Stannous PYP Kit for the preparation of Technetium Tc-99m Pyrophosphate Injection

Product Package Insert

Calgary Radiopharmaceutical Centre
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Canada

NAME

Stannous PYP Kit
Technetium Tc-99m Pyrophosphate Injection

PHARMACOLOGICAL CLASSIFICATION

Radiodiagnostic agent

DESCRIPTION

Stannous PYP Kit is supplied as a frozen solution.

Each vial of Stannous PYP Kit contains 20 mg of pyrophosphate and 3.4 mg of stannous chloride dihydrate in 1.0 mL.

When reconstituted with Technetium Tc-99m sodium pertechnetate in saline, each mL of Technetium Tc-99m Pyrophosphate Injection contains a complex composed of:

Technetium Tc-99m	0.8-2.0	GBq
Sodium Pyrophosphate	4.0-10.0	mg
Stannous chloride dihydrate	0.68-1.7	mg
L-ascorbic acid	0.4-1.0	mg
Sodium chloride	0.9	%

The addition of Technetium Tc-99m sodium pertechnetate in sterile saline provides Technetium Tc-99m Pyrophosphate Injection as a sterile, non-pyrogenic solution for intravenous administration.

ACTION

When administered intravenously, up to 50% of Technetium Tc-99m Pyrophosphate localizes onto osteogenic surfaces within 1 to 3 hours. Osseous uptake appears to be due to an affinity for hydroxyapatite crystals in bone. Technetium Tc-99m Pyrophosphate also concentrates in infarcted myocardium, primarily in areas where irreversible damage has occurred.

Stannous PYP has an affinity for red blood cells. When injected 20 minutes prior to Technetium Tc-99m pertechnetate, greater than 80% of the activity remains in the blood pool. Therefore, Stannous PYP Kit is useful for gated cardiac blood pool imaging.

INDICATIONS

Technetium Tc-99m Pyrophosphate Injection is indicated for diagnostic skeletal imaging and as an adjunct in the diagnosis of acute myocardial infarction. Stannous PYP Kit is useful as a blood pool imaging agent for gated cardiac blood pool imaging.

CONTRAINDICATIONS

Hypersensitivity to this agent.

WARNINGS

As with any radiopharmaceutical, this product should not be administered to pregnant patients unless the potential benefit outweighs the possible risks. Ideally, examinations using radiopharmaceuticals, especially those elective in nature, of a woman of childbearing capability should be performed during the first few (10) days following menses. Nursing mothers should substitute formula feeding for 48 hours since Technetium Tc-99m Pyrophosphate Injection may be excreted in the milk.

This class of compound is known to complex cations such as calcium. Care should be exercised when administering this product to patients with significant hypocalcemia.

This product should only be used by qualified physicians who have been licenced by the appropriate agency to use and administer radiopharmaceuticals.

The contents of the kit are not radioactive. However, after Technetium Tc-99m sodium pertechnetate is added, adequate shielding of the final preparation must be maintained.

False-positive or false-negative brain scans have been reported when Technetium Tc-99m sodium pertechnetate was administered after a bone scan using Stannous PYP Kit. Therefore, when both a brain and bone scan are indicated, the brain scan should be performed first.

Blood pool scans may be impaired in those patients receiving anticoagulant therapy with sodium heparin.

PRECAUTIONS

The contents of the vial are sterile and non-pyrogenic. It is essential for the user to employ aseptic procedures during reconstitution and withdrawals for administration.

Adequate shielding must be maintained to minimize radiation exposure to personnel and patients.

Since Technetium Tc-99m Pyrophosphate Injection does not contain a bacteriostatic agent and to maintain radiochemical stability, storage at 4°C is advised. Do not freeze.

To minimize radiation dose to the bladder, patients should be encouraged to drink fluids and to void as often as possible for 4 to 6 hours after the injection. Excess fluid may be contraindicated, depending on the patient's cardiac status.

ADVERSE REACTIONS

Adverse reactions have not been noted with Stannous PYP Kit or Technetium Tc-99m Pyrophosphate Injection.

PHYSICAL CHARACTERISTICS

Technetium Tc-99m decays by isomeric transition with a physical half-life of 6.02 hours. The principal photon useful for imaging studies is:

Radiation	Gamma-2
Mean % for disintegration	89.07
Mean energy (keV)	140.5

EXTERNAL RADIATION

The specific gamma ray constant for Technetium Tc-99m is 5.4 microcoulombs/kg MBq h (0.78 R/mCi-h) at 1 cm. The first half value layer of lead is 0.017 cm. To facilitate control of the radiation exposure from MBq amounts of this radionuclide, the use of a

0.25 cm thickness of lead will attenuate the radiation emitted by a factor of about 1000.

DOSAGE AND ADMINISTRATION

The suggested intravenous doses of Technetium Tc-99m Pyrophosphate Injection are based on the weight of an average adult (70 kg):

Bone Imaging: 740 MBq; optimal imaging at 3 to 4 hours post-injection.

Myocardial Imaging: 740 MBq; optimal imaging at 3 to 5 hours post-injection.

