Effect of ventilation images on observer interpretation of lung perfusion examinations. *Am J Roentgenol* 128: 1037–1038, 1977

Rapid Miniaturized Chromatographic Quality-Control Procedures for Tc-99m Radiopharmaceuticals

To those of us in nuclear pharmacy responsible for the preparation of Tc-99m radiopharmaceuticals, a simple and rapid chromatographic system is a valuable tool for the daily quality control of radiopharmaceuticals before the patient doses are dispensed. The technique recently presented by Zimmer and Pavel (*1*) is indeed simple and rapid and, as such, is representative of the "state of the art" in Tc-product quality control. However, some of the procedures described for the development and evaluation of the system need clarification.

Figure 1 illustrates the 1 cm × 6 cm strip as described by Zimmer and Pavel. The solid lines at 1, 3, and 5 cm are the origin (or.), center line (c) and solvent front (sf), respectively. The dotted lines show where the strip was "cut into eight equal segments: four below the center line and four above." The cross-hatched area represents the colored tape added to each strip for identification.

According to Fig. 1, if the radioactivity remained at the origin during chromatographic development, as expected for particulate radiopharmaceuticals, then the maximum activity would be counted in Segment 2, rather than Segment 1, as reported. No activity would be counted in Segment 1 unless the applied spot was quite large (>5 mm dia.) or the activity migrated before the strip was dried—highly unlikely for insoluble particles. Similarly, if development was stopped when the solvent front reached the 5 cm pencil line, no activity at all would be counted in Segment 8. As much as 96.9% of the radioactivity was reported in Segment 8 for the soluble Tc-complexes on ITLC-SG paper developed with normal saline. Although the precise segmental positioning of the activity appears to be in error as reported, no error results when the strips are cut at the center line and each half is counted separately.

Examination of the segmental distribution of radioactivity for Tc-99m Sn pyrophosphate on 31 ET paper developed in acetone revealed 21% of the activity in Segments 5–8, indicating 21% free pertechnetate. The authors, however, commented that these "unusually high values for the hydrolyzed reduced Tc-99m fraction in Tc-99m pyrophosphate" were consistent with those obtained from commercial chromatography kits. The data reported using ITLC-SG paper and normal saline showed only 1.3% of the activity as hydrolyzed reduced Tc-99m. Accordingly, one could easily question the amount of available stannous tin in the pyrophosphate kit(s) used in the chromatographic study.

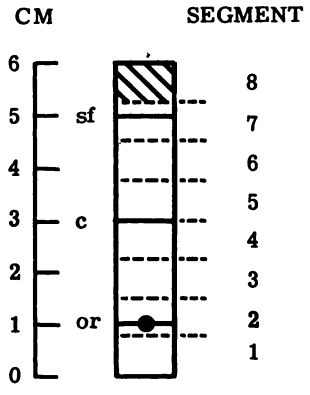

FIG. 1. Diagram of chromatographic strip.

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REFERENCE

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Reply

We welcome the comments made by Dr. Mock regarding the miniaturized chromatography system developed in our laboratory. Indeed, the statement regarding the cutting of the strips for counting does need some clarification. As illustrated in Fig. 1, the strips were cut into eight equal segments: four below and four above the center pencil line. However, the strips were cut in such a manner that the initial strip section (strip section number 1) encompassed the origin (0.3 cm below the bottom pencil line) and the last strip (strip section number 8) encompassed the solvent front (0.3 cm above the top pencil line).

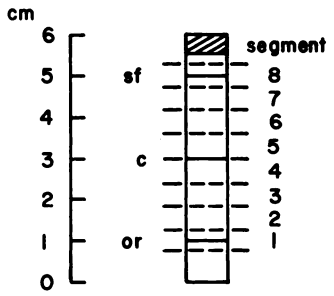

FIG. 1. Diagram of chromatographic strip.

Regarding the results of the chromatographic evaluation of Tc-99m-Sn-pyrophosphate, there is indeed a free pertechnetate level of 21% in the example given, using 31ET paper chromatography. This value has nothing whatsoever to do with the hydrolyzed reduced Tc-99m level and can only be determined using ITLC-SG paper and normal saline. The comments regarding "unusually high values for hydrolyzed reduced Tc-99m fraction in Tc-99m pyrophosphate" refer to commercial chromatography kits, which do not use ITLC-SG paper chromatography. In this case there is an overestimation of the amount of hydrolyzed reduced Tc. The phenomenon has been observed not only by us, but also by other investigators including Colombetti et al. (*1*).

