

procedure. It is Du Pont's position that this information should be transmitted to nuclear medicine technologists, nuclear pharmacists and any other individuals preparing a dose of I.V. Persantine through customer education and training. Such instructions do not appear to be a normal part of a drug's package insert (PI). A review of the PDR indicates that no major parenteral product commercially available in ampules includes a statement requiring that these products be filtered prior to administration.

Second, the authors indicate that although the PI clearly states that the product should be protected from direct light, it is not clear why the I.V. Persantine injection reacts to light exposure and for how long a period of time I.V. Persantine can be exposed to light without causing any noticeable degradation of the drug. We offer the following information to clarify this concern. Once I.V. Persantine is diluted, there is an apparent increase in light sensitivity of the dipyridamole molecule. In studies performed by BIPI, the maximum rate of degradation varied from about 3 hr to 30 hr. The 3-hr rate occurs in diluted (reconstituted) I.V. Persantine, while the 30-hr rate corresponds to relatively more concentrated aqueous I.V. Persantine solutions. The degradation rate constant is obviously dependent on the light intensity in the laboratory. Thus originates the I.V. Persantine package insert statements "avoid direct light", "keep the product in the original carton to provide protection from light until dispensed" and "solution should not be used if discolored." Prudent use of I.V. Persantine would suggest storing the undiluted ampules in a cabinet, free from direct light subject to the expiration date. After dilution, the material should either be stored free from direct light (ideally) or not longer than about 3 hr when exposed to ambient light (prior to patient administration).

Finally, the last question asked by the authors is why is I.V. Persantine packaged in a 2-ml ampule containing 10-ml of dipyridamole versus a larger single patient dose ampule or multiple patient dose ampule/vial. The 2-ml ampule is the first commercially available form for I.V. Persantine because data for this "putup" was submitted in the original NDA to the FDA. We are currently working on alternative putups for I.V. Persantine that must be submitted for FDA review prior to commercialization.

We hope that this adequately answers the questions outlined by the authors from the Mayo Clinic. If anyone has any further questions, please do not hesitate to call the Du Pont Pharma nuclear cardiology hotline at 1-800-343-7851 for further clarification.

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Detection of Myocardial Validity

TO THE EDITOR: The January 1991 issue of the *The Journal of Nuclear Medicine* contains a Clinicopathologic Conference (CPC) on detection of myocardial viability with PET in a patient with probable ischemic cardiomyopathy.

The case is excellently presented by Dr. Weiss. The discussion by Dr. Eisen is topical, informative, and well-written with pertinent references. I am perplexed however by Fig. 1 in the CPC. These images are planar images (the text states that a "tomographic thallium study was performed . . ."). The legend for Figure

1 indicates that the images "show an anterior and upper septal defect with no redistribution." To this reader's eye the "anterior and upper septal defect" could easily represent normal decreased activity in the LV outflow tract/mitral apparatus. I would assume tomography showed fixed defects in the above-mentioned areas, however, other than LV dilation, the images in Figure 1 are unremarkable.

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REPLY: The question raised by Dr. Campeau regarding the thallium scans in Figure 1 can be explained by the fact that the patient in the CPC underwent two thallium studies. The first was a tomographic thallium study during cardiac pacing and was performed on September 7, 1989. The patient's heart was paced to 87% of predicted maximum and a large fixed defect was noted in the septum, apex and inferior walls with dilatation of the left ventricle. Only slight improvement was noted in the anteroseptal wall. The patient was then transferred to our institution on September 18, 1989. He underwent a stress-rest thallium study on September 22, 1989. This was a planar study and is shown in Figure 1. For this study, the patient achieved 60% of maximal-predicted heart rate. Scintigraphy revealed a dilated left ventricle with fixed defects in the anterior and upper septal walls consistent with scar. No ischemia was noted. Dr. Campeau is correct that these defects could represent decreased activity normally seen in the LV outflow tract and mitral apparatus, although the anterior defect in the LAO 70° view appears to be too extensive to be a normal variant. The findings described for the planar thallium-stress test shown in Figure 1, which was obtained at our institution, are similar to those reported in the pacing tomographic thallium study performed at the referring institution, except that we did not see the inferior wall defect. We were unable to obtain satisfactory images for reproduction purposes from the initial pacing thallium study. The results of both the tomographic thallium scan at the referring hospital and the planar thallium scan obtained at our hospital and shown in Figure 1 are discussed on page 131 of the CPC.

