U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 030-01391/90001(DRSS)

Docket No. 030-01391

License No. 12-01087-07 Category G 1 Priority 1

Licensee: V.A. Edward Hines, Jr., Medical Center (Hines)
Hines, IL 60141

Special Inspection Conducted On: February 7, 1990

Inspector: W. P. Reichhold
W. P. Reichhold

1 MARCH 1990
Date

Approved By: George W. McCann for
D. J. Sreniawski, Chief
Nuclear Materials Safety
Section 1

March 3, 1990
Date

Inspection Summary

Inspection on February 7, 1990 (Report No. 030-01391/90001(DRSS))
Areas Inspected: This special, announced inspection was performed in response to a diagnostic misadministration of iodine-131 hippuran. The inspection included a review of the circumstances surrounding the misadministration, and a review of the corrective actions Hines is taking to prevent a similar misadministration.
Results: No violations were found.

DETAILS

1. Persons Contacted

*John R. Fears, Chief Executive Officer
*Lawrence Case, Radiation Safety Officer
Gary Eastman, Chief Nuclear Medicine Technologist
Lisa Urano, Staff Nuclear Medicine Technologist

*Indicates the individuals present at the exit meeting on February 7, 1990.

2. Purpose of Inspection

This was a special inspection performed to review the circumstances surrounding a diagnostic misadministration of iodine-131 hippuran. Hines reported the misadministration to the NRC Region III office on February 1, 1990. The inspection included a review of the circumstances surrounding the misadministration and the corrective actions Hines is taking to prevent a similar misadministration.

3. Incident: On February 1, 1990, a nuclear medicine technologist was preparing a dose of thallium-201 for a patient's heart scan.

Hines receives their thallium-201 in multi-dose vials in a white shielded container. Hines receives their iodine-131 hippuran in a multi-dose vial that also has a white shielded container. On the day of the incident, thallium-201 and iodine-131 hippuran, both in white shielded containers, were in the dose preparation area. Both containers were labeled correctly. The technologist needed a volume of 2.5 milliliters of thallium-201 to obtain the prescribed dose (3.5 millicuries) needed to do a heart scan.

The technologist was not able to withdraw the total volume of thallium-201 due to insufficient quantity. The technologist assumed that the second white container was also thallium-201, but it contained iodine-131 hippuran. The technologist withdrew the remaining volume from the iodine-131 hippuran container by mistake. The patient was given a mixture of thallium-201 and iodine-131 hippuran. The technologist found the error because the image of the patient's heart was not clear. Iodine-131 hippuran can contain 3% free iodine. The patient was given potassium iodide to reduce the radioactive iodine uptake by the thyroid. Hines estimated that the patient's thyroid dose was 14 rads. This dose is about the same thyroid dose a patient would receive from a diagnostic renal function scan using iodine-131 hippuran (see attached product data). The patient's heart scan was successfully completed later that day.

Conclusion: No NRC requirements were violated. Hines reported the misadministration to Region III by telephone on February 1, 1990. Hines submitted a written report on the misadministration within 15 days as required by NRC regulations (see attached). Hines' actions to prevent a similar misadministration is outlined in their letter dated February 7, 1990 (copy attached).

Attachment: Ltr dtd 2/7/90,
VA Hines to NRC

Attachment

Edward Hines, Jr.
Hospital

Veterans
Administration

February 7, 1990

Chief, Material Safety and Safeguards Section
U.S N.R C.
799 Roosevelt Road
Building 4
Glen Ellyn, IL 60137

Dear Sir:

Subject: Compliance with 10 CFR Part 35.33 (C)

On February 1, 1990, a misadministration occurred at this facility in which a patient received an estimated dose to the thyroid gland of approximately 14 rads. This exceeds your regulation which states: "... an organ dose greater than 2 rem ..."

The circumstances involving the details which caused the occurrence are described in the following attachments. Your required form NRC 473 is also attached. We refer you also to conversations between members of our staff which transpired on February 7, 1990 with your Mr. Bill Reichhold.

