RESEARCH PROTOCOL TEMPLATE
INVESTIGATOR INITIATED TREATMENT TRIALS

Title of Project: *Postoperative Gastric Point of Care Ultrasound (G-POCUS) in Abdominal Surgery: Can G-POCUS Guidance in Clinical Management of Gastrointestinal Recovery Lead to Better Outcomes?*

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Abstract
In this evaluation of gastric point of care ultrasound (G-POCUS) following abdominal surgery, patients will be randomized to either a control group or an intervention group. In the study group, patients will have a gastric POCUS exam at 0600 on post operative day 1 and daily thereafter until they have return of bowel function. In the control group, patients will receive standard postoperative care without the addition of any G-POCUS exams. In the study group, the results of the G-POCUS exams will be employed in a care algorithm designed to help clinicians decide how to advance patients' diets and when to place and remove nasogastric tubes (NGT). Both groups will be assessed to determine the potential impact of G-POCUS on predicting time to GI-3 recovery (defined as the ability to tolerate a regular diet and have either flatus or bowel movement), postoperative ileus (POI), delayed return of bowel function (DBF), tolerance of diet advancement, incidence of emesis or aspiration, length of stay and readmission to the hospital.

A. Specific Aims

With the advent of applications for G-POCUS, a series of handheld ultrasound devices have come to market with published equivalent results to G-POCUS exams performed using larger console-based machines in various fields.[10-12] Given that G-POCUS, to predict DBF and POI, would be performed by the resident care team at the bedside during daily exams, handheld ultrasound machines would have far greater utility than the larger, more expensive and more cumbersome console-based ultrasound machines should results be equivalent. Now that clinicians can carry hand-held ultrasound devices, the paradigm has shifted to the possibility of utilization by clinicians at the bedside with ease daily. **Goals and aims of the study:** We will test the application of a clinical postoperative algorithm that utilizes gastric POCUS data to aid in decision-making regarding advancing diets in patients who have had colorectal/general intestinal surgery. We hope to show that utilization of G-POCUS can significantly improve our clinical acumen in diagnosing issues with return of bowel function and consequently reduce the serious complications associated with impairment in bowel function return.

B. Background and Significance

Delayed bowel function (DBF) and postoperative ileus (POI), or disruption of the normal forward peristaltic bowel activity after abdominal surgery, is a common complication with an estimated incidence of up to 27% in general surgery patients.[1,2] It can lead to nausea, emesis, bowel perforation, or aspiration pneumonitis. DBF and POI increase length of stay, morbidity, and mortality in general surgery patients with an estimated additional cost of $750 million per year in the United States (US).[3]

It is extremely difficult to predict who will develop DBF and POI. Further, diagnosing patients with postoperative DBF or POI is almost entirely based upon clinical acumen, history, and physical exam. To date no imaging or laboratory studies are specifically recommended to diagnose these complications.[4] Enhanced recovery after surgery (ERAS) pathways, which limit IV fluid delivery, opioid usage, and promote early mobility and removal and minimization of tubes and drains, have helped decrease the incidence of delayed gastrointestinal function somewhat.[5,6] However, postoperative DBF and POI remain serious complications after abdominal surgery.

Gastric Point of Care Ultrasound (G-POCUS) is a simple and reliable imaging modality that can be performed at the bedside and does not involve ionizing radiation. It has been previously validated in preoperative patients to predict aspiration risk.[7,8] Recently, there has been interest in using G-POCUS for bedside evaluation and clinical decision making but its role in predicting postoperative surgical and medical complications remains largely uninvestigated.

