Myocardial Perfusion Imaging (A Nuclear Stress Test), Guidelines, Imaging **Techniques** and Challenges

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American Society of Nuclear Cardiology (ASNC)

www.asnc.org

Updated Imaging Guidelines for Nuclear Cardiology Procedures If your lab is Intersocietal Accredited in Nuclear Cardiology, you must follow ASNC guidelines



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Education Guidelines and Standards				
	Health Policy	ASNC served as the author or co-author on each of the documents listed below. The date shown with each guideline or statement reflects the most recent date of approval or endorsement.		
	Journal of Nuclear			
	Lardiology (JNC)	Appropriateness Criteria for SPECT MPI (Single-Photon Emission Computed Tomography Myocardial Perfusion Imaging) September 2005		
1	Member Center	Accreditation Infomiation		
	News and Announcements	ticke		
Nuclear Cardiology Foundation Clinical Use of Cardiac Radionuclide Imaging ACC/AHA/ASNC Guideline — June 2003 Nuclear Cardiology Industry Site Index Computed Tomographic Imaging Within Nuclear Cardiology ASNC Information Statement — November 2004				
		<u>DICOM and Interconnectivity Update</u> ASNC Information Statement — September 2003		
		<u>Imaging Guidelines for Nuclear Cardiology Procedures</u> , Part 1 ASNC Guideline — November 2000		
		<u>Imaging Guidelines for Nuclear Cardiology Procedures</u> , Part 2 ASNC Guideline — June 1998		
		<u>PET Myocardial Glucose Metabolism and Perfusion Imaging Guidelines</u> ASNC Guideline — October 2003		
		<u>Reporting of Radionuclide Myocardial Perfusion Imaging Studies</u> ASNC Information Statement — August 2003		
		<u>Suspected Acute Ischemic Syndromes in the Emergency Department or Chest Pain Center</u> ASNC Position Statement — September 2001		
		<u>Women and Coronary Artery Disease: The Role of Myocardial Perfusion Imaging</u> ASNC Consensus Statement — September 2002		

Program Outline

Patient Prep

- Food
- **Caffeine**
- Alcohol
- Medications
- Study Time Frame
 - One day
 - Two day
 - Dual Isotope
- Sestamibi vs. Tetrofosmin
 - Subtle differences
 - ASNC Guidelines

Program Outline

Methods of Stress Testing

- Exercise
 - Treadmill
 - Bicycle
- Chemical
 - Adenosine
 - Regadenoson (Lexiscan)
 - Dipyridamole (Persantine)
 - Dobutamine
 - Low level exercise combined wit chemical stress
- Extra: Satisfaction Surveys
 - Patient
 - Physician

Program Outline

Technical Challenges/Decisions ■ Artifact Beta Blocker Diaphragmatic ■ Breast **GI** ■ LBBB Motion Low counts

Patient Preparation

1. NO:

Food (2-4 hrs) Alcohol (4-6 hrs) Caffeine (12-24 hrs)

Comfortable clothes and shoes Bring Medications Discontinue Medications Diagnostic vs. Functional Scan

Medications

- Insulin- Take ¹/₂ of dose
- Nitroglycerin- 4-6 hours
- Nitrates- 12 hours
- Diuretics- 12 hours
- Bronchodilators- 24 hours
- Beta Blockers- 48 hours
- Calcium Channel Blockers- 24 hours
- Caffeine-12- 24 hours

Beta Blockers – 48 hours

- Acebutolol hydrochloride
- Atenolol
- Betaxolol hydrochloride
- Bisoprolol fumarate
- Labetalol hydrochloride
- Metoprolol tartrate
- Nadolol
- Pindolol
- Propanolol hydrochloride
- Timolol

Sectral Tenormin, Tenoretic Kerlone Zebeta Normodyne, Trandate Betaloc, Lopressor, Toprol Cordard, Corzide Visken Betachron, Inderal Blocadren, Apo-timolol, Ziac

Patient Preparation

Calcium Channel Blockers- 24 hrs

Amlodipine

Norvasc

Diltiazem

Cardizem, Dilacor, Tiazac

Nimotop

Sular

- Felodipine Plendil
- Isradipine DynaCirc
- Nicardipine hydrochloride Cardene
- Nifedipine Adalat, Procardia
- Nimodipine
- Nisoldipine
- Verapamil hydrochloride Calan Isoptin, Verelan, Cardura, Lotrel, Cartia