If you require information other than the enclosed, please contact our Hospital Radiation Safety Officer, Mr. Lawrence Case at (708) 343-7200 Ext. 1955.

Sincerely yours,

John R. Fears
Director

Attachments

cc: DM&S Regional Director's Safety Staff (138S17)

FEB 13 1990

"America is #1—Thanks to our Veterans"

NRC FORM 473
(6-87)
10 CFR § 35.33

U.S. NUCLEAR REGULATORY COMMISSION
Approved by OMB
3150-0170
Expires 6/31/88

DIAGNOSTIC MISADMINISTRATION REPORT

(N1) LICENSEE NAME: EDWARD HINES JR. HOSPITAL

(N2) LICENSE NUMBER: 1121-10110817-107

(N3) CITY: HINES

(N4) STATE: IL

(N5) EVENT DATE			(N6) REPORT DATE		
MONTH	DAY	YEAR	MONTH	DAY	YEAR
10	2	90	10	11	90

(N7) TYPE OF MISADMINISTRATION
- [ ] (01) WRONG RADIOPHARMACEUTICAL
- [ ] (02) DOSAGE DIFFERING FROM PRESCRIBED BY 50%
- [ ] (03) WRONG PATIENT
- [ ] (04) WRONG ROUTE

(N8) DID THE MISADMINISTRATION INVOLVE AN ISOTOPE OF IODINE
- [x] (999) YES
- [ ] (111) NO

(N9) NUMBER OF PATIENTS WHO RECEIVED A MISADMINISTRATION UNDER THIS REPORT: 1

(N10) INTENDED		(N10A) INTENDED				(N11) GIVEN			
		MILLICURIES	ISOTOPE	CHEMICAL FORM	STUDY	MILLICURIES	ISOTOPE	CHEMICAL FORM	STUDY
[ ] (05) NO CLINICAL PROCEDURE	[ ] (08) ULTRASOUND STUDY								
[x] (06) NUCLEAR MEDICINE STUDY (Complete (N10A) INTENDED and (N11) GIVEN)	[ ] (09) CT STUDY	3.5	TL201	CHLORIDE	CARDIAC THALLIUM	3.0	TL201	CHLORIDE	CARDIAC THALLIUM
	[ ] (10) NMR STUDY					.776	I131	HIPPURAN	
[ ] (07) X RAY STUDY	[ ] (11) OTHER								

(N12) PRECIPITATOR
- [ ] (71) REFERRING PHYSICIAN
- [ ] (72) WARD NURSE
- [ ] (73) WARD CLERK
- [ ] (74) NUCLEAR PHARMACY
  - NAME OF NUCLEAR PHARMACY | CITY | STATE
- [ ] (76) HOT LAB TECHNOLOGIST
- [x] (77) IMAGING TECHNOLOGIST
- [ ] (78) CLINIC RECEPTIONIST
- [ ] (79) SCHEDULING TECHNOLOGIST
- [ ] (80) PATIENT
- [ ] (81) OTHER

(N13) ERROR

HOT LAB		REFERRAL	ADMINISTRATION	OTHER
[ ] (11) MISLABELED A SYRINGE	[x] (15) SELECTED WRONG VIAL WHEN DRAWING DOSAGE	[ ] (20) MISUNDERSTOOD REFERRING PHYSICIAN'S REQUEST	[ ] (30) SELECTED WRONG PATIENT	[ ] (40) OTHER
[ ] (12) MISLABELED A VIAL OR VIAL SHIELD	[ ] (16) SET DOSE CALIBRATOR IMPROPERLY	[ ] (21) REQUESTED WRONG STUDY	[ ] (31) ANSWERED WAITING ROOM PAGE INTENDED FOR OTHER PATIENT	
[ ] (13) RECONSTITUTED WRONG REAGENT KIT	[ ] (17) MISREAD DOSE CALIBRATOR	[ ] (22) REQUESTED STUDY FOR WRONG PATIENT	[ ] (32) BROUGHT WRONG PATIENT TO CLINIC	
[ ] (14) PLACED RECONSTITUTED VIAL IN WRONG SHIELD	[ ] (18) MISUNDERSTOOD RADIOPHARMACEUTICAL OR DOSAGE ORDER		[ ] (33) SELECTED WRONG SYRINGE FROM DOSAGE CART	

