

WHEN FEASIBLE, EXERCISE TESTING IS PREFERRED

The Rationale

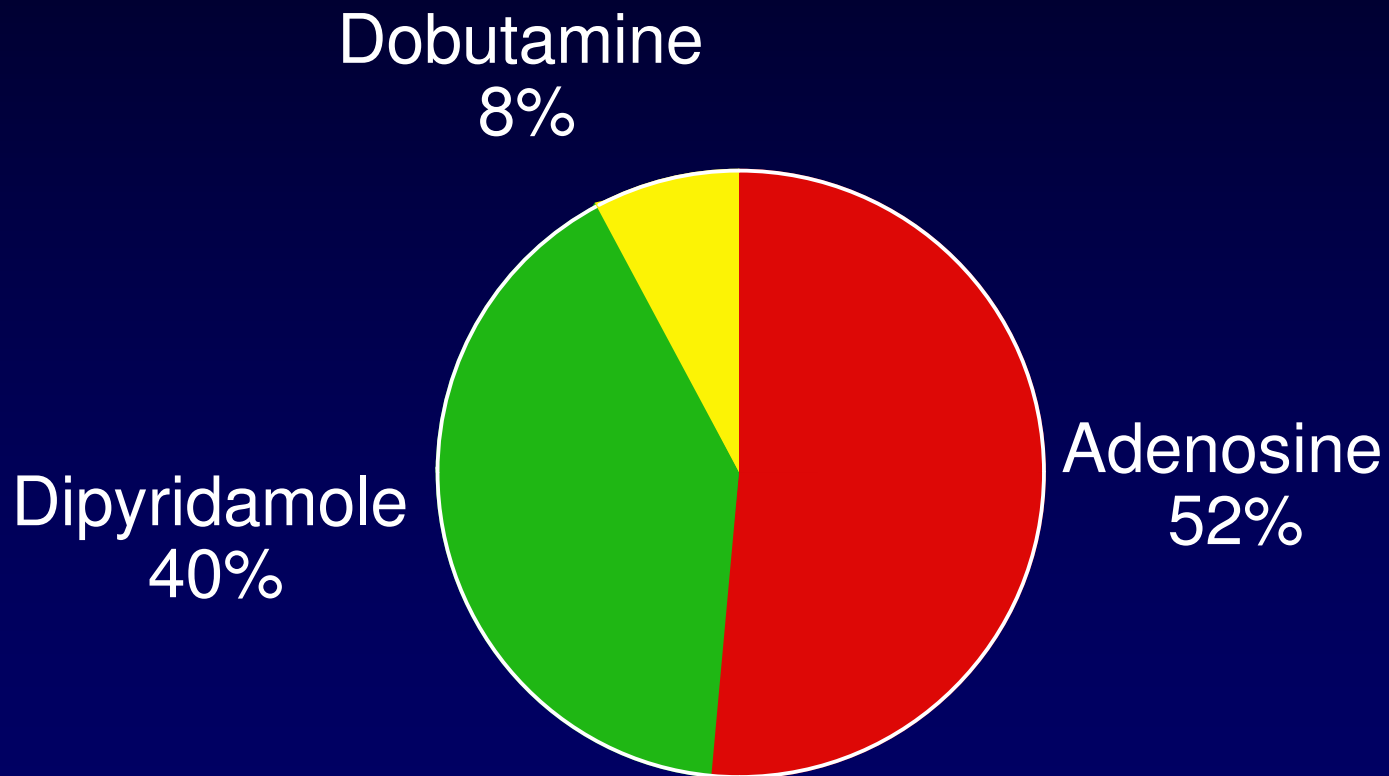
- Exercise duration (time or METS)
- Symptoms
- Arrhythmia/conduction disorders
- Reason for termination
- Heart rate response
- Blood pressure response
- ECG changes

PHARMACOLOGIC STRESS TESTING

Indications and Applications

- Inability to exercise
 - CNS
 - Orthopedic
- Limited capacity for exercise
 - Poor conditioning/motivation
 - PVD
 - COPD
 - Medication
- Contraindications to exercise
 - AAA
 - Aortic stenosis
- Left bundle branch block/pacemaker

PHARMCOLOGIC STRESS MYOCARDIAL PERFUSION IMAGING



Source: AMR

STRESS TESTING

Characteristics of Technique

	EXER	DOBUT	DIPYRID	ADENO
\dot{Q}_c CBF	2-3X	2-3X	3-4X	3-5X
Ischemia ?	Yes	Yes	No	No
Onset, min	3-5	2-4	4-6	1-2
Offset, min	2-5	4-6	10-30	0.5-1
AV Block	No	No	Sl increase	Increase
SA/AV cond	Increase	Sl increase	Sl decrease	Decrease
Ectopy	Yes	Yes	Rare	Rare

