

Evaluation of nasal swab method to assess occupational internal contamination with I-131, I-123, and Tc-99m

Introduction

The volatility of some radionuclides during the preparation of radiopharmaceuticals may cause internal contamination and increases the inhalation hazards for workers. Our internal dosimetry laboratory tested the nasal swab method to screen any potential internal radioactive contamination.

Materials and methods

The nasal swab method was evaluated for workers at Al-Bairouni nuclear medicine center in Damascus, Syria. Nasal swabs were collected from workers preparing radioactive materials. As the effectiveness of such samples is limited to a very short period after exposure, the sample collection was carried out during the first hour following the expected exposure.

In addition, the collected data from nasal swabs was associated with in vivo (thyroid) and / or in vitro (urine) measurements.

Nasal swabs and bioassay measurements were collected from 15 workers for 92 expected intake cases. The samples were collected by inserting a clean cotton swab (moistened with water) about 2 cm into each nostril in a circular motion.

The committed effective doses were estimated for all measurements and were compared with each other. The measurements of nasal swab and urine samples were carried out by using stationary N-type HPGe detector, whereas thyroid counting was done by using portable unit of HPGe detector.

Results and discussion

The measured value, M , was considered to be significant if it exceeds the decision threshold (DT) of the said measurement method. The value of DT equals half the value of detection limit (DL) according to ISO 11929:2010 (Table 1). The ranges of obtained results were summarized in the Table 2 for three radionuclides (^{131}I , ^{123}I , and $^{99\text{m}}\text{Tc}$).

The dataset contained 33 cases where significant activities for both nasal swabs and other bioassay methods have been observed. Also, there were 20 cases where nasal samples had significant activity while the results from other bioassay methods were lower than the relevant detection limit. On the other hand, 13 cases were found to have no detectable activity in nasal samples whereas other bioassay methods measured activities greater than the detection limit. In other words, the absence of activity in nasal swabs does not constitute sufficient evidence that an inhalation exposure has not occurred. Actually, this may be due to various possible reasons like: some workers were breathing by mouth, nose was self-cleaned if samples were not collected early, the worker washed his nose unconsciously before collecting the sample, and also particle size can significantly affect nasal deposition and clearance.

Conclusion

There was great variability in the relationship between internal dose estimated from nasal swab measurements and those from other bioassay results. Nasal swab measurements were found to be a very poor method for the assessment of internal radioactive contamination because of the large uncertainty involved in the proposed nasal model. Gamma spectrometry measurements of nasal swab samples can provide rapid information on radionuclide composition, and it can be used in nuclide identification especially when worker may be exposed to more than one radionuclide in the workplace.

Finally, the annual committed effective dose of most monitored workers was lower than 1 mSv.

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