LETTERS TO THE EDITOR

Meal Size and Gastric Emptying

In their paper, “Effects of Meal Size and Correction Technique on Gastric Emptying Time: Studies with Two Tracers and Opposed Detectors” (1), Christian et al. neglected to mention an important conclusion that their data suggest: gastric emptying rates for lighter meals can be estimated accurately using only anterior camera views.

Recent papers (1,2) describe an advantage in using a geometric mean of stomach counts from anterior and posterior camera views. Material may shift anteriorly as it moves from the fundus into the antrum and pylorus, and, when only anterior views are used, such shifting makes the gastric emptying rate appear slower than it actually is. This bias occurs because not all matter has shifted anteriorly by the time emptying begins. The greater and more prolonged the anterior displacement, the greater is the bias toward a slower rate.

We would expect smaller meals to produce a shorter period of anterior displacement and thus less bias. This is borne out by the data in Tables 1 and 2 of Christian’s article. For a 300-g solid meal, the geometric mean and anterior half-emptying times differ by only 8 min. In contrast, for a 900-g solid meal, the two times differ by a substantial amount, 50 min. Results for liquids correlate even better: for a 300-g liquid meal, the geometric mean and anterior half-emptying times differ by just 3 min.

A further indication of the adequacy of using only anterior camera views for lighter meals is that the geometric mean and anterior across-patient variances are nearly the same. Thus, the anterior approach overestimates half-emptying times by consistently small amounts. If the anterior approach were less consistent than the geometric-mean, the anterior across-patient variance would exceed the geometric mean’s across-patient variance. This is, in fact, what happens for larger meals. The implication is that the period and amount of anterior displacement vary only slightly from person to person for lighter meals and substantially for heavier ones.

Incidentally, if we did not know a priori that the anterior approach can be biased, the data in Tables 1 and 2 would not have demonstrated it statistically. We computed unequal variance t-statistics for each of the six meals listed in the tables, and the maximum was 1.1, which is not significant. Of course, in all six comparisons, the anterior approach produced slower rates than did the geometric mean. This fact alone could indicate a bias, since the one-sided probability of six independent, unbaised “trials” turning out that way is 0.006 or 0.016. However, the data for each meal appear to have been drawn from the same ten volunteers, which suggests that the six trials are probably not independent.

We conclude, therefore, that using the geometric mean for computing gastric emptying rates is indicated either for studies requiring an unusual degree of accuracy or for those involving large solid or very large liquid meals. For most studies involving smaller solid or liquid meals, a simple anterior approach will suffice.

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REFERENCES


Reply

Drs. Rattner, Charkes, and Malmud have pointed out that some gastric emptying studies may be performed using only anterior imaging. Our studies (1,2) have required both precision and accuracy in studying the simultaneous emptying of liquids and solids for various sized meals. The use of geometric-mean correction was first introduced by Tothill et al. (3) and has also been applied to studies by Patton et al. (4). Gastric emptying studies typically require the use of a scintillation camera and computer system for 1–3 hr, during which time one or more patients may be studied at various imaging intervals. Acquisition of the posterior images adds no significant time to the total procedure.

Although the average half-emptying time for a 300-g meal was overestimated by 10.3% by anterior imaging alone, the average error for each individual subject was 15.4%, with the highest overestimate being 56.7% on one subject. The differences for each subject and the errors for the average half-emptying times became larger with the 900-g and 1,620-g meals. Figure 1 shows the difference between anterior and geometric-mean-corrected imaging for the solid-food component of a 900-g meal. The increase in anterior counts was more pronounced for the 1,620-g meal and more subtle with the 300-g meal. The difference between anterior and geometric-mean data for In-111 was smaller because of the lesser attenuation of the 247-keV gamma energy.

Although we had stated that “The largest variations between anterior and geometric-mean data for half-emptying time occurred with larger meals,” we routinely use this technique for all meal sizes because it requires no additional time, is easy to perform, and adds accuracy to our procedures.

FIG. 1. Solid-phase emptying patterns for anterior and geometric-mean data for a 900-g meal.