Bronchodilators- 24 hours

- Aerolate
- Aminophylline
- Aquaphyllin
- Asmalix
- Choledyl
- Elizophylline Slo-bid
- Slo-Phyllin
- Theo-Dur
- Theovent

Meds Containing Caffeine- 24 hrs

- Anacin
- Carredrine
- Cardiotea
- Exedrin
- Fioricet
- Fiorinal
- Hycomine
- Norgesic
- Repan
- Vivarin

Miscellaneous Meds – 24 hrs

- Aggrenox
- □ Cafergot
- Dipyridamole
- Trental
- Plental

Video

(Note, DOBUTAMINE is least common chemical stress test in Nuclear Medicine)



Examination One Day Protocol Single Isotope Rest/Stress

- Verify the Patient Identity
- Verify Order
- Obtain Patient History
- Verify Patient is Prepped
- Explanation of Exam
- Answer Questions
- Consent
- Start IV
- Inject Radiopharmaceutical low dose 10 mCi Tc99m Sestamibi or Tetrofosmin
- Waiting period
- Image
- Stress (Rpx injection again, high dose 30 mCi Tc99m Sestamibi or Tetrofosmin)
- Waiting period
- Have your Patient Drink a Glass of Cold Water
- Image
- Review Images
- Remove IV
- CUT PATIENT LOOSE!!

(ASNC)	Rest	Stress	
Dose	8–12 mCi	24–36 mCi	Standard
Position	Supine	Supine	Standard
Delay time			
Inj to Imaging	30-60 minutes	15-60 minutes	Standard
Rest to Stress	30 minutes to 4 hours		Standard
Acquisition protoc	col		
Energy window	15 -20% symmetric	Same	Standard
Collimator	LEHR	Same	Preferred
Orbit	180 (45 RAO to 45 LPO)	Same	Preferred
Orbit type	Circular	Same	Standard
	Noncircular	Same	Standard
Pixel size	$6.4 \pm .4 \text{ mm}$	Same	Standard
Acquisition type	Step and shoot	Same	Standard
Number of proj	60-64	Same	Standard
Matrix	64 X 64	Same	Standard
Time/projection	25 s	20 s	Standard
ECG gated	Optional	Standard	Preferred
Frames/cycle	8	8	Standard
R-to-R window	100%	100%	Preferred

Examination One Day Protocol Single Isotope Stress/Rest

- Verify the Patient Identity
- Verify Order
- Obtain Patient History
- Verify Patient is Prepped
- Explanation of Exam
- Answer Questions
- Consent
- Start IV
- Stress (Rpx injection, low dose 10 mCi Tc99m Sestamibi or Tetrofosmin)
- Waiting period
- Image
- Inject Radiopharmaceutical high dose 30 mCi Tc99m Sestamibi or Tetrofosmin
- Waiting period
- Have your Patient Drink a Glass of Cold Water
- Image
- Review Images
- Remove IV
- CUT PATIENT LOOSE!!

(ASNC)	Stress	Rest	
Dose	8–12 mCi	24–36 mCi	Standard
Position	Supine	Supine	Standard
Delay time			
Inj to Imaging	15-60 minutes	30-60 minutes	Standard
Stress to Rest		30 minutes to 4 hrs	Standard
Acquisition protoc	ol		
Energy window	15 -20% symmetric	Same	Standard
Collimator	LEHR	Same	Preferred
Orbit	180 (45 RAO to 45 LPO)	Same	Preferred
Orbit type	Circular	Same	Standard
	Noncircular	Same	Standard
Pixel size	$6.4 \pm .4 \text{ mm}$	Same	Standard
Acquisition type	Step and shoot	Same	Standard
Number of proj	60-64	Same	Standard
Matrix	64 X 64	Same	Standard
Time/projection	25 s	20 s	Standard
ECG gated	Optional	Standard	Preferred
Frames/cycle	8	8	Standard
R-to-R window	100%	100%	Preferred

Examination Two Day Protocol Day One Single Isotope

- Verify the Patient Identity
- Verify Order
- Obtain Patient History
- Verify Patient is Prepped
- Explanation of Exam
- Answer Questions
- Consent
- Start IV
- Stress Patient and inject radiopharmaceutical high dose 30 mCi Tc99m Sestamibi or Tetrofosmin
- Waiting period
- Have your Patient Drink a Glass of Cold Water
- Image
- Review Images
- **Remove IV**
- **CUT PATIENT LOOSE!!**

Examination Two Day Protocol Day Two Single Isotope

- Verify the Patient Identity
- Verify Patient is Prepped
- Explanation of Exam refresher of what will happen that day
- Answer Questions
- Start IV or straight stick
- Inject radiopharmaceutical high dose 30 mCi Tc99m Sestamibi or Tetrofosmin
- Waiting period
- Have your Patient Drink a Glass of Cold Water
- Image
- Review Images
- Remove IV if you started one
- □ CUT PATIENT LOOSE!!

