

# Pharmacological stress test with Regadenoson when Adenosine is contraindicated: Prospective documentation of side effects in over 700 patients with COPD or bronchial asthma

## M. Keller, M. Rippel, S. Silber, Cardiology Practice, Munich, Germany

ESC Congress 2020  
The Digital Experience

### Background-1:

In the face of an increasingly elder population with its restricted physical ability, treadmill or bicycle exercise tests with their inherent need to achieve maximal heart rates become more meaningless. Therefore, there is an increasing need for pharmacological stress tests combined with an imaging technique. For stress tests to provoke myocardial ischemia, vasodilator stress is most frequently used. Whereas Dipyridamole is obsolete, the predominant drug applied within this context is Adenosine for myocardial scintigraphy, magnetic resonance imaging and physiologic tests like FFR. Adenosine, however, is contraindicated in patients with COPD or bronchial asthma, predominantly due to a possible exacerbation of bronchospasm or other pulmonary side effects. In contrast, Regadenoson was especially developed as a highly selective A<sub>2A</sub> receptor agonist to circumvent these limitations.

### Demographics:

Only patients with suspected or proven chronic coronary syndrome (CCS) were included.

Mean age was 72±9 years, 47% were male, 53% were female. 66% had a history of COPD and 34% of bronchial asthma.

12% of the patients had a preexisting first degree AV-block. According to the Regadenoson contraindications, patients with a higher degree AV-Block were excluded. 4% had left bundle branch block and 5% had right bundle branch block.

### Background-2:

Besides this, the practical use of Regadenoson is much easier than the use of Adenosine without any need of an infusion pump and - in contrast to Adenosine - there is no need of body weight-related dose calculation, because a standard dose of 400 µg i.v. is applied to each patient. However, as any vasoactive drug, Regadenoson has side effects, but there is only limited data regarding this issue available from some smaller studies, no prospectively collected data from real world application in high-volume cardiology centers regarding specifically patients with COPD or bronchial asthma.

### Results: Heart Rate

Mean ± SD	
Rest (baseline)	66.8 ± 8.3 bpm
Maximum	98.0 ± 17.3 bpm* (vs. Rest)
After 10 minutes	78.8 ± 7.9 bpm* (vs. Rest)

\* p < 0.001 according to Student's t-Test

### Goal:

Goal of this study is to prospectively collect data in patients with COPD or bronchial asthma regarding safety and tolerability of Regadenoson undergoing pharmacological stress test for myocardial scintigraphy.

Between February 16<sup>th</sup> 2012 and July 15<sup>th</sup> 2020 a total of 815 myocardial stress tests with 99m Tc-Tetrofosmin were conducted in patients with COPD or bronchial asthma with their inherent insufficient capacity of physical exercise.

### Results: Blood Pressure

Mean ± SD	
Systolic Blood Pressure	
Rest (baseline)	125.9 ± 12.3 mmHg
Minimum	117.7 ± 26.6 mmHg* (vs. Rest)
After 10 minutes	123.0 ± 25.8 mmHg
Diastolic Blood Pressure	
Rest (baseline)	73.6 ± 9.3 mmHg
Minimum	66.9 ± 12.5 mmHg* (vs. Rest)
After 10 minutes	76.1 ± 11.6 mmHg

### Methods:

The standard dose of 400µg i.v. was injected initially over 10 seconds and after May 2012 over 20 seconds. Soon after the injection of Regadenoson, usually at a clearly visible increase of the heart rate, 99m Tc-Tetrofosmin was injected. Heart rate, blood pressure and ECG were continuously monitored before injection (rest), and up to 10 minutes after the injection of Regadenoson. All side effects were prospectively documented. SPECT perfusion scans were acquired appr. 12 minutes after the injection of Regadenoson with a dual-head Anger heart gamma camera.

### Frequent Side Effects (≥ 10%):

	Percentage
Shortness of Breath "Feeling of Increased Breathing"	73 %
Headache	23 %
Feeling of Warmth	22 %
Chest Pain	17 %
Gastrointestinal Discomfort	17 %
Dizziness	10 %

### Rare Side Effects (< 10%):

	Percentage
Nausea	8 %
Tussive Irritation	4 %
Tightness in the Throat	4 %
Sensation in the Legs	3 %
Feeling of Weakness	3 %
Feeling of Dry Throat and/or Mouth	2 %
Sensations in the Hands	2 %
Palpitations	1 %
Vomiting	1 %
Sweating	1 %

### Severe Complications:

	Percentage
Asystole (≥ 6 seconds)	none
Intermittent 2 <sup>nd</sup> or 3 <sup>rd</sup> degree AV-Block (with a relevant pause)	none
Symptomatic Bradycardia (< 40 bpm)	none
Symptomatic Drop in Blood Pressure	none
Seizure	none

1 patient (with no preexisting AV-block) had severe shortness of breath and a heart rate decrease from 107 to 60 bpm occurring within 10 minutes after the injection, which was immediately interrupted with i.v. Theophyllin and Atropine. There was neither any case of Regadenoson-induced bronchospasm nor any stroke. No fatalities occurred.

### Summary and Conclusions-1:

- Pharmacologic stress testing is an important tool for making pivotal clinical decisions. In our practice, appr. 20% of all myocardial SPECT perfusion scans are with Regadenoson.
- Switching from Adenosine to Regadenoson makes sense and was immediately accepted by our medical staff.
- General advantages of Regadenoson vs. Adenosine:**
  - > advantage for patients: less related side effects
  - > advantage for medical staff: time-saving due to no dose calculations and no infusion pumps necessary
- Specific advantages of Regadenoson vs. Adenosine in Nuclear Cardiology:**
  - > for patients: no further drug infusion after <sup>99m</sup>Tc injection
  - > for medical staff: easier handling, no stopcock confusion
  - > for patients and medical staff: minimization of droplet exposure and contact time between patients and medical staff

### Summary and Conclusions-2:

- In contrast to Adenosine, Regadenoson has no contraindication for pharmacological stress tests in patients with COPD or bronchial asthma undergoing myocardial scintigraphy or FFR measurement.
- Therefore in these patients, Regadenoson is the vasodilator of choice for pharmacological stress testing.
- The most common side effect in our prospective series of 815 patients was shortness of breath / feeling of increased breathing in 73%.
- In addition, there are various different unspecific and transient rare side effects.
- Life-threatening side effects did not occur, even not in patients with a preexisting first degree AV-block.
- Overall, the use of pharmacologic stress test with Regadenoson in patients with COPD or bronchial asthma seems to be safe and well tolerated.
- Beyond this data, in these "times of Corona", physical exercise tests could and should be avoided for the safety of medical staff.