

Doporučení pro provedení SPECT a SPECT/CT myokardu

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SPECT myokardu - doporučení

- **Indikace - ESC → ČKS:** Souhrn doporučených postupů pro dg. a léčbu stabilní ICHS (r.2013)
- **Provedení – EANM** (r.2015, 2005)
- **Interpretace a popis - EANM/EACVI** (European Association of Cardiovascular Imaging) – r.2015

GUIDELINES

EANM procedural guidelines for radionuclide myocardial perfusion imaging with SPECT and SPECT/CT: 2015 revision
















A large number of minor changes have been described in more detail in the fully revised version available at:

<http://eanm.org/publications/guidelines/index.php?navId=37>  **105 stran**

1. Patient information and preparation
2. Radiopharmaceuticals and CT contrast agents
3. Injected activities, dosimetry, and radiation exposure
4. Stress tests
5. Instrumentation
6. Imaging protocols
7. Image acquisition
8. Quality control of instrumentation and image acquisition
9. Reconstruction methods
10. Attenuation and scatter correction
11. Data analysis of regional perfusion imaging
12. Data analysis of left ventricular function
13. Data analysis of hybrid imaging
14. Reports and image display.

EANM procedural guidelines for radionuclide myocardial perfusion imaging with SPECT and SPECT/CT: 2015 revision

Hesse B, et al. **2005**  Verbene HJ, et al. **2015**

- ☐  EANM procedural guidelines for radionuclide myocardial perfusion imaging with SPECT and SPECT/CT: 2015 revision
 -  Abstract
 -  Preamble
 -   **The selective coronary vasodilator regadenoson**
 -   Radiation exposure: new ICRP models
 -  Instrumentation: dedicated cardiac systems
 -  Instrumentation: SPECT/CT hybrid systems
 -   Coronary CT contrast agents
 -  Reconstruction methods
 -   Data analysis of hybrid imaging
 -  References

Klinický efekt subtypů adenosinových receptorů

■ A_{2A}

- Koronární vasodilatace
- Částečná periferní vasodilatace

REGADENOSON

■ A_{2B}

- Periferní vasodilatace
- Degranulace žírných buněk
- Bronchokonstrikce

■ A_1

- Negativní a-v převod
- Negativní chronotropie, inotropie

■ A_3

- Degranulace žírných buněk
- Bronchokonstrikce

Regadenoson (*RAPISCAN*)

- **nová alternativa farmakologické zátěže**
- **krátký vyšetřovací protokol**
- **jednorázová rychlá aplikace (bolus 10 sec.)**
- **jednotná dávka bez ohledu na hmotnost, věk, pohlaví**
- **není kontraindikace u bronchoobstrukčních onemocnění, u postižení ledvin či jater**
- **méně komplikací než adenosin a dipyridamol**
- **přesto nutná opatrnost (zátěžový test)**
- **cena 1740 Kč + 14%DPH**

<http://www.asnc.org/guidelinesandstandards>

[SPECT: Stress, Protocols, and Tracers](#) - 2016

ASNC IMAGING GUIDELINES



ASNC imaging guidelines for SPECT nuclear cardiology procedures: Stress, protocols, and tracers

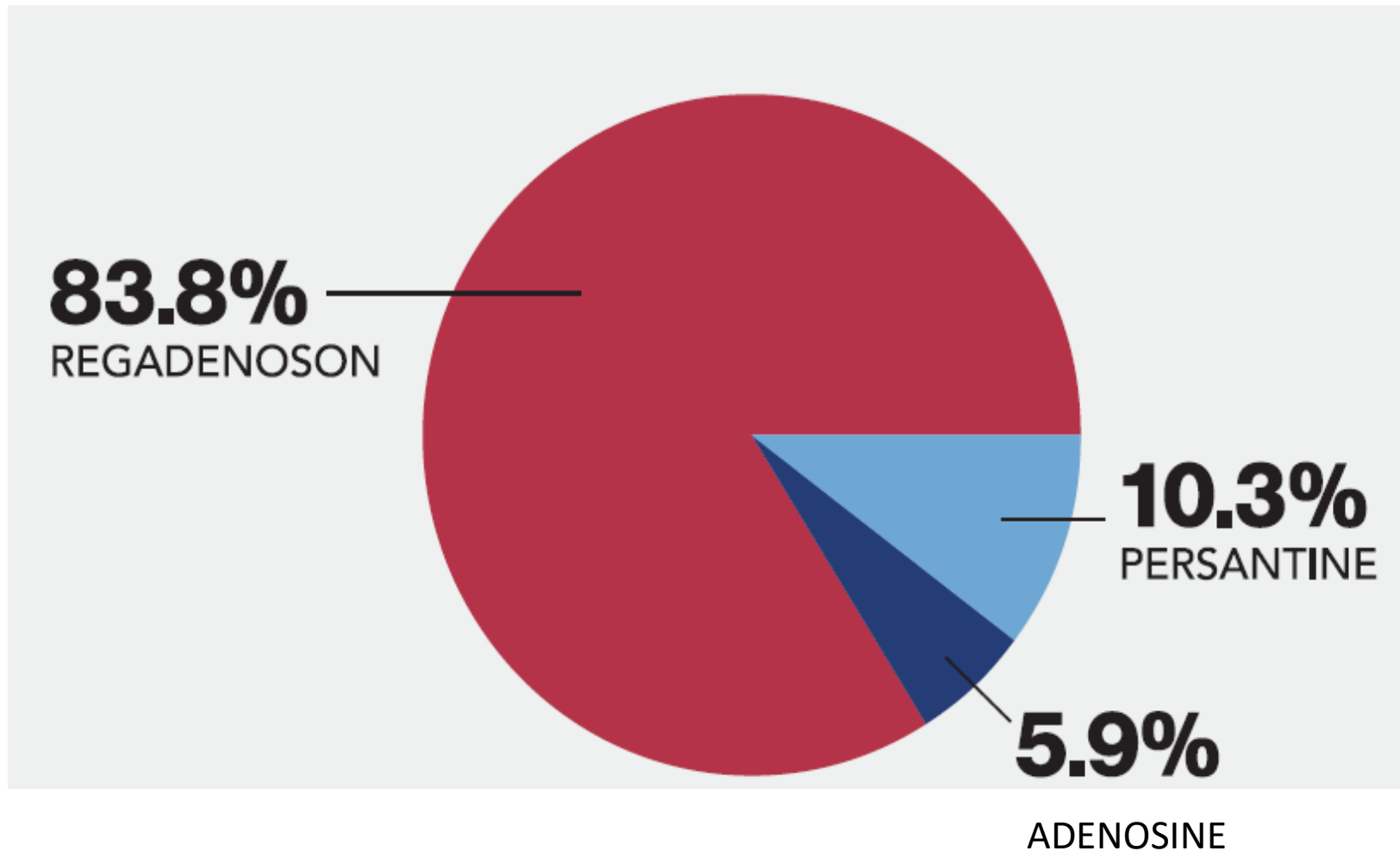
Milena J. Henzlova, MD,^a W. Lane Duvall, MD,^b Andrew J. Einstein, MD,^c Mark I. Travin, MD,^d and Hein J. Verberne, MD^e