ASNC)	Stress	Rest	
Dose	30 mCi	30 mCi Standard	
Position	Supine	Supine	Standard
Delay time			
Inj to Imaging	15-60 minutes	30-60 minutes	Standard
Acquisition protoc	ol		
Energy window	15 -20% symmetric	Same	Standard
Collimator	LEHR	Same	Preferred
Orbit	180 (45 RAO to 45 LPO)	Same	Preferred
Orbit type	Circular	Same	Standard
	Noncircular	Same	Standard
Pixel size	6.4 ± .4 mm	Same	Standard
Acquisition type	Step and shoot	Same	Standard
Number of proj	60-64	Same	Standard
Matrix	64 X 64	Same	Standard
Time/projection	20 s	20 s	Standard
ECG gated	Optional	Standard	Preferred
Frames/cycle	8	8	Standard
R-to-R window	100%	100%	Preferred

Examination One Day Protocol Dual Isotope

- Verify the Patient Identity
- Verify Order
- Obtain Patient History
- Verify Patient is Prepped
- Explanation of Exam
- Answer Questions
- Consent
- Start IV
- Inject Radiopharmaceutical Tl 201 3.5 mCi
- Waiting period
- Image
- Stress (Rpx injection again, 30 mCi Tc99m Sestamibi or Tetrofosmin)
- Waiting period
- Have your Patient Drink a Glass of Cold Water
- Image
- Review Images
- Remove IV
- CUT PATIENT LOOSE!!

Rest	Stress	
2.5-3.5 mCi Tl201	30 mCi Tc99m	Standard
Supine	Supine	Standard
10-15 minutes	15-60 minutes	Standard
	No Delay	Standard
ol		
25-30% symmetric 70 keV	15 -20% symmetric 140 keV	Standard
20% symmetric 167 keV		
LEHR	Same	Preferred
180 (45 RAO to 45 LPO)	Same	Preferred
Circular	Same	Standard
Noncircular	Same	Standard
$6.4 \pm .4 \text{ mm}$	Same	Standard
Step and shoot	Same	Standard
32-64	60-64	Standard
64 X 64	Same	Standard
40 s (32 fr) 25 s (64 fr)	20 s	Standard
Optional	Standard	Preferred
8	8	Standard
100%	100%	Preferred
	Rest $2.5-3.5 \text{ mCi Tl201}$ Supine $10-15 \text{ minutes}$ $10-15 \text{ minutes}$ $25-30\%$ symmetric 70 keV 20% symmetric 167 keV 20% symmetric 167 keV LEHR $180 (45 \text{ RAO to 45 LPO})$ Circular Noncircular $6.4 \pm .4 \text{ mm}$ Step and shoot $32-64$ 64×64 $40 \text{ s} (32 \text{ fr}) 25 \text{ s} (64 \text{ fr})$ Optional 8 100%	RestStress2.5-3.5 mCi Tl201 30 mCi Tc99m SupineSupine10-15 minutesI5-60 minutes No Delay10-15 minutes15-20% symmetric 140 keV $25-30\%$ symmetric 70 keV $15 -20\%$ symmetric 140 keV 20% symmetric 167 keVLEHR180 (45 RAO to 45 LPO)SameGircularSameNoncircularSame $6.4 \pm .4 \text{ mm}$ SameStep and shootSame $32-64$ $60-64$ 64×64 Same $40 \text{ s} (32 \text{ fr}) 25 \text{ s} (64 \text{ fr})$ 20 s OptionalStandard 8 8 100% 100%

Examination Thallium Only Alternate Protocol Tc99 Shortage

- Verify the Patient Identity
- Verify Order
- Obtain Patient History
- Verify Patient is Prepped
- Explanation of Exam
- Answer Questions
- Consent
- Start IV
- Stress patient and Inject Radiopharmaceutical Tl 201 3.5 mCi
- Image within 10 minutes
- Review images
- Remove IV
- Patient leaves and returns 4 hours later
- Image
- Review Images
- CUT PATIENT LOOSE!!

