

## Smart Pill

### Dataset Introduction

#### Abstract

This study evaluated gastric emptying, small bowel transit time, and total intestinal transit time in 8 critically ill trauma patients. These data were compared with those obtained in 87 healthy volunteers from a separate trial. Data were obtained with a motility capsule that wirelessly transmitted pH, pressure, and temperature to a recorder attached to each subject's abdomen. Transit times were available for almost all patients, however, pH, pressure and temperature data is missing for all critically ill patients and sparsely missing for the healthy volunteers. These are data from a study by Rauch et al. "Use of Wireless Utility Capsule to Determine Gastric Emptying and Small Intestinal Transit Times in Critically Ill Trauma Patients". *Journal of Critical Care* 2012; 27(5): 534.e7 – 534.e12.

#### Background

Delayed gastric emptying is a well-known problem in critically ill patients and is associated with feeding disturbances and inadequate nutrition. However, evaluating gastrointestinal function remains challenging in critically ill patients who are mechanically ventilated. Many tests that are practical and accurate under standardized, controlled conditions often fail in the critical care setting. For example, the consensus recommendations for gastric emptying scintigraphy are impractical in intubated patients because they recommend low-fat, egg white meal with imaging at 0, 1, 2, and 4 hours after meal ingestion. Another test, the lactulose hydrogen breath test, relies on prompt bacterial breakdown of lactulose in the colon; however, changes in bacterial flora—which are presumably common in critical care patients—can produce false transit times.

The <sup>13</sup>C-octanoic acid breath test was reported as successful when used bedside to measure gastric emptying. However, manometry only assesses the upper gastrointestinal function, mainly esophagus, stomach, and proximal small bowel. Finally, video capsule technology has been used to determine small bowel transit time and pathomorphology in critically ill patients, although inadequate battery lifespan of the capsule (approximately 8-10 hours) could prevent complete examination in some cases.

An alternative technique, wireless capsule technology, may be useful for evaluating gastrointestinal motility in critical care patients. A newly developed motility capsule for assessing gastric emptying in patients with suspected gastroparesis has been available since 2006. It is a wireless capsule that transmits pH, pressure, and temperature.

## **Study Objective**

This study describes the first use of a novel motility capsule to compare gastric emptying and small bowel transit times in critically ill trauma patients with intracranial hemorrhage with times recorded previously in healthy volunteers. Secondly, this study compares critically ill patients and volunteers on whole-gut transit time.

## **Study Design**

Prospective cohort study

## **Subjects & Variables**

This study enrolled 8 critically ill patients. Each patient was enrolled within 36 hours of ICU admission. All had major trauma and had an intracranial hemorrhage. Positioning of the motility capsule (SmartPill GI Monitoring Capsule; SmartPill, Inc, Buffalo, NY) was coupled with the medically necessary feeding tube placement 2 days after patients were admitted to an ICU. The capsule was deployed into the stomach, and its position was confirmed radiographically. Data were transmitted to a recorder attached to the patient over a 5-day period. The control group consisted of 87 healthy volunteers with no history of major abdominal surgery.

MotiliGI software was used to calculate the primary outcomes of gastric emptying and transit times. The transition from stomach to small bowel was marked by an abrupt pH rise ( $>3$  pH units) from gastric baseline to a pH greater than 4 as well as a change in pressure patterns before emptying. Pressure recordings showed high-amplitude phasic contractions just before the capsule's emptying from the stomach. The pH change marked the end of the gastric pressure analysis window and the beginning of the small bowel pressure analysis window. Small bowel transit time was calculated from the time the capsule entered the duodenum until it reached the cecum characterized by a drop in pH and pressure changes. Pressure patterns are characterized as high-amplitude phasic gastric contractions, mean peak amplitude, and mean contractions per minute. Mean peak amplitude (between 10 and 300 mmHg) is the sum of amplitudes/number of contractions. Total gastrointestinal transit time was calculated from the time the capsule was placed until it passed from the body, therefore, these times could be much longer than the lifespan of the device's battery as it was determined by observation of the device in the feces, which did not require electronic transmission. As the transmissions were only recorded for 5 days (120 hours), any stage not completed by that time was not recorded as a transmission time. Since the colonic transit time is the last stage of the process, it is the stage most often missing a value. However, the colonic transit time can be estimated by taking the whole gut time and subtracting away the gastric emptying time and the small bowel transit time.



N = 95 subjects

22 variables

**Citation(s)**

Rauch et al. "Use of Wireless Utility Capsule to Determine Gastric Emptying and Small Intestinal Transit Times in Critically Ill Trauma Patients". *Journal of Critical Care* 2012; 27(5): 534.e7 – 534.e12.