Předchozí verze:

[Single Photon Emission Computed Tomography](#) - 2010

[Stress Protocols and Tracers](#) - 2009  **Regadenoson již v této verzi !**

Farmakologická zátěž - USA 2013



Kombinace farmakologické a nízké úrovně fyzické zátěže

LBBB: Yes

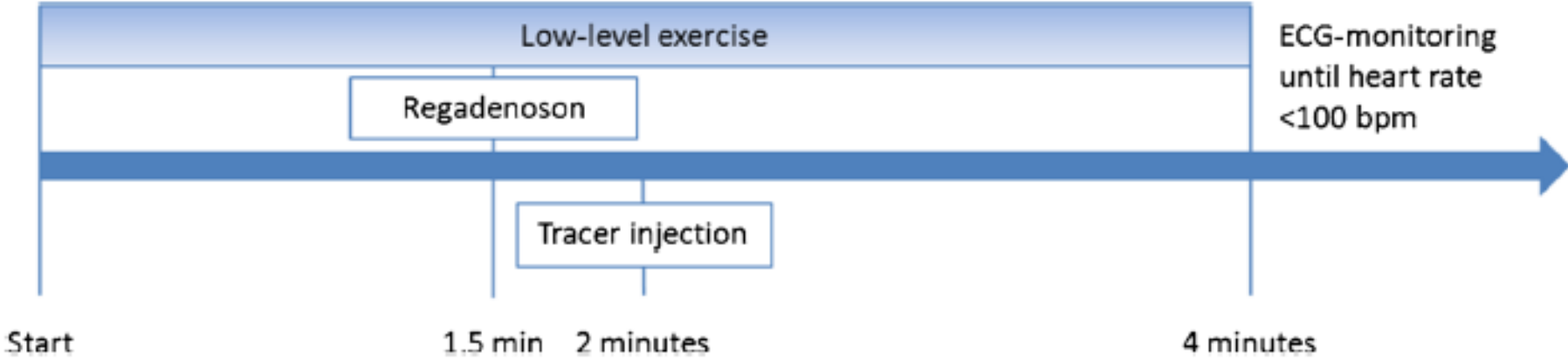



Vasodilator without low level ergometry


LBBB: No




Vasodilator with low level ergometry




☐  EANM procedural guidelines for radionuclide myocardial perfusion imaging with SPECT and SPECT/CT: 2015 revision

 Abstract









 Preamble

+  The selective coronary vasodilator regadenoson

+  Radiation exposure: new ICRP models

- ^{99m}Tc -tetrofosmin (stress and rest): 0.0058 and 0.0063 mSv/MBq, respectively
- ^{99m}Tc -sestamibi (stress and rest): 0.0066 and 0.0070 mSv/MBq, respectively
- ^{201}Tl -chloride (redistribution): 0.102 mSv/MBq.

Nové fantomy pro výpočet absorbované dávky, nové váhové faktory, nový biokinetický model (cca o **20% nižší hodnoty**)

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1. Dual-detector variable camera in a 90° configuration
2. Dedicated cardiac systems: **Cadmium zinc telluride (CZT)**

The D-SPECT® (Spectrum Dynamics)

Discovery NM530c (GE Healthcare)

Clinical evaluations of both systems have demonstrated performance similar to that of traditional systems, **but with shorter imaging times or lower administered activities.**

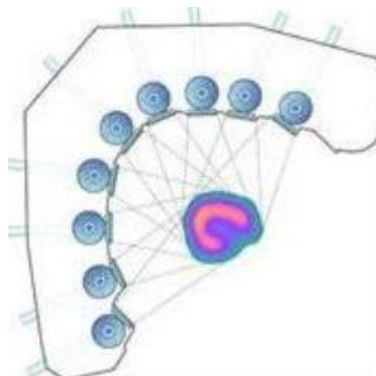
D-SPECT™ Cardiac Scanner

Dynamic SPECT
(D-SPECT)