\dot{Q}_c CBF =change in coronary bloodflow, min =minutes;

SA/AV cond= sinoatrial and atrioventricular node conduction

CONTRAINDICATIONS TO PHARMACOLOGIC STRESS TESTING

- GENERAL

- Hypotension
- ACS w/i 24 hours
- Decompensated heart failure
- Critical AS
- Severe LM stenosis
- Severe LV outflow obstruction
- Hypersensitivity to agent

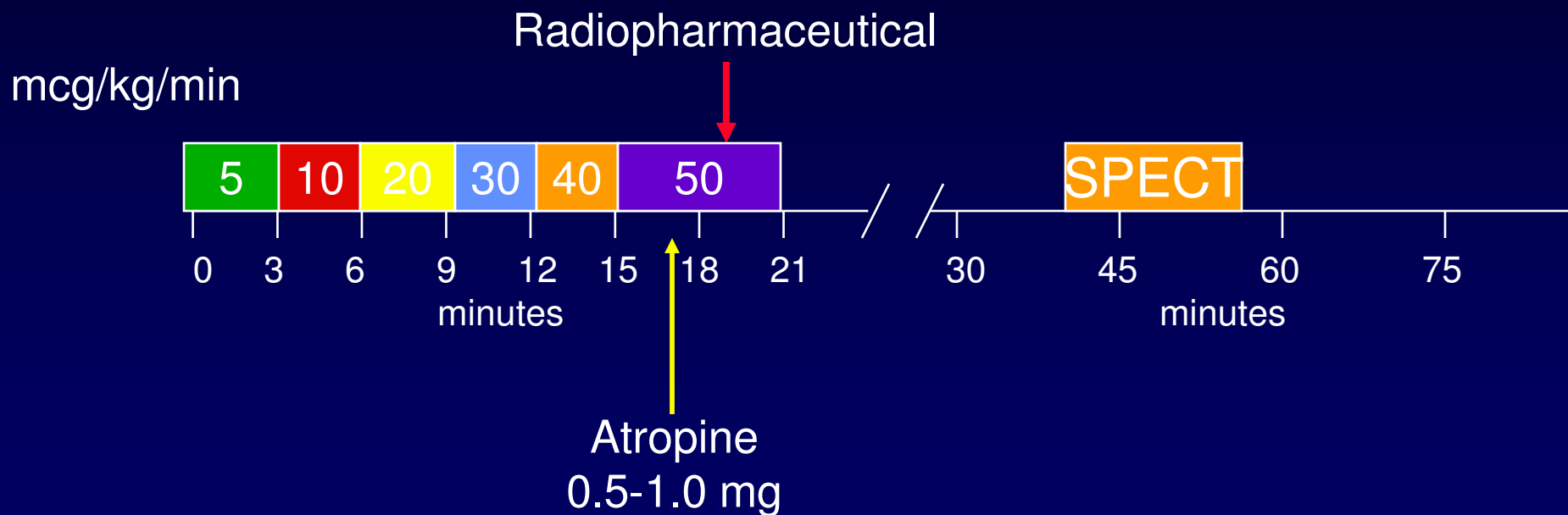
- DIPYRIDAMOLE, ADENOSINE

- Use of dipyridamole (for adenosine)
- Severe (active) asthma or COPD
- Allergy to aminophylline
- 2nd or 3rd AV block
- Caffeine, other methylxanthine w/i 12 hrs

