each 100-millisecond sample, with resulting values exported to Excel. Data was collected during different GES conditions: GES On, GES at ½ voltage, GES Off, and GES back on. The threshold for nerve activity bursts was determined as the mean of iSKNA values + two times the standard deviation in each section.

Results:

Histograms of average aSKNA values showed reduced nerve activity with GES off. Left and vagal nerve activity on SKNA1 was significantly lower with GES fully on or off compared to GES at ½ voltage. No other significant differences were observed in variabilities or average aSKNAs in SKNA1 or SKNA2.

Future Directions & Potential Impact:

Burst analysis of iSKNA data will address key questions. Variations in burst activity with different GES conditions may elucidate GES's therapeutic effects on gastroparesis. Subsequent segmentation of data into patients with resolved and unresolved symptoms could reveal the relationship between burst activity and therapeutic efficacy. Additionally, correlation of burst data with heart rate variability analysis will provide insights into the impact of GES on cardiac function. This study will advance our understanding of GES effects and safety, potentially improving patient outcomes.