C. Preliminary Studies/Progress Report

We hypothesized that G-POCUS volume would correlate with measures of delayed bowel functioning based on identification of full versus empty stomach postoperatively following colorectal surgery. To test this hypothesis, we performed a small pilot study utilizing a large console-based ultrasound machine (borrowed from our anesthesia department) in 20 colorectal patients. Patients were split into cohorts based on whether they were found to have empty or full stomachs (per Van de Putte *et al* classifications[8])

on their first postoperative day following colorectal surgery. Despite the small study sample, we found a significant correlation between patients with full stomachs and prolonged GI-3 recovery (defined as patients tolerating a regular diet and having flatus *or* bowel movements[9]) by over one full day (Full: 2.1+0.4 days v Empty: 1.0+0 days, *p=0.009*). We have published these findings (Lamm R, Bloom J, Collins M, Goldman D, Beausang D, Costanzo C, Schwenk ES, Phillips B. A Role for Gastric Point of Care Ultrasound in Postoperative Delayed Gastrointestinal Functioning. J Surg Res. 2022 Mar 24;276:92-99.) This result implies that one may be able to utilize gastric ultrasound postoperatively to differentiate patients who will recover bowel function quickly from patients who are at higher risk of developing delayed bowel function. A second phase of the study performed with handheld ultrasounds on 50 patients confirmed these encouraging results. Patients whose stomachs were read as empty via G-POCUS had a shorter time to GI-3 recovery, shorter length of stay, and fewer nasogastric tubes placed. These results lend support to our theory that G-POCUS may be able to help guide clinical decision making in postoperative abdominal surgery patients.

D. Research Design and Methods

This will be a randomized single-blinded study of handheld G-POCUS in which our study population will be inpatients hospitalized after abdominal/colorectal surgery at TJUH, Methodist Hospital, or Abington Hospital. Patients will be randomized to an unblinded intervention arm or an unblinded standard of care arm. On POD1, patients will be asked if they are having any GI symptoms. These are defined as presence of nausea, emesis, belching, and/or hiccups. In the intervention arm, clinicians will use the results of G-POCUS and presence/absence of GI symptoms to inform decision making according to one of two standardized algorithms (see **Appendix**) In the control arm, presence of GI symptoms will be assessed, and once of two standardized algorithms which are representative of the current standard of care for postoperative diet management. Data from both groups will be used to determine if the G-POCUS studies' results can predict the incidence of primary or secondary outcomes (control) or if intervening on results of G-POCUS can decrease the incidence of undesirable outcomes. This will be a multicenter study enrolling patients at TJUH, Methodist Hospital, and Abington Hospital.

E. Statistical Methods

Sample size = 128 participants
80% power using 2-sided t test – would require 64 patients per group (128 total) to show a 25% decrease in time to GI3 recovery in G-POCUS group vs standard care group.

Sample size calculation was performed using a continuous variable as the primary endpoint (number of days to GI-3 recovery), and assuming an alpha of 0.05 and a power of 80%. Results from the pilot study were used to inform sample size calculation. All patients in the pilot study took on average 1.5 days (SD 1-3 days) to reach GI-3 recovery, while patients in the pilot study with empty stomachs on G-POCUS on POD1, took 1 day on average (SD 1-2) to reach GI-3 recovery.

F. Gender/Minority/Pediatric Inclusion for Research

Participation will be offered to all eligible patients in our practice who can freely provide consent without coercion and do not meet defined exclusion criteria.

G. Human Subjects

1. Provide number, age range, and health status of the subject population. List criteria for inclusion or exclusion.

128 participants will be enrolled in the intervention and control arms combined, using the inclusion and exclusion criteria listed below:

Inclusion Criteria: Individuals must meet all of the following inclusion criteria in order to be eligible to participate in the study:

- Completed signed and dated informed consent form
- Willing to comply with all study procedures
- Male or female, 18 years of age or older
- Presenting for a schedule elective colorectal/abdominal surgery, either open, robotic, or laparoscopic

Exclusion Criteria: An individual who meets any of the following criteria will be excluded from participation in this study:

