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## *Significant Interactions*

There are numerous drug-radio-pharmaceutical interactions that will alter nuclear medicine images and procedures. There are drugs that will cause increased kidney uptake, decreased thyroid uptake, false negatives, false positives, decreased labeling efficiency, increased breast uptake, etc., etc. Fortunately, truly significant interactions do not occur with great frequency. Nuclear medicine professionals should be aware of the truly significant interactions to prescreen patients. This handout is to be used as a helpful guide in practice, but in no way covers all the drug-

radiopharmaceuticals interactions that may occur. Suspected alterations in bio-distribution should be investigated. There are significant resources that are available to aid in the recognition of interactions. Textbooks, drug information centers, and the internet all provide an excellent resources for your practice. I would also like to highly recommend that you work with your nuclear pharmacist as an excellent resource to answer your clinical nuclear medicine problems. Together we make a great team!

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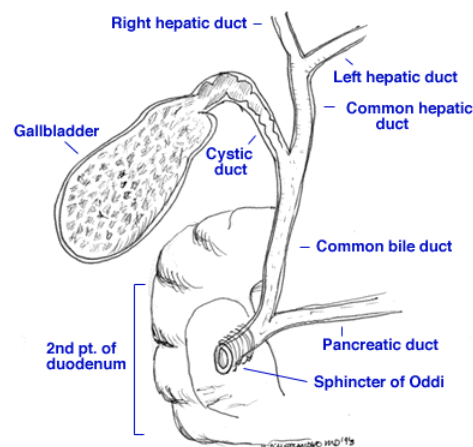
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## *Narcotic Analgesics*

Morphine	MS-Contin, Oramorph SR
Codeine	Tylenol #3 or #4
Oxycodone	Percodan, Percocet, Tylox
Roxicodone	Roxiprin, Roxicet
Merperidine	Demerol
Hydromorphone	Dilaudid
Methadone	Dolophine
Hydrocodone	Lortab, Lorcet, Vicodin
Propoxyphene	Darvon, Darvocet, Wygesic
Fentanyl	

- ◆ Opioids constrict the Sphincter of Oddi, which may cause non-visualization of the intestine in hepatobiliary imaging.



# Xanthine Containing Medications

<i>Theophylline Containing Medications</i>	
TRADE NAMES	
Aerolate	T-Phyl
Slo-Bid	Uniphyl
Slo-Phyllin	Sustaire
Theo-24	Uni-Dur
Theolair	Quibron
Theochron	Theo-Dur

Patients should withhold theophylline medications for 48 hours prior to a Dipyridamole or Adenosine study. However, with asthma patients you may want to use Dolbutamine.

<i>Caffeine Containing Products</i>
<ul style="list-style-type: none"> <li>Headache Products                             <ul style="list-style-type: none"> <li>- Anacin, Excedrin</li> </ul> </li> <li>Stimulant Products                             <ul style="list-style-type: none"> <li>- No Doz, Vivarin</li> </ul> </li> <li>Menstrual Products                             <ul style="list-style-type: none"> <li>- Aqua-Ban, Midol, Diurex</li> </ul> </li> <li>Prescription Drugs                             <ul style="list-style-type: none"> <li>- Cafegot, Darvon Cpd, Fiorinal</li> <li>- Synalog DC, Wigraine</li> </ul> </li> <li>Coffee, Tea, &amp; Soft Drinks                             <ul style="list-style-type: none"> <li>- many decaffeinated drinks are also not allowed.</li> </ul> </li> </ul>



Xanthines will block the vasodilatory effects of adenosine. Patients should be withheld from caffeine for 6 hours

## Beta Blockers

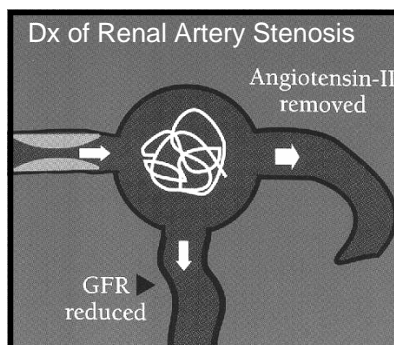
GENERIC NAME	TRADE NAME
Acebutolol	Sectral
Atenolol	Tenormin
Betaxolol	Kerlone
Bisoprolol fumarate	Zebeta
Carteolol hydrochloride	Cartrol
Metoprolol tartrate	Lopressor
Metoprolol succinate	Toprol-XL
Nadolol	Corgard
Nebivolol	Bystolic
Penbutolol sulfate	Levatol
Pindolol	Visken
Propranolol	Inderal

BETA BLOCKER / DIURETIC COMBINATIONS
Tenoretic
Ziac
Lopressor HCT
Corzide
Inderide
Timolide

Beta Blockers will prevent treadmill stress patients from reaching their target heart rate. DC 48 hours before testing is suggested or switch to pharmacologic stress.

## ACE Inhibitors

GENERIC NAME	TRADE NAME
Benazepril	Lotensin
Captopril	Capoten
Enalapril	Vasotec
Fosinopril	Monopril
Lisinopril	Prinivil, Zestril
Moexipril	Univasc
Quinapril	Accupril
Ramipril	Altace
Trandolapril	Mavik



ACE Inhibitors should be discontinued prior to ACE-Inhibitor Renography.

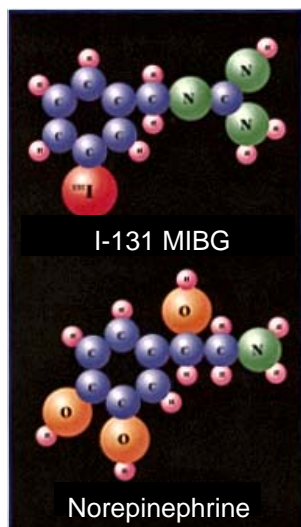
## Angiotensin II Receptor Blockers

GENERIC	TRADE
Losartan	Cozaar
Valsartan	Diovan
Irbesartan	Avapro

## Direct Renin Inhibitor

GENERIC	TRADE
Ailskiren	Tekturna

## *MIBG Interactions*



MIBG is an analog of norepinephrine that is used for imaging neuroendocrine tumors.

