23rd WiN Global Annual Conference

24-28 August 2015, Vienna, Austria

# RADIATION DOSE TO PATIENTS AND MEDICAL STAFF IN DIFFERENT PROCEDURES OF NUCLEAR MEDICINE

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**PURPOSE:** The purpose of this study is to provide information on developing technologies and clinical techniques for hybrid SPECT/CT imaging using ionizing radiation and their associated radiation dose to patients and medical staff.

**METHODS:** A thermoluminescent dosimeters (TLD) was used in this study to analyze the historic records of the external radiation doses to staff members working in our medicine department in 7 procedures, including elution of 99mTc from 99mMo/99mTc generators, syringe pre - paration, radiopharmacy kit preparation, injection, acco - mpanying patients, SPECT/CT scan, oral I-131 preparation. A retrospective review of 110 clinical studies of various nuclear medicine procedures obtained on hybrid SPECT/ CT systems was performed to calculate the effective radiation dose to patients.

**RESULTS:** The average effective doses (mSv) from low dose CT and radiofarmaceuticals for each examination of our results are presented in Table 1. The results for doses (E) mean ± SD in SPECT/CT examination are given in Table 2.

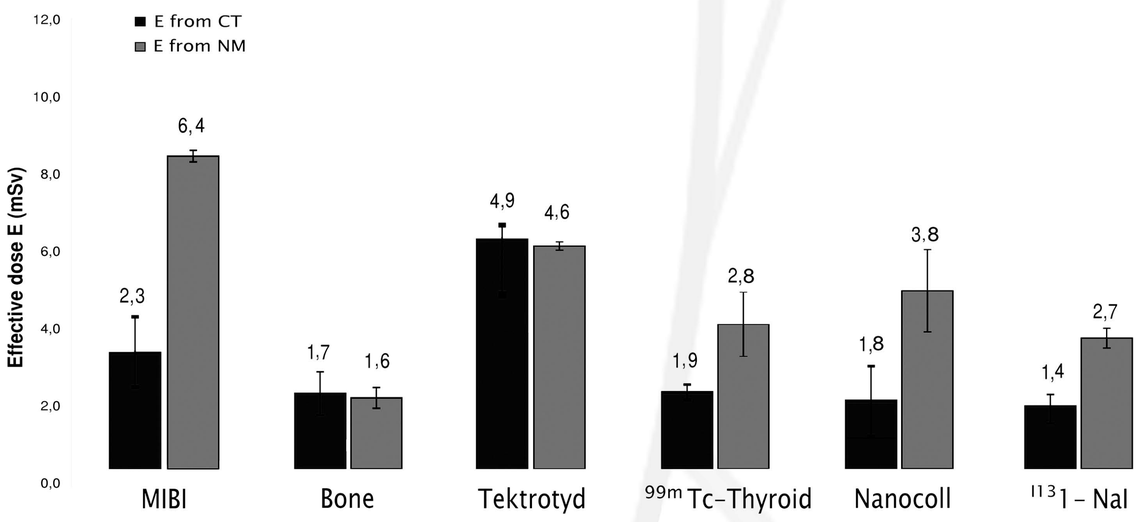


Table 1. The average effective doses from low dose CT and radiofarmaceuticals

| Effective dose from CT (mSv) | | Effective dose from nuclear medicine examination (mSv) |
|---|---|---|
| $^{99m}$Tc–MIBI Tetrofosmin | E = 2,3±1,4 mSv | E = 6,4 ±0,1 mSv (mean A=666MBq $^{99m}$Tc MIBI) |
| $^{99m}$Tc–MDP Bone scan | E = 1,7± 1,4 mSv | E = 1,6 ±0,6 mSv (mean A=740MBq $^{99m}$Tc– MDP) |
| $^{99m}$Tc–Tektrotyd | E = 4,9±1,4 mSv | E = 4,6±1,8 mSv (mean A=740MBq $^{99m}$Tc–Tektrotyd) |
| $^{99m}$Tc–Thyroid | E = 1,9±0,8 mSv | E = 2,8±0,4 mSv (mean A=74 MBq $^{99m}$Tc Pertechnetate) |
| $^{99m}$Tc–Nanocoll | E = 1,8±0,2 mSv | E =3,8 ±0,4 mSv (mean A=148MBq $^{99m}$Tc – Nanocoll) |
| $^{131}$I–Nal Thyroid | E = 1,4±0,5 mSv | E = 2,7±0,4 mSv (mean A=185 MBq – $^{131}$I NaI) |

