INSTANT ^{99m}Tc-DTPA

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A procedure for the preparation of a ^{99m}Tc-labeled chelate of diethylenetriaminepentaacetic acid (^{99m}Tc-Fe DTPA) has previously been reported by this Laboratory (*1*). Chemical and biological stability studies as well as clinical evaluation all indicate that the ^{99m}Tc-Fe DTPA chelate is superior to ^{99m}Tc-pertechnetate for brain scanning in addition to being useful for kidney studies (*2*).

During recent studies involving the labeling of red blood cells with ^{99m}Tc-Sn citrate (*3*), we found that stannous ion is generally applicable for labeling chelates with technetium. This information has resulted in a rapid efficient procedure for the preparation of ^{99m}Tc-labeled DTPA (instant ^{99m}Tc-DTPA). The advantage of the stannous method is that all nonradioactive components can be pre-mixed in a single vial before the technetium activity is added. No final pH adjustment, further chemical manipulation or purification steps are required.

The preparation of a stock solution for about 40 patients is as follows:

To 1 ml of $CaNa_3DTPA$ solution* (100 mg/ml):

1. Add 5 mg $SnCl_2 2H_2O$ and heat at 100°C under N_2 for 15 min.
2. Dilute to 18 ml with sterile H_2O.
3. Adjust pH to 4.0 with HCl.
4. Dilute to 20 ml with sterile H_2O.
5. Purge solution with N_2 for 15 min.
6. Filter solution through a sterile 0.22-micron filter into evacuated vials, 1 ml of solution per vial.

To prepare solutions of instant ^{99m}Tc-DTPA solution, add 3 ml of pertechnetate saline solution to 1 ml for stock DTPA solution and mix for 1 min. No purification is necessary because the chelate is formed in greater than 95% yield. Strict adherence to the procedure described must be maintained because of the strong tendency of the stannous ion to hydrolyze.

Injection of a 2 ml quantity per patient results in the administration of a 2.5 mg DTPA (4.4 μM) and 125 μg $SnCl_2 2H_2O$ (0.55 μM) per patient. This quantity contains less than 0.14% of the maximum daily dose of Na_3Ca DTPA (1.75 gm) that can be used for treatment of heavy metal poisoning (*4*). Published toxicology data (*5*) indicate that the acute toxicity of nonprecipitant stannous citrate by intravenous injection into rabbits is of the order of sodium citrate so that the tin salts as such are not acutely toxic.

Stability of the stock solution and the instant ^{99m}Tc-DTPA was determined. The stock solution was stable for at least 7 days as indicated by preparation of ^{99m}Tc-DTPA with less than 5% impurity. The instant ^{99m}Tc-DTPA was stable for at least 4 hr as indicated by less than 5% impurity. Stability studies were conducted using gel chromatography (Sephadex G25) and paper chromatography (Whatman 3MM in saline).

Mice distribution studies gave results similar to those for ^{99m}Tc-Fe DTPA mentioned earlier (*2*). Human studies now in progress will be reported in the near future.

The development of a simplified procedure for preparing ^{99m}Tc-DTPA should promote the use of this valuable brain and kidney scanning agent, especially in hospitals with limited nuclear medicine facilities. This procedure is also conducive to prepackaging in "kit form" by industrial manufacturers.

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REFERENCES

1. RICHARDS P, ATKINS H: ^{99m}Technetium labeled compounds. *Jap Nucl Med* 7: 165–170, 1968 and *Proc 7th Ann Meeting Japanese Soc Nucl Med, Japan, 1967*

2. HAUSER W, ATKINS H, NELSON KG, et al: Technetium-99m DTPA: a new radiopharmaceutical for brain and kidney scanning. *Radiology* 94: 679–684, 1970

3. ECKELMAN W, RICHARDS P, HAUSER W, et al: Technetium labeled red blood cells. *J Nucl Med,* in press.

4. CATSCH A: Zur Toxikologie der Diäthylentriaminpentaessig sävre, Naunyn-Schmiedebergs. *Arch S. Exper Path u Pharmakol* 246: 316–329, 1964

5. SOLLMANN T: *A Manual of Pharmacology,* W. B. Saunders Co., Philadelphia, 1964, p. 1310

* Available from the Div. of Biology and Medicine, U.S. Atomic Energy Commission, Washington, D.C.

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