(N14) CONTRIBUTING FACTORS
- [ ] (81) STUDENT TECHNOLOGIST
- [ ] (82) NEW EMPLOYEE
- [ ] (83) FOREIGN LANGUAGE
- [ ] (84) PATIENT INCOHERENT OR UNCOOPERATIVE
- [ ] (85) REQUISITION NOT CHECKED
- [ ] (86) PATIENT CHART NOT CHECKED
- [ ] (87) NEW PROCEDURE
- [ ] (88) HEAVY WORKLOAD
- [ ] (89) OTHER

(N15) ACTION TAKEN TO PREVENT RECURRENCE
- IMPLEMENT NEW PROCEDURES FOR:
  - [ ] (C1) VERIFICATION OF REQUEST
  - [ ] (C2) RADIOPHARMACEUTICAL LABELING AND HANDLING
  - [ ] (C3) VERIFICATION OF PATIENT IDENTIFICATION
- [x] (C4) REINSTRUCT PERSONNEL
- [x] (C5) REPRIMAND PERSONNEL (VERBAL COUNSEL BY SERVICE CHIEF)
- [ ] (C6) IMPROVE SUPERVISION OF PERSONNEL
- [ ] (C7) INITIATION
- [ ] (C8) OTHER

(N16) EFFECT ON PATIENTS
- [x] NONE APPARENT
- [ ] SEE ABSTRACT

(N17) ABSTRACT (If more space is required, attach additional sheets.)

(SEE ATTACHED REPORTS)

NUCLEAR REGULATORY COMMISSION USE

(I)	(N18) AS	(N20) REGIONAL LOG NUMBER	(N21) ACCESSION NUMBER	(N22) INITIALS	
0 NO 1 YES					

Misadministration (Diagnostic/~~Therapeutic~~)

Report of the Chief of Service:

Name of patient: [redacted]
Social Security No: [redacted]
Prescribed Dose: 3.5 mCi TL201
Administered Dose: 3.0 mCi TL201 + 0.716 mCi of I131 hippuran.
Date of Misadministration: Feb. 1, 1990

1. Please see the chief technologist's report detailing the circumstances of misadministration to this patient.

2. Mr. [redacted] was examined by one of our resident physician, who in consultation with an attending physician determined that the patient would not experience any ill effect from the misadministration.

3. It was estimated by our health physicist and chief technologist that the patient received 716 uCi of I-131 hippuran. The method by which this dose was determined is described in the chief technologists report. Based on this information, exposure was estimated using the package insert for hippuran with the following results:

Kidney: .06 Rads
Gonads: .08 Rads
Total Body: .08 Rads
Thyroid: .08-28 Rads

The large thyroid dose range is the result of the possible range of free I-131 in a hippuran preparation (0-3% free I-131). After reviewing this dosimetry data, the only intervention which was considered appropriate was administration of KI (SSKI) to block the thyroid uptake of free I-131. Accordingly, the exposure to this patient's thyroid was reduced by approximately 50% (Medical Management of Radiation Accidents, FA Metler Jr. (Ed) CRC Press) such that the upper limit for dose to thyroid in this individual was in fact 14 Rads.

4. The question of misadministration was discussed with the chief technologist and other technologists and steps were taken to minimize the likelihood of misadministrations in the future.

5. The referring physician was notified of the misadministration by phone at approximately 2:00 p.m. and explained that we did not anticipate any clinical ill effect from the relatively low dose of I131.

