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CRC®-25W

**The new CRC®-25W
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Captus® 600/3000 Bloopers
How to Save Thyroid Uptakes

by Kathy Thomas, MHA, CNMT, PET and Art Hall, BS, CNMT, FSNMTS

Captus® 600 and Captus® 3000 users will tell you that technical errors associated with thyroid uptakes occur when you least expect them -- or have time to resolve them. They describe a typical crazy morning as one when patients are early; the phones are ringing off the hook; the radiopharmacy delivery is late and you're trying to get things done as quickly as possible -- and then someone calls in sick. They state that scenarios such as this create the perfect environment for technical errors including forgetting to count a capsule before administration; entering the wrong calibration information for the capsule; patient demographic errors and patient counting errors. While repeating the patient study is an option, the results of that action will have a very negative impact on patient care, referring physician, patient confidence, department costs and productivity. Captus® users including Nanci Burchell, Children's Mercy Hospital, Kansas City, MO describe a protocol that will, in most cases, save the thyroid uptake using the Multichannel Analyzer (MCA) and previous patient studies using the same isotope and activity. **Users emphasize the need to obtain approval from their interpreting physician before working outside the software protocol on the Captus® 600 or Captus® 3000 as the data obtained will be the responsibility of the user.**

**How to Determine Standard Counts -
Capsule Administered Prior to Counting:**

In most cases, departments adhere to a specific protocol for thyroid uptakes, including the same activity/isotope for each patient study; therefore, by reviewing the previous 5 studies using the same approximate isotope and activity, the standard counts per minute (cpm) per microcurie (µCi) can be determined.

The following calculation uses I-123 as the example:

- Patient #1 = 450,000 cpm for 230 µCi
@ 10 am = 1957 cpm/µCi
 - Patient #2 = 500,000 cpm for 258 µCi
@ 8 am = 1938 cpm/µCi
 - Patient #3 = 470,000 cpm for 240 µCi
@ 9 am = 1958 cpm/µCi
 - Patient #4 = 443,000 cpm for 227 µCi
@ 10 am = 1952 cpm/µCi
 - Patient #5 = 520,000 cpm for 266 µCi
@ 7 am = 1954 cpm/µCi
- Average cpm/ Ci = 1952 cpm/µCi

Calculate the cpm of the administered dose:

To determine the cpm for the administered capsule at the time of assay, multiply the calibrated activity by the averaged cpm/µCi:
231 µCi at 7:30 am x 1952 cpm/µCi = 450,912 cpm

Decay-correct the capsule counts to the time administered:

If the capsule was not administered immediately following calibration, it will be necessary to decay correct the standard counts to the time of administration:

The I-123 capsule was calibrated at 7:30 am and the cpm was calculated as: 450,912 cpm
The I-123 capsule was administered at 9:30 am: 450,919 cpm times the 2 hr decay factor for I-123 (.9) equals: 405,821 cpm

What if the capsule was not counted prior to administration?

Although use of the activity of the capsule, say 200 µCi, calibrated for 12:00 noon as reported by the radiopharmacy can be used to determine the average cpm/µCi, the user must recognize that this technique brings with it an increased error factor when compared to calculations made using an accurate calibration of the capsule for determining the cpm/µCi.

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Counting the patient:

Because the capsule counts were not stored in the unit, the remaining counting procedure must be performed using the Multichannel Analyzer (MCA). The following directions for the Captus® 600 or Captus® 3000 will allow the user to complete the patient procedure and manually calculate the percent uptake based on the data derived from counts obtained from the MCA.

Captus® 600

Count/store background:

- Select 'home'
- Select 'utilities'
- Select MCA
- Select 'probe'
- Select 'measure background'
- Select 200 keV energy scale by highlighting 200 keV with the F1 button
- Select F4 (Ok)
- Set counting time
- Select F4 to start 'Count'
- Select F3 to save count

Count Patient:

- Use the BSP key to return to MCA screen
- Select 'measure source'
- Set the MCA screen:
 - Energy scale: 200 keV
 - Peak Counts: 100 x
 - Counting time: same as bkg
 - Cut-off Channel: 5
 - Counting time base: LIVE (select with F2)
- Select 'OK' (F4)
- On MCA ROI screen:
 - ROI number: 1
 - From Channel: 143
 - To Channel: 191
- Position patient for background count
- Select F4 (start) to begin counting
- Print/record results
- Position patient for neck counts
- Select F1 (count)
 - Confirm set-up information (see above)
- Select F4 (count)
- Print/record results
- Decay-correct capsule counts

Repeat procedure for follow-up patient counts

Captus® 3000

MCA set-up:

- Select MCA from main screen
- Select 'probe'
- Select 'Counting set-up'
 - Set counting time to: LIVE
 - Set time to desired counting time
- Select 'ROI from isotope'
 - Select isotope
 - Modify isotope window as desired.

Note: it is recommended that the window be set to match the window in the thyroid protocol (Select Thyroid Uptake program, select 'setup' and use the windows noted in the uptake protocol for the MCA ROI for the selected isotope. Remember: each channel = 2 keV. Factory set-up: I-123 = 10% below and 20% above or 72 and 95; I-131 = 20% symmetric window or 146 and 219.

