

# Very low dose myocardial perfusion imaging with 1 mSv using Cadmium-Zinc-Telluride (CZT) cameras and Tc99m-sestaMIBI.

B. Songy, M. Guernou, F. Karoune, D. Lussato, M. Queneau  
Centre Cardiologique du Nord ( CCN ), Paris, France



## Background:

- Myocardial perfusion imaging leads to relative high radiation exposure (average: 20 mSv) and contributes up to 20% of the estimated annual collective radiation dose in the developed countries. It could result in additional future cancers. (Berrington de Gonzalez, *Circulation* 2010; 122:2403-2410)
- The American guidelines recommend to reduce exposure lower than 9 mSv. (Cerqueira, *J Nucl Cardiol.* 2010; 17:709-718)
- We previously published validation of new CZT cardiac cameras, improvement of diagnostic performances and reduction of dosimetry with thallium-201. (Songy, *Clinical Nuclear Medicine* 2011; 36:776-780)

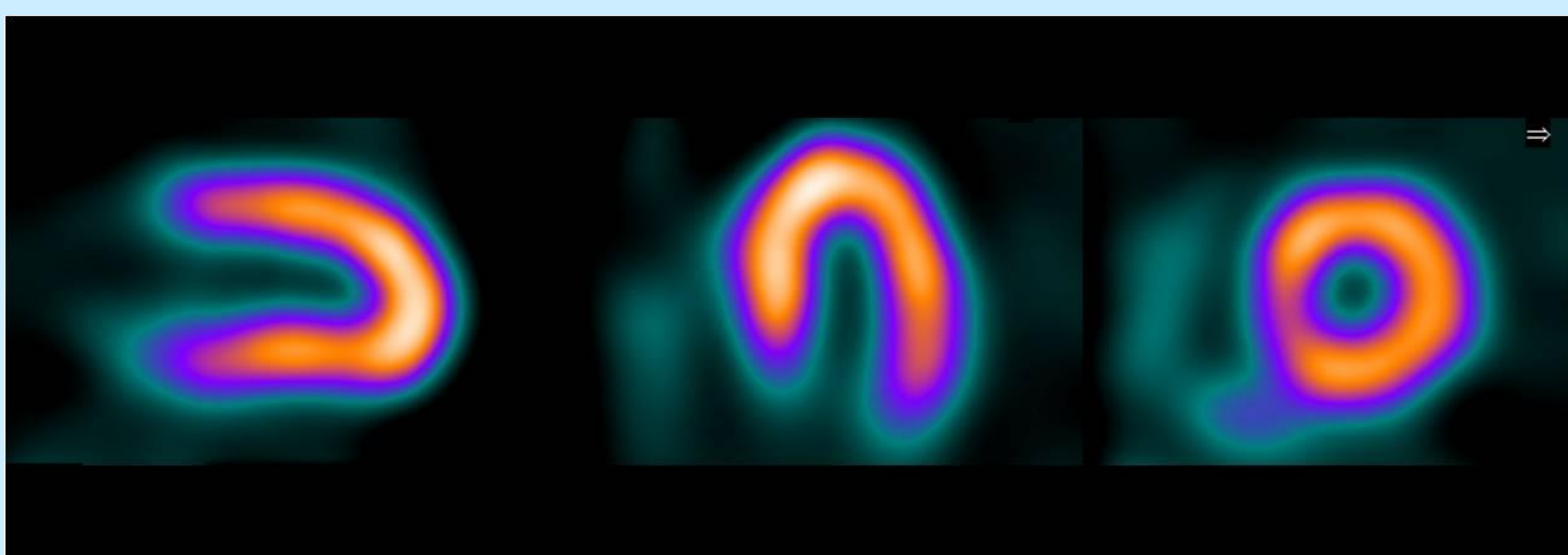
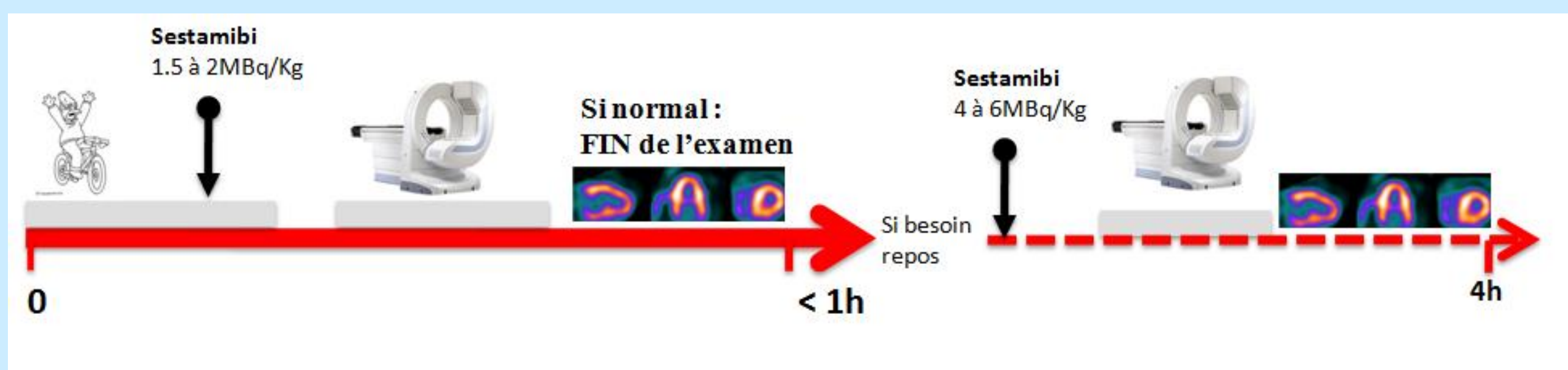