Report of Incident

Chief technologist's report:

On February 1, 1990, Mr. [redacted], SS #[redacted], was referred from 10E for a persantine thallium study. The prescription written by the resident physician and countersigned by an authorized user, read 3.5 mCi TL201. The technologist, Lisa Urano, drew up a thallium dose from a partially used vial. Not being able to get the full ordered dose of TL201 from that vial, she picked up another vial of what she thought was TL201; but it was however I131 hippuran. To complete the dose, a certain volume of I131 was withdrawn from the vial. The total dose measured in the dose calibrator was 3.58 mCi. Upon noticing the error and because the heart was not visualized clearly, a second dose of TL201 (3.6 mCi) was administered as ordered by an authorized user. Upon investigation into the amount of each isotope given, it was determined that the total dose of TL201 was approximately 3.0 mCi and the maximum dose of I131 hippuran was approximately 716 uCi. The latter was estimated in the following way: Upon receiving the vial on the morning of 1/29/90, the activity was assayed at 1.60 mCi, (inventory # 4339). On the morning of 2/1/90 this activity physically decayed to approximately 1240 uCi. Prior to this incident, a I131 hippuran dose was drawn from this vial for a renal scan for another patient. This dose was assayed at 329 uCi. 195 uCi remained in the vial after Mr. [redacted] injection leaving a difference of 716 uCi in the vial which was withdrawn for Mr. [redacted].

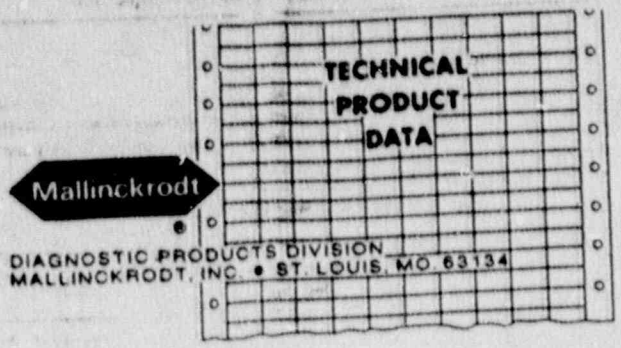
The dose slip read 3.58 mCi of Tl-201; since 716 uCi of I-131 would give a reading of approximately 0.6 mCi with the dose calibrator on the Tl-201 scale we estimate that the injected activity of Tl-201 was 3.0 mCi.

In order to prevent reoccurance of this type of incident, the thallium 201 and iodine 131 hippuran vials will be clearly marked in indelible ink. In addition, we will consider purchasing the I131 hippuran from a different source in order to not have on hand, like vial shields with different isotopes.

The technical staff discussed these proposals with the service chief and agreed to implement them. Additional safeguards such as only removing from storage the vial required and replacing it to storage immediately after use as also discussed. This episode does not, we feel, represent a pattern, but rather an unfortunate reality of human error. We will strive to reach 100% accuracy and do everything within our power to prevent a reoccurance.

The patient's primary physician was contacted regarding this error by Dr. Bushnell.

115 R9/88



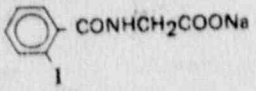
HIPPURAN® I 131 INJECTION

Iodohippurate Sodium I 131 Injection

Diagnostic – For Intravenous Use

DESCRIPTION

Hippuran I 131 is a sterile, non-pyrogenic solution containing iodohippurate sodium I 131 at a specific activity of 11.1 megabecquerels (0.3 millicurie) per milligram at the time of calibration. Each milliliter contains 0.833 milligram [9.25 megabecquerels (0.25 millicurie)] iodohippurate sodium. The solution is preserved with 37.5% propylene glycol, 0.1% methylparaben and 0.03% propylparaben and stabilized with 0.015% sodium citrate and 0.005% edetate disodium. It may contain sodium hydroxide or hydrochloric acid for pH adjustment and trace quantities of sodium acetate. The pH is between 7.0 and 8.5. The amount of free (unbound) iodine-131 does not exceed 3%. Iodohippurate sodium I 131 has the following chemical structure:



Physical Characteristics

Iodine-131 decays by beta and associated gamma emissions with a physical half-life of 8.04 days.[1] The principal beta emissions and gamma photons are listed in Table 1.

