Postoperative Ultrasound Evaluation of Gastric Distension; A Pilot study

M Jaronczyk MD, W Boyan Jr. MD, M Goldfarb MD. FACS.

MMC Dept of Surgery

Nausea and vomiting are common complaints of postoperative patients. Postoperative ileus can lead to gastric distension and vomiting. Narcotic pain medication can also lead to nausea even if there is normal bowel function without any gastric distension. Lack of bowel function is common in the early postoperative period and, therefore, subjective complaints are not always reliable. Aspiration is a highly feared complication of vomiting. At our institution, 11 of 13 patients who aspirated status post bowel surgery over a 5-year period subsequently died.

Nasogastric tubes (NGT) are frequently used after a patient has an episode of vomiting and sometimes as a prophylactic measure to decompress the stomach when ileus is suspected. NGTs are frequently met with resistance because of discomfort and they are not routinely used in elective cases. Moreover, multiple studies have proven that postoperative prophylactic NGTs are not beneficial. Cheatham, et al[1] performed a meta-analysis that supported this finding. Nearly 4000 patients were reviewed and the use of NGT decompression did not alter the outcomes. The number needed to treat in this study was greater than 20 patients.

Unfortunately, no diagnostic tools exist to determine whether nausea is due to gastric distension. Ultrasonography (US) is commonly used in medicine as a means of diagnosis by differentiating solids from liquids in the body. This technology is noninvasive, portable and easily available throughout the hospital. An additional benefit is that it does not require exposure to radiation or contrast. Handheld devices make US a rapid and practical tool during bedside evaluation of a patient. US is user dependant, but it is routinely used by surgeons for central

venous access and FAST exams. Carp, et al[2] proved US is useful in assessing gastric contents. They were able to assess gastric contents in healthy volunteers and pregnant patients. Their goal was to show that gastric emptying may be delayed during labor.

The aim of this pilot study is to use US to assess gastric distension. If there is gastric distension, then an NGT can be placed. If there is no distension, then the nausea can be attributed to another cause and an NGT is unnecessary. We coupled our measurements with the recording of nausea and vomiting to assess for a correlation between symptoms and gastric distension.

Prior to the study, benign post-gastrectomy specimens procured from bariatric sleeve gastrectomies were examined with our ultrasound. Moistened paper towels were placed over the specimen to mimic skin and subcutaneous tissue. Increasing amounts of saline were injected into the specimen. Ultrasound measurements were taken using the SonoSite 180 Plus ultrasound with a 2-5MHz convex abdominal probe. Increasing anterior-posterior diameters were noted as infusions of up to 2 liters of saline were injected into the stomach specimens

We performed a prospective study of twenty patients that underwent elective colorectal resections by two board-certified colorectal surgeons between August, 2013 and October, 2013. The patients' stomachs were examined and measured with our bedside US on the day of surgery in the preoperative holding area. Patients had been NPO for eight hours and completed bowel preparation. US measurements were conducted by one of two residents. The largest anterior-posterior diameters were recorded. After surgery, the US examinations were repeated every morning while the patients were asked if they experienced any nausea or vomiting. NGTs were placed based on clinical findings in applicable patients.

The indications for surgery were both benign and malignant conditions. Eleven patients had diverticulitis, eight patients had cancer and one patient had adhesions related to

endometriosis. The operations performed were thirteen laparoscopic low anterior resections, four laparoscopic right hemicolectomies, one laparoscopic extended left hemicolectomy, one abdominal-perineal resection and one colostomy reversal.

No patients complained of nausea or vomiting prior to surgery during their first measurement. No patient had a prophylactic NGT inserted after the procedure. Postoperatively, the patients were given clear liquids and all patients were encouraged to ambulate on the first postoperative day. Pain medications and anti-emetic medications were ordered on a prn basis. The diet orders were advanced as tolerated with bowel function and reduced based on nausea, vomiting, distension and obstipation. No clinical decisions were made based on US findings.