## Objectives:

To decrease the effective dose with technetium agents in myocardial perfusion imaging with new cardiac CZT cameras.

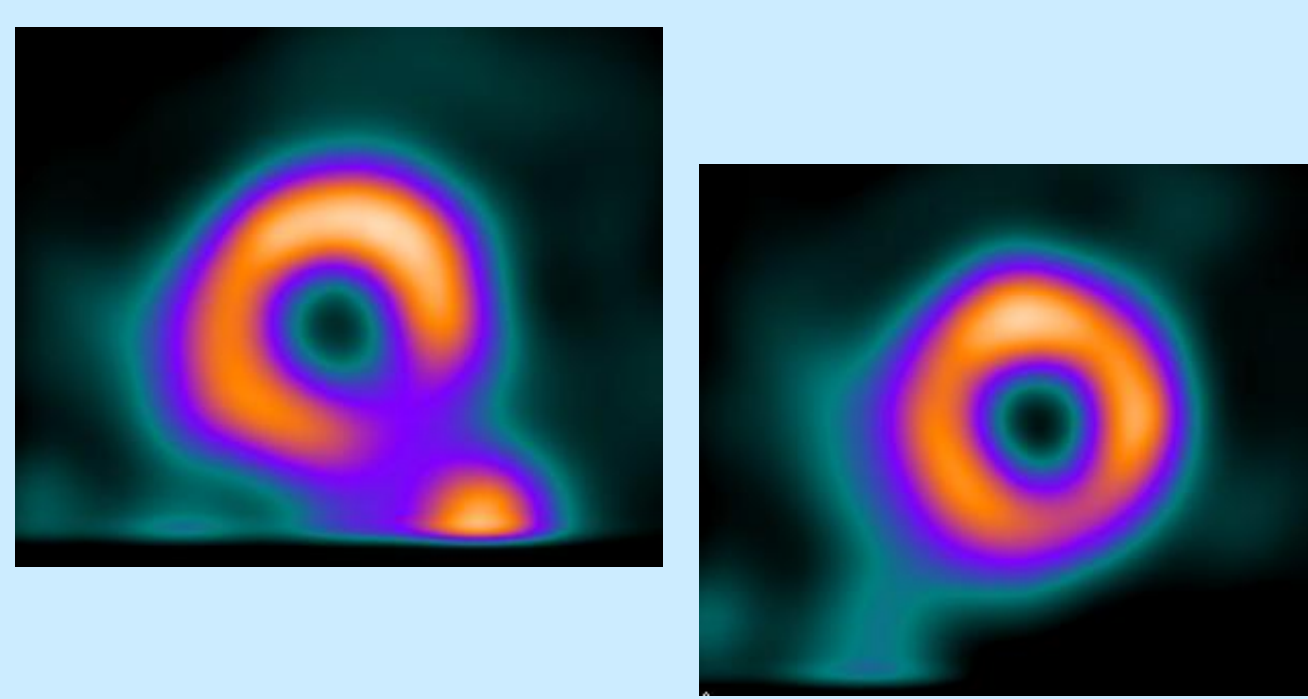
## Methods:

