Validation with thallium-201 of a new Cadmium-Zinc-Telluride (CZT) cardiac camera

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Objectives:

• Validation with thallium-201 of the new CZT cardiac camera GE Discovery NM 530C

• This cardiac camera introduced by GE manufacturer in 2009 is characterized by Cadmium Zinc Telluride (CZT) solid state detectors, focused collimation, stationnary data acquisition and 3D iterative reconstruction

• This camera had been validated with technetium agents (Esteves, J Nucl Cardiol, 2009; 16:927-934) but had not yet been validated with thallium-201
Caméra GE Discovery NM 530c
Methods (1):

• Monocentric prospective study

• Inclusion of 153 consecutive patients referred for exercise myocardial perfusion imaging in july 2009

• Age: 60y ± , BMI: 27 ± , men: 78%

• Injection of 111 to 148 MBq at peak of exercise, and redistribution with reinjection (37MBq) when initial images were abnormal
Methods (2):

• **Successive acquisitions at**
  – *Anger camera* (Philips dual head axis camera) with 30 steps of 40 to 60 seconds (so total time = 10-15 mn), prone, with filtered backprojection reconstruction
  – *Then CZT in 5 minutes*, prone then supine
  – Immediatly after stress
  – 4 to 6 hours later at redistribution

• **Blinded images analysis** by two experimented physicians
Results (1):

- We excluded 7 patients:
  - 1 mispositionning
  - 1 patient motion
  - 3 camera breakdowns
  - 1 too late acquisition (>30mn)
  - 1 refuse of delayed images
Results (2):

- Acquisition is **more comfortable** for ALL patients

- **Counts rate** is 3 times more with CZT  
  \((3.5 \text{ to } 5 \text{ vs } 1 \text{ to } 1.5 \text{ kcts/s})\)

- **Myocardial counts** are 6 to 8 more with CZT  
  \((400 \text{ to } 600 \text{ Kcts in } 5 \text{mn vs } 150 \text{ to } 200 \text{ in } 10 \text{ to } 15 \text{ mn})\)

- **CZT image quality** is better (40%), equal (56%) or less (4%)*  
  *Compare with the results obtained in 135 patients 3 months later: CZT quality best in 70%, equal in 24% and less in 6%. Songy, French nuclear medicine convention, Nice, may 2010, 10*
Results (3):

• Diagnosis agreement in 94%

• Disagreements:
  – 2 Anger artefacts
  – 1 CZT artefact
  – 4 cases of early redistribution
  – 2 disagreements about reversibility
Results (4):

• Comparison prone - supine with CZT:

  – Prone imaging quality better in 41%, equal in 34%, less in 25%

  – Two times more artefacts in supine than in prone
    (11% versus 6%, p=0.05)
STRESS_IRNC(G)

EF: 60%
EDV: 52ml
ESV: 21ml
Recon: OSEM/Bw/0.36/15
Discussion (1):

- Our study is a “real life” study

- Positioning was easy for most patients, even when BMI >>30

- With experience, we find that CZT image quality is better in 70% of patients (better delineation of cavities, visualisation of papillary muscles, better analysis of thickening and motion) and less in only 5% (digestive activity, inferolaterobasal decrease uptake)

- We missed no known diagnosis, even for small territories

- In our experience we find 2 times less artefacts with CZT camera
Discussion (2):

• The most important point is the myocardial counts rate which is 6 to 8 times more with CZT camera:
  – 200 Kcounts in 15 minutes with dual head Anger camera
  – 400 to 600 Kcounts in 5 minutes with CZT camera

• So CZT camera allows either decrease of time acquisition or decrease of injected thallium activity or both
Conclusions:

• With thallium-201, the GE Discovery NM 530c CZT cardiac camera allows 5 minutes acquisitions with an increased image quality and a reliable diagnosis quality, both in prone and in supine positions.

• The myocardial counts rate is multiplicated by 6-8 by comparison with a Anger double head tomographic camera.

• This high myocardial counts rate allows to decrease acquisition time or thallium injected activity (and so effective dose) or both.
And now... low dose...

MBq

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<th>Low Dose</th>
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Femme de 42 ans

1m72, 60 kgs

45 MBq, 8 mn

1 Mcps,
450 Kcps dans le myocarde

7 mSv !

STRESS_IRNC(G)
EF: 63%
EDV: 45 ml
ESV: 17 ml
Femme de 42 ans
1m72, 60 kgs
45 MBq, 8 mn
1 Mcps,
450 Kcps dans le myocarde
7 mSv !

STRESS_IRNC(G)
EF: 63%
EDV: 45ml
ESV: 17ml
Homme de 62 ans

1m70, 52 kgs

30 MBq, 8 mn

1.05 M cps

400 Kcps dans le myocarde

5 mSv !
Homme de 62 ans
1m70, 52 kgs
30 MBq, 8 mn
1.05 M cps
400 Kcps dans le myocarde
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