Spectrum-Dynamics
Haifa, Israel

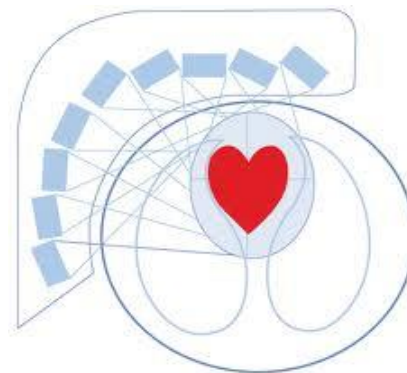


CZT technologie



9 detektorů

GE Discovery NM 530c














19 detektorů

Výrazná redukce aplikovaných aktivit: efekt.dávka pod 1 mSv

15:00

Discovery



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 -   Coronary CT contrast agents

- **Calcium scoring (CACs): ≥ 6 -slice is recommended**
- **Coronary CT angiography (CCTA): ≥ 64 -slice multidetector-row CT is recommended**, with an imaging capability for slice width of 0.4–0.6 mm and temporal resolution of 500 ms or less; ≤ 350 ms is preferred

SPECT



SPECT/CT

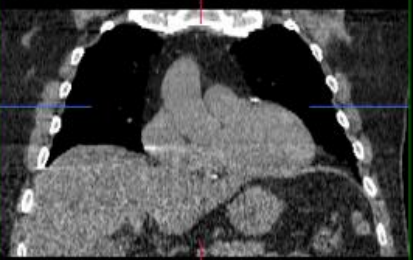




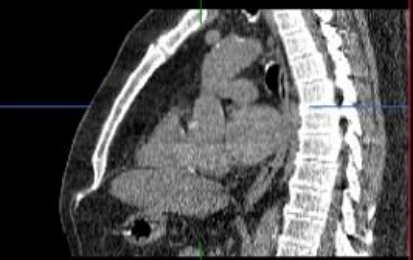
Transverse
MPR



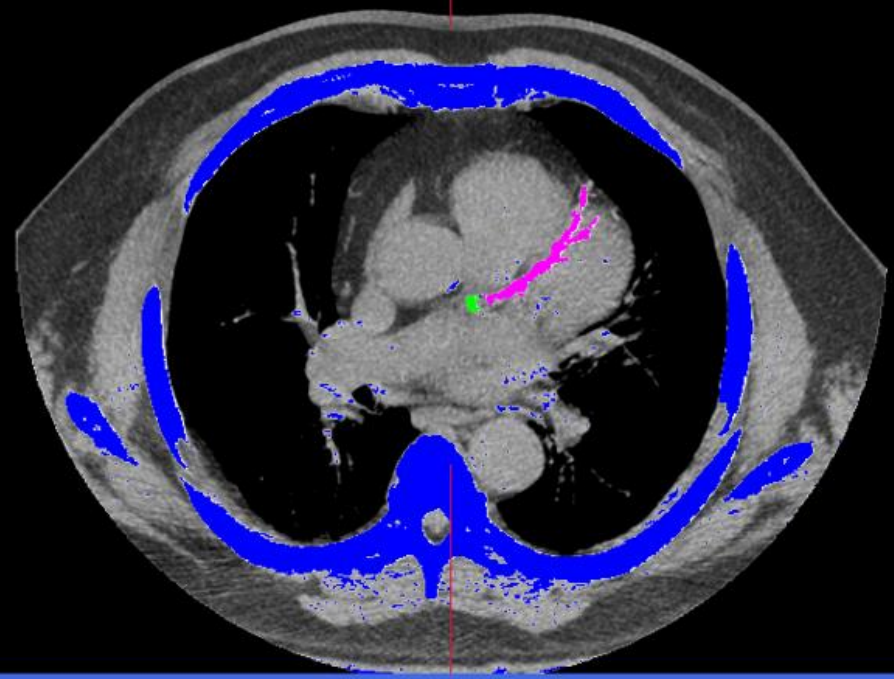