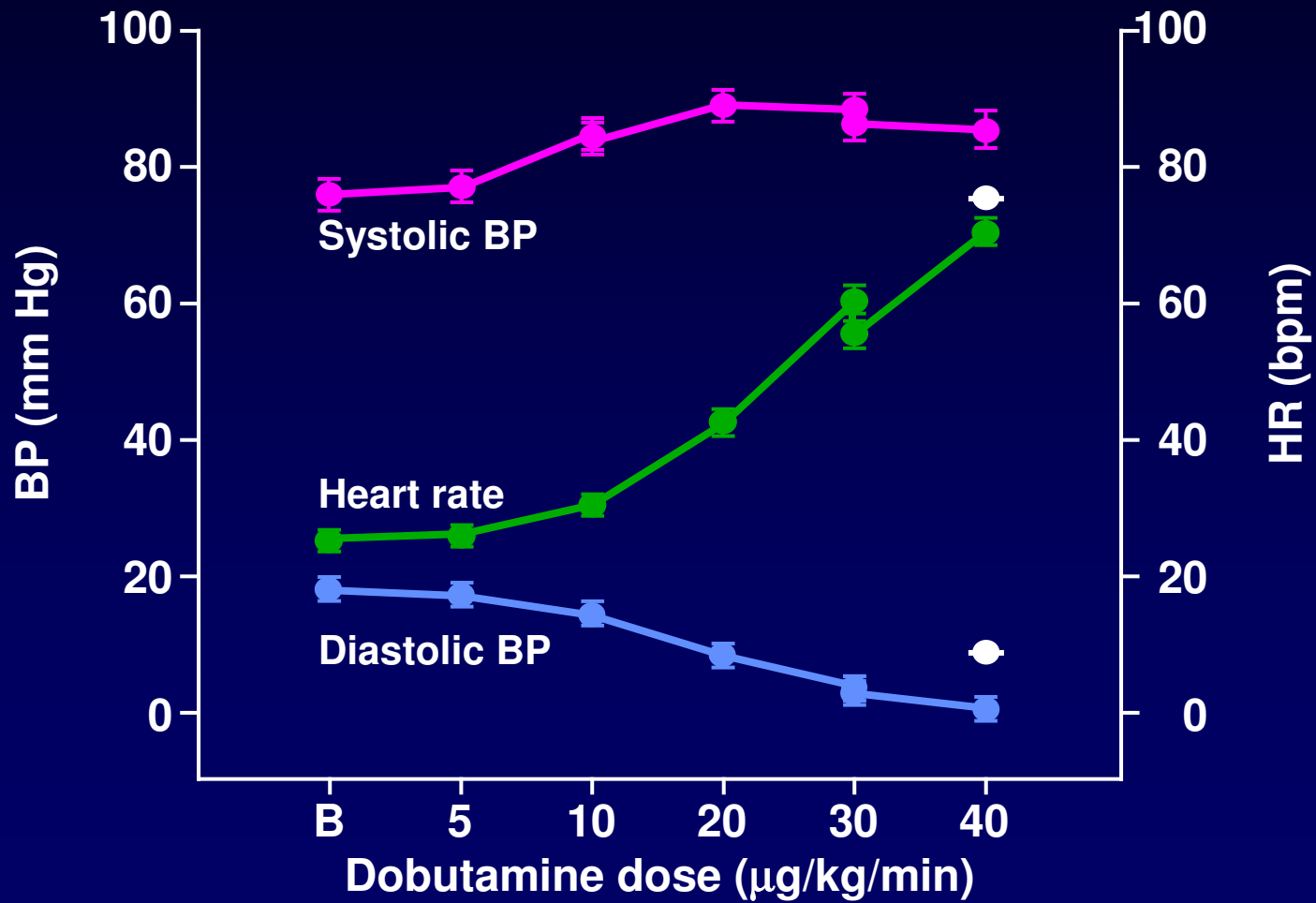
- DOBUTAMINE

- Hypertension
- Uncontrolled atrial fibrillation/flutter
- Serious VEA
- Large aortic aneurysm
- Beta-blockers w/i 24 hrs