Table 2. Effective dose (E) mean ± SD in SPECT/CT

| STAFF | YEAR | Mean Hp(0.07) ± SE (range), mSv | Mean Hp(10) ± SE (range), mSv |
|---|---|---|---|
| NM physician 1 | 2012 | 1.03 ± 0.03 (0.12 – 1.58) | 1.05 ± 0.03 (0.10 - 1.78) |
| NM physician 2 | 2012 | 0.96 ± 0.03 (0.68 – 2.75) | 1.06 ± 0.03 (0.07 - 1.49) |
| NM technician 1 | 2012 | 1.05 ± 0.01 (0.84 – 3.96) | 1.07 ± 0.01 (0.08 - 2.90) |
| NM technician 2 | 2012 | 1.94 ± 0.01 (0.08 – 2.92) | 1.00 ± 0.01 (0.08 - 2.65) |
| Radio-pharmacist | 2012 | 2.60 ± 0.13 (0.14 – 2.96) | 1.09 ± 0.03 (0.18 - 2.83) |
| Medical physicist | 2012 | 0.90 ± 0.04 (0.08 – 2.35) | 0.94 ± 0.04 (0.08 - 1.53) |
| Auxiliary personnel | 2012 | 1.03 ± 0.01 (0.08 – 2.86) | 1.05 ± 0.01 (0.08 - 1.81) |

| STAFF | YEAR | Mean Hp(0.07) ± SE (range), mSv | Mean Hp(10) ± SE (range), mSv |
|---|---|---|---|
| NM physician 1 | 2013 | 1.29 ± 0.03 (0.11 – 1.96) | 1.06 ± 0.03 (0.10 - 1.88) |
| NM physician 2 | 2013 | 1.56 ± 0.04 (0.19 – 1.85) | 1.12 ± 0.03 (0.08 - 1.63) |
| NM technician 1 | 2013 | 1.10 ± 0.03 (0.91 – 3.76) | 1.07 ± 0.04 (0.18 - 3.10) |
| NM technician 2 | 2013 | 0.99 ± 0.02 (0.70 – 3.82) | 1.00 ± 0.03 (0.08 - 2.95) |
| Radio-pharmacist | 2013 | 1.00 ± 0.08 (0.19 – 3.77) | 1.03 ± 0.06 (0.20 - 3.43) |
| Medical physicist | 2013 | 0.97 ± 0.04 (0.09 – 2.61) | 0.94 ± 0.04 (0.06 - 1.84) |
| Auxiliary personnel | 2013 | 1.03 ± 0.03 (0.04 – 2.46) | 1.05 ± 0.01 (0.03 - 2.51) |

| STAFF | YEAR | Mean Hp(0.07) ± SE (range), mSv | Mean Hp(10) ± SE (range), mSv |
|---|---|---|---|
| NM physician 1 | 2014 | 0.93 ± 0.02 (0.10 – 1.26) | 1.05 ± 0.01 (0.11 - 1.56) |
| NM physician 2 | 2014 | 0.88 ± 0.01 (0.09 – 1.52) | 1.06 ± 0.02 (0.06 - 1.63) |
| NM technician 1 | 2014 | 1.12 ± 0.10 (0.81 – 2.35) | 1.04 ± 0.06 (0.07 - 2.59) |
| NM technician 2 | 2014 | 1.14 ± 0.05 (0.08 – 2.5) | 1.00 ± 0.01 (0.10 - 2.71) |
| Radio-pharmacist | 2014 | 2.05 ± 0.13 (0.16 – 4.16) | 1.84 ± 0.11 (0.27 - 2.96) |
| Medical physicist | 2014 | 0.79 ± 0.04 (0.09 – 2.10) | 1.54 ± 0.03 (0.05 - 2.24) |
| Auxiliary personnel | 2014 | 1.05 ± 0.03 (0.08 – 1.93) | 1.05 ± 0.01 (0.04 - 1.21) |

Table 3. The mean annual occupational exposure dose ± SE

The historic records of the external radiation doses to staff members working in our nuclear medicine depart - ment for the past three years (2012-2014) was analyzed and shown on Table 3.

**CONCLUSION:** The results from this study showed that annual effective radiation doses to nuclear medicine staff members were within permissible levels.The increases in effective doses from SPECT/CT study is considered clinica - lly acceptable in view of the diagnostic benefits of the CT.