Comparative Studies of Thyroid $^{99m}$Tc Uptake Measured with Gamma Camera and Scintillation Probe

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Abstract

The purpose of these studies was to compare data obtained in thyroid $^{99m}$Tc uptake measurements carried out with a gamma camera against results from a scintillation probe.

Data from 30 patients (average age of 52 years) with hyperthyroidism were calculated after intravenously administered of 60 MBq of $^{99m}$TcO$_4^-$ (~1ml). The radioactivity of radiopharmaceutical was measured after 20 min with gamma camera Nucline AP (Mediso) equipped with a pinhole collimator and with a scintillation probe SSU-70-2 (Polon).

The difference in the thyroid $^{99m}$Tc uptake resulting from gamma camera measurement and the data obtained from the scintillation probe was not greater than 2.3%.

Keywords: radioisotope diagnostic of thyroid, $^{99m}$TcO$_4^-$ thyroid uptake, hyperthyroidism

Introduction

The radioisotope diagnosis method shows not only the morphology but also the thyroid function [1-3]. