Nuclear Gastric Emptying Studies: All That Glitters Is Not the Gold Standard

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The radionuclide gastric emptying test (GET) is the gold standard for diagnosing gastroparesis. Although commonly performed by most nuclear medicine departments, there are many subtleties and nuances that improve its performance characteristics. As an example, the preparation is not just “nothing to eat after midnight,” since there are key measures that should be followed in order to obtain the most accurate results. The existing guidelines were endorsed by the American Neurogastroenterology and Motility Society and the Society of Nuclear Medicine in 2008 [1]. Recommendations state that patients should be instructed to stop medications that might accelerate gastric emptying such as metoclopramide or that slow emptying such as opiates or anticholinergics for 48 h before the test. There is a validated meal of 4 oz. of liquid egg whites labeled prior to cooking with 0.5–1.0 mCi ^{99m}Tc sulfur colloid, 2 slices of white bread, 30 gm of strawberry jam, and a glass of water, all of which should be consumed in 10 min or less [2]. Another important requirement is that the blood sugar should be ≤ 275 prior to the test in order to improve test reliability. Cigarette smoking (not just marijuana) is not allowed the morning of or throughout the test. Moreover, many radiology departments report gastric emptying in terms of a 90-min half-life. Unfortunately, although this saves time, to the disciples of motility and the original creators of the GET, this is unacceptable, since the test was developed and validated based on observations that tested the effects of meal size, fat content, consistency, and liquid volume, and also studied methods of tracer incorporation while defining the area of interest and timing of image acquisition [3]. For instance, standardization of fat content is extremely important as it can slow gastric emptying and a liquid meal alone has been noted to be too rapid [1, 4]. Acquisition of images in the standing position was also adopted because acquiring images in the prone position

has been found to slow gastric emptying [3]. According to the results of considerable experimentation, the ideal test reports the percent retention at 1, 2, and 4 h with a positive test demonstrating $> 10\%$ retention at 4 h. A 1 h image is considered essential to capture those individuals with rapid gastric emptying [5]. As part of the study, there should be a statement recorded regarding whether patients consumed the whole meal, or if they vomited any of the meal, and medications that were consumed within 24 h of having the test done. There are also additional features regarding image acquisition and interpretation by radiologists [2].

In this issue of *Digestive Diseases and Sciences*, Wise et al. from the Mayo Clinic Jacksonville sent an IRB approved questionnaire that assessed patient information, patient preparation, and procedure protocol as well as meal content and preparation, imaging protocol, interpretation and reporting [6]. This survey was sent via Survey Monkey to members of the Society of Nuclear Medicine and Medical Imaging (SNMMI) with instructions to direct the survey to the supervisor of nuclear medicine of their respective institutions and to limit responses to just one per medical facility. Sadly, only about 14% of the 872 possible institutions surveyed responded. Forty percent of the responses were from academic institutions and 60% from private facilities.

When examining the compliance to the performance of these guidelines, they found the disconcerting result that that the gold standard protocol was only followed by slightly more than 60% for both academic and non-academic institutions. Further, when the results were broken down to the most important subset of protocol features that ensured quality, performing a 4 h test; monitoring and controlling blood sugar levels; and ensuring that pain medications and other medications were restricted; only 4.5% of the institution complied with all of these instructions, and 12.5% complied with none of them.

For those of us who rely on the GET for the diagnosis of gastroparesis, this is most distressing news. Despite this nonadherence, this standard for nuclear GET has not yet

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been abandoned. In a position statement that was published this year by a joint committee with representation from the SNMMI, the American Gastroenterological Association, the American College of Physicians, and the American College of Nuclear Medicine, the nuclear GET remains the test endorsed as the appropriate test for the diagnosis of gastroparesis [7]. Although the response rate to the survey in this study was less than ideal, one cannot rationalize and state that this study does not represent any serious problems under the assumption that all of the non-responding institutions are strictly adherent to the guidelines. As the authors point out, major diagnostic and treatment decisions are made on the basis of this test, including the decision of whether or not to use medical therapies and dietary changes but also to perform the newest treatment, gastric peroral endoscopic myotomy (G-POEM), a procedure that can be very helpful to a subset of patients with refractory gastroparesis. The potential major effects on medical costs are well-summarized in the discussion section of the article.

One might ask why is the performance of the 4 h GET so important. Other modalities exist to evaluate gastric emptying; in fact a spirulina $^{13}\text{CO}_2$ breath test was recently approved by the FDA [7]. While it is convenient to have a non-nuclear test, it is far from perfect and can be confounded by small intestinal bacterial overgrowth, lung disease, and liver disease. Also, the use of the nuclear gastric emptying test as the standard comparator that was used for approval reinforced that the GET is the current gold standard. Smart Pills are not like food and are better suited as measures of whole gut motility than for assessing gastric emptying, due to the weight of the pill and how it travels. One also needs to throw out nuclear tests done with oatmeal and those that use a sole 90 min endpoint. Making the diagnosis of gastroparesis is challenging since the symptoms of nausea, vomiting and abdominal pain are nonspecific and can be confusing to characterize when a validated, correctly performed GET is unavailable.

The findings of this study make it apparent that GETs require careful evaluation by the ordering clinician in order to ensure their validity. Accordingly, it is imperative to speak with the nuclear medicine department at one's institution and at the very least confirm that the four protocol features that ensure quality are followed. The consequences and costs to our integrity as clinicians and to our patients in terms of overall health, quality-of-life, and cost of care depend on it.

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