There are many significant drug interactions with I-131 MIBG. Drugs that cause either the inhibition of uptake or depletion of storage vesicle contents may result in a false negative study. Patients must be carefully screened for prescription, OTC, and natural products to prevent a false negative study.

A listing of drug interactions is found at <http://nuclearpharmacy.uams.edu> see “Resources”.

## *Calcium Channel Blockers*

### GENERIC

Diltiazem  
 Mebexradil  
 Verapamil  
 Amlodipine  
 Felodipine  
 Isradipine  
 Nicardipine  
 Nifedipine  
 Nisoldipine

### TRADE

Cardizem SR & CD, Dilacor XR, Tiazac  
 Posicor  
 Isoptin SR, Calan SR, Veralan, Covera HS  
 Norvasc  
 Plendil  
 DynaCirc CR  
 Cardene SR  
 Procardia XL, Adalat CC  
 Sular

### Calcium Antagonists/ ACE Inhibitors Combination Drugs

Lotrel  
 Teczem  
 Tarka  
 Lexxel

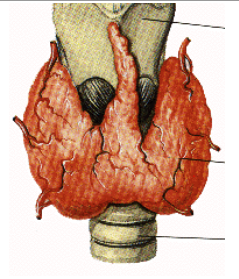
Calcium Antagonists interfere with MIBG studies and exercise stress testing. DC 48-72 hours before study.

## *F-18 FDG Interactions*

- Drugs that raise blood glucose:
  - Corticosteroids
  - Floroquinolones
  - Aripiprazole
- Atypical antipsychotics (olanzepine) may produce insulin resistance
- Colony-stimulating factors will produce profound marrow uptake
- Stimulant laxatives will cause gut uptake
- High density contrast agents (barium) will cause attenuation

Anything that stimulates insulin production or is an insulin product, will alter the bio-distribution by shifting the uptake to GLUT4-dependent tissues such as muscle, heart and brown fat.

## *Thyroid Uptake Interactions*



DECREASED UPTAKE	Duration of Effect
Lugol's solutions, SSKI, Tincture of Iodine	2-4 weeks
Kelp	2-4 weeks
Iodine containing cough medicines (Organidin), and vitamin-mineral products (Micebrin, Unicap)	2-4 weeks
Topical iodide products (Betadine, Vioform, Iodex, and Iodine)	1-9 months
Water-soluble intravascular contrast media	2-4 weeks
Oral cholecystographic contrast media	4 wks - indefinite
Fat-soluble brochographic, lymphographic, and myelographic contrast media	4 wks - years
Thyroid hormone: Thyroxine (T4)	4-6 weeks
Thyroid hormone: Triiodothyronine (T3)	2-3 weeks
ACTH, adrenal steroids	8 days
Antithyroid drugs: PTU & Tapazole (no effect on Tc-99m)	2-8 days
Perchlorate, $\text{TcO}_4^-$ , & monovalent anions	1 week
Goitrogenic foods: cabbage, turnips	Variable

Renal or liver failure and lithium will increase the thyroid uptake percentage.

Interferences with radioiodine uptake will also occur with  $\text{TcO}_4^-$ .

<i>Bone Imaging Interactions</i>
Etidronate (Didronel) Excess Vitamin D supplements Iron Dextran Injections

*DC 8-10 days before a bone scan*

<i>Drugs That Cause Pulmonary Fibrosis</i>	
Bleomycin	Lomustine
Busulphan	Melphalan
Carmustine (BCNU)	Methotrexate
Chlorambucil	Mitomycin
Cyclophosphamide	Nitrofurantoin
Cytarabine	Procarbazine

*Will interfere with Ga-67 and other scans*

## *Resources for Information*

- The Nuclear Pharmacy  
<http://nuclearpharmacy.uams.edu...> see Resources
- *Essentials of Nuclear Medicine Science*, Williams & Wilkins 1987, Hladik Saha, Study.
- KU Radiopharmaceutical Drug Information Center  
<http://www2.kumc.edu/druginfo/radio.html>
- Medline:  
<http://healthy.net/Library/search/medline.htm>

One of the best resources you have is your local nuclear pharmacist.

Additional review articles include:

Lentle B, Attariwila R, Lyster D, Drug-Induced Changes in Radiopharmaceutical Biodistributions. UNM Continuing Education Series. Volume 11, Lesson 4, 2004

Hesslewood F, Leung E. Drug interactions with radiopharmaceuticals. Eur J Nucl Med 1994;21:348-356.

Lentle BC, Williams J, Coupland D. Variables in radiotracer kinetics and biodistributions. J Nucl Med Technol 1991;19:94-98.

Hladik WB, Nigg KK, Rhodes BA. Drug-induced changes in the biologic distribution of radiopharmaceuticals. Semin Nucl Med 1982;12:184-210.

Laven DL, Shaw SM. Detection of drug interactions involving radiopharmaceuticals: a professional responsibility of the clinical pharmacist. J Pharm Pract 1989;2(5):287-298.

Lentle BC, Schmidt R, Noujaim AA. Iatrogenic alterations in radionuclide biodistributions. Semin Nucl Med 1979;9:131-143.

Shaw SM. Drugs and diseases that may alter the biodistribution or pharmacokinetics of radiopharmaceuticals. Pharmacy International 1985;6(Dec):293-298.