- prospective study
- **100 consecutive patients**
  - without previously known coronary artery disease (CAD).
  - referred for diagnostic stress myocardial perfusion imaging.
- injection at stress of **Tc99m-sestaMIBI (1.7 MBq/kg)**,
- **immediate** stress myocardial imaging in **10 mn** with a CZT camera GE DNM 530c.
- If normal result, no additional image
- when stress images were abnormal, rest myocardial imaging 4 hours later with injection of a treble activity.



### Normal CZT scan with 0.86 mSv:

55 years old man, 72 kg weight, diabetes, smoker, exercise chest pains, 120 MBq sestaMIBI-Tc99m, 10 mn acquisition time.



### Low quality scan:

Extracardiac activity;  
Iterative reconstruction artifact;  
Second scan normal after a fat meal.

## Results:

- Patients:
  - 59 males and 41 females,
  - $61 \pm 11$  years old
  - $78 \pm 15$  kg (males: 81 kg, females: 74 kg)
- Injected activity at stress:  $135 \pm 30$  MBq of Tc99m-sestaMIBI. (males: 141 MBq, females: 127 MBq)
- Total acquired counts:  $1092 \pm 308$  kcts
- Myocardial acquired counts:  $317 \pm 91$  kcts (males:  $343 \pm 87$ ; females:  $280 \pm 82$ )
- Quality of scans:
  - excellent: 82 cases,
  - acceptable: 10 cases
  - poor: 8 cases, leading to an additional scan half an hour later after a fat meal.
- Results of scans:
  - normal: 90 cases
  - abnormal: 10 cases (3 artifacts, 4 stress ischemia and 3 previously unknown myocardial infarction scar).
- Normal stress ejection fraction:  $68 \pm 7\%$ , end-diastolic volume:  $72 \pm 27$  ml, end-systolic volume:  $23 \pm 11$  ml.
- Effective dose at stress:
  - $0.89 \pm 0.06$  mSv for men
  - $1.19 \pm 0.07$  mSv for women (7.4  $\mu$ Sv/MBq for men and 9.9  $\mu$ Sv/MBq for women, ICRP publication 80).
- Additional effective dose of 3.02 mSv for men and 3.89 mSv for women when additional rest activity (average 430 MBq) (8.5  $\mu$ Sv/MBq for men and 11  $\mu$ Sv/MBq for women, ICRP publication 80).



Acknowledgments to our technologists team.

## Discussion:

Myocardial raw counts are higher with CZT camera than with conventional SPECT. Injected activity was calculated to maintain this high myocardial counts statistic, according to the previous results obtained with thallium-201, with a **high sensitivity and an increased specificity**.

In women, myocardial counts are lower but effective dose is higher. So we could suggest in women to decrease the injected dose down to **1.5 MBq/kg** in increasing acquisition time to **12 mn** to increase myocardial counts upper than 300 Kcts and decrease the effective dose to **1 mSv**.



## Conclusion:

With reduced activities of Tc99m-sestaMIBI, CZT cameras give high quality imaging.

It leads to an important decrease of equivocal results and a low ratio of patients needing an additional rest scan.

Thus, for CAD primary diagnosis, the **effective dose** is very low, less or equal to **1 mSv** in most cases.