- History of gastroparesis or known gastric/intestinal motility disorder
- History of gastric/bariatric surgery
- Intubated/sedated postoperatively
- Presence of open abdominal wounds (including abdominal wound vac)
- Patients who received a complex abdominal wall reconstruction
- Class III/IV Wound (Contaminated/Infected/Dirty)
- Surgery was emergent/urgent/unscheduled
- NGT placed or present at time of operation
- Presence of ileostomy/colostomy
- J-pouch reconstruction patients
- Currently pregnant patients
- Patients aged <18 years old

2. Identify sources of research material in the form of specimens, records or data.

All patient-related data will be obtained from Epic via chart review by investigators, as well as via patient interview at their preoperative clinic visit. Results of G-POCUS exams, patient demographics, patient medical history, data from the intraoperative record, data from the medication administration record, data from notes, and radiographic data obtained postoperatively will be reviewed in Epic by investigators and stored in Redcap. Name, Length of Stay, Dates (treatment), MRN#, ultrasound images, ultrasound measurements, diet at times of evaluation, patient reported symptoms of DBF and POI, and need for NGT placement will be collected.

3. Describe plans for recruitment and consent procedures to be followed.

There will be no compensation for enrolment. Patients will enroll at will during the preoperative visit and will provide informed consent. Patients who are withdrawn from the study will not be followed after withdrawal. They will be treated according to standard of care for post-surgical patients.

4. Describe risks and assess likelihood and seriousness.

G-POCUS is a harmless, painless intervention and there are no safety risks to patient participants inherent to G-POCUS in either arm of the study.

5. Describe procedures for protecting against or minimizing potential risks.

Patients will be treated according to the standard of care. There is no additional risk conferred by performing G-POCUS on postoperative patients.

6. Describe potential benefits and importance to the subjects and others.
Patients may personally benefit from taking part in this research by avoiding be avoiding aspiration or ileus. Additionally, future patients may be helped by what is learned in this study.

7. Discuss why risks are reasonable in relation to benefits.

By implementing ultrasound into the patients' evaluation, there is no additional risk than standard of care. However, with this additional clinical information, a more informed decision can be made regarding their bowel function and diet status, potentially leading to increased clinical accuracy.

H. Data and Safety Monitoring Plan

This protocol poses minimal patient risk, and a DSMP is not required.