ASNC)	Stress	Redistribution Rest	
Dose	2.5-3.5 mCi Tl201	NA	Standard
Position	Supine	Supine	Standard
Delay time			
Inj to Imaging	10 minutes max	NA	Standard
Stress to Rest		3-4 hrs	Standard
Acquisition protoc	ol		
Energy window	25-30% symmetric 70 keV 20% symmetric 167 keV	Same	Standard
Collimator	LEAP	Same	Preferred
Orbit	180 (45 RAO to 45 LPO)	Same	Preferred
Orbit type	Circular	Same	Standard
	Noncircular	Same	Standard
Pixel size	6.4 ± .4 mm	Same	Standard
Acquisition type	Step and shoot	Same	Standard
Number of proj	32-64	Same	Standard
Matrix	64 X 64	Same	Standard
Time/projection No Gate	40 s (32 fr) 25 s (64 fr)	Same	Standard

Examination Thallium Only Alternate Protocol Tc99 Shortage with reinjection

- Verify the Patient Identity
- Verify Order
- Obtain Patient History
- Verify Patient is Prepped
- Explanation of Exam
- Answer Questions
- Consent
- Start IV
- Stress patient and Inject Radiopharmaceutical Tl 201 3.5 mCi
- Image within 10 minutes
- Review images
- Patient leaves and returns 4 hours later
- Inj 1 mCi Tl201
- Image
- Review Images
- Remove IV
- CUT PATIENT LOOSE!!

ASNC)	Stress	Reinjection	Redistribution F	Rest
			scan	
Dose	2.5-3.5 mCi Tl201	1.0-1.5 mCi	NA	Standard
Position	Supine		Supine	Standard
Delay time				
Inj to Imaging	10 minutes max		NA	Standard
Stress to Redistribution	ution		3-4 hrs	Standard
Reinjection to Ima	ging		20-30 mi	nStandard
Acquisition protoc	col			
Energy window	25-30% symmetric 70 keV		Same	Standard
Collimator	20% symmetric 10/ kev		Samo	Droforrod
Orbit	180 (45 RAO to 45 IPO)		Same	Dreferred
Orbit type	Circular		Same	Standard
Clott type	Noncircular		Same	Standard
Pixel size	$64 \pm 4 \text{ mm}$		Same	Standard
Acquisition type	Step and shoot		Same	Standard
Number of proj	32-64		Same	Standard
Matrix	64 X 64		Same	Standard
Time/projection	40 s (32 fr) 25 s (64 fr)		Same	Standard
No Gate				

Examination Viability Protocol

- Verify the Patient Identity
- Verify Order
- Obtain Patient History
- Verify Patient is Prepped
- Explanation of Exam
- Answer Questions
- Consent
- Start IV or straight stick
- □ Inject Radiopharmaceutical Tl 201 4 mCi
- Waiting period
- Image
- Review images
- Remove IV if one was started
- Patient leaves and returns 24 hours later
- Image
- Review Images
- CUT PATIENT LOOSE!!



Dose	2.5-3.5 mCi Tl201	Standard
Position	Supine	Standard
Delay time		
Inj to Imaging	20-30 minutes	Standard
Inj to 2nd Imaging	24 hrs	Standard
Acquisition protoco	ol	
Energy window	25-30% symmetric 70 keV 20% symmetric 167 keV	Standard
Collimator	LEAP	Preferred
Orbit	180 (45 RAO to 45 LPO)	Preferred
Orbit type	Circular	Standard
	Noncircular	Standard
Pixel size	6.4 ± .4 mm	Standard
Acquisition type	Step and shoot	Standard
Number of proj	32-64	Standard
Matrix	64 X 64	Standard
Time/proj day1	40 s (32 fr) 25 s (64 fr)	Standard
Time/proj day 2	60 s (32 fr) 45 s (64 fr)	
No Gate		

Study Time Frame

- Study time frame varies by selected protocols and Radiopharmaceutical; however a typical One Day Protocol with low dose rest Tc99m and high dose stress Tc99m is normally completed in approximately 2 to 3 hours. (This is approximately the same when using a dual isotope protocol using Tl201 at rest)
- Thallium only initially takes about 45 minutes, then the patient returns four hours later and that part takes only the imaging time, so 30 minutes tops
- Two Day Protocols and Viability studies do require the patient to return 24 hours later with each day taking approximately 1 to 1.5 hours to complete.

