Technical Considerations in Gastric Ulcer Localization Using Technetium-99m Sucralfate

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After the completion and evaluation of 17 patient studies using technetium-99m-labeled sucralfate for the detection of ulcerated areas, we felt that the technical aspects of the studies should be evaluated. The factors for evaluation are: the time the patient is kept fasting; the time the patient is being imaged and rotated for various anatomic views; the technologist time and camera time that are involved in one study; and the cost factor of the testing procedure. Based on the findings of our small sample of patients, the sensitivity of the test is uncertain.

One of the newer studies to be introduced to the nuclear medicine community is the detection of gastrointestinal ulceration. The procedure uses in vitro (*1,2*) or in vivo (*2,3*) labeling of sucralfate* with ^{99m}Tc. Sucralfate is an aluminum hydroxide complex of sulfated sucrose which promotes healing of gastric ulcers by binding to denuded mucosa and forming a protective coating (*3*). This coating provides a protective covering of the raw areas from the effects of acid, enzymes, and other irritants for several hours after ingestion (*1*).

The sensitivity of this test has been found to be equal to or better than barium studies or endoscopy (*1,2*). Vasquez et al. (*1*) state that ulcers as small as 0.5 mm may be found using these nuclear studies. None of the other studies (*2,3*) is this sensitive or specific.

Our laboratory has performed both in vitro and in vivo studies. The purpose of this paper is to consider the technical aspects of this procedure, which include patient cooperation and the length of time the technologist and the camera are involved in the study. Labeling procedures will not be addressed.

MATERIALS AND METHODS

To investigate potential ulcer patients, ^{99m}Tc sucralfate studies were performed on 5 controls and on 12 patients. Control subjects were free from all ulcer symptoms and had no prior history of an ulcer. All patients had ulcer symptoms, with eight patients having prior diagnosed ulcers. For correlative purposes, each patient had a barium study, and many also had endoscopy.

All patients and subjects were NPO from midnight on the day of the study. Imaging was started ~ 60 min after ingestion of the radiopharmaceutical. Images were taken every 15–30 min for 2–3 hr. Three anterior views were taken with varied body positions: a) supine, with the camera over the patient's abdomen; b) left decubitus, with the subject laying on the left side with the camera at a 90° angle to the vertical; and c) an upright anterior view. After the first 7 patients, a fourth projection was added—a left anterior oblique, where the patient was at a 45° angle. We used a pillow wedged at the patient's back, where the camera was also at a 45° angle. Each image in the first set was taken for 150,000–200,000 counts. Remaining image sets were taken for the same time as the first set.

Cobalt markers, taped to the subject's xyphoid and umbilicus, were used for anatomic location and for consistent patient positioning throughout the procedure. At later time periods, a lead apron was placed over the subject's abdomen to block out some of the radioactive material in the intestines.

A positive study was demonstrated by a localized area of activity that did not move either with time or as the subject assumed different positions (*3*). The procedure was evaluated from a patient and technologist viewpoint.

RESULTS AND DISCUSSION

Two examples of patient studies are presented in figures 1 and 2. Case 1 (Fig. 1) was a 59-yr-old black female with a history of peptic ulcer disease. She had a past history of high levels of ethanol intake, with no ethanol intake for 3 yr. The patient presented to the hospital with epigastric pain. Endoscopy showed a questionable area of ulceration at the pyloric channel. The nuclear study was read as normal. Because of the patient's symptoms and complaints, she was started on ulcer medication.

The second subject, a 40-yr-old white male, was also one of the control subjects. Only after repeated questioning did he admit to diarrhea and mild epigastric pain relieved with antacid. The barium study showed a spasm of the pyloric bulb. The nuclear study showed a persistent area of activity (Fig. 2) at the pyloric bulb on the supine and left lateral views at 1, 1.5, 2, and 2.5 hr time periods. This subject was also started on oral ulcer medication.

Rather than evaluating this procedure from the clinical point of view, we evaluated this study from the patient's and technologist's point of view. As with x-ray barium study or endoscopy, the patients were kept NPO from midnight the day of the study.