I. Literature Cited

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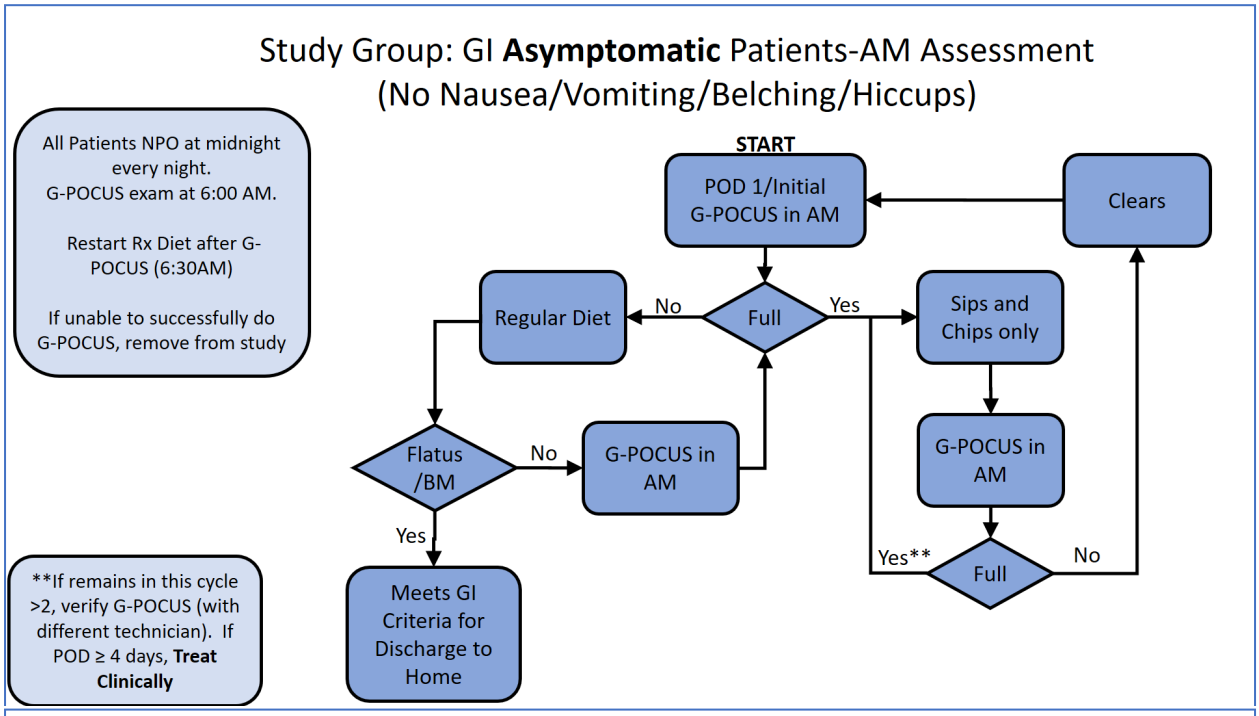