Table 1. Principal Radiation Emission Data[1]

Radiation	*Mean Percent Per Disintegration*	*Energy (keV)*
Beta-1	2.12	69.4 Avg.
Beta-3	7.36	96.6 Avg.
Beta-4	89.3	191.6 Avg.
Gamma-7	6.05	284.3
Gamma-14	81.2	364.5
Gamma-17	7.26	637.0

External Radiation

The specific gamma ray constant for iodine-131 is 2.27 R/hr-mCi at 1 cm. The first half-value thickness of lead (Pb) for iodine-131 is 0.24 cm. A range of values for the relative attenuation of the radiation emitted by this radionuclide that results from interposition of various thicknesses of Pb is shown in Table 2. For example, the use of 4.6 cm of Pb will decrease the external radiation exposure by a factor of about 1,000.

Table 2. Radiation Attenuation by Lead Shielding[2]

Shield Thickness (Pb), cm	*Coefficient of Attenuation*
0.24	0.5
0.95	10^{-1}
2.6	10^{-2}
4.6	10^{-3}
6.5	10^{-4}

To correct for physical decay of this radionuclide, the fractions that remain at selected time intervals before and after the date of calibration are shown in Table 2.

[1]Kocher, David C., "Radioactive Decay Data Tables", DOE/TIC 11026, page 133 (1981).

[2]Data supplied by Oak Ridge Associated Universities, Radiopharmaceutical Internal Dose Information Center, Oak Ridge, TN, 1987.

Table 3. Physical Decay Chart; Iodine-131, Half-Life 8.04 Days

Days	*Fraction Remaining*	*Days*	*Fraction Remaining*	*Days*	*Fraction Remaining*
0*	1.000	11	0.387	21	0.164
1	0.917	12	0.355	22	0.150
2	0.842	13	0.326	23	0.138
3	0.772	14	0.299	24	0.126
4	0.708	15	0.274	25	0.116
5	0.650	16	0.252	26	0.106
6	0.596	17	0.231	27	0.098
7	0.547	18	0.212	28	0.089
8	0.502	19	0.194	29	0.082
9	0.460	20	0.178	30	0.075
10	0.422				

*Calibration Day.

CLINICAL PHARMACOLOGY

Following intravenous injection of Hippuran I 131 the appearance, concentration and excretion of the tracer in the kidney can be monitored. Tubular cell secretion is primarily displayed. An index of renal vascular competence and renal evacuation may also be estimated.

INDICATIONS AND USAGE

Hippuran I 131 Injection is a diagnostic aid in determining renal function, renal blood flow, and urinary tract obstruction, and a renal imaging agent.

CONTRAINDICATIONS

None known.

WARNINGS

This drug may contain up to 3% free iodine-131. A saturated solution of potassium iodide or a dose of 10 to 20 drops of Lugol's solution should be administered prior to and following the examination to decrease thyroid accumulation of iodine-131.

PRECAUTIONS

General

As in the use of other radioactive material, care should be taken to insure minimum radiation exposure to the patient, consistent with the proper patient management, and to insure minimum radiation exposure to occupational workers.

The vial contents are sterile. It is essential that the user follow the directions carefully and adhere to strict aseptic procedures.

Carcinogenesis, Mutagenesis, Impairment of Fertility

No long-term animal studies have been performed to evaluate the carcinogenic or mutagenic potential, or whether this drug affects fertility in males or females.

Pregnancy Category C

Animal reproduction studies have not been conducted with iodohippurate sodium I 131. It is also not known whether iodohippurate sodium I 131 can cause fetal harm when administered to a pregnant woman or can affect reproduction capacity. Iodohippurate sodium I 131 should be given to a pregnant woman only if clearly needed.

Ideally, examinations using radiopharmaceuticals, especially those elective in nature, of a woman of childbearing capability should be performed during the first few (approximately 10) days following the onset of menses.

Nursing Mothers

Iodine-131 is excreted in human milk during lactation, therefore, formula feedings should be substituted for breast feedings.

