衛署藥製字第 R00023 號

特洛鎝造影劑
GMS TRODAT-1 KIT

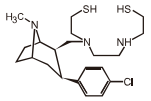
用以製備Technetium Tc-99m TRODAT-1 注射劑

性狀、成份

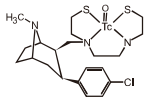
特洛鎝造影劑為一無菌核子醫學藥劑配方，每一凍晶小瓶內含：

TRODAT-1•3HCl	126 微克
Sodium glucoheptonate	320 微克
Disodium ethylenediaminetetraacetate dihydrate	930 微克
Stannous chloride dihydrate	32 微克
Mannitol	20 毫克
Anhydrous sodium phosphate dibasic	4.1 毫克
Sodium phosphate monobasic	460 微克

本品以氮氣封存，不含抗菌劑，使用前須依照調劑步驟，加入鎝-99m孳生器無菌淘洗液調劑，以製備靜脈注射用鎝-99m-TRODAT-1。調劑後之注射液酸鹼值為6.5～8.5。本品未經調劑或加入鎝-99m淘洗液以外之其他溶劑者，均不得用為造影注射劑。



TRODAT-1



Tc-TRODAT-1

適應症

對紋狀體區突觸前神經末梢處之多巴胺轉運體之標示顯影劑

類別

本藥限由醫師使用

調劑時必備器材

小瓶輻射防護用鉛容器、5毫升無菌注射針筒、無菌0.9%氯化鈉注射液(生理鹽水注射液)、取瓶用夾鉗或鑷子、75%藥用酒精、高壓蒸氣滅菌器或水浴槽。

調劑步驟

為確保調劑造影注射劑品質，請務必以無菌操作進行調劑。

1.取一瓶特洛鎝造影劑，剝除塑膠護蓋，置於適當大小之鉛容器內，瓶蓋橡膠部分以75%藥用酒精擦拭。

2.使用一支10毫升無菌注射針筒，抽取5毫升含約1480 MBq (40 mCi)之鎝-99m過鎝酸鈉之生理鹽水注射液(詳見注意事項)注入特洛鎝造影劑小瓶；抽出針筒前，先抽除約5毫升之瓶內氣體，以平衡瓶內壓力。

3.搖動鉛容器約10秒，使小瓶內容物完全溶解。

4.於鉛屏蔽下以下列方式擇一進行加熱：

(1)滅菌鍋加熱法：置於高壓蒸氣滅菌器中，以121°C加熱30分鐘。

(2)水浴槽加熱法：置於100°C沸水之水浴槽中(確保小瓶整瓶於沸水中)，加熱60分鐘(若使用乾式加熱器需確保溫度>100°C，且小瓶與加熱器緊密接觸)。

5.取出冷卻至室溫，測量小瓶放射活度。

注意事項

1.請使用淘洗後未超過6小時之鎝-99m過鎝酸鈉溶液調劑。

2.此鎝-99m孳生器淘洗距前一次淘洗時間請勿超過24小時。

3.所使用之鎝-99m孳生器淘洗液必須符合藥典鎝-99m過鎝酸鈉注射液之規範。

4.所使用的鎝-99m孳生器淘洗液放射濃度為每毫升222～296 MBq (6～8 mCi)，調劑總活度請勿超過1628 MBq (44 mCi)，必要時得以不含添加劑之生理鹽水注射液先行稀釋。

5.所使用的鎝-99m過鎝酸鈉溶液不得含有氧化劑，以免影響標幟效率。

6.建議醫生以圈選ROI計算S/O(striatal/occipital) uptake ratio進行造影判讀，或以「視力量表分析」作為輔助參考，並搭配神經科醫師的臨床觀察，可增加診斷之準確性。

放射化學純度分析方法

使用薄層層析法(TLC)分析。

1.每一待測檢品使用兩片iTLC-SG薄片，每片切成1.5 X 13 cm。

2.準備兩種移動相：

(1)系統一：生理食鹽水(0.9% NaCl水溶液)