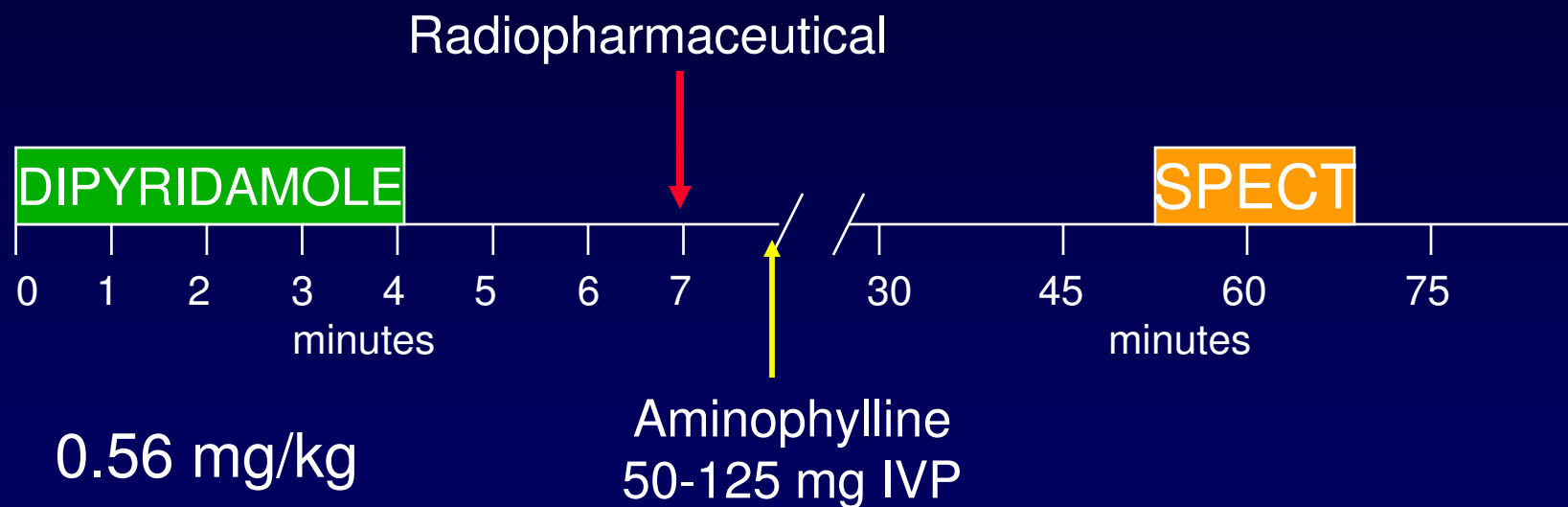
DOBUTAMINE STRESS TESTING



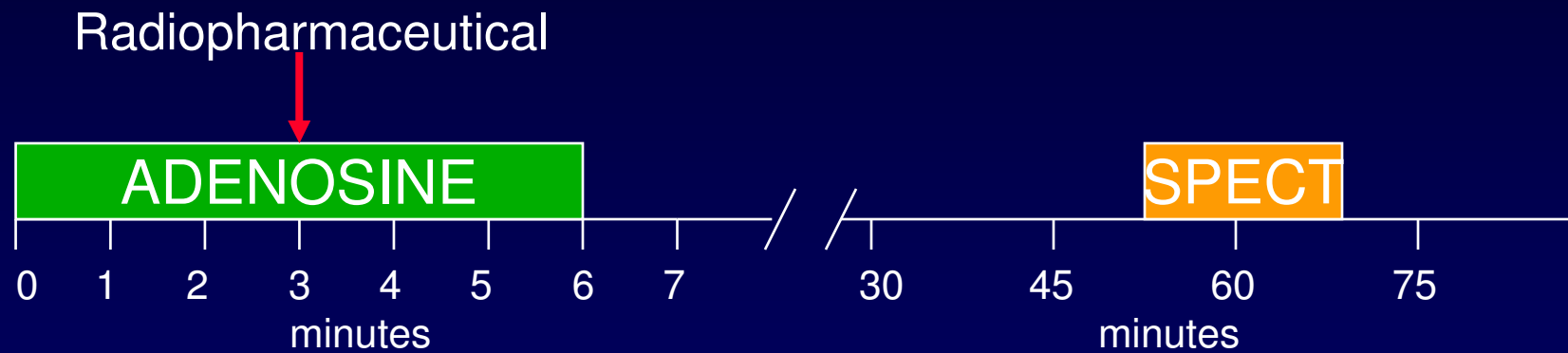
HEMODYNAMIC EFFECTS OF DOBUTAMINE



DIPYRIDAMOLE STRESS TESTING



ADENOSINE STRESS TESTING