The in vitro labeling method took ~ 60–75 min to tag the

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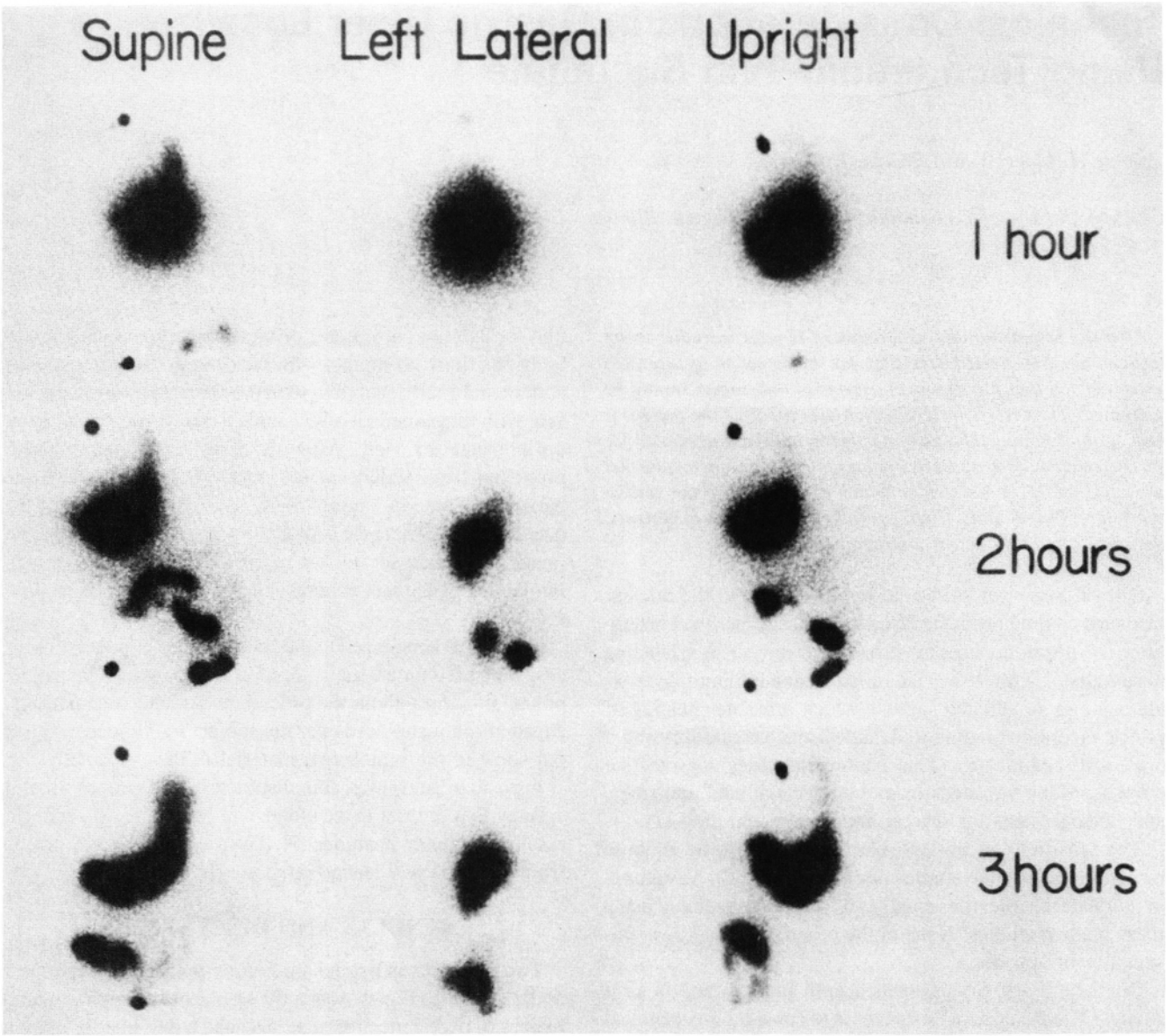

FIG. 1. Normal study shown in supine, left lateral, and upright views at 1, 2, and 3hr.

sucralfate to HSA and to the ^{99m}Tc. The in vivo labeling method took slightly less technologist time, ~ 30–45 min. There was a 1-hr time delay after the ingestion of the radiopharmaceutical before the scanning was started. We found it easier to administer the radiopharmaceutical in the patient's room, instead of having the patient sit in our laboratory for the extra hour.

Imaging time consisting of 2–6 hr (*3*), with a set of images being taken every 15–30 min, was averaged to a set of images every 20 min. Obtaining projections from 4–12 sets of images required not only a great deal of patient cooperation, but a patient in reasonably good health to sustain the amount of repositioning the patient must assume. Patient repositioning and different projections are taken so that overlying anatomic structures are moved, and the possibility of missing an ulcerated area is decreased. As illustrated in Case 2, the persistent area of activity was seen only in two views.

Other reports suggest that it is conceivable to do portable studies (*1–3*), although it may not be possible to take the same 3–4 projections as is the case with the healthier patient. The portable camera's field of view is smaller than most stationary cameras, which limits the visual anatomic area being imaged. Both of these factors could increase the possibility of missing the ulcerated area. In addition, if the patient is extremely debilitated, consumption of the oral pharmaceutical may not be possible. Vasquez et al. (*1*) state that there is less physician time involvement and, unlike barium and endoscopy studies, accuracy of the nuclear study is not dependent on the skill of the physician. We agree with this statement, but we did find that there is considerable technologist time involvement, at least 3–4 times more than either of the other two studies. Accuracy of the test may be dependent on the technologist's

