

NOVEL USE OF MAGNETICALLY CONTROLLED CAPSULE ENDOSCOPY AND ARTIFICIAL INTELLIGENCE VIDEO ANALYSIS TO STUDY GASTRIC MOTILITY IN GASTROPARESIS AND FUNCTIONAL DYSPEPSIA



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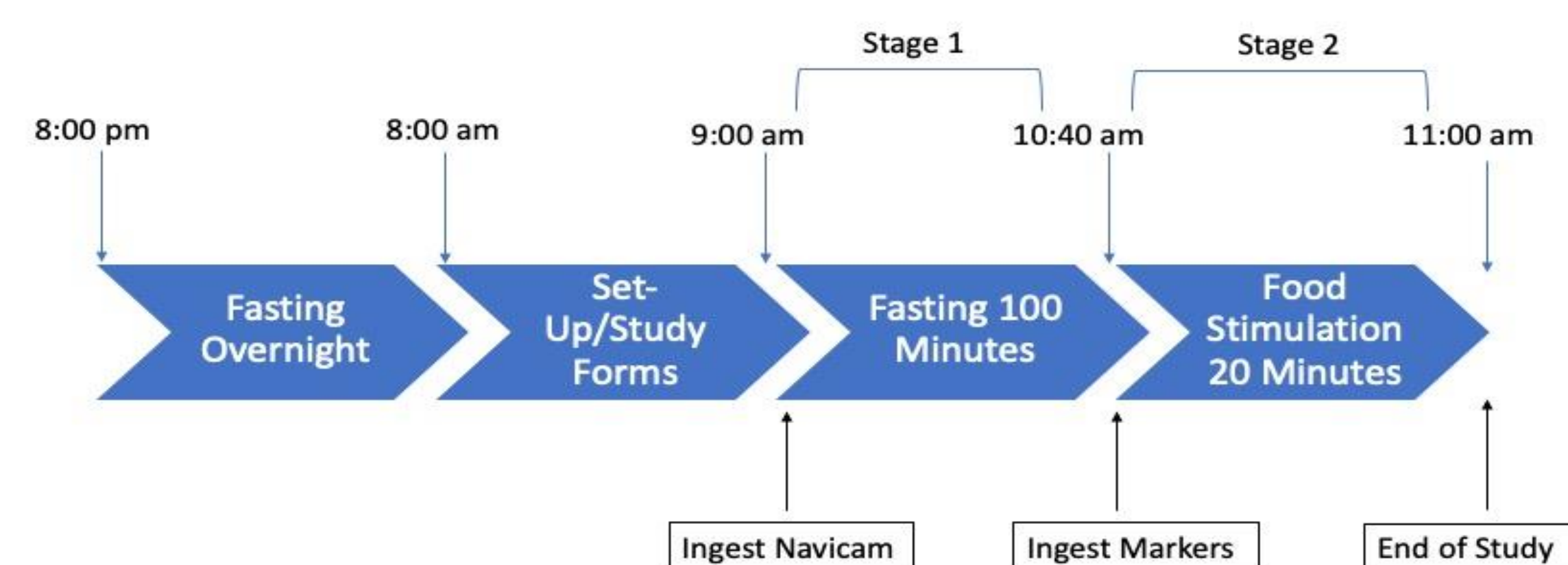
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BACKGROUND

- Gastroparesis (GP) and functional dyspepsia (FD) are common upper gastrointestinal disorders that can present with nausea, vomiting, early satiety, and abdominal discomfort^{1,2}.
- There is significant overlap between the two conditions, with no clinical biomarker for FD. The gold standard for GP diagnosis, delayed gastric emptying, does not consistently correlate with symptoms³.
- Magnetically controlled capsule endoscopy (MCCE) is a minimally invasive, sedation-free alternative to endoscopy using external magnetic control of an ingestible pill-sized camera.**

METHODS

- Study Design: Prospective Feasibility Study
- Inclusion criteria: Adults with GP (defined by positive gastric emptying study and Gastroparesis Cardinal Symptom Index [GCSI] score >0) or FD (positive ROME IV criteria⁴)
- Baseline Dyspepsia Severity Score⁵ (DSS) and GCSI⁶ were obtained. Medications that interfered with gastric motility were held for 48 hours. **Subjects then underwent a protocolized observation of the stomach in the fasting state and after a sham meal utilizing the NaviCam MCCE system.** An artificial intelligence (AI) deep learning model was used to analyze videos obtained during this study.