Coronal
MPR



Sagittal
MPR



Transverse
Thin MIP
5 Slices



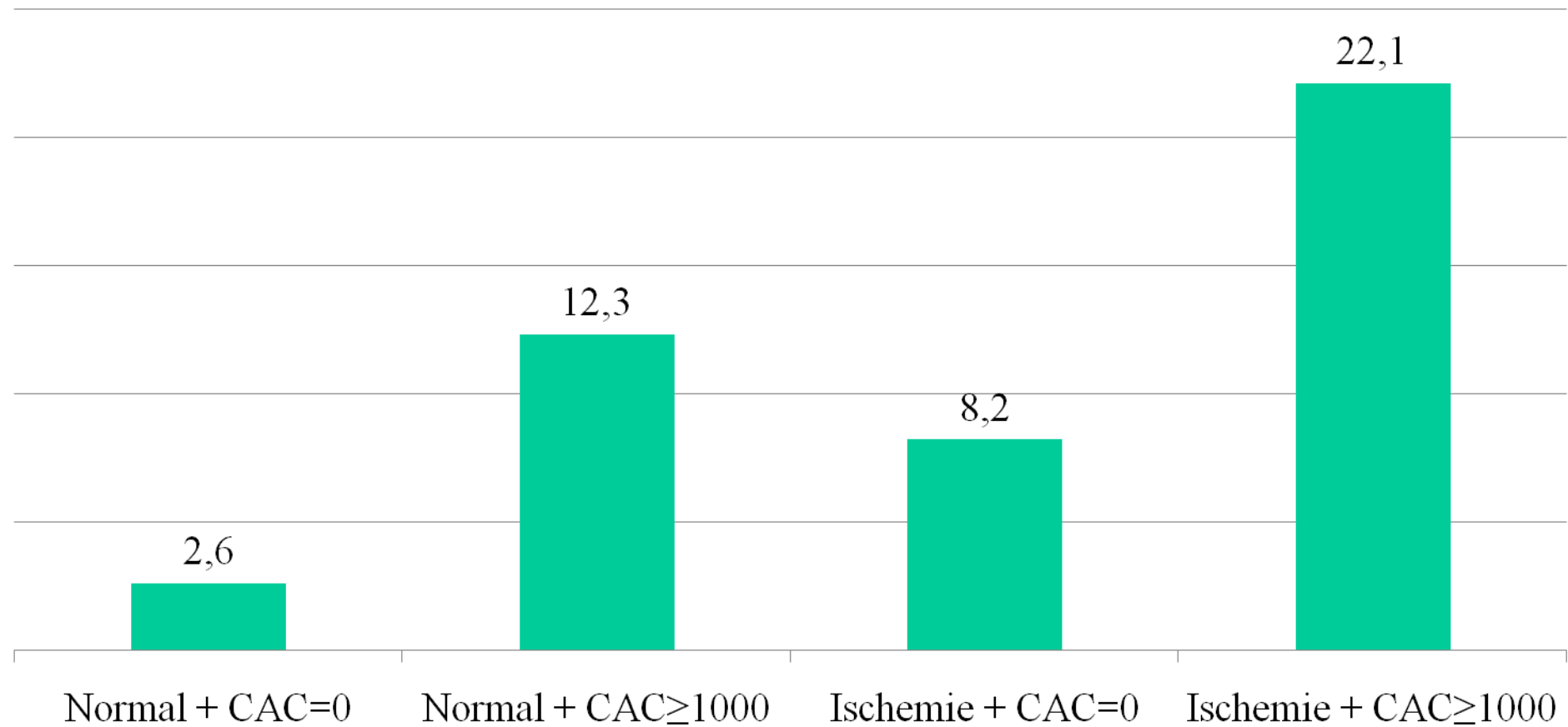
130 HU

Vessel	Lesions	Volume (mm ³)	Agatston Score
LM	1	191.3	255
LAD	10	1227.7	1595
LCX	9	188.4	194
BCA	14	611.7	754
Total	34	2219.1	2798

No Calcium

SPECT + CAC vs. SPECT alone

- 695 pacientů, kardiální příhody (%)/rok



EANM procedural guidelines for radionuclide myocardial perfusion imaging with SPECT and SPECT/CT

<http://eanm.org/publications/guidelines/index.php?navId=37>

 **105 stran**

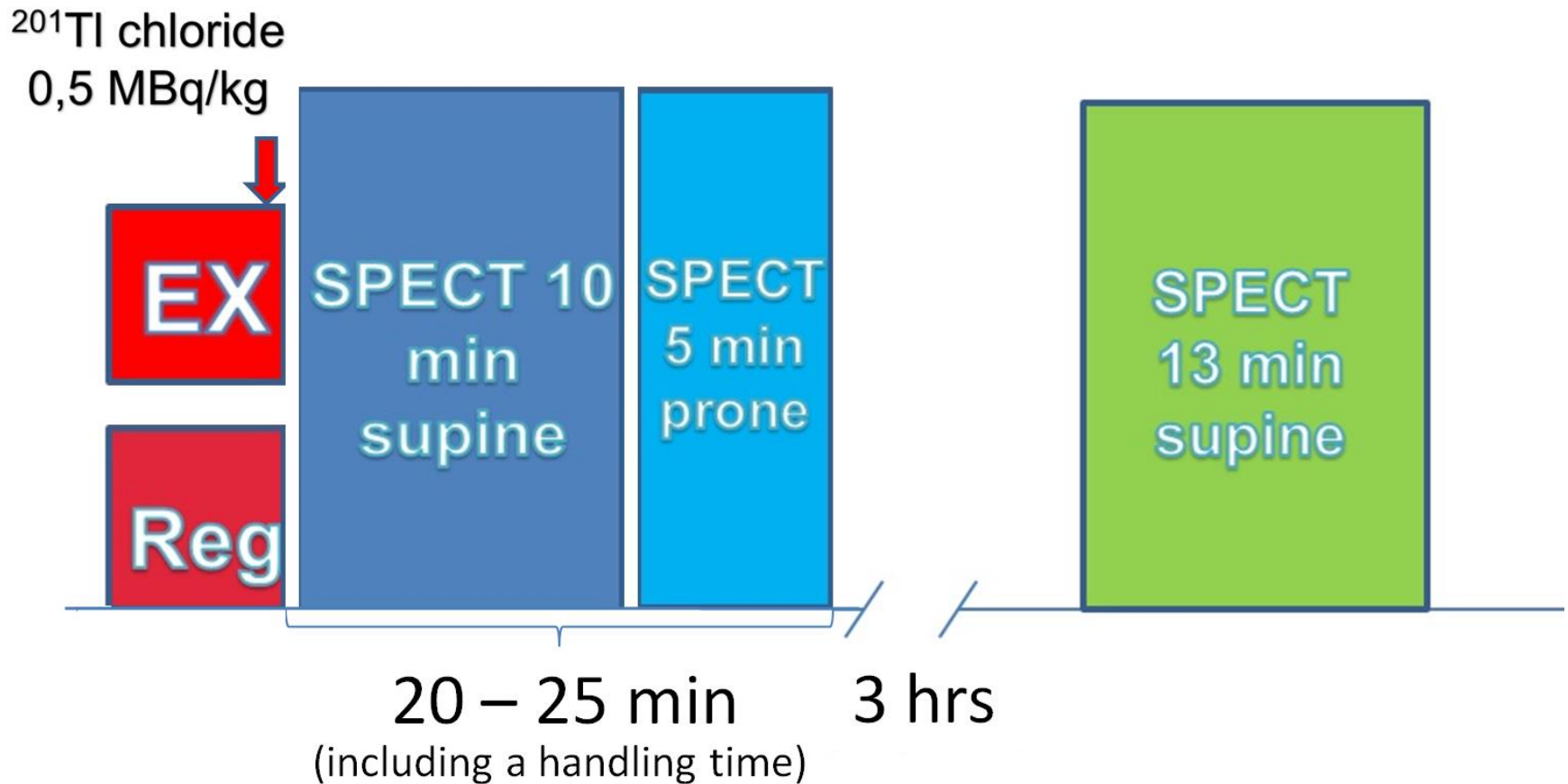
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Feasibility of ultra low-dose thallium stress-redistribution protocol including prone imaging in obese patients using CZT camera.