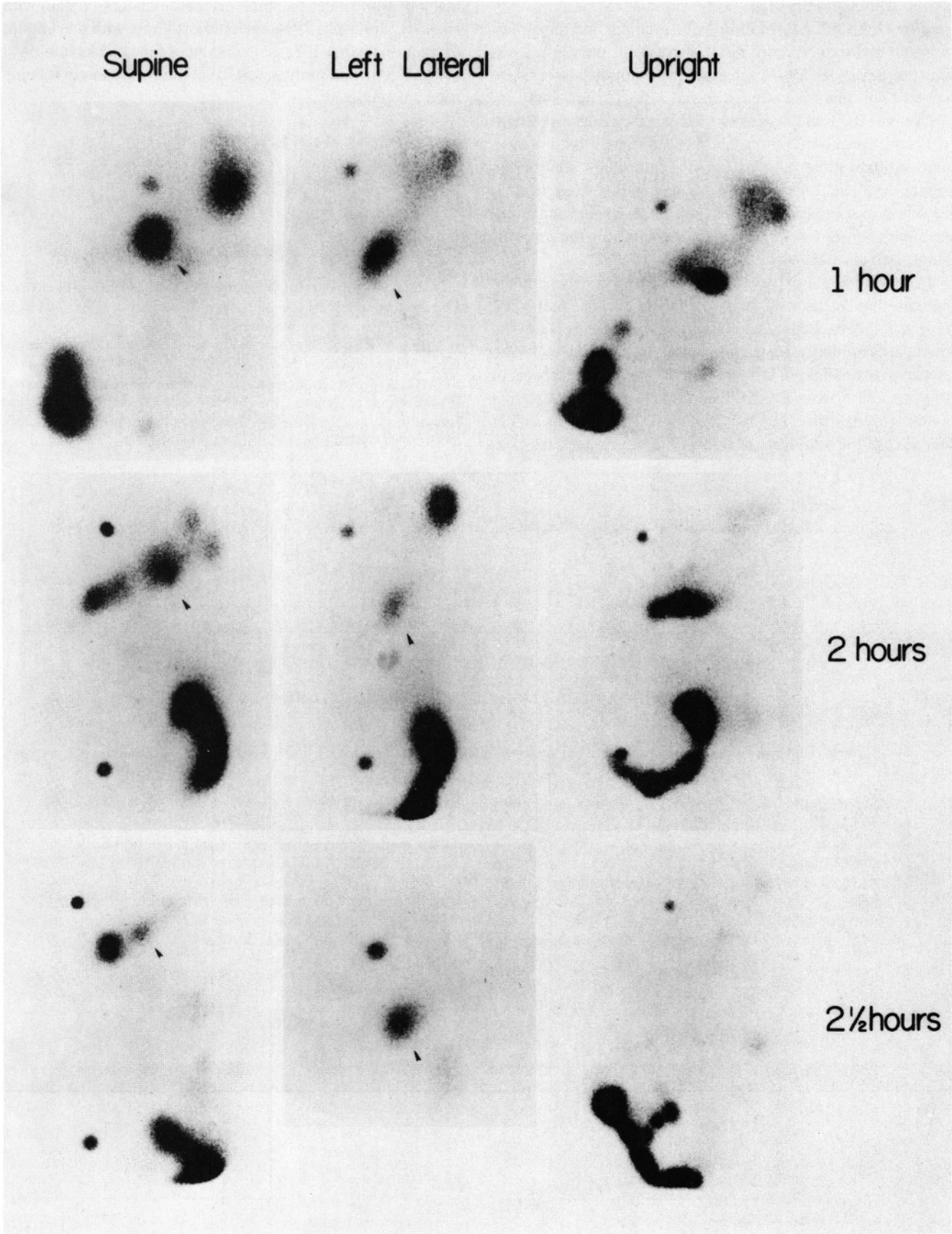

FIG.2. Abnormal study. See area of persistent activity (arrow) on the supine and left lateral views at 1, 2 and 2.5 hr. Note that the abnormal area cannot be seen on the upright view.

skills. Although Pera et al. (*2,3*) state that the barium study requires both full cooperation from a patient and the ability to stand and rotate according to instruction, our experience illustrates the need for the same patient requirements—criteria no different than that needed in the x-ray barium study.

Cost factors would have to be established by each institution. It is conceivable that the sucralfate study may be more expensive than either the barium or endoscopy study. One technologist and one camera were used in this study for 2–4 hr, which may be acceptable in a large multi-camera and multi-technologist department, but unacceptable in the smaller, single camera department.

In conclusion, we feel that any test that can benefit the patient, that is reasonably easy on the patient, and that is not cost prohibitive, is an asset not only to the patient, but to the medical community—especially a test that can detect and be sensitive to an ulcer of 0.5 mm. When the clinical aspects of this procedure are evaluated, the technical aspects and patient comfort levels should also be considered. These factors should include: 1) the total time period a patient is kept fasting, as many possible ulcer patients suffer from increased pain with an empty stomach; 2) patient comfort levels with the amount of rotation involved; 3) total amount of time one technologist is involved in one study; and 4) total time one camera is being used for one study.

FOOTNOTE

*Carafate® , Manon Inc., Kansas City, MO.

REFERENCES

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