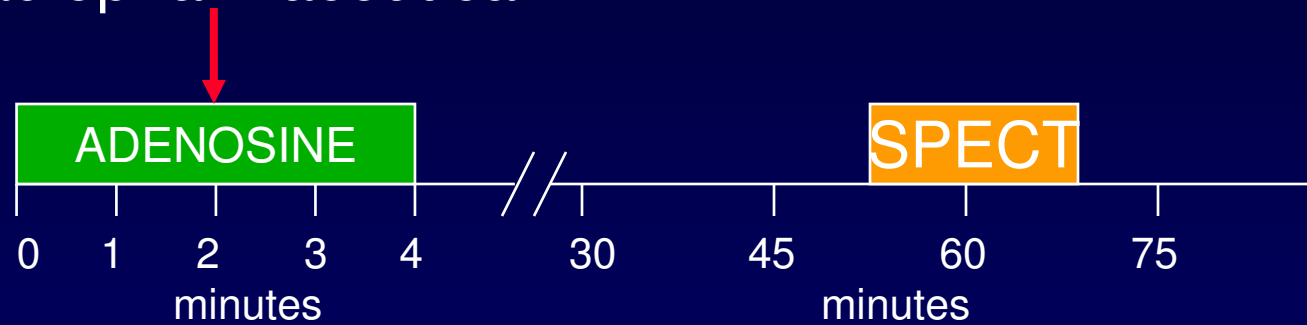


140 mcg/kg/min

ADENOSINE STRESS TESTING

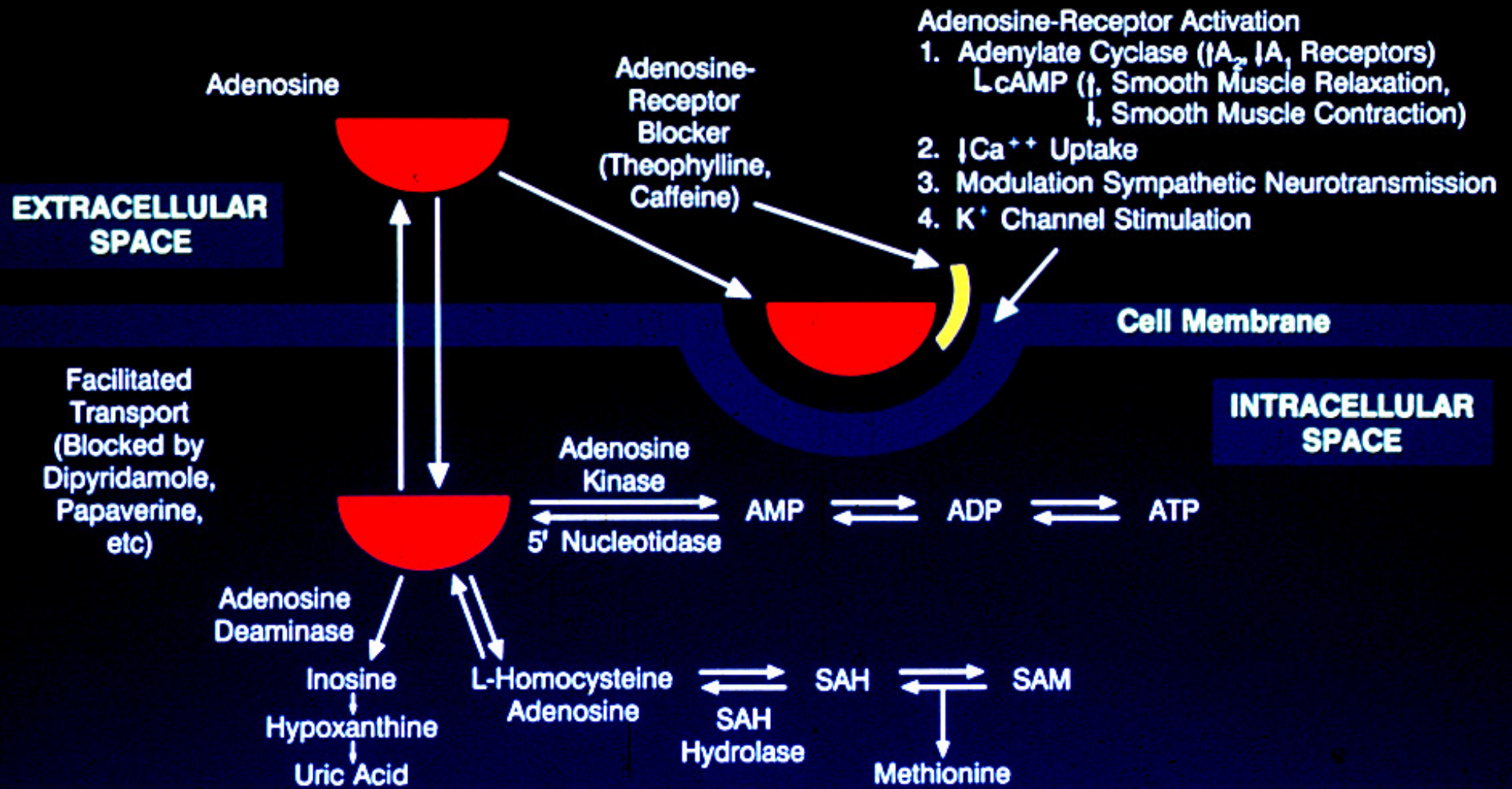
Abbreviated Protocol

Radiopharmaceutical



140 mcg/kg/min

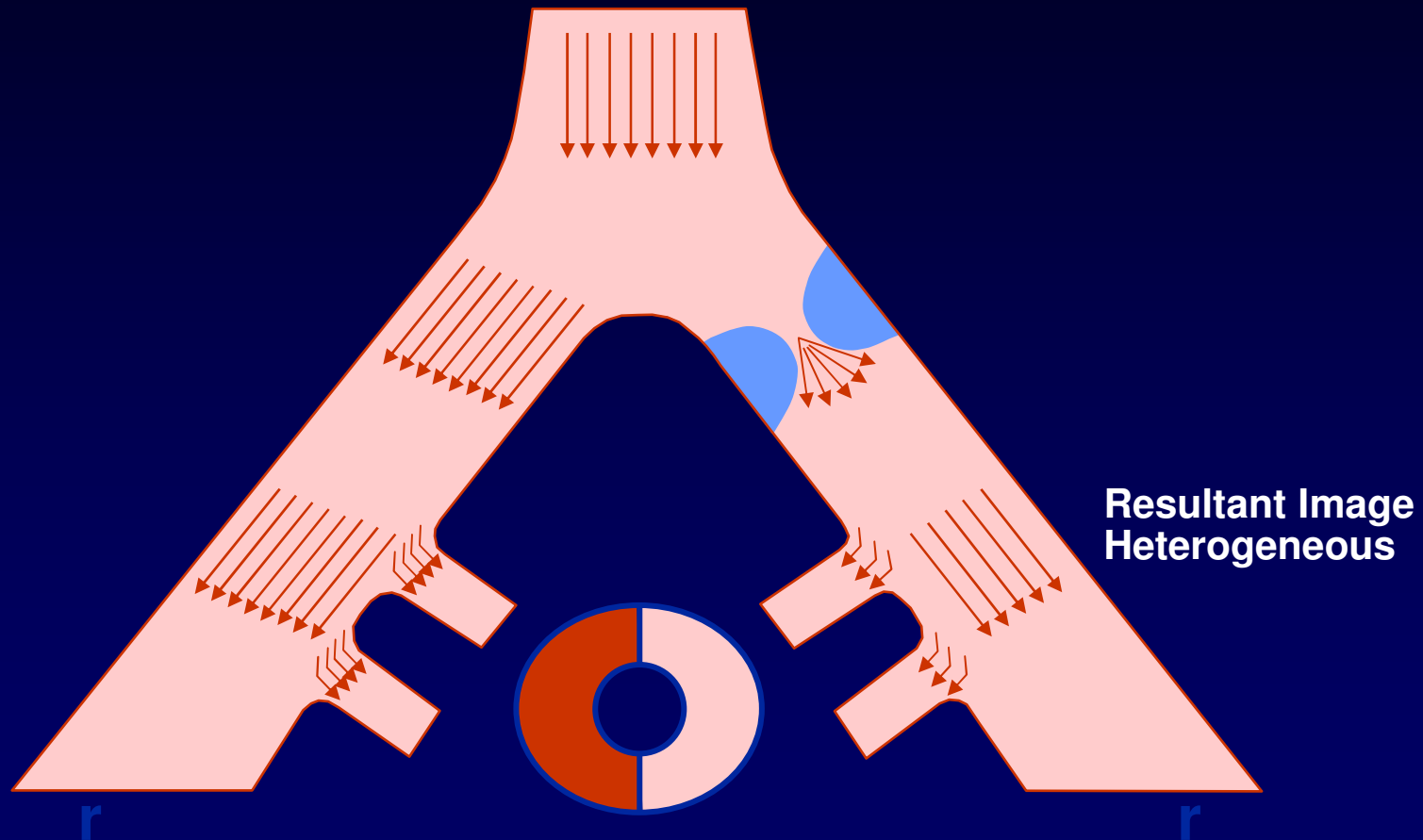
ADENOSINE MECHANISM OF ACTION¹



cAMP = cyclic adenosine monophosphate; AMP = adenosine monophosphate; ADP = adenosine diphosphate; ATP = adenosine triphosphate; SAH = S-adenosyl homocysteine; SAM = S-adenosyl methionine

