

## **Gastric Emptying Time: How to Measure & Apply in Clinical Practice**

**Ping-Huei Tseng**

**Attending physician, Department of Internal Medicine, National Taiwan University Hospital**

Normal gastric emptying relies on the coordinated activity in the proximal and distal regions of the stomach, and may be affected by several factors, including the volume, composition and total calories of the ingested food, various neurohormonal interaction and personal factors, such as pregnancy, anxiety and aging. Delayed or rapid gastric emptying has been associated with a number of gastrointestinal disorders, such as diabetic gastroparesis, functional dyspepsia, gastroesophageal reflux disease and dumping syndrome. Among them, diabetic gastroparesis is the most recognized and is characterized by the delayed gastric emptying, accompanied by severe nausea, vomiting and abdominal fullness, in the absence of mechanical obstruction of the stomach. Since delayed and rapid gastric emptying may cause similar gastrointestinal symptoms, such as nausea, vomiting and bloating, the importance of determining the rate of gastric emptying to guide the treatment choice has been stressed.

Currently, gastric emptying scintigraphy (GES) with solid test meals remains the gold standard to assess delayed gastric emptying. Nevertheless, methodologies related to the test meals and imaging protocols in determining gastric emptying time differ between institutions and regions. Recently, a low-fat egg-white test meal has been standardized by both the American Neurogastroenterology and Motility Society and the Society of Nuclear Medicine based on a large multicenter study of 123 healthy volunteers. In that study, normal gastric emptying values were established for a standard scintigraphy protocol, which included a meal of scrambled egg substitute equivalent to 2 eggs, 2 slices of bread, strawberry jam, and water, with an overall caloric value of 255 kcal. Images were acquired in the upright position at 0, 1, 2, and 4 h after meal ingestion and the gastric retention of >10% at 4 hours is indicative of delayed emptying.

Other novel tests, including <sup>13</sup>C-octanoate breath testing and wireless motility capsule, have been applied in several recent studies to determine gastric emptying, and each has its own advantages and limitations. Notably, in Taiwan and other Asian countries, gastric scintigraphy protocol, especially the test meal, have not been standardized till now. In addition, a significant portion of patients in many Asian societies cannot eat egg-containing food due to religious or health reasons (i.e. egg allergy or intolerance). Recently, instant oatmeal, which has satisfactory radiolabel adherence in gastric juice and good correlation with the protocol utilizing scrambled egg meal, has been gaining popularity, and normative data have been established in both the Western and the Chinese populations. From a practical point of view, instant oatmeal is widely available, patient-friendly, easy to prepare and reliable in assessment of gastric emptying rate and therefore may serve as a good alternative test meal for patients who were vegetarians or could not tolerate the standardized egg-based test meal. Further pharmaceutical clinical trials or gastric motility studies to validate these novel gastric emptying tests are warranted.