Revised dose calculations for iodide I-123, I-124, I-125 and I-131 for diagnostic procedures in nuclear medicine

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Introduction

Iodide is used to diagnose thyroid diseases such as:

- Thyroid cancer
- Hypothyroidism
- Hyperthyroidism

This is an ongoing study within the ICRP task group 36
Two different iodide models

ICRP publ. 53 to patients from radiopharmaceuticals

ICRP publ. 56 and 63 for occupational workers
Aim

Recalculate the doses for iodide that includes:

- Leggett’s iodide biokinetic model
- The ICRP standardized biokinetic models
- ICRP/ICRU adult computational reference voxel phantoms
- The ICRP publ. 103 Tissue weighting factors
Biokinetic model

- Leggett’s iodide biokinetic model (2010)
Standardized biokinetic model

HAT-model (ICRP 100)  Kidney-bladder model (ICRP 30)

Mean transit time through the kidneys of 5 min  Urinary voiding time of 3.5 h

Kidneys  Urinary bladder content
Biokinetic model for iodide
Voxelized reference phantom

Dose estimations using computational reference phantoms

Cristy & Eckerman (1987) Male phantom
ICRP adult reference male and female computational phantoms (2009)
Updated $w_T$ for stochastic effects

ICRP publication 60 (1991)  ICRP publication 103 (2007)
Results - normal uptake

Effective dose

<table>
<thead>
<tr>
<th>Iodine</th>
<th>I-123</th>
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Absorbed dose to the Thyroid

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Results - blocked uptake

Absorbed dose to the Thyroid

Effective dose

ICRP 53 Male Female

This study
Conclusion

• The new calculations mainly influences the dose estimates for blocked thyroid
  – mainly due to the changed assumption concerning the uptake of inorganic iodine

Questions?

• More realistic estimation of the radiation-induced risk, which is of most importance when justifying the use of iodide in nuclear medicine examinations.