(2)系統二：先以丙酮(acetone)展開，薄片風乾後再以生理食鹽水展開

3.準備兩個展開槽，分別倒入1公分高之生理食鹽水及丙酮，蓋上展開槽蓋，使展開槽中充滿溶劑蒸氣。

4.取樣3～10微升的待測檢品，在距薄片下緣2公分、薄片中央處點上檢品，樣本點儘可能集中於小圓。

5.薄片分別置於上述兩系統中展開。

6.當液鋒(Solvent front)展開至12公分處，取出薄片風乾，以適合之分析儀分析。

7.鎝-99m-TRODAT-1的放射化學純度(RCP)可由下列計算而得：

RCP(%) = 100 – [系統一液鋒(Solvent front)之放射活性分布百分比 + 系統二原點(Origin)之放射活度分布百分比]

8.放射化學純度應≥90%。

用法用量

造影開始前4小時靜脈注射，成人(以70公斤計)注射劑量為814～1036 MBq (22～28 mCi)。

配伍禁忌

無

副作用

鎝-99m-TRODAT-1偶爾會引起眩暈、背痛、高血壓、感覺異常。

警語

1.本品內容物不具放射性，但加入鎝-99m過鎝酸鈉溶液完成調劑之造影注射劑具放射性，使用及處理應遵守游離輻射防護相關法規，注意輻射安全，並以適當屏蔽容器盛裝。

2.本品未加入鎝-99m過鎝酸鈉溶液調劑前，不可直接使用於病患。

3.調劑後超過4小時之造影注射劑請勿使用。

4.完成造影後6小時內，請病患盡量多喝水及排尿、排便，以降低體內輻射劑量。

5.孕婦：鎝-99m-TRODAT-1並沒有進行動物的生殖毒性研究報告。對於鎝-99m-TRODAT-1是否會導致生殖傷害並不清楚，對於孕婦必須確認是必須施用，否則孕婦不應使用鎝-99m-TRODAT-1。

6.哺乳婦女：鎝-99m-TRODAT-1在哺乳時會經由乳汁分泌，因此須以嬰兒配方奶（Formula feedings）來取代母乳。

輻射劑量分佈

對於約70公斤之成人給予靜脈注射鎝-99m-TRODAT-1 後預估之體內輻射劑量分佈如下表1所示。

表1-鎝-99m-TRODAT-1於各器官之輻射劑量分布

器官	mGy / MBq	rad / mCi
肝臟	0.047	0.173
腎臟	0.035	0.131
大腸前段壁	0.028	0.104
脾臟	0.023	0.085
膀胱壁	0.020	0.074
大腸後段壁	0.018	0.067
膽囊壁	0.016	0.060
小腸	0.016	0.058
心臟壁	0.015	0.057
肺臟	0.015	0.055
甲狀腺	0.012	0.046
腎上腺	0.010	0.037
胰腺	0.010	0.037
卵巢	0.008	0.029
子宮	0.007	0.024
胃	0.006	0.023
骨表面	0.005	0.019
乳房	0.005	0.019
全身	0.005	0.019
紅骨髓	0.004	0.014
肌肉	0.003	0.012
胸腺	0.003	0.011
腦	0.002	0.008
皮膚	0.001	0.005
睪丸	0.001	0.004
有效等效劑量	0.015	0.055
有效劑量	0.012	0.046

輻射曝露與屏蔽

鎝-99m之特定特定伽馬射線常數在1公分處為5.4 micro-coulombs/ Kg-MBq-hr (0.78 R/ mCi-hr)。對於鉛的第一半值層厚度為0.017公分。表2列出不同厚度的鉛所造成之輻射衰減係數。

表2-鉛屏蔽對鎝-99m之輻射衰減係數

鉛厚度 cm	輻射衰減係數
0.017	0.5
0.08	0.1
0.16	0.01
0.25	0.001
0.33	0.0001

儲存方法

本品請於30°C以下避光儲存。調劑後之注射液請在室溫下存放，並在4小時內使用。

包裝

每盒5瓶或30瓶裝

仿單版次

8.0

印製日期

2019年9月

GMS Global Medical Solutions Taiwan

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MT5903

GMS TRODAT-1 KIT

For the Preparation of

Technetium Tc-99m TRODAT-1 for Injection

DESCRIPTION

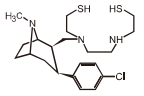
The kit consists of reaction vials which contain the sterile, nonpyrogenic, non-radioactive ingredients necessary to produce Technetium Tc-99m TRODAT-1 for diagnostic use by intravenous injection.