Kincl V, Kamínek M, Vašina J, Panovský R, Havel M.
Int J Cardiovasc Imaging. 2016 Jun 2. [Epub ahead of print]

70 kg patient: 35 MBq \approx 3,5 mSv



Prone pozice



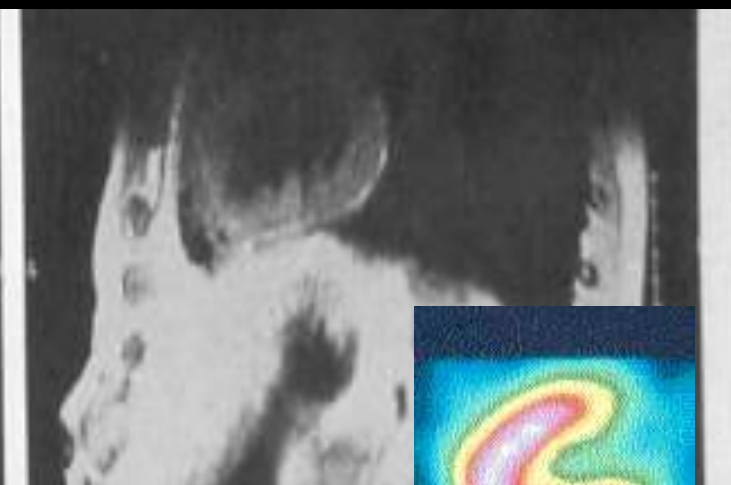
MR

SUPINE

PRONE



SPECT



EANM Procedural Guidelines

<http://eanm.org/publications/guidelines/index.php?navId=37>

 **Str. 71**

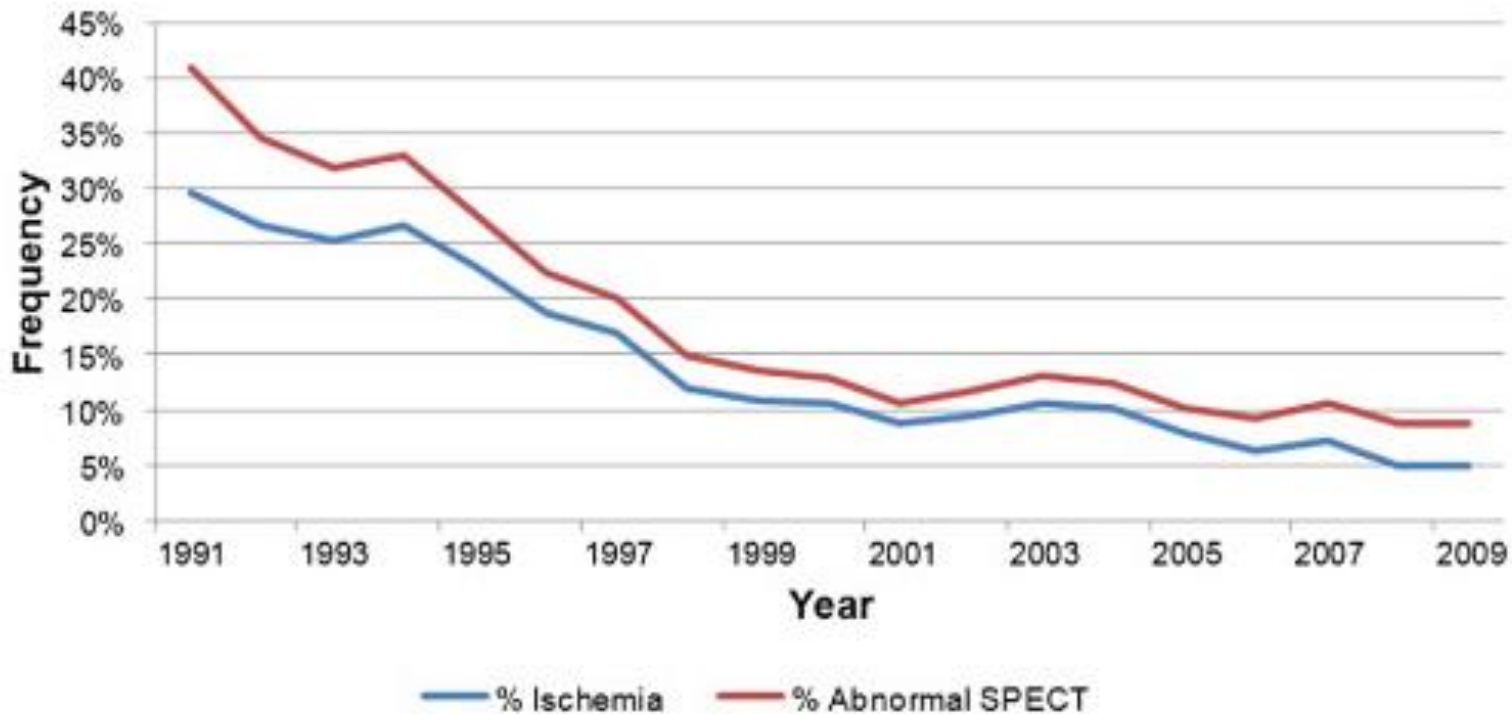
- Pokud není k dispozici systém pro atenuační korekci (AC), **snímání v jiné než originální pozici** může pomoci rozhodnout, zda je či není regionální snížení počtu impulsů způsobeno atenuací.