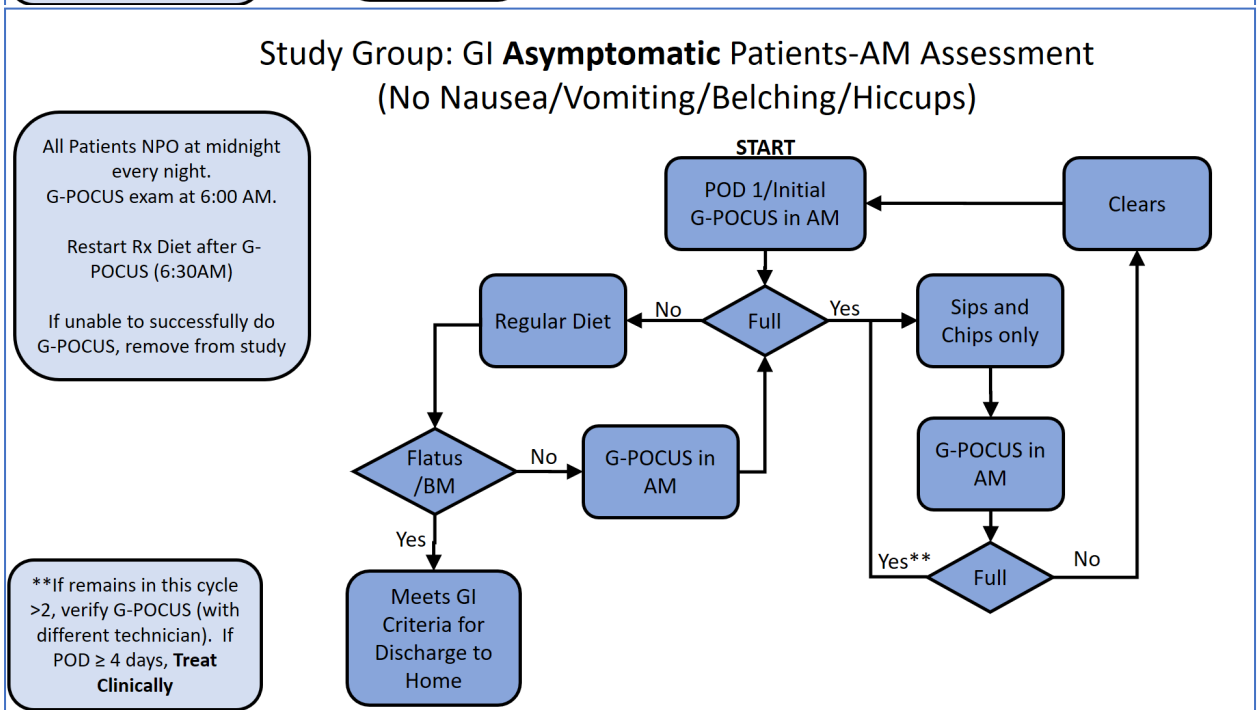
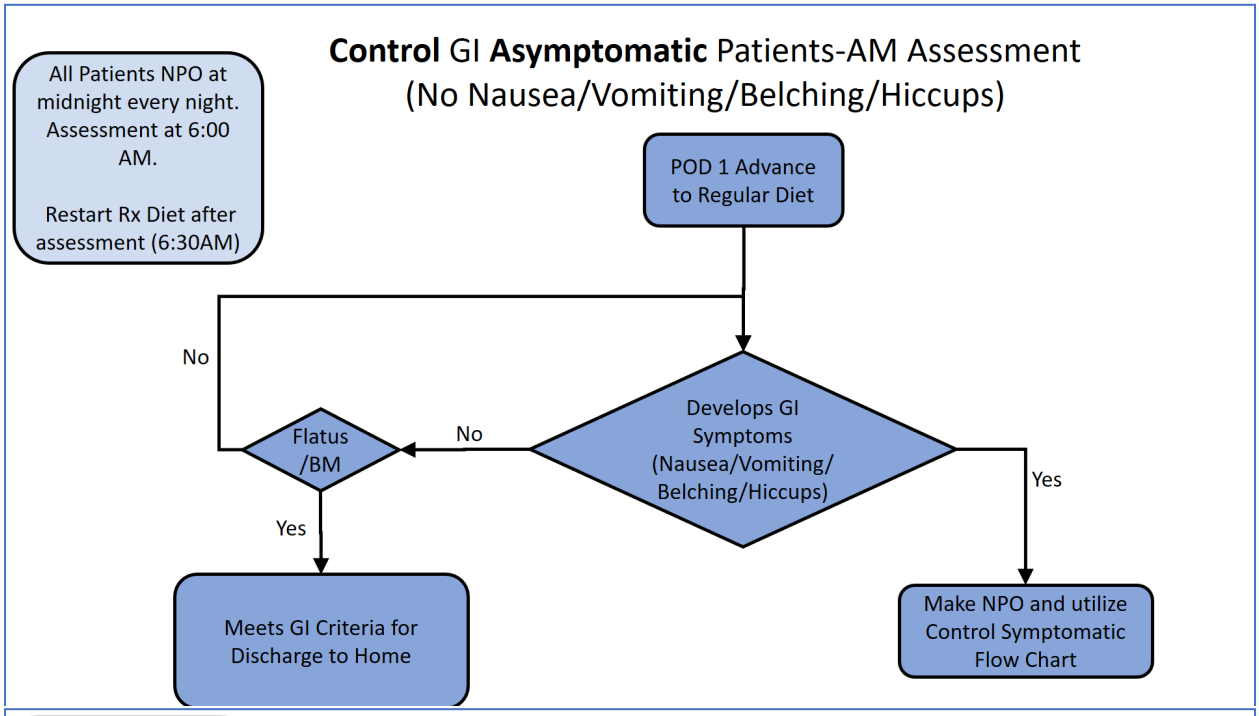
Principal Investigator Signature  Date 8/3/2022