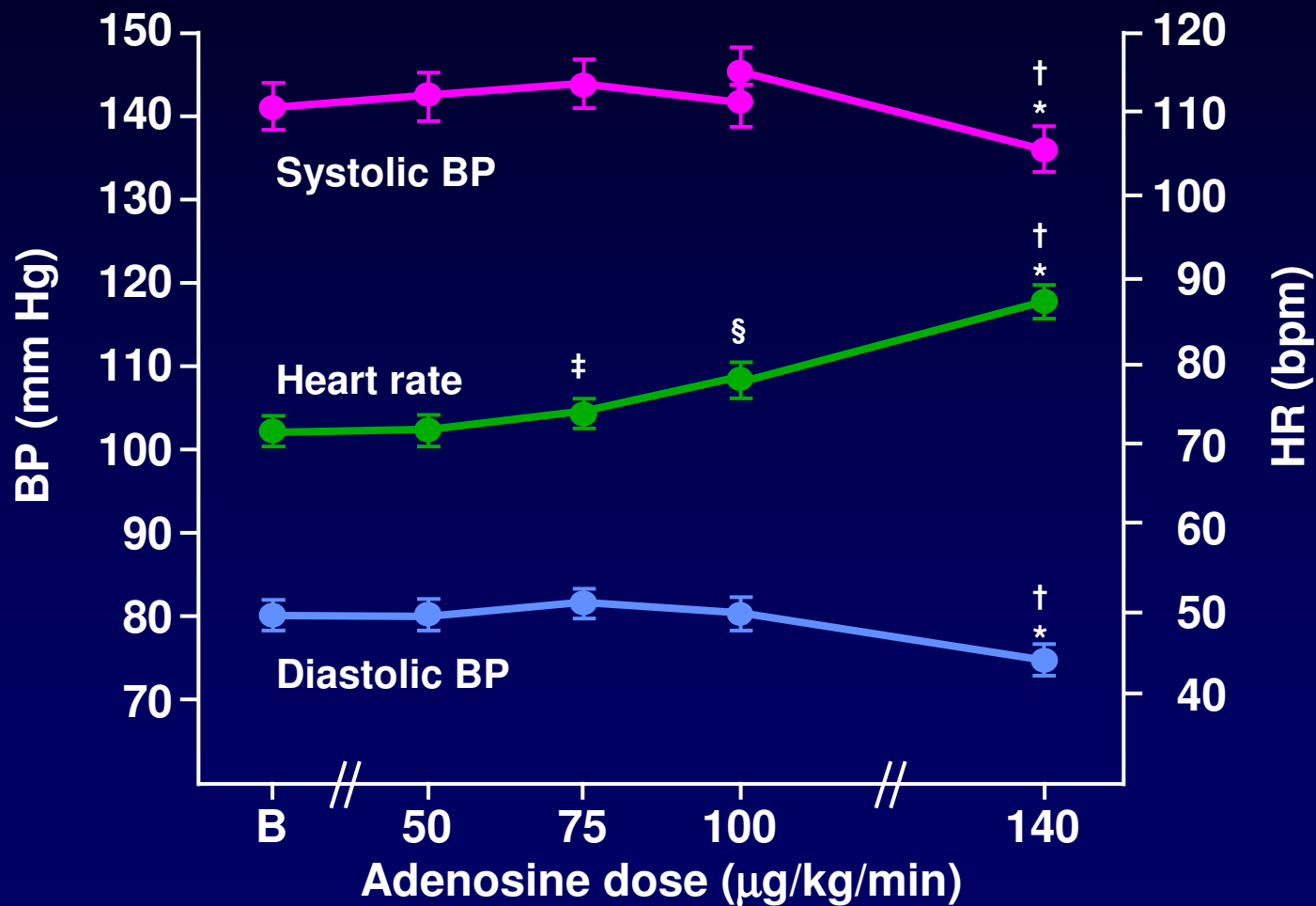
1. Adapted from Verani MS, Mahmarian JJ: *Am J Cardiol* 1991;67(May suppl):12D-17D.

CORONARY FLOW IN PATIENT WITH CAD AFTER VASODILATOR



Flow disparity due to augmented flow in normal bed and attenuated response in stenosed bed

HEMODYNAMIC EFFECTS OF ADENOSINE



†B-140 ($P=0.0003$); *100-140 ($P=0.0001$); ‡B-75 ($P<0.05$); §75-100 ($P=0.0001$)

Verani MS et al. *Circulation*. 1990;82:80-87

PHARMACOLOGIC STRESS TESTING WITH VASODILATORS

GENERAL PROPERTIES

- Excellent safety with stable pts
- Avoid w/ bronchospasm, AV block
- May be combined with exercise
- Well-proved diagnostic and prognostic utility

DIFFERENCES

- Dipyridamole
 - Indirect action
 - Prolonged action
- Adenosine
 - Direct receptor agonism
 - Rapid onset/offset
 - Avoid if pt receiving dipyridamole