Efficiency Evaluation*: Comparison of Tc99m Tetrofosmin and Tc99m Sestamibi

	Time (min)		
Study	Tc99m Tetrofosmin	Tc99m Sestamibi	<i>P</i> Value
Rest	47.7 ± 21.7	74.3 ± 25.8	0.0001
Stress	42.9 ± 23.3	48.4 ± 25.0	0.0066
Rest + stress	90.0 ± 32.7	124.0 ± 37.0	0.0001

*1,134 imaging studies.

Reference: Ravizzini GC et al. Nucl Med Comm. 2002;23:203-208.

Rescan Rate*: Comparison of Tc99m Tetrofosmin and Tc99m Sestamibi

Rescan rate % (n)				
Study	Tc99m Tetrofosmin	Tc99m Sestamibi	<i>P</i> Value	
Rest	10.0 (26/261)	21.4 (75/351)	0.001	
Stress	5.8 (15/259)	9.9 (26/263)	0.082	
Rest + stress	7.9 (41/520)	16.4 (101/614)	0.01	

*Rescans due to liver and combined liver and bowel activity. Physician blinded study.

Reference: Ravizzini GC et al. Nucl Med Comm. 2002;23:203-208.

If you can scan faster and have less liver artifact, why would you not use Tetrofosmin??

Physician preference or.... because with the release of generic Sestamibi a few years ago, it is less money going out up front. Even though reimbursement will be what you paid (it is straight across the board) the is less money going out up front.

ASNC Guidelines: Injection to Scan Time

- Tetrofosmin Rest: 30 minutes
- Sestamibi Rest: 60 minutes
- **Thallium Rest:** 15 minutes
- Tetrofosmin Treadmill Stress: 10-15 minutes
- Sestamibi Treadmill Stress: 15-20 minutes
- Tetrofosmin Pharma Stress: 30 minutes
- Tetrofosmin Pharma Stress: 60 minutes

Radiopharmaceutical Doses

- **Tl-201 2.5 to 3 mCi**
- Tc99m Agents
 - Two-day protocol: 15-30 mCi
 - One-day protocol: 1:3 ratio 10 and 30 mCi
 - Overweight patients (based on 70 kg/155 lb patient)
 - Low dose (.11 mCi/kg)
 - High dose (.31 mCi/kg)

Methods of Stress Testing

Bicycle Ergometer or Arm Ergometer

Treadmill

- Bruce Protocol
- Modified Bruce Protocol
- Naughton
- Pharmacological
- Dipyridamole (Persantine)
- Adenosine
- Dobutamine
- A2A Adenosine Agonists Regadenoson (Lexiscan)

Bicycle Ergometer

Patients pedal at constant speed beginning at a workload of 25 to 50 W and increasing by 25 W every 3 min

Arm Ergometer

Cycling speeds of 60 to 75 revolutions per minute must be maintained. Work rate increments of 10 W per 2-minute stage are suggested

Treadmill Stresses

Bruce Protocol Treadmill

- The Bruce protocol is a diagnostic test used in the evaluation of cardiac function, developed by Robert A. Bruce.
- He developed the multistage test, consisting of several stages of progressively greater workloads. It was this multistage test, a description of which was first published in 1963, that became known as the Bruce Protocol.

Bruce Protocol

In the initial paper, Bruce reported that the test could detect signs of such conditions as angina pectoris, a previous heart attack, or a ventricular aneurysm. Bruce and colleagues also demonstrated that exercise testing was useful in screening apparently healthy people for early signs of coronary artery disease.

Bruce Protocol (each stage is 3 min)

Stage	e Minutes	% Grade	MPH
1	3	10	1.7
2	6	12	2.5
3	9	14	3.4
4	12	16	4.2
5	15	18	5.0
6	18	20	5.5
7	21	22	6.0

Modified Bruce Protocol (each stage is 3 min)

Stage	Minutes	% Grade	MPH
1	3	0	1.7
2	6	5	1.7
3	9	10	1.7
4	12	12	2.5
5	15	14	3.4
6	18	16	4.2
7	21	18	5.0

This video is of Treadmill Stress only with no injection, but it's funny! FYI, you can hold on to the rails! (Modified Bruce)



Naughton Stress (Low Level each stage is 2 min)

Stage	Minutes	% Grade	MPH
1	2	0	1
2	4	0	2
3	6	3.5	2
4	8	7	2
5	10	10.5	2
6	12	14	2
7	14	17.5	2

Chemical Stresses

- There are currently three vasodilator agents available:
 - Dipyridamole
 - Adenosine
 - Regadenoson
- They all work by producing stimulation of A2A receptors
- Dobutamine
 - Dobutamine infusion results in direct b1 and b2 stimulation with a dose-related increase in heart rate, blood pressure, and myocardial contractility.