ICNC konference, Madrid, květen 2015:

Piotr Slomka

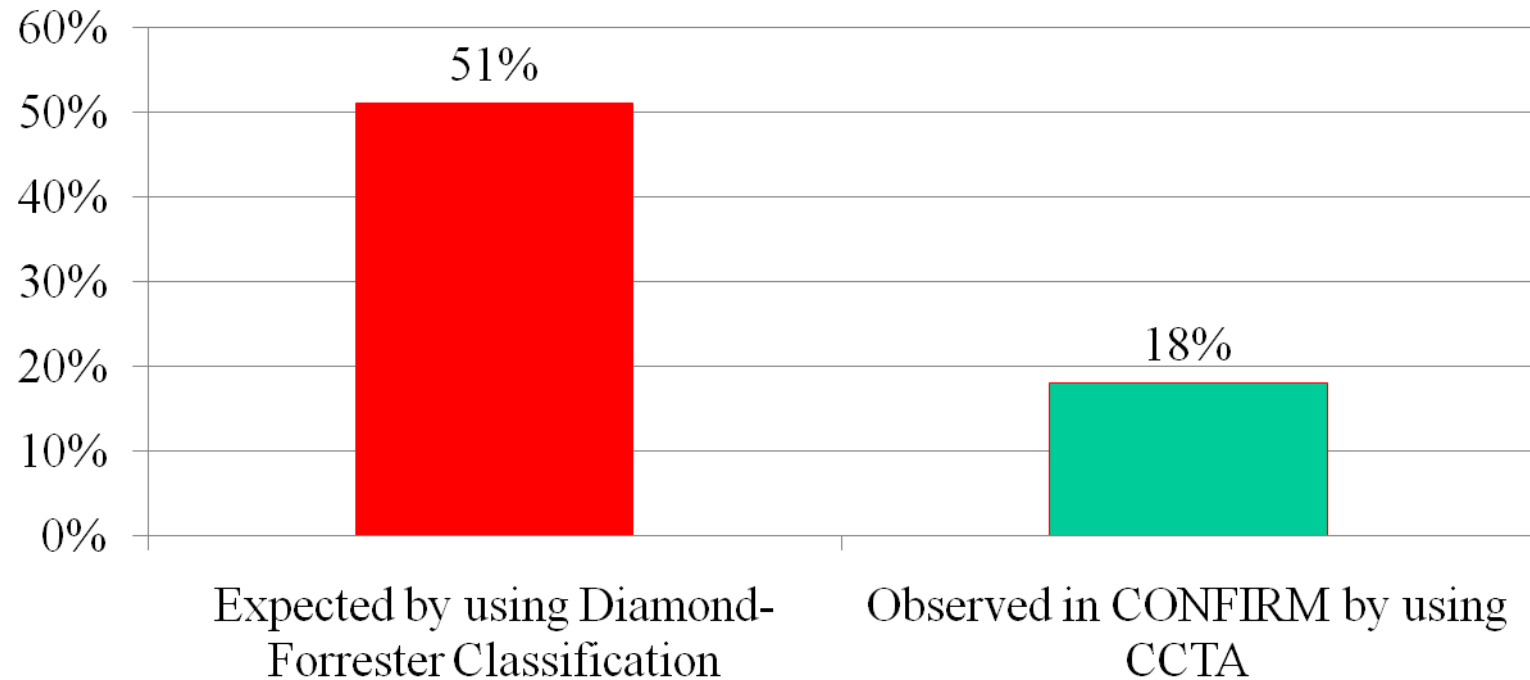
- AC používá celosvětově < 10% pracovišť
- Pokud není systém pro AC, změna polohy těla ji plně nahradí a je absolutně nezbytná
- **Cedars-Sinai Medical Center – používají prone**

Rozanski A, et. Al. Temporal Trends in the Frequency of Inducible Myocardial Ischemia During Cardiac Stress Testing : 1991 to 2009



Diamond-Forrester Classification overestimates likelihood of angiographically “significant CAD”

