PROTOCOL FOR CAMERA DEADTIME MEASUREMENT

The prevailing unqualified use of the term "deadtime" is ambiguous. The term must be defined, and the values measured and applied for data correction in a manner consistent either with a paralyzable or with a nonparalyzable system. To clearly maintain this distinction, we use τ for the deadtime of a paralyzable system and T for that of a nonparalyzable one. In either system, deadtime varies with a number of factors which include counting rate, analyzer window width, scatter, and the presence or absence of a collimator. It may also vary slightly with source position. "Deadtime" may be considered a term of mathematical convenience for the correction of all sources of coincidence loss from an entire scintillation camera and data-processing system. The numerical values of deadtime may be considerably greater than indicated from oscilloscope wave forms.

We have developed a two-source method protocol for the measurement of deadtime (*1*). For mathematical convenience the system is treated as nonparalyzable (*2*). The protocol is rapid, accurate, and eliminates error from radioactive decay when employing short-lived sources such as ^{99m}Tc or ^{113}In.

On request, the authors will be pleased to provide a copy of this protocol.

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GEL CHROMATOGRAPHY AS AN ANALYTICAL TOOL FOR ^{99m}Tc RADIOPHARMACEUTICALS

It has been suggested by Eckelman, Meinken, and Richards that gel chromatography be used for the analysis of ^{99m}Tc-labeled compounds because of its ability to separate labeled proteins, chelates, pertechnetate, and hydrolyzed reduced technetium (*1*). In this article, they described the use of Sephadex G25 as a gel chromatographic medium for the analysis of a number of ^{99m}Tc-chelates. They detected three separate fractions, the pertechnetate fraction, the chelate fraction, and a fraction which was not eluted from the column which they referred to as "hydrolyzed reduced technetium". More recently, Valk, Dilts, and McRae (*2*) have shown that the results obtained from Sephadex G25 gel chromatography are sometimes inconsistent with the in vivo biological behavior of the preparation being tested. This they identified as an artifact of the gel chromatography and suggest that care must be taken in the interpretation of the results obtained from gel chromatography, especially when the radiopharmaceutical concerned is a weak chelate. Although this is a very good point and should be carefully noted by those endeavoring to analyze chelates of technetium, it should not cause them to neglect the very useful tool of gel chromatography.

Valk, Dilts, and McRae point out that Sephadex is a polymerized polysaccharide and, like other carbohydrates, will probably complex Tc(VII) which has been reduced with stannous ion. They suggest that the persistence of ^{99m}Tc on the Sephadex column when a weak Tc chelate is being eluted may be from an exchange of the ^{99m}Tc between the weak chelating agent and the Sephadex. This would seem to be a very likely explanation. If this is true, then the problem is with the Sephadex medium rather than with the technique of gel chromatography and fortunately there are alternative gel chromatography media available. One such alternative is Bio-Gel (marketed by Bio-Rad Laboratories) which is prepared from copolymerized acrylamide and methylene-bis-acrylamide. To check the validity of this explanation, Sephadex G25 and Bio-Gel P10 columns were run in conjunction with silica gel thin-layer chromatograms in saline and butyl acetate (*3*) on four different

TABLE 1. COMPARISON OF ANALYTICAL METHODS

	P10			G25			TLC		
Product	Chelate	Ionic	Bound to column	Chelate	Ionic	Bound to column	Chelate	Ionic	Hydrolysis reduced Tc
Tc-gluconate	98	0.4	0.6	37.4	2.6	60	98	1.2	0.8
Tc-glucoheptomate	99	0.6	0.4	66	1.3	33	99	0.6	0.3
Tc-pyrophosphate	95	0.6	4.3	22	—	78	97	0.4	2.7
Tc-DTPA	94	1.1	4.8	95	0	5	95	—	5

The above are averages of duplicate preparations.

^{99m}Tc-chelates. The chelates were ^{99m}Tc-gluconate prepared by electrolytic labeling, ^{99m}Tc-glucoheptonate prepared from a commercial freeze-dried kit which used stannous chloride as the reductant, ^{99m}Tc-pyrophosphate prepared by electrolytic labeling, and ^{99m}Tc-DTPA prepared by a modification of the procedure of Hauser, et al (*4*). The thin-layer chromatography provides a method of quantitating both the free pertechnetate using butyl acetate as the solvent and the "hydrolyzed reduced technetium" using normal saline as the solvent (*3*). These values may then be compared with those obtained from gel chromatography. The results obtained are shown in Table 1. It is apparent that whereas Bio-Gel retains the hydrolyzed reduced technetium, it does not retain any of the ^{99m}Tc which was originally associated with the radiopharmaceutical even if that radiopharmaceutical is a weak technetium chelate such as technetium gluconate. Thus, it can be seen that Bio-Gel does not exhibit the same artifact as Sephadex with weak technetium chelates.

However, it cannot be overemphasized that it is necessary to know what artifacts may be created by a given quality-control method in order that the suitability of that method for a particular radiopharmaceutical may be evaluated and misinterpretation of results avoided.

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"RADIOPHARMACEUTICAL SCIENTIST"

The term "radiopharmaceutical scientist" was prominently used in the recently held International Symposium on Radiopharmaceuticals in Atlanta, February 12–15, 1974. It is an awkward term, not in conformity with ordinary usage. By the word "scientist" is meant an individual learned in science or a scientific investigator; it is usually used when the individual's specialty or particular field of investigation is not specified. When the specialty is known, the individual is called by his specialty suffixed with an "-ist" such as chemist, internist, physicist, radiologist, etc. If the field of specialty does not lend itself to such an appendage, the word "specialist" is added instead, such as nuclear medicine specialist, etc. To qualify a general term "scientist" with a rather restrictive term "radiopharmaceutical" contradicts the accepted usage, is redundant, and should be avoided. Perhaps, in considering the realm of his function, the term "radiopharmaceuticist" or "radiopharmaceutic specialist" would appear to be more appropriate than "radiopharmaceutical scientist." One may even doubt that the new term is more descriptive and less ambiguous than such recognized terms "radiopharmaceutical chemist" and "radiopharmacist."

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