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Determining Gastric Emptying Rate

TO THE EDITOR: Gastric emptying and its rate are determined by multiple complex factors, many of which are inextricably interrelated. There is, however, one variable of a test meal that cannot possibly influence gastric motility except indirectly—its caloric content.

In spite of the obviousness of this thesis, the nuclear medicine gastric motility literature offers a litany of ill-conceived hy-

potheses and experiments designed to test them, whose goal is to show an effect of the caloric content of a test meal on gastric emptying. Because of this, I found the discussion of the nice study by Phillips and his colleagues of special interest (1).

The caloric content of a meal is measured by placing it in a calorimeter, oxidizing it completely, and measuring the heat produced. A living organism has no physiologic mechanism to measure a meal's calories, much less react to them. In fact, the calories of a meal are released over a long period of time after it is digested—probably days. An acute effect of an ingested meal's calories on gastric motility, or anything else for that matter, is preposterous.

The problem presented to investigators of this bankrupt idea is that it is impossible to prepare two meals that only differ in caloric content and do not differ in many already recognized and physiologically important variables. In summary, I find calories influencing gastric motility indigestible.

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REPLY: We agree with Dr. Hattner that gastric emptying is determined by multiple complex factors. The meal phase (1) (liquid versus solid), composition of the meal (2) (carbohydrate:protein:fat), weight (2) and volume (3) of the meal, stimulation of osmoreceptors (4), as well as energy density (5,6) (kcal/g) have all been reported to affect the rate of gastric emptying.

Although many of the articles in nuclear medicine and gastric motility literature emphasize the effect of the caloric content of a test meal on gastric emptying (5-7) (an increased number of calories is associated with slower gastric emptying), this theory is not always consistent. Our article (*J Nucl Med* 1991;32:377-381) described a 400-kcal glucose solution emptying almost twice as slowly as our 200-kcal glucose solution. However, we described in the same article a 400-kcal liquid glucose solution having a longer half-emptying time than the 600-kcal meal in the Velchik et al. study (107 min with the 400-kcal glucose solution versus 95 min with the 600-kcal solid meal). This difference, we believe, may be due to a slower rate of intestinal absorption of the solid meal, compared to the more rapid intestinal absorption of the glucose solution.

Thus, although we believe that all the variables mentioned above affect gastric emptying, in our opinion it is the rate of absorption of nutrients by the small intestine that is the most important factor controlling gastric emptying. The release of at least one gut hormone, gastric inhibitory polypeptide (GIP), has been shown to be dependent on the rate of absorption of nutrients by the small intestine (8). Another possibility is that circulating blood levels of nutrients could exert a strong control on gastric emptying. Several investigations have shown that intravenous infusion of glucose greatly slows gastric emptying (9,10). Obviously, the rate of absorption of nutrients by the small intestine and circulating blood levels are closely connected.

This rate of absorption, as Dr. Hattner has mentioned, can

vary greatly between different types of foods (11). The absorption rate is dependent on the physical properties of each food.

The use of glucose solutions, as in our studies, allows for very rapid intestinal absorption after the glucose is emptied from the stomach. In this case, the gastric emptying time should be increasingly prolonged with increasing caloric content, caloric content being simply an indirect way of specifying the quantity of glucose.

If these ideas are correct, they have important applications in the performance of gastric emptying studies. Therefore, we believe that, in order to have reproducible gastric emptying studies, the physical properties and quantity (weight) of a gastric emptying meal must be rigidly controlled.

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A Novel In Vivo Red Cell-Specific Label

TO THE EDITOR: In his editorial (1), Ronald J. Callahan listed 13 radionuclides that have been used to label human red blood cells and commented on the in vitro and in vivo labeling protocols. We would like to add radioiodine to the list following our work on the selective labeling of human erythrocytes by para-iodobenzenesulphonamide (pIBS). The results of these studies have recently been published (2-4), and we simply wish to point out the advantages of our technique over current methodologies.

Our targeting method is based on the use of a facilely radioiodinated, lipophilic enzyme-inhibitor as a radionuclide "carrier." Red cells are ideal for this approach since they contain a high concentration of the target enzyme, carbonic anhydrase. Further-