New technology in 18F-FDG handling by technologists: impact of fully automated dispensing on staff radiation protection

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EANM 2011 - Birmingham - October 15th to 19th

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Goal

Quantification of the radiation protection benefit to technologists provided by a fully automated fractionating device in comparison with manual syringe filling, and their dedicated injection devices.

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Material and Methods

BEFORE : Lermerpax high energy cell (2004)

AFTER : Trasis Unidose automated cell (2010)

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Before

Lermerpax high energy cell (2004)

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After

Trasis Unidose automated cell (2010)

Material and Methods

We compared :

- whole-body doses and extremity doses
- over 2 two-week periods
- before and after the installation of the system

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Material and Methods

We used :

- An ion storage dosimeter (operational dosimetry) to measure whole-body radiation doses
- 4 thermoluminescent ring dosimeters (passive dosimetry) to measure extremity radiation doses (indexes + thumbs)

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Material and Methods

Operational dosimeter

- Siemens EPD Mk2
- X, γ, β-
- Energy range : X γ 15 keV to 10 MeV
  β- 100 keV to 2 MeV
- Dose range : 0 to 16 Sv
- Dose rate range : 0 to 4 Sv/h

Ring dosimeters (Thermo Luminescent Device)

- LCIE LANDAUER
- FLi pellets
- Energy range : X γ 15 keV to 8 MeV
  β- from 150 keV
- Dose range : 0.2 mSv to 10 Sv

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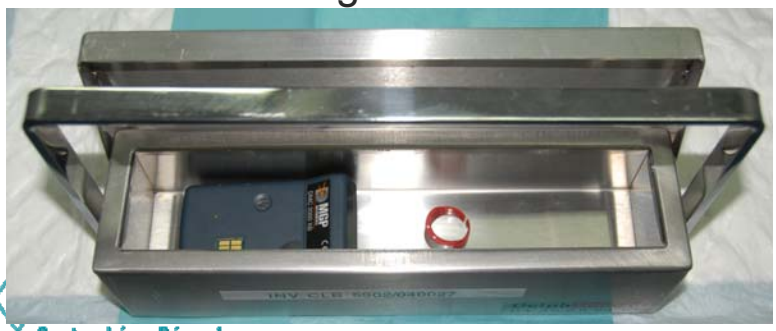
Material and Methods

These dosimeters were worn exclusively while preparing and administering ^{18}F-FDG doses.



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Material and Methods

Radiametre RAM DA 3-2000

Dose rate range	0,5µSv/h to 1 Sv/h
Range display	0,01 µSv/h à 1 Sv/h

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Results

BEFORE

- Contact syringe shield : 2.04 mSv/h (220 MBq)
- Behind semi-automated injector : 9.42 µSv/h (220 MBq)
- Contact glove box : 12.2 µSv/h (1.5 GBq inside)

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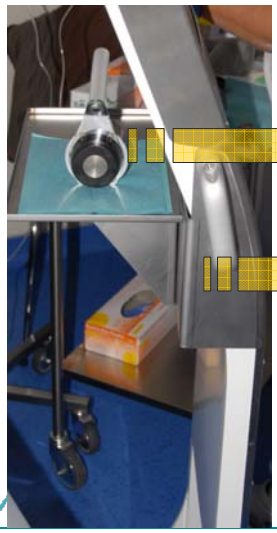
Results



AFTER

- Contact syringe shield : 66.28 µSv/h (220 MBq)
- Behind shield : 2.42 µSv/h (220 MBq)
- Contact of automated cell : 1.04 µSv/h (1.5 GBq)

Results

	Before	After
Number of patients	115	88
Total administered activity (MBq)	25030	19337
Total whole-body dose (µSv)	331	78
Mean whole-body dose per administered activity (µSv/MBq)	0.013	0.004
Mean whole-body dose per patient (µSv/patient)	2.87	0.89
Highest ring dose (thumb & index of dominant hand) (mSv)	8.2	0.40
Mean ring dose per administered activity (µSv/MBq)	0.33	0.02
Mean ring dose per patient (µSv/patient)	71	4.5

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Conclusions

63% reduction of whole-body radiation doses to technologists

95% reduction of extremity radiation doses to technologists

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Conclusions

Exposure of technologist per 370 MBq dose prepared and injected :

- whole-body : **1.48 µSv**
- Extremities : **7.4 µSv**

NB: manufacturer announces ~1 and <20 µSv respectively

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