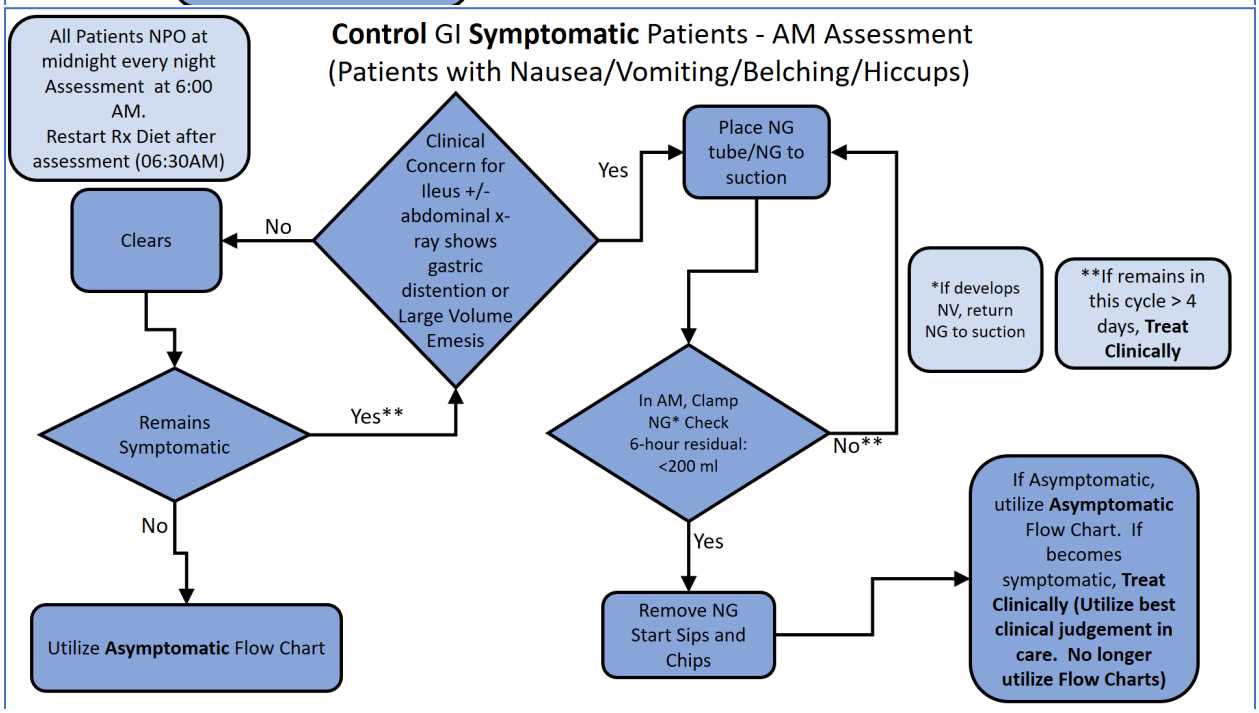
Version 1.0

Appendix: Clinical Treatment Algorithms






Control GI Asymptomatic Patients-AM Assessment
(No Nausea/Vomiting/Belching/Hiccups)
All Patients NPO at midnight every night. Assessment at 6:00 AM.
Restart Rx Diet after assessment (6:30AM)
POD 1 Advance to Regular Diet
Develops GI Symptoms (Nausea/Vomiting/ Belching/Hiccups)
No
Yes
Flatus /BM
No
Yes
Meets GI Criteria for Discharge to Home
Make NPO and utilize Control Symptomatic Flow Chart


Control GI Symptomatic Patients - AM Assessment
(Patients with Nausea/Vomiting/Belching/Hiccups)
All Patients NPO at midnight every night Assessment at 6:00 AM.
Restart Rx Diet after assessment (06:30AM)
Clinical Concern for Ileus +/- abdominal x-ray shows gastric distention or Large Volume Emesis
Yes
Place NG tube/NG to suction
No
Clears
*If develops NV, return NG to suction
**If remains in this cycle > 4 days, Treat Clinically
Remains Symptomatic
Yes**
In AM, Clamp NG* Check 6-hour residual: <200 ml
No**
No
Yes
Utilize Asymptomatic Flow Chart
Remove NG Start Sips and Chips
If Asymptomatic, utilize Asymptomatic Flow Chart. If becomes symptomatic, Treat Clinically (Utilize best clinical judgement in care. No longer utilize Flow Charts)