All 20 patients were examined at least daily during their inpatient stay. The mean hospital stay was 4.8 days with a range of 4-6 days. Prior to surgery, the diameters of the stomachs measured a mean of 4.1 centimeters with a range of 3.2-5.4 centimeters. The postoperative measurement means were 4.3, 4.5, 4.3, 4.2 and 4.4 centimeters on postoperative days 1-5, respectively. Postoperatively, 15 patients did not experience any nausea. Of the five patients reported who nausea, three patients ultimately vomited. Two of these vomiting patients received NGTs while the third had only small amounts of clear emesis.

One patient had nausea and vomiting that correlated with US measurements. Prior to surgery, his diameter was 3.3 centimeters. On postoperative day one, the patient was nauseated and had a single bout of vomiting. The diameter was 5.1 centimeters. On postoperative day two, the patient complained of continued nausea and suffered additional episodes of vomiting. The diameter was 8 centimeters prior to NGT, which was a notable outlier. After the NGT was inserted, 1.5L of bilious fluid was removed and the diameter decreased to 3.5 centimeters.

The second patient who required a nasogastric tube had anterior-posterior diameters near the mean. However, she was nauseated and had multiple episodes of vomiting on her first postoperative day. After nasogastric tube insertion, there was 850 milliliters of bilious fluid drained from her stomach without a major change in her anterior-posterior diameter.

The two patients who only suffered nausea had US measurements below or near the mean and never vomited. The patient with the clear vomitus also had measurements near the mean. None of these patients received a NGT and their hospital courses were uncomplicated. No major complications occurred in any patient in this study.

The goal of this pilot study was to test US measurement of gastric distension and identify patients at risk of vomiting and aspiration. Although user dependent, US for gastric measurement can provide a means to differentiate nausea related to gastric distension from other etiologies. If gastric distension is diagnosed, then an NGT can be inserted to decompress the stomach thereby preventing vomiting and aspiration. The use of bedside US is becoming more prevalent in surgical training. Residents perform US testing on patients with suspected biliary disease, appendicitis, trauma and abscesses. US is rapid, noninvasive, portable and easily available throughout the hospital. An additional benefit is it does not require exposure to radiation or contrast. If standardized, this bedside investigation could prove a valuable asset in the daily assessment of patient distension and avoid potential disastrous complications.

Nausea is one of the most common symptoms in the postoperative patient. The causes of postoperative nausea are numerous. Alterations in medications, anti-emetics and stepwise diet advancement can help control these symptoms. A serious cause of postoperative nausea is ileus causing gastric distension. This distension can lead to vomiting which can result in aspiration.

NGT are used to treat bowel obstruction to prevent distension and vomiting but since they are among the most complained about treatment by patients they have been relegated to use only when necessary.

Our study included four patients who were nauseated with gastric diameters close to the mean. The fifth patient had a noticeable increase in his stomach distension. Both patients who received NGTs felt a resolution of their symptoms. Three patients' symptoms seemed to be caused by other etiologies as they never were distended and US did not exemplify any gastric distension.

We reviewed the US images of the two patients who received nasogastric decompression. We found both had hyperechoic posterior gastric walls without any imaging artifact from gaseous distension. The findings on these images showed fluid-filled stomachs. The first patient showed his distension in the increased diameters. However, the second patient's distension was not identified with this measurement. The summation point is these patients could only project liquid material from their stomachs instead of eructation seen with gaseous distension. We hypothesize that a fluid-filled stomach seen on ultrasound may also be useful to predict patient vomiting. Further study of this topic is necessary as this is a small patient cohort.

An additional finding during this project was upon reviewing our institutional database regarding aspiration. Since 1998, our hospital has recorded morbidities and mortalities in surgical patients. Starting in 2007, routine NGT use had fallen out of favor. Since that time we had noted above the 13 patients who had aspirated with a high mortality rate. Reviewing the complications from the ten years prior, there were only two recorded incidents of aspiration status post bowel surgery. Both of those patients expired shortly thereafter. We do not seek to refute the published data regarding routine NGT use. However, select patients may benefit from

prophylactic NGT decompression. These select patients can be diagnosed using bedside gastric ultrasound before they have symptoms.

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