Pediatric Use

Safety and effectiveness in children have not been established.

Radiopharmaceuticals should be used only by physicians who are qualified by specific training in the safe use and handling of radionuclides produced by nuclear reactor or particle accelerator and whose experience and training have been approved by the appropriate government agency authorized to license the use of radionuclides.

ADVERSE REACTIONS

As with all organic iodine-containing compounds, the possibility of allergic type reactions must be kept in mind. Nausea, vomiting and fainting have been reported in conjunction with the administration of Hippuran I 131 Injection.

HIPPURAN® I 131 INJECTION
Iodohippurate Sodium I 131 Injection

DOSAGE AND ADMINISTRATION

The suggested dose range employed in the average patient for renal function studies (70 kg) is up to 1.295 megabecquerels (35 microcuries) administered intravenously [18.5 kilobecquerels (0.5 microcurie) per kilogram body weight].

When renal imaging is required, the dose for the average patient (70 kg) is up to 12.95 megabecquerels (350 microcuries) [111 to 185 kilobecquerels (3 to 5 microcuries) per kilogram body weight].

The patient dose should be measured by a suitable radioactivity calibration system immediately prior to administration.

Parenteral drug products should be inspected visually for particulate matter and discoloration prior to administration, whenever solution and container permit.

Instructions for the handling of Iodohippurate Sodium I 131:

1. Waterproof gloves should be used during the entire handling and administration procedure.
2. Using proper shielding, the vial containing the Iodohippurate Sodium I 131 should be visually inspected to insure that it is free of particulate matter and discoloration prior to use.
3. Maintain adequate shielding during the life of the product and use a sterile, shielded syringe for withdrawing and injecting the preparation.

Radiation Dosimetry

The estimated radiation doses[3] to an average patient (70 kg) from an intravenous dose of 12.95 megabecquerels (350 microcuries) of Iodohippurate Sodium I 131 are shown on Table 4. The values are based on a completely blocked thyroid and a biphasic excretion curve. After administration of the drug about 62% of the activity has an effective half-life of 7.4 minutes, and 38% has an effective half-life of 37 minutes.

[3] Method of calculation: A Schema for Absorbed-Dose Calculation for Biologically Distributed Radionuclides, Supplement No. 1, MIRD Pamphlet No. 1, *J. Nucl. Med.*, p. 7, 1968.

Table 4. Absorbed Radiation Doses

Tissue	*Absorbed radiation doses for 12.95 megabecquerels (350 microcuries)*	
	mGy	*rads*
Thyroid	0.39*	0.039*
Kidneys	0.28	0.028
Bladder Wall	20.0	2.000
Testes	0.39	0.039
Ovaries	0.46	0.046
Total Body	0.39	0.039

*This product may contain up to 3% free iodine-131. If the thyroid is not blocked with saturated potassium iodide or Lugol's solution, and the thyroid uptake is 25%, the absorbed radiation dose for the thyroid would be 14 rads. This value will decrease proportionately if less than 3% free iodine-131 is present, or if the uptake is less than 25%. Conversely, it will increase if the uptake is greater than 25%.

HOW SUPPLIED

Catalog Number

115 Hippuran I 131 Injection (Iodohippurate Sodium I 131 Injection). A sterile, non-pyrogenic solution containing 37.5% propylene glycol, 0.1% methylparaben, and 0.03% propylparaben as preservatives; 0.015% sodium citrate and 0.005% edetate disodium as stabilizers. May contain sodium hydroxide or hydrochloric acid for pH adjustment and trace quantities of sodium acetate. Hippuran I 131 Injection is available in vials containing 37 megabecquerels (1 millicurie) with a concentration of 9.25 megabecquerels (0.25 millicurie) per milliliter and specific activity of 11.1 megabecquerels (0.3 millicurie) per milligram as of time of calibration.

In conformance with recommendations in the U.S.P., Hippuran I 131 Injection should not be used after six weeks from the date of manufacture. The expiration date for the product is stated on the label.