Dipyridamole

Dipyridamole is administered at 0.56 mg/kg intravenously over a 4-minute period (142 mcg/kg/min). Although an infusion pump is preferable, Dipyridamole can also be administered by hand injection or drip. The radiotracer is injected 3-5 minutes after the completion of Dipyridamole infusion. The halflife of Dipyridamole is approximately 30-45 minutes.

Dipyridamole

Side Effects: Over 50% of patients develop side effects (flushing, chest pain, headache, dizziness, or hypotension). Aminophylline (125-250 mg intravenously) is often required to reverse these side effects. Aminophylline should also be used in the presence of ischemic ECG changes after Dipyridamole.

Adenosine

Adenosine should be given as a continuous infusion at a rate of 140 mcg/kg/min over a 6-minute period. The tracer is injected at 3minutes and the infusion continues for another 3 minutes. A shorter-duration adenosine infusion, lasting 4 minutes, has been found to be equally effective for the detection of CAD compared to the standard 6-minute infusion. For shorter duration protocols, the minimum time to tracer injection should be 2 minutes and the infusion should continue for at least 2 minutes after tracer injection.

Adenosine

Minor side effects are common and occur in approximately 80% of patients. The common side effects are flushing (35-40%), chest pain (25-30%), dyspnea (20%), dizziness (7%), nausea (5%), and symptomatic hypotension (5%). Chest pain is nonspecific and is not necessarily indicative of the presence of CAD. AV block occurs in approximately 7.6% of cases. However, the incidence of second-degree AV block is only 4%, and that of complete heart block is less than 1%. Most cases (95%) of AV block do not require termination of the infusion. ST-segment depression of 1 mm or greater occurs in 5-7% of cases. However, unlike chest pain, this is usually indicative of significant CAD. Fatal or nonfatal myocardial infarction is extremely rare. Due to an exceedingly short half-life of adenosine (10 seconds), most side effects resolve in a few seconds after discontinuation of the adenosine infusion, and aminophylline infusion is only very rarely required.

Regadenoson

The recommended intravenous dose of Regadenoson is 5 mL (0.4 mg Regadenoson) and should be given as a rapid (approximately 10 seconds) injection into a peripheral vein using a 22 gauge or larger catheter or needle. Administer a 5-mL saline flush immediately after the injection of Regadenoson. Administer the radionuclide myocardial perfusion imaging agent 10-20 seconds after the saline flush. The radionuclide may be injected directly into the same catheter as Regadenoson.

Regadenoson

The most common reactions to administration of Regadenoson during MPI are shortness of breath, headache, and flushing. Less common reactions are chest discomfort, angina pectoris or ST, dizziness, chest pain, nausea, abdominal discomfort, and feeling hot. In patients with a prior adenosine stress study, rhythm or conduction abnormalities were seen in 26% with Regadenoson (30% for Adenosine). First degree AV block was detected in 3% with Regadenoson (7% with adenosine), second degree AV block in 0.1% (1% with adenosine). Most adverse reactions begin soon after dosing and generally resolve within approximately 15 minutes, except for headache which resolves in most patients within 30 minutes. Aminophylline may be administered in doses ranging from 50 to 250 mg by slow intravenous injection (50-100 mg over 30-60 seconds) to attenuate severe and/or persistent adverse reactions to Regadenoson.