RESULTS

Table 1: Clinical Characteristics

	HC (N=5)	FD (N=5)	GP (N=4)
Age [Mean (SD)]	35.4 (9.6)	31.2 (6.6)	36.8 (16.1)
F [Count (%)]	2 (40)	5 (100)	3 (75)
Race [Count (%)]			
White	3 (60)	4 (80)	3 (75)
Black	0 (0)	1 (20)	0 (0)
Asian	2 (40)	0 (0)	0 (0)
Declined to state	0 (0)	0 (0)	1 (25)
Ethnicity: Hispanic	0 (0)	0 (0)	3 (75)
SF12 PCS [18-68; Mean (SD)]	55.2 (2.5)	48.7 (12.8)	41.8 (13.6)
SF12 MCS [18-68; Mean (SD)]	59.0 (1.8)	45.8 (10.3)	35.7 (8.2)
HADS Anxiety [0-21; Mean (SD)]	1.6 (1.5)	5.4 (3.6)	10.8 (3.8)
HADS Depression [0-21; Mean (SD)]	0.2 (0.4)	1.4 (1.7)	9.2 (3.3)

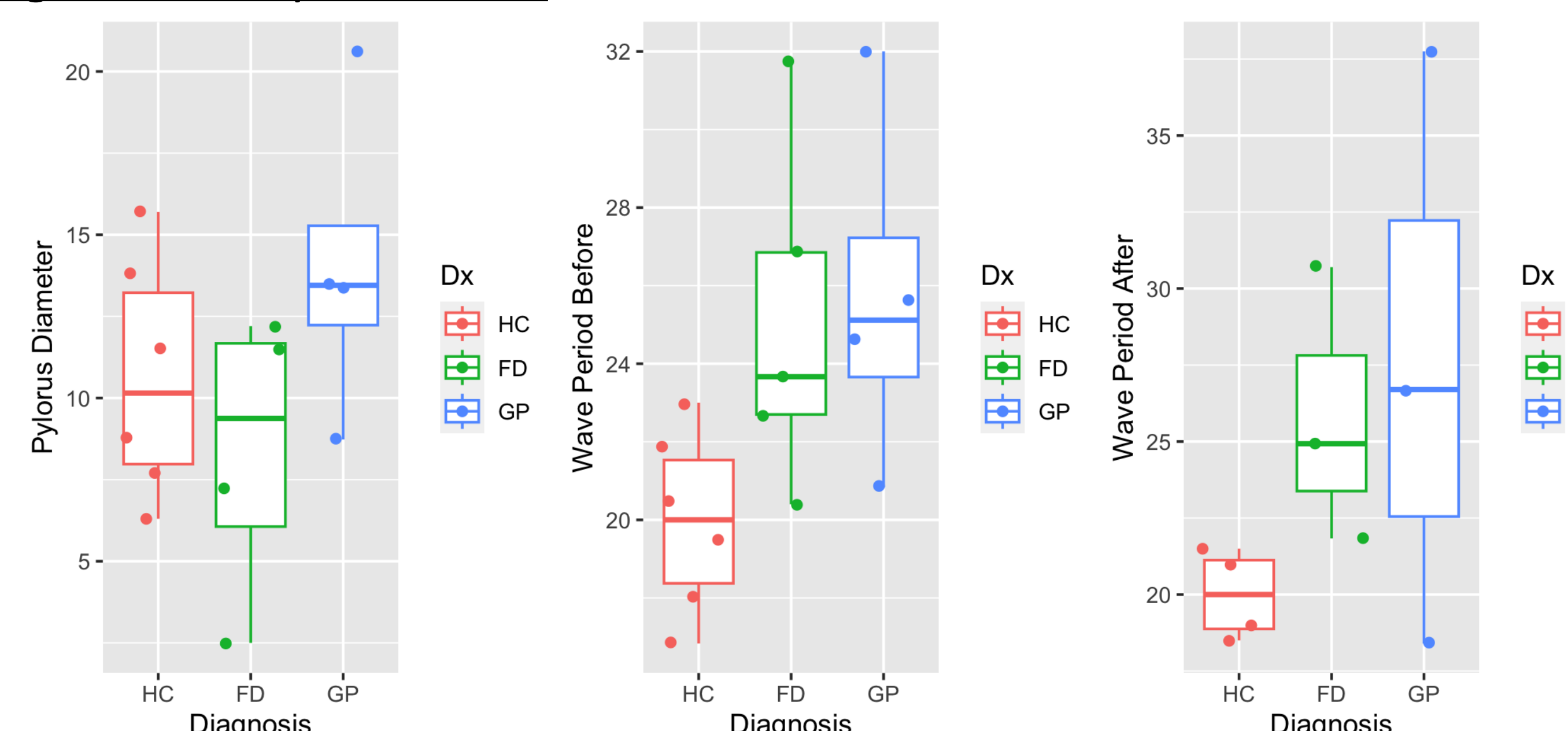
HC, healthy controls; FD functional dyspepsia; GP gastroparesis; SD, Standard Deviation; SF12, Short Form (12) Health Survey⁷; PCS, Physical Component Summary; MCS, Mental Component Summary; HADS, Hospital Anxiety and Depression Scale⁸

