SELECTIVE DISTRIBUTION OF CAVAL BLOOD

In their article "Selective distribution of caval blood within the lungs," El-Zayat and Razzak conclude that the distribution of ^{131}I-MAA in the lungs of a majority of recumbent subjects depends on whether the ^{131}I-MAA enters the heart via the superior or inferior vena cava (*1*). This is based on the idea that streamline flow may prevent complete mixing of the two blood streams even after passing through two chambers of the heart. The proof of this idea would be worthwhile, and El-Zayat and Razzak present an interesting experimental technique for doing so. However, an analysis of the data contained in their article (in their Table 1) does not support their conclusion.

It is true that the ratio of activity in the upper lobes to that in the lower lobes (UL/LL) of several patients appears to increase when the ^{131}I-MAA is injected via the superior vena cava rather than the inferior vena cava. In fact, the mean change of the ratio for all 20 subjects is +25%. But when the standard deviation of the changes about the mean is calculated by well-known methods, it is found to be ±53%. Thus, the +25% ±53% change is not significantly different from no change at all.

The ratio (UL/LL) varies among the subjects from 0.50 to 20.0. This is a very large variation for a normal population. Some of this variation might come from differences in detector placement which could yield improper ratios. It would be interesting to repeat this project with a gamma camera with areas of interest to avoid the positioning problem and to be sure of selecting a normal population of subjects.

In conclusion, the phenomenon of selective distribution of caval blood within the lungs may exist, but the article by El-Zayat and Razzak is inconclusive in establishing that fact.

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THE AUTHOR'S REPLY

We agree that the gamma camera would help in minimizing the positioning problems, but it cannot abolish the differences in the counting rate caused by the variations in the thickness of the lung tissue seen by the detector, nor that caused by differences in the thickness of the tissues interposed between the lung and the detector. This is why we had to rely on a ratio rather than the absolute counting rate. Furthermore, the test was repeated without the least change in patient position or detector placement, thus using the patient as his own control.

Regarding the type of subjects included, they were chosen after thorough examination to exclude any cardiac and/or pulmonary disease that might possibly affect the results obtained.

As stated in the paper, the existence of selective distribution of caval blood within the lungs appears to be supported by the results which showed a significant positive increase in the ratio of the counting rate in 65% of the 20 patients examined in the recumbent position. The mean for the increase in the ratio was calculated in these 13 cases and not in the whole group as suggested by Ehrhardt. Finally, an explanation was given for the results obtained in the remaining seven subjects and which differed from the rest of the group.

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CALL A SPADE A SPADE

While there is continuing debate on the accuracy, indications, and techniques of so-called "blood flow studies" of organs such as brain, kidneys, and liver, most workers in the field agree that these procedures have a definite value in the diagnostic workup of many patients. However, the battle about the proper name for these studies goes on. If they are called "flow studies", physiologically inclined scientists get very indignant and point out, correctly, that we are far from measuring blood flow in terms of milliliters per unit time per organ mass. If we speak about "scintiangiograms" or "radionuclide angiograms" our colleagues, the radiologic angiographers, get equally indignant and point out, again with full justification, that our crude images do not visualize individual blood vessels. In addition, if you use the

term "angiogram", your malpractice insurance premium may suddenly increase.

Why not avoid this dilemma by using a descriptive term which is not as open to criticism? I propose the term *"perfusion distribution study"*. This may not be very euphonious, but at least it calls a spade a spade and does not appropriate terminology used in other fields. If we in nuclear medicine agree on one suitable term and use it consistently, we may find it easier to communicate with our colleagues.

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TECHNETIUM-LABELED RED CELLS

In a recent publication, Korubin and coworkers reported on "The evaluation of technetium-labeled red cells for determination of red cell volume in man" (*1*).

The authors labeled two different aliquots of red blood cells (RBC) with ^{51}Cr-chromate (^{51}Cr) and ^{99m}Tc-pertechnetate (^{99m}Tc), respectively; a mixture of equal amounts of both aliquots was reinjected intravenously. In blood samples taken serially thereafter, the authors determined a constant ^{51}Cr specific activity (SA) of the RBCs; in contrast, the ^{99m}Tc SA of the RBCs decreased gradually. The authors concluded that gradual elution of ^{99m}Tc from RBC occurs in vivo.

This conclusion cannot necessarily be derived from the published data: Eckelman, et al (*2*) have shown that treatment of RBCs with tin chloride ($SnCl_2$) in high doses (0.5 mg $SnCl_2$/ml RBC) leads to their rapid splenic sequestration. Therefore, it seems possible that treatment of RBCs with low doses of $SnCl_2$, as used by Korubin, et al (*1*) during the ^{99m}Tc-labeling procedure might induce low-grade splenic sequestration of RBCs as well. The decreasing SA of ^{99m}Tc-labeled RBCs may then be due to such splenic sequestration of the $SnCl_2$-treated RBCs rather than in vivo elution of the red cell label.

Using a method almost identical to that of Korubin, et al (*1*), we (*3,4*) performed similar studies to evaluate the usefulness of ^{99m}Tc-labeled RBCs for the determination of the red cell volume in man. When we labeled two different aliquots of RBCs with ^{51}Cr and ^{99m}Tc, respectively, we obtained results very similar to those reported by Korubin, et al (*1*). To evaluate whether the decreasing SA of ^{99m}Tc-labeled RBCs in vivo is due to their splenic sequestration or to in vivo elution of the label, a second series of experiments were performed with RBCs labeled with ^{51}Cr and ^{99m}Tc simultaneously. After reinjection of these double labeled RBCs, we again found a decreasing ^{99m}Tc SA of the red cells while their ^{51}Cr SA remained constant. These results confirm that the dose of $SnCl_2$ used in our ^{99m}Tc-labeling procedure (0.01 mg/ml RBCs) does not induce splenic sequestration of ^{99m}Tc-labeled RBCs but that in vivo elution of ^{99m}Tc from RBCs is responsible for their decreasing SA.

We agree with Korubin and coworkers (*1*) that ^{99m}Tc is a useful RBC label to determine the red cell volume in man. Compared with radiochromium, it often may be advantageous, as it is readily available, can be used repeatedly in short intervals, represents a much lower radiation burden to the patient, and does not interfere with other ^{51}Cr studies often used in hematological examinations (e.g., platelet or white cell labeling studies).

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THE AUTHOR'S REPLY

I have read with interest the results of Drs. Lohrmann and Heimpel and am pleased to find that they have corroborated our findings as previously published in the *Journal of Nuclear Medicine*. I think their results and our continued experience with the use of ^{99m}Tc-labeled erythrocytes indicate that this is a very useful agent for the measurement of red cell mass in man and, because of the lower radiation