Dobutamine

Dobutamine is infused incrementally starting at a dose of 5-10 mcg/kg/min, which is increased at 3-minute intervals to 20, 30, and 40 mcg/kg/min. The half-life of Dobutamine is approximately 2 minutes. As with exercise stress, achieving 85% of the predicted heart rate is desirable. The tracer is injected at 85%

Dobutamine

Side effects occur in about 75% of patients. The common side effects are palpitation (29%), chest pain (31%), headache (14%), flushing (14%), dyspnea (14%), and significant supraventricular or ventricular arrhythmias (8-10%). Ischemic ST-segment depression occurs in approximately one-third of patients undergoing Dobutamine infusion. Severe side effects may require IV administration of a short-acting b-blocker (esmolol, 0.5 mg/kg over 1 minute)

Technical Challenges/Decisions

The Unprepped Patient

- Reschedule Patient

Diaphragmatic and Breast Attenuation

- Prone Imaging
- Breast Taped
- Other Artifact
 - Increased Gut Activity/Loop of Bowel/Stomach/Liver
 - Motion
 - -LBBB
- Obese Patients
 - 2 Day Tc/Tc Protocol

The Unprepped Patient/Beta Blocker

Effect of Beta-Blockade and Dipyridamole (Diagnostic Vs. Function)



Taillefer R, et al. Acute Beta-Blockade Reduces the Extent and Severity of Myocardial Perfusion Defects with Dipyridamole Tc99m sestamibi SPECT Imaging. J Am Coll Cardiol 2003:42:1475-83.

Taillefer et al tested 21 patients at baseline, after low-dose intravenous metoprolol tartrate and after high-dose intravenous metoprolol tartrate. They found that the stress defect extent and severity were reduced by 25% to 30% even at the low dose of the B-Blocker, with no change in the rest defect appearance. As such, B-blockers "masked" the ischemic burden.

Diaphragmatic Attenuation

- Commonly seen in obese males or males with large chests
- May appear as black area underneath the heart on cine view
- Defect seen as fixed inferior wall defect
- Upward creep diaphragmatic reversible defects were more commonly seen with thallium imaging

Supine vs. Prone



Breast Attenuation

- Usually seen in large-breasted females
- Fixed anterior or anterolateral defect
- Defect may appear as partially reversible if breast positioning differs for the rest and stress acquisitions
- Defect size and position may vary depending on breast size and positioning

Breast Attenuation

Before



Breast taped

Extra-cardiac Activity

• Liver Activity

 Excessive liver activity can cause scatter artifacts and an increase in inferior wall activity



Extra-cardiac Activity

- Bowel Activity
 - Activity within bowel loops can cause inferior wall defects
 - Liver, gallbladder, or bowel activity may cause normalization problems



Motion Artifact

- Approximately 20% of defects can be attributed to motion
- Motion correction programs can correct only one pixel motion shift or greater, therefore, a repeat scan may be required
- Patient comfort and cooperation is critical

Hurricane Sign



Motion Defect



Exercising a patient on the treadmill with a LBBB will cause a septal defect

Pt 1 exercised on a Treadmill note defect



Patient 1 stressed with Adenosine and rescanned

Note lack of defect



Low count study



Two-day protocol. Ideally, stress and rest imaging with Tc-99m agents should be performed on two separate days to avoid having residual activity from the first study contaminate the second study. In overweight patients (ie, >250 lb or body mass index >30) or in female patients where significant breast attenuation is anticipated, a low dose of Tc-99m radiotracer may result in suboptimal images and a 2-day imaging protocol is preferable.

Patient Satisfaction

What was your scheduling experience like?

- My personal schedule was accommodated
- Insurance questions were answered
- I received a confirmation call

What was your arrival at our clinic like?

- I was able to find the office easily
- I was greeted professionally and courteously
- The technologist greeted me professionally and courteously
- The office was neat and clean

What was your testing Experience like?

- Technologist thoroughly explained the test process.
- Temperature of my room was satisfactory to me.
- Technologist was attentive to my needs
- Overall the testing experience was satisfactory to me

Physician Survey

To improve our nuclear program, please complete this brief questionnaire regarding services provided by the Cardiovascular Nuclear Stress Lab. Your responses will assist us in improving quality care to your patients and facilitate our reporting to you. Thank you, in advance, for your time and candor in providing this information. **Please rate the Nuclear Cardiology Laboratory using the following scale:** 1 = Excellent 2 = Very Good 3 = Good 4 = Fair 5 = Poor

_____ Timeliness of written communications/reports to your office

_____ Timeliness of faxed reports on abnormal stress exams

_____ Overall satisfaction with ease of scheduling studies

- _____ Feedback from patients regarding the nuclear exam has been favorable
- _____ Overall satisfaction with the test results generated by the stress lab
- _____ Overall satisfaction with the quality of care provided
- _____ Overall satisfaction with the Nuclear Cardiology process

Comments and Recommendations:

Name (optional)

WAKE UP!!