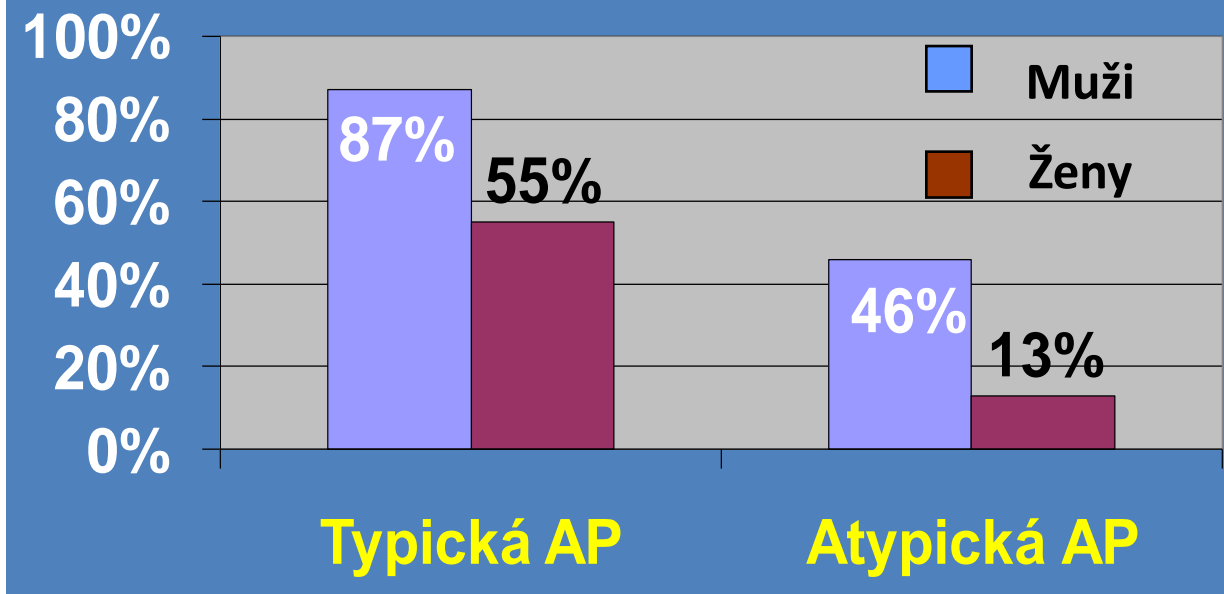
Overall Obstructive CAD prevalence in patients with NonAng, AtypAng, and TypAng (n= 8106)



Cheng et al. CONFIRM. Circulation 2011

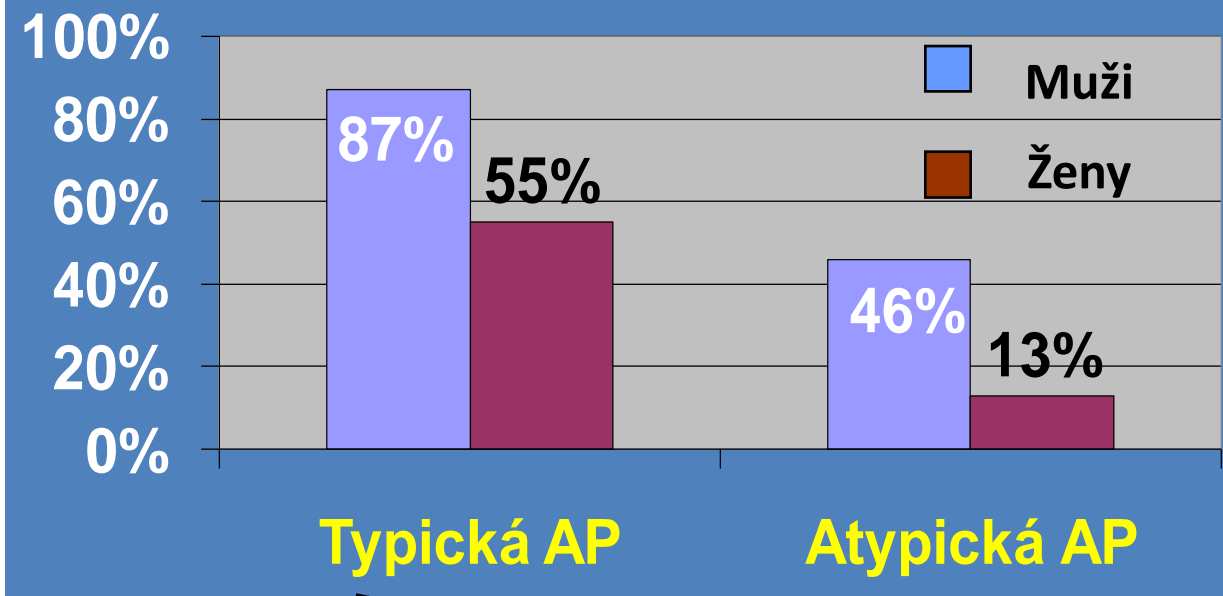
**Předtestová
pravděpodobnost
ICHHS
Věk: 40-49 let**

*Diamond GA, Forrester JS.
N Engl J Med 1979*



Předtestová pravděpodobnost ICHS Věk: 40-49 let

*Diamond GA, Forrester JS.
N Engl J Med 1979*



Souhrn Doporučených postupů ESC
pro diagnostiku a léčbu stabilní ischemické
choroby srdeční – 2013.