Count Patient:

- Count patient's thigh (bkg)
 - Record 'integral' counts
- Count patient's neck
 - Record 'integral' counts
- Decay correct capsule counts

Repeat procedure for follow-up patient counts

Manual Calculation of the Thyroid Uptake

Calculation of the thyroid uptake requires that the following information be incorporated into the thyroid uptake formula:

- Room background counts
- Standard counts
- Background counts (thigh)
- Neck counts
- Appropriate decay factor

Thyroid uptake formula:

$$\text{Net neck cpm} = \text{neck cpm} - \text{thigh cpm}$$

$$\frac{\text{net neck cpm}}{\text{Decay corrected capsule counts}} \times 100 = \% \text{ uptake}$$

Useful decay factors-I-123:

1 hr:	.949	6 hrs:	.730
2 hrs:	.900	24 hrs:	.284
4 hrs:	.811		

Useful decay factors-I-131:

4 hrs:	.985	48 hrs:	.841
6 hrs:	.978	72 hrs:	.771
24 hrs:	.917		

Patient/data information that CAN be edited during the uptake procedure

Although the Captus® 600 does **not** allow information or data to be changed or deleted during the uptake procedure, the Captus® 3000 allows the user to edit the following parameters during the uptake procedure:

- Patient name
- Patient ID
- Physician name
- Birthdate
- Capsule
 - serial number
 - activity
 - calibration date
 - calibration time

Patient/data information that CANNOT be edited during procedure

The Captus® 3000 will not allow the following variables to be changed or deleted during the uptake procedure:

- Administration time
- Counting protocol
- Counting distance
- Patient counts

What additional factors affect thyroid uptakes?

- Thyroid phantom: The thyroid phantom is designed to be representative of the surrounding tissue in the neck when counting the thyroid capsule. Different phantom construction can alter the counts of the capsule significantly. The Capintec Thyroid Phantom is designed to minimize these problems and provide consistent and reproducible counting results providing that the capsule is placed in the phantom holder and the holder is correctly aligned in the unit. Incorrect placement or alignment of the capsule can reduce the count rate by as much as 10%.
- Attenuating material: the graphite rod on the Captus® 600 and Captus® 3000 is an excellent resource for distance verification between the probe and the thyroid phantom or the patient; however, the graphite rod can attenuate gamma rays and reduce the overall count rate of the capsule or the neck counts by as much as 10% if left in place during the counting period. Metal and other materials can also have the same adverse effect; therefore, it's important to remember to remove all attenuating materials, including the graphite rod

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- prior to counting the capsule or patient.
- **Geometry:** Source placement and distance plays a significant role in uptake accuracy.
 - Inconsistent distance between the radioactive source and the probe will cause the count rate to be inappropriately high or low, depending on the position of the source. Make sure that distance remains constant during all counting procedures.
- **Patient motion effects count accuracy.** Motion can affect distance and overall precision of the counting results. Confirm patient comfort and neck stability prior to initiating the counting procedure. If necessary, place the patient in a supine position to minimize motion. Capintec recommends two repetitions of the neck count to assess potential patient motion during the counting procedure.
- **Counting time:** Adequate counting statistics are important for study validity. Avoid counting periods that are too short for adequate counts to be obtained. A minimum of 60-120 seconds is recommended for accurate results. Additionally, counting times throughout the study should be consistent.

Other Technical Bloopers:

Selecting the wrong protocol: If the wrong counting protocol I-123 vs. I-131 was selected and the capsule has been administered:

- Calculate the cpm of the calibrated cap-

sule and complete the procedure in the MCA mode.

Patient data access problems

- Problems associated with access to patient data have occurred when a power surge or loss of power occurs and the program was left open on the counting screen. To prevent this problem, always click 'Exit' at the completion of the patient or capsule measurement. If a current patient cannot be accessed and data has been printed for the initial measurements, complete the study using the MCA mode. If the initial data is not available, either reschedule the patient study or, if approved by the interpreting physician, calculate the standard from the calibrated dose and complete the study in the MCA mode. Note: only measurements from the subsequent MCA uptakes will be used for the final interpretation.

Counting mCi activity

- Counting mCi activity can be a challenge for probe technology. Capsule activity resulting in a dead time exceeding 80% should be avoided. If dead time exceeds 80%, either increase the distance from the probe to the source, or reduce the activity being counted.

In most cases, thyroid uptakes can be salvaged using the MCA mode on the Captus® 600 or Captus® 3000. **Users emphasize the need to obtain approval from their inter-**

preting physician before working outside the software protocol on the Captus® 600 or Captus® 3000 as the data obtained will be the responsibility of the user. If you need assistance with encountered problems, please call technical support at 1-800 631-3826.

DISCLAIMER: Capintec does not endorse any user deliberately circumventing their FDA approved clinical software. Capintec cannot be held responsible for errors introduced by modifying procedures.



Captus® 3000

RSNA 2007

Visit Capintec at RSNA 2007 to see some of our outstanding products in person:

- CRC®-25W
- Pin-Tec™ & C-Tec™ Syringe Shields
- RSD Phantoms
- Cap-DICOM™ Interface
- Captus® 3000 Thyroid Uptake System
- New Products and much more!

**November 25-30, 2007 • Chicago IL
BOOTH #3117**

Capintec Meeting Schedule

Nov. 25-30	RSNA	Chicago, IL
Feb. 14-17	SNM Midwinter	Newport Beach, CA
Feb. 28	SNM Northern CA Chapter	Pleasanton, CA
Mar. 7-8	SNM Greater NY Chapter	Atlantic City, NJ
Mar. 28-30	SNM Southwest Chapter	Little Rock, AR

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