PHARMACOLOGIC VASODILATORY STRESS

**ADENOSINE:** Mechanism of action. Direct coronary arteriolar vasodilatation that induces an attenuated hyperemic response in myocardial regions supplied by disease coronary artery. Depending on the severity of coronary artery. Depending on the severity of coronary stenosis and limitations in coronary flow reserve, adenosine will induce relative heterogeneity in coronary blood flow. The initial uptake of Tc99m MIBI and T1-201 is flow dependent and unequal distribution of radioisotope into the myocardium will be identified as perfusion defect.

**Dose:** 140ug/kg/min over a 6 minute period

- **Indications:**
  - Inability to perform adequate exercise or in patients with left bundle branch or in patients taking medications that would interfere with the test.
  - Diagnosis and evaluation of coronary artery disease.
  - Risk stratification particularly in the early post infarction setting setting ( >48hours)
  - Evaluation of therapeutic benefits after angioplasty or coronary artery bypass surgery

**Hemodynamic Effects**
A post related modest increase in heart rate.
Decrease in both systolic and diastolic blood pressure.

**Absolute contraindications**
On going wheezing
Greater than first degree AV block without pacemaker
Hypotension (systolic blood pressure < 90mm Hg)

**Relative contraindications**
Remote history reactive airway disease (asthma, COPD)
Sick sinus syndrome
Severe sinus (<40/min) bradycardia

**Procedure:**
1. An infusion pump is necessary for the administration of adenosine.
2. A dual-ported connector is used for injecting the radiopharmaceutical.
3. Electrocardiographic monitoring and blood pressure determinations are performed as with exercise stress.
4. Adenosine infusion rate at 140ug/kg/min for 3 minutes followed by injection of radiopharmaceutical. The infusion is then continued for 3 additional minutes.

**Early termination of adenosine infusion**
- Severe hypotension (b\p <90 mm Hg)
• Development of symptomatic, persistent second-degree or complete heart block.
• Wheezing
• Severe chest pain associated electrocardiographic ischemic changes (> 2mm ST segment depression)

Side effects of adenosine
• Occur in approximately 80% of patients. The most common are flushing (35%), chest pain (34%), dyspnea (19%), electrocardiographic ST segment depression (13%), dizziness (7%), nausea (5%), and hypotension (3%).
• Fatal or nonfatal myocardial infarctions have been rarely reported with adenosine.
• Due to the exceedingly short half life of adenosine (<2 seconds), most side effects resolve within 1 or 2 minutes of terminating the adenosine, aminophylline can be administered.
• If side effects persist after stopping the infusion of adenosine, aminophylline can be administered.

Dobutamine

Unlike the coronary vasodilators, Dobutamine is a positive isotropic, through stimulation of beta-1 receptors, produces an increase in heart muscle contraction and resulting increase in oxygen demand produces a stressed state. Doses of dobutamine >20 ug/kg/min also have chronotropic effects on the heart. High doses of dobutamine 40 ug/kg/min produce an increase in heart rate from 70 +/- 16 to 121 +/- 23 bpm.

Dose:

Dobutamine is infused incrementally starting at a dose of 5ug/kg/min, which is increased at 3 minutes intervals to 10, 20, 30 and up to 40 ug/kg/min.

Indications:

Dobutamine is secondary pharmacological stressors that are used in patients who cannot undergo exercise stress, but yet have contraindications to pharmacologic vasodilator stressors.

Contraindications:
• Recent (1 week) myocardial infarction
• Unstable angina
• Hemodynamically significant left ventricular outflow tract obstruction
• Critical aortic stenosis
• Atrial tachyarrhythmia with uncontrolled ventricular response
• Ventricular tachycardia
• Uncontrolled hypertension
• Patients with aortic dissections or large aortic aneurysm

Procedure:
• Infusion pump required for Dobutamine administration
• Electrocardiographic monitoring blood pressure determinations as with other Pharmacologic stressors
• Dobutamine administered starting at a dose of 5ug/kg/min and increasing at 3 minute intervals up to 40ug/kg/min, with injection of radiopharmaceutical at 1 minute into the highest
Dobutamine dose
  o Dobutamine infusion is maintained for 2 minutes after the tracer injection.

Early termination of Doutamine
  • Similar indications as those used for exercise stress. Termination for ventricular tachycardia or ST segment evaluation is more likely than with other stressors.

Side effects:
  • Are reported in some 75% of patients
  • Most common side effects are chest pain (31%), palpitations (29%), Headache (14%), flushing (14%), Dyspnea (14%), and paresthias (12%). Ischemia ST Segment occurs in approximately 50% of patients during dobutamine infusion.
  • Severe side effects may require IV administration of short-acting beta-blocker(ESmolol).

LEXISCAN (Regadenoson) injection
  Is a pharmacologic stress agent indicated for radionuclide myocardial perfusion imaging in patients unable to undergo adequate stress.

Dose:
  The recommended dose of lexican is 5ml (0.4mg regadenoson) by rapid IV injection, followed by saline flush and radiopharmaceutical.

Indications:
  Lexiscan is indicated for use in pharmacologic stress MPI, with no specific requirements regarding the tracer or imaging protocol used. Pharmacologic stress is conducted in patients who are unable to exercise adequately due to poor physical conditioning, poor motivation, or diseases or conditions that limit physical exertion or activity (e.g., lower limb amputation, arthritis, etc.).

Hemodynamic effects:
  The majority of patients had an increase in heart rate and a decrease in blood pressure within 45 minutes after the administration of lexican.

Absolute Contraindications:
  Do not administer lexican to patients with second or third degree AV block, or sinus node dysfunction unless these patient s have a functioning article pacemaker.

Warning and precautions:
  Myocardial Ischemia Fatal cardiac arrest, life threatening ventricular arrhythmias, and myocardial infarction may result from the ischemia induced by pharmacologic stress agents. Cardiac resuscitation equipment and trained staff should be available before the administering lexican.
  Sinoatrial and Ativoventricular Nodal Block- in clinical trials first degree AV block (PR prolongation >220 msec) development in 3% of patients within 2 hours of lexican administration; transient second degree AV block with one dropped beat was observed in one patient receiving lexican. All episodes of AV block were asymptomatic and did not require intervention.
Hypotension-decreased systolic blood pressure (>35mm Hg) was observed in 7% of patients and decreased diastolic blood pressure (>25mm Hg) was observed in 4% of patients within 45 minutes of lexiscan administration. The risk of serious hypotension may be higher in patients with autonomic dysfunction, hypovolmia, left main coronary artery stenosis, stenotic valvular heart disease, pericarditis, or pericardial effusions or stenotic carotid artery disease with cerebrovascular insufficiency.

Bronchoconstrictor-Adenosine receptor agonists may cause bronchoconstriction and respiratory compromise. For patients with known or suspected bronchoconstrictive disease, COPD or asthma appropriate bronchodilator therapy and resuscitative measures should be available prior to lexiscan administration.

**Procedure:**

1. Administer lexiscan as a rapid (approximately 10 seconds) injection into a peripheral vein using a 22 gauge or larger catheter or needle,
2. Administer a 5ml saline flush immediately following the injection of lexiscan.
3. 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 the lexiscan.

**Side effects:**

- Are reported in some 80% of patients
- The most common side effects are dyspnea (28%), headache (26%), flushing (16%), chest discomfort (13%), angina pectoris or ST segment depression (12%), dizziness (8%), chest pain (7%), nausea (6%), abdominal discomfort (5%), and feeling hot (5%).