Blood Pool Imaging: The optimal dose of stannous ion for blood pool imaging ranges from 10 to 20 μg per kg body weight (1). Each 1 mL of Stannous PYP Kit provides 1.79 mg stannous ion. Table I provides the volume of Stannous PYP Kit required to deliver the ideal concentration of stannous ion for various body weights.

Table I

Weight of Patient (kg)	Volume of Stannous PYP Kit required to deliver concentration of stannous ion listed below	
	10 μg/kg	**20 μg/kg**
5	0.03	0.06
10	0.06	0.11
15	0.08	0.17
20	0.11	0.22
25	0.14	0.28
30	0.17	0.33
35	0.20	0.39
40	0.22	0.45
45	0.25	0.5
50	0.28	0.56
60	0.34	0.67
70	0.39	0.78
80	0.45	0.89
90	0.5	1.0
100	0.56	-

In Vivo: Tin patient's blood by injecting 0.4 mL (for 70 kg body weight) of Stannous PYP Kit. After a period of 20 to 30 minutes, inject 740 to 1000 MBq of Technetium Tc-99m sodium pertechnetate.

In Vivo/In Vitro: Tin blood as above. After 20 to 30 minutes, withdraw blood into a syringe containing 1 mL ACD solution (total volume 10 mL). Add 740 to 1000 MBq Technetium Tc-99m sodium pertechnetate to blood and mix by gentle inversion of syringe. Incubate blood 10 to 20 minutes. Reinject labelled blood.

Optimal imaging for either method is immediately after injection for first pass studies; 5 minutes post-injection for blood pool imaging.

RADIATION DOSIMETRY

The estimated absorbed doses to an average person (70 kg) from an intravenous injection of 740 MBq of Technetium Tc-99m Pyrophosphate Injection are listed below (2):

Bone and Cardiac Imaging

ORGAN		mGy/740 MBq
Total Body		1.7
Skeleton		7.9
Bone Marrow		5.6
Kidneys		2.8
Bladder	2 hour void	19
	4.8 hour void	46
Ovaries	2 hour void	1.9
	4.8 hour void	3.1
Testes	2 hour void	2.0
	4.8 hour void	3.1

Blood Pool Imaging

Total Body	3.2
Heart	7.9
Bladder	24
Ovaries	3.7
Testes	2.7

DIRECTIONS FOR PREPARATION

1. Remove one Stannous PYP Kit from the freezer and allow to thaw. Check for clarity and absence of particulate matter.
2. Aseptically add 1 to 4 mL of a solution of Technetium Tc-99m sodium pertechnetate in 0.9% Saline for Injection USP to the kit and mix. The maximum recommended activity is 4.0 GBq.
3. Measure radioactivity content in a dose calibrator. Complete documentation and affix label to shielded container.
4. Radiochemical purity must be checked prior to patient administration.

QUALITY CONTROL

Instant thin layer chromatography is used to determine the levels of Technetium Tc-99m sodium pertechnetate and Technetium Tc-99m colloidal impurities in the product.

Technetium Tc-99m colloid impurity

1. Approximately 1 cm from the bottom of a 1 x 7 cm strip of Gelman ITLC-SG chromatography paper, spot a small drop of product, using a 1 mL syringe with a 25 g needle.
2. Develop strip with 0.9% sodium chloride. Allow solvent to run to within 1 cm of the top of the strip.
3. Cut strip into 2 equal pieces between the origin and solvent front. Measure the radioactivity contained in each segment using a suitable detector. Technetium Tc-99m Pyrophosphate and Technetium Tc-99m sodium pertechnetate will migrate to the solvent front; Technetium Tc-99m colloid will remain at the origin.
4. Calculate the percent Technetium Tc-99m colloidal impurity using the formula:

$$\frac{\text{total counts at origin}}{\text{total counts in all segments}} \times 100$$

Technetium Tc-99m sodium pertechnetate impurity

1. Approximately 1 cm from the bottom of a 1 x 7 cm strip of Gelman ITLC-SG chromatography paper, spot a small drop of product, using a 1 mL syringe with a 25 g needle.
2. Develop strip with methyl ethyl ketone. Allow solvent to run to within 1 cm of the top of the strip.
3. Cut strip into 2 equal pieces between the origin and solvent front. Measure the radioactivity contained in each segment using a suitable detector. Technetium Tc-99m sodium pertechnetate will migrate to the solvent front; Technetium Tc-99m Pyrophosphate and Technetium Tc-99m colloid will remain at the origin.
4. Calculate the percent Technetium Tc-99m sodium pertechnetate impurity using the formula:

$$\frac{\text{total counts at solvent front}}{\text{total count in all segments}} \times 100$$

Calculate the percent purity of the product as follows:

Purity = 100 - (% Tc-99m sodium pertechnetate impurity + % Tc-99m colloidal impurity).

Do not use the product if the purity is less than 90%.

STORAGE CONDITIONS

Stannous PYP Kits are kept frozen at -10°C. Technetium Tc-99m Pyrophosphate Injection is stored at 4°C.

EXPIRY

Technetium Tc-99m Pyrophosphate Injection expires 12 hours from preparation.

REFERENCES

1. Saha GB. Fundamentals of Nuclear Pharmacy, 4th ed. New York: Springer-Verlag New York Inc. 1998: 118.
2. Pyrolite Package Insert, NEN Medical Products, February 1983.

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