Table 2: GI Symptoms

	FD (N=5)	GP (N=4)	p-value
Overall GI Symptom Severity [0-20; Mean (SD)]	10.5 (4.4)	9 (5.2)	0.67
Abdominal Pain Severity [0-20; Mean (SD)]	8.6 (5.5)	7.8 (5.6)	0.83
Bloating Severity [0-20; Mean (SD)]	11.5 (8.7)	9 (4.7)	0.64
DSS_Score [0-27; Mean (SD)]	3.2 (2.3)	9.2 (8.5)	0.25
Baseline GCSI Score [0-5; Mean (SD)]	2.07 (1.02)	2.66 (1.08)	0.38
Post-Sham Meal GCSI Score [0-5; Mean (SD)]	2.07 (1.0)	2.7 (1.1)	0.43

FD functional dyspepsia; GP gastroparesis; SD, Standard Deviation; DSS Dyspepsia Severity Score⁵; GCSI Gastroparesis Cardinal Symptom Index⁶

Figure 1: Study Outcomes



The boxplots show group differences between healthy control (HC, in red), functional dyspepsia (FD, in green) and gastroparesis (GP, in blue) for pylorus diameter (Panel A) wave period before (Panel B) and wave period after (Panel C). The boxplots represent median and interquartile range. **Add sentence wave period before/after sham meal.** Wave period is defined as the time between successive occurrences of a contraction; a higher wave period means a lower frequency.

RESULTS

Table 3: Study Outcomes

	HC (N=6)	FD (N=5)	GP (N=4)	FD vs HC - p value	GP vs HC - p value	GP vs FD - p value	Kruskal-Wallis test P value
Pylorus diameter [Median (IQR)]	10.2 (5.25)	9.38 (5.61)	13.4 (3.04)	0.52	0.52	0.34	0.26
Frequency/wave period before sham meal [Median (IQR)]	20 (3.16)	23.7 (4.15)	25.1 (3.57)	0.078	0.078	0.73	0.043
Frequency/wave period after sham meal [Median (IQR)]	20 (2.25)	24.9 (4.43)	26.7 (9.68)	0.17	0.94	1	0.215

FD functional dyspepsia; GP gastroparesis; SD, Standard Deviation; IQR Interquartile Range

DISCUSSION

- MCCE provided a complete, normal gastric exam in all participants.
- No controls reported symptoms during the study vs 5/7 patients (71%).
- AI analysis found **significantly higher median (IQR) wave period (less frequent contractions) prior to the sham meal in GP and FD patients vs controls**
- Median (IQR) maximum pylorus diameter was higher in GP patients vs FD patients and controls
- The lack of significance for 2 of the 3 endpoints may be due to the small sample size

CONCLUSIONS

- MCCE is a promising new technology to not only exclude structural disease but potentially identify diagnostic biomarkers for GP and FD such as decreased contraction frequency and pylorus diameter.

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