Each 10 mL reaction vial contains:

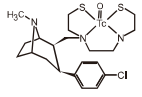
TRODAT-1•3HCl	0.126 mg
Sodium glucoheptonate	0.32 mg
Disodium ethylenediaminetetraacetate dihydrate	0.93 mg
Stannous chloride dihydrate	0.032 mg
Mannitol	20 mg
Anhydrous sodium phosphate dibasic	4.1 mg
Sodium phosphate monobasic	0.46 mg

The contents are in a lyophilized form under an atmosphere of nitrogen. No bacteriostatic preservative is present.

Technetium Tc-99m TRODAT-1 for Injection is in its final dosage form when sterile sodium pertechnetate Tc-99m solution is added to each vial. The pH of the reconstructed product is 6.5-8.5. No less than 90% of the sodium pertechnetate Tc-99m added to a reaction vial is bound to TRODAT-1 at preparation time and remains bound throughout the 4 hour lifetime of the preparation.



TRODAT-1



Tc-TRODAT-1

NOTE

The reaction vial should not be reconstituted with any solvent other than sodium pertechnetate Tc-99m injection.

INSTRUMENTS FOR PREPARATION OF Technetium Tc-99m TRODAT-1

A suitable lead vial shield, 5 ml sterile syringe with needle, 0.9% sterile sodium chloride injection, 75% alcohol, and autoclave or water bath.

INSTRUCTIONS FOR PREPARATION OF Technetium Tc-99m TRODAT-1

Use aseptic procedures throughout and take precautions to minimize exposure by use of suitable shielding. Waterproof gloves should be worn during the preparation procedure.

To prepare Technetium Tc-99m TRODAT-1 for Injection:

1. Remove the protective plastic disc from a reaction vial and swab the rubber septum with either an alcohol swab or a suitable bacteriostatic agent to sanitize the surface.
2. Place the vial in a suitable lead vial shield.
3. Using a shielded syringe, obtain 5 ml of a sterile sodium pertechnetate Tc-99m injection with radioactivity of 1480 MBq (40 mCi). Add the sodium pertechnetate Tc-99m injection to the reaction vial aseptically. Remove an equal volume of headspace to maintain atmospheric pressure within the vial before withdrawing the syringe.
4. Swirl the contents of the vial for 10 seconds.
5. Heat the contents of the vial by using one of the methods listed below:
   (1) Autoclaving: heat the vial in an autoclave at 121°C for 30 minutes.
   (2) Boiling method: place the vial in a boiling water bath (ensure ot immerse the vial in water) for 60 minutes. if a dry bath/ black is used, ensure the block retains the temperature above 100°C and the close contact of vial-to-block walls.
6. Remove the vial from the autoclave or water bath and cool to room temperature.
7. Assay the product in a suitable calibrator.

NOTE

1. **Sodium pertechnetate Tc-99m injection is used no later than 6 hours from the time of generator elution.**
2. **The ^{99}Mo/^{99m}Tc generator should be eluted within 24 hours from the previous elution.**
3. **The sodium pertechnetate Tc-99m injection used in the reconstitution of the reaction vial should be in compliance with the Pharmacopoeia.**
4. **The specific activity of sodium pertechnetate Tc-99m injection used in the preparation of Technetium Tc-99m TRODAT-1 for Injection is 222-296 MBq/mL (6-8 mCi/mL). Total radioactivity should not exceed 1628 MBq (44 mCi). The sodium pertechnetate Tc-99m injection can be diluted with a sterile preservative-free saline.**
5. **Oxidant-free sodium pertechnetate Tc-99m injection is used; otherwiselabeling efficiency will be adversely affected.**
6. **To increase the accuracy of diagnosis, it is recommended to evaluate theSPECT imaging with striatal/occipital uptake ratio, combining brain images score by ordinal scale or clinical observations.**

DETERMINATION OF RADIOCHEMICAL PURITY (RCP) IN PRPERATION

1. Obtain two plastic iTLC-SG plates, pre-cut to 15 mm × 130 mm.
2. Prepare two types of mobile phase: (1) 0.9% sodium chloride solution and (2) acetone. Pour adequate amount of each mobile phase into two distinct developing tanks, respectively, to a depth of <2 cm. Cover the tank and let the solvent equilibrate for 10 minutes.
3. Apply one drop of Technetium Tc-99m TRODAT-1 at the center of the place 2 cm from the bottom of each plate.
   - **System 1:** develop the plate with 0.9% sodium chloride solution in thecovered TLC tank for a distance of 12 cm from the bottom of the plate.
   - **System 2:** develop the plate with acetone in the covered TLC tank for adistance of 12 cm from the bottom ofthe plate. After drying, develop the plate again with 0.9% sodium chloride solution.
4. Measure the distribution of Tc-99m activity by an appropriate radiation detector.
5. Calculate the %RCP of Technetium Tc-99m TRODAT-1 as: %RCP of Technetium Tc-99m TRODAT-1 = 100 - [(% radioactivity in the SOLVENT FRONT of System 1) + (% radioactivity in the ORIGIN of System 2)]
6. Radiochemical purity sholud not be less than 90%.