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Rapid determination of oxidation state of unbound ^{99m}Tc and labeling yield in ^{99m}Tc labeled radiopharmaceuticals. *J Nucl Med* 17: 805–809, 1976

Prominent Motion of a Meckel's Diverticulum

Abdominal scintigraphy with sodium pertechnetate is a useful clinical screening test for the presence of a Meckel's diverticulum (*1*). In the usual procedure, the patient is imaged in the fasting state and serial images are obtained (*2,3*). On a positive scan, a Meckel's diverticulum usually appears as a stationary focus of activity that accumulates at the same rate as gastric activity. Occasionally this abnormal focus of activity moves during the imaging procedure (*3*). This communication describes the findings in a patient with a Meckel's diverticulum that showed prominent motion during imaging.

The patient was an 18-month-old male with a history of intestinal bleeding. After an 8-hr fast, 1 mCi Na^{99m}TcO$_4$ was given intravenously. Serial images of the abdomen were obtained with computer-assisted gamma camera systems. An acquisition time of 10 min was used for each of the first three images. When a changing pattern of activity became apparent, the imaging time was shortened to 5 min for two images and to 2 min for one image.

The serial images showed a single focus of abnormal activity in the abdomen, moving from the left lower quadrant to the extreme right lower quadrant during the imaging procedure (Fig. 1). This motion caused double exposures of the abnormal activity in three of six images obtained in 42 min. The patient did not move significantly during this period. The images were therefore interpreted as showing a Meckel's diverticulum with motion due to intestinal peristalsis. Subsequently surgical removal and pathologic examination confirmed the presence of a large ulcerated Meckel's diverticulum.

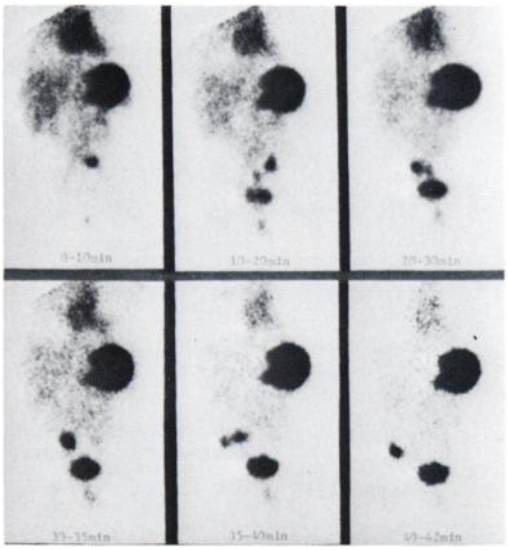

FIG. 1. Pertechnetate scintigrams in an 18-month-old male showing four discrete sites occupied by a Meckel's diverticulum that was subsequently confirmed at surgery. The images with two abnormal foci of activity resulted when the single abnormal focus in the diverticulum made a sudden transition from one site to another during the imaging period.

The interesting feature of this case was the prominent motion of the Meckel's diverticulum throughout the imaging procedure. Observation of the persistence scope during imaging helped to prevent confusion in the interpretation of the resulting images. As an image with a double exposure of the diverticulum activity was acquired, the first abnormal focus of activity suddenly stopped accumulating counts when the second abnormal focus appeared. These sudden transitions of the abnormal activity between four discrete sites in 42 min were thought to be most compatible with motion of a Meckel's diverticulum by intestinal peristalsis. In retrospect, shorter imaging times would have reduced the probability of double exposure of the Meckel's diverticulum without unduly reducing image quality.

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Rating of the Radiopharmaceuticals for Brain Imaging

In recent years, Haynie et al. (*1,2*) have compared the biologic behavior of a number of radiopharmaceuticals in an animal brain-tumor model, employing a rating system that they expounded in their first paper (*1*). Without undermining the importance of their well-planned, well-thought-out, and well-executed experiments, I wish to point out some of the shortcomings of this rating system. The authors are aware of some of the important shortcomings, such as the lack of tumor-to-bone ratios, which were therefore excluded from the rating system. My purpose is not to dwell on these, but to draw attention to those that are intrinsic in the rating system itself.

1. All of their measurements are quantitative, yet in their rating system, they have converted these quantitative observations into a qualitative rank order. As a result, one can only say, for example, that Agent A is better than B, but cannot specify how much better. It may be slightly better or it may be infinitely superior. In mathematical terms, an interval scale has been reduced to an ordinal scale (*3*) with the concomitant loss of the quantitativeness in the rating system.

2. Four of these qualitative parameters (grades for % administered dose/g, and tumor-to-brain, tumor-to-blood, and tumor-to-skin ratios) have been combined together with equal emphasis. Since, in two-dimensional scanning, one more or less sums the counts arising from different depths in an organ, more counts are contributed to a brain scan by the radioactivity present in the brain and blood than by the radioactivity present in the skin. Therefore, tumor-to-skin ratios should not be used with the same emphasis as the tumor-to-brain and tumor-to-blood ratios. Also, I am not sure whether the % administered dose/g belongs in this rating system at all. Since this parameter bears primarily on