PHARMACOLOGIC STRESS TESTING

Side Effects

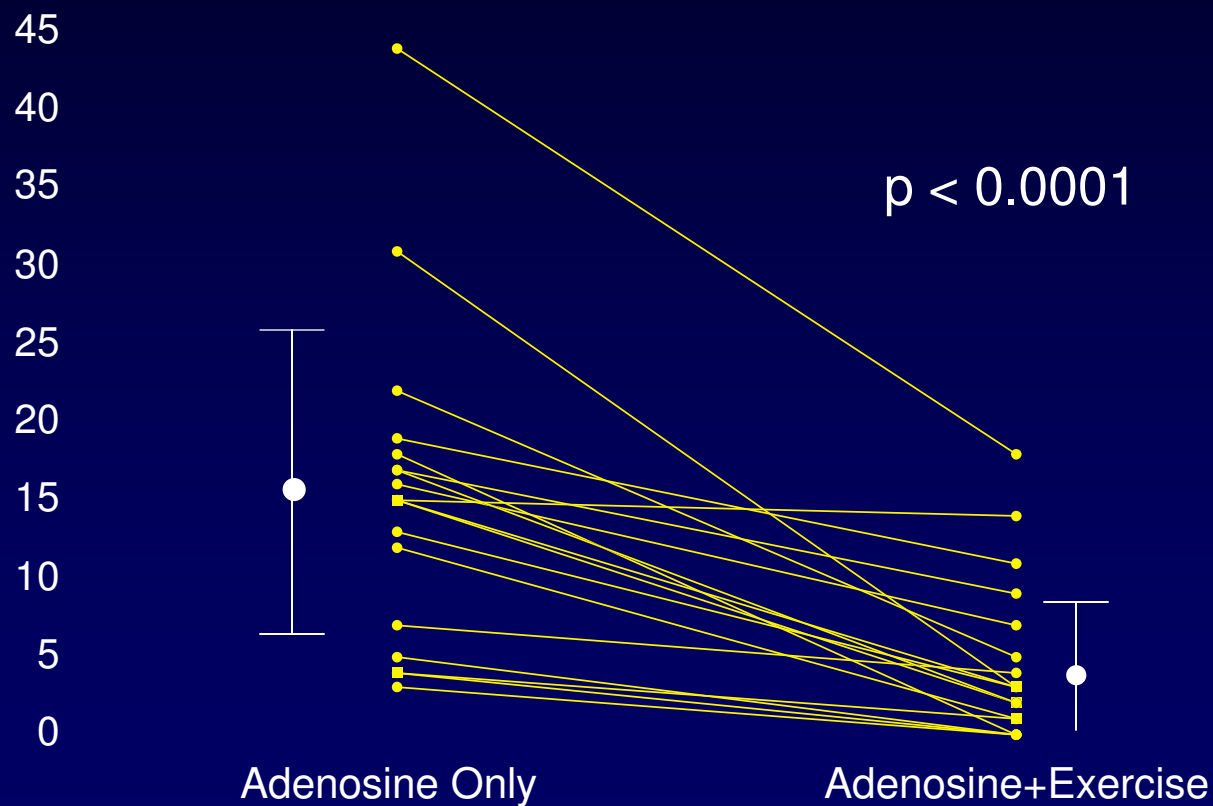
	ADENOSINE¹ n=9,256	DIPYRIDAMOLE² n=476	DOBUTAMINE³ n=1,076
Chest Pain	35%	20%	39%
Flushing	37%	43%	<1%
Dyspnea	35%	3%	6%
Dizziness	9%	12%	4%
GI discomfort	15%	6%	1%
Headache	14%	12%	7%
Arrhythmia	3%	5%	45%
AV Block	8%	0%	0%
ST _T	6%	8%	20-31%
ANY	81%	47%	50-75%

ST_T = ST segment changes on ECG; ANY = any side effect

¹Cerquiera, JACC 1994; 23: 384 ²Ranhosky, Circ 1990; 81: 1205 ³Elhendy, JNM 1998; 39: 1662

REDUCTION OF SYMPTOMS WITH ADJUNCTIVE EXERCISE

Symptom Severity Score



PHARMACOLOGIC STRESS TESTING

Adjunctive Exercise

- Can be performed in most patients
- Minimal logistic issues
- Similar diagnostic information
- Improved image contrast
(myocardium:background ratios)
- Less hepatic interference
- Markedly reduced side effects
 - Symptoms
 - Conduction disturbances

STRESS PROTOCOLS

Conclusions

- Exercise preferred in most situations (except LBBB)
- Pharmacologic methods provide excellent alternative
- Adenosine/dipyridamole preferred
- Dobutamine when bronchospasm/COPD present
- Diagnostic and prognostic value for all methods