DOSAGE AND ADMINISTRATION

The recommended dose range for intravenous administration of Technetium Tc-99m TRODAT-1 for a 70 kg patient is 814-1036 MBq (22-28 mCi). SPECT imaging should be performed 4 hours post-administration.

CONTRAINDICATIONS

None known.

ADVERSE REACTIONS

Dizziness, back pain, hypertension and paresthesia have been reported occasionally.

PRECAUTIONS

1. **Contents of the reaction vial before preparation are nonradioactive. However, after the sodium pertechnetate Tc-99m injection is added, adequate shielding must be maintained.**
2. **Contents of the reaction vial are intended only for use in the preparation of Technetium Tc-99m TRODAT-1 and are not to be administered directly to the patient without reconstruction.**
3. **Technetium Tc-99m TRODAT-1 should not be used more than 4 hours after preparation.**
4. **To minimize radiation dose to the bladder and other target organs, the patient is encouraged to drink fluids and to void frequently during the 6 hours after injection.**
5. **Pregnancy: Animal reproduction studies have not been conducted with Technetium Tc-99m TRODAT-1. It is also not known whether this drug can cause fetal harm when administered to a pregnant woman or can affect reproduction capacity. Therefore, Technetium Tc-99m TRODAT-1 should be administered to a pregnant woman unless the potential benefit justifies the potential risk to the fetus.**
6. **Nursing Mothers: Technetium Tc-99m TRODAT-1 can be excreted in human milk. Therefore, formula feedings should be substituted for breast-feeding.**

Radiation Dosimetry

The estimated human absorbed radiation doses to an adult (70 kg) from intravenous administration of Tc-99m TRODAT-1 are shown in Table 1.

Table 1-Estimated Absorbed Radiation Doses After Intravenous Administration of Technetium-99m TRODAT-1

Organ	mGy / MBq	rad / mCi
Liver	0.047	0.173
Kidneys	0.035	0.131
ULI wall	0.028	0.104
Spleen	0.023	0.085
Urinary bladder wall	0.020	0.074
LLI wall	0.018	0.067
Gallbladder wall	0.016	0.060
Small intestine	0.016	0.058
Heart wall	0.015	0.057
Lungs	0.015	0.055
Thyroid	0.012	0.046
Adrenals	0.010	0.037
Pancreas	0.010	0.037
Ovaries	0.008	0.029
Uterus	0.007	0.024
Stomach	0.006	0.023
Bone surfaces	0.005	0.019
Breasts	0.005	0.019
Total body	0.005	0.019
Red marrow	0.004	0.014
Muscle	0.003	0.012
Thymus	0.003	0.011
Brain	0.002	0.008
Skin	0.001	0.005
Testes	0.001	0.004
EDE	0.015	0.055
Effective dose	0.012	0.046

ULI= upper large intestine; LLI= lower large intestine; EDE= effective dose

External Radiation

The specific gamma ray constant for Technetium Tc 99m is 5.4 micro-coulombs/Kg-MBq-hr (0.78 R/mCi-hr) at 1cm. The first half-value thickness is 0.017cm of lead (Pb). A range of values for the relative attenuation of the radiation emitted by this radionuclide that results from interposition of various thicknesses of lead is shown in Table 2.

Table 2-Radiation Attenuation of Tc-99m by Lead Shielding

Shield Thickness lead (Pb) cm	Coefficient of Attenuation
0.017	0.5
0.08	0.1
0.16	0.01
0.25	0.001
0.33	0.0001

STORAGE

Store the unreconstructed reaction vials below 30°C and protect from light. After labeling with Technetium Tc-99m, store the solution at room temperature in a suitable lead shield, and discard after 4 hours.

PACKAGE

5 or 30 vials pack

Version

8.0

Printed date

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