Storage and Handling

Store at room temperature (Below 86°F/30°C).

Storage and disposal of Hippuran I 131 Injection should be controlled in a manner that is in compliance with the appropriate regulations of the government agency authorized to license the use of this radionuclide.

PERFORMING THE RENOGRAM

Patient Preparation

The state of hydration of the patient will influence the excretion of the tracer and the shape of the renogram curve. In dehydrated patients, the time required to reach the peak radioactivity level in the kidney is prolonged, and the second and third phases of the renogram are flatter. False differences in rates of tracer excretion may occur due to increased pooling of highly concentrated urine in slight non-pathologic variations of the ureteral outlets. In the nydrated patient, good second phase comparisons are obtained, but differences in rates of excretion may be obscured.

Positioning

The patient is generally placed in a sitting position. The prone or supine position may also be employed if the patient is unable to maintain a steady sitting position. A gamma camera interfaced with a computer is placed directly over the kidneys at right angles to the back.

Interpretation of Results

The renogram provides diagnostic information relating to two basic problems: those affecting kidney function or blood supply and those obstructing urinary tract flow.

Figure 1 is a schematic representation of a normal renogram. The three segments of the curve were originally called the vascular, tubular and excretion phases. Dore et al.[4] renamed these segments as: 1) tracer appearance, 2) blood flow, and 3) drainage.

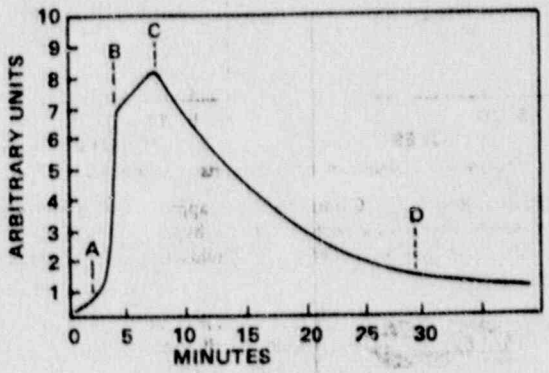


Figure 1. Normal Renogram

[4] Dore, E.K., Taplin, G.V. and Johnson, D.E., Current Interpretation of the Sodium Iodchippurate I 131 Renocystogram, J.A.M.A. 185:925, September 21, 1963.

The first phase, segment AB, represents the initial appearance of the radioactivity under the detector. This appearance is noted a few seconds following the injection and lasts about 30 seconds. The second phase, segment BC, is the uptake of the tracer by the kidney. The shape of this portion of the curve is affected by changes in the renal blood flow and the cellular function of the kidney. This slowly rising second phase of the renogram usually lasts for about 2 to 5 minutes. Segment CD, or the third phase, represents the removal of the tracer from the kidney pelvis. The state of hydration, capacity of the renal pelvis, anatomic relations between the pelvis and the ureter, and any existing pathologic abnormalities influence the shape of this curve. The tracing is normally continued for about 30 minutes, although sufficient information may be obtained after about 15 minutes.

Illustrated in Figures 2 and 3 are examples of abnormal renograms. Figure 2 is a renogram showing a moderate decrease in function or blood supply in the right kidney; Figure 3 shows an acute unilateral (right) urinary tract obstruction.

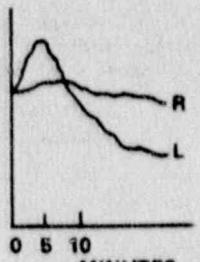


Figure 2.

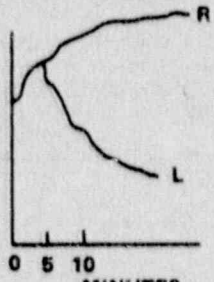


Figure 3.

Abnormal Renograms

The U.S. Nuclear Regulatory Commission has approved distribution of this radiopharmaceutical to persons licensed to use byproduct material listed in Sections 35.100 and 35.200, and to persons who hold an equivalent license issued by an Agreement State.

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