Cor et Vasa

<http://www.kardio-cz.cz/doporucene-postupy-ceske-kardiologicke-spolecnosti-460/>

Věk	Typická angina		Atypická angina		Neanginózní bolest na hrudi	
	Muži	Ženy	Muži	Ženy	Muži	Ženy
30–39	59	28	29	10	18	5
40–49	69	37	38	14	25	8
50–59	77	47	49	20	34	12
60–69	84	58	59	28	44	17
70–79	89	68	69	37	54	24
> 80	93	76	78	47	65	32

<10% pacientů se susp. ICHS má pomocí SPECT zobrazení ischemii

Př.: Pacienti s 50% pravděpodobností ICHS (*Diamond-Forrester*)

- 20% z nich má $\geq 50\%$ stenózu na CT koronarografii*
- 90% z nich má $\geq 50\%$ stenózu na invazivní koronarografii**
- 57% z nich má abnormální FFR***
- 77% z nich má ischemii na SPECT (kolateralizace)****
- **$0.20 \times 0.90 \times 0.57 \times 0.77 = 8\%$**

* Cheng (*CONFIRM*) *Circulation* 2011

** Budoff et al (*ACCURACY*) *JACC* 2008

*** Tonono et al (*FAME*) *JACC* 2010

**** Zhou et al *EJR* 2014 (*Meta analysis*)

Závěr

- Doporučené postupy EANM pro SPECT myokardu **2005 vs. 2015: výrazná evoluce v zobrazování**
- 2015 Updated procedural guidelines for SPECT and SPECT/CT:
 - Regadenoson
 - Dedikované kardiologické CZT kamery
 - Hybridní SPECT/CT

Závěr

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 - Hybridní SPECT/CT
- **ASNC Imaging Guidelines – častější revize**

Lindner O, et al.

Eur J Nucl Med Mol Imaging (2016) 43:718–728
















DOI 10.1007/s00259-015-3270-8

ORIGINAL ARTICLE

Nuclear cardiology practice and associated radiation doses in Europe: results of the IAEA Nuclear Cardiology Protocols Study (INCAPS) for the 27 European countries

- **Stress-only imaging and weight-adjusted activity might be targets for optimization of European nuclear cardiology practice**

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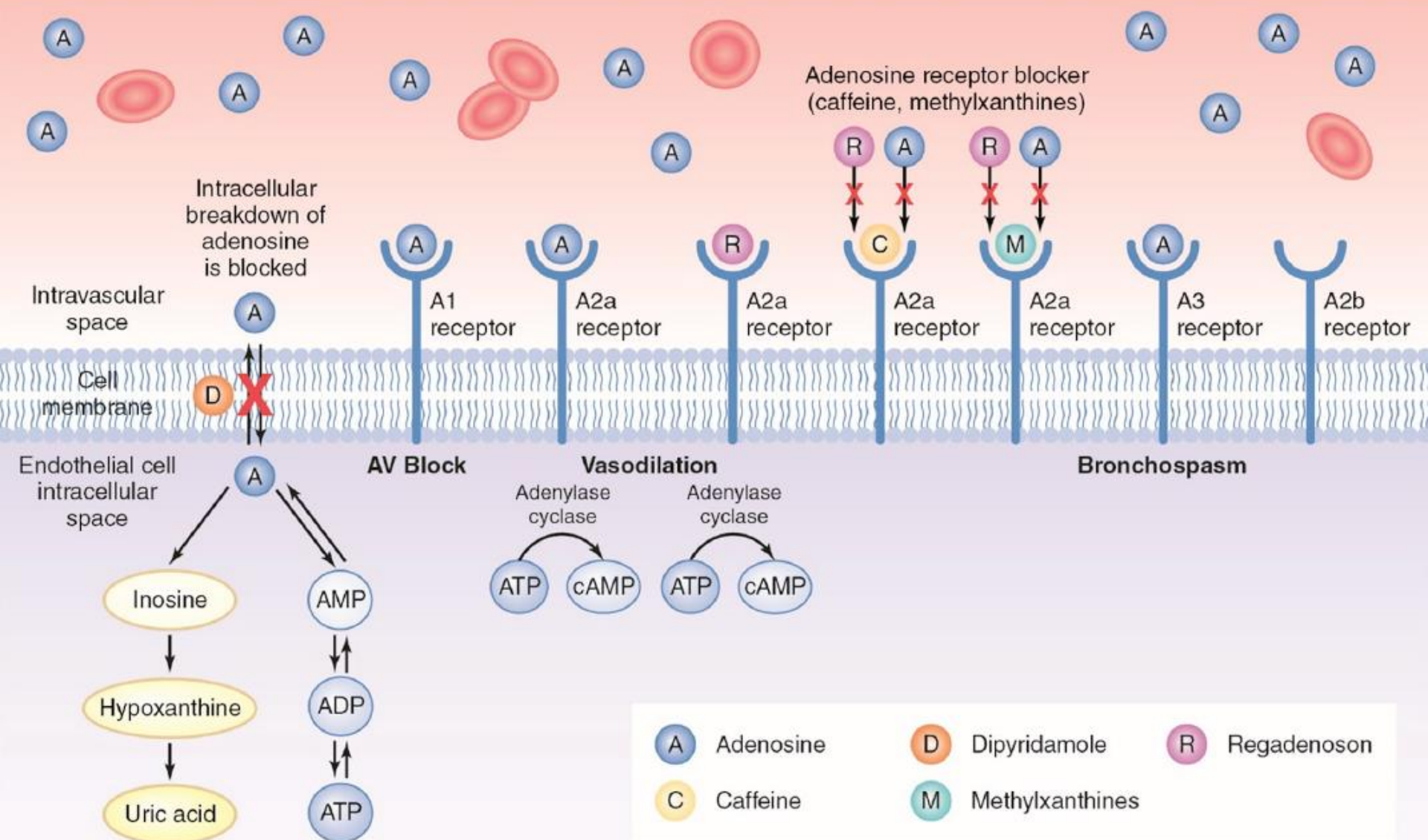


Figure 1. Mechanism of action of coronary vasodilators. *ADP*, Adenosine diphosphate; *AMP*, adenosine monophosphate; *ATP*, adenosine triphosphate; *AV*, atrioventricular; and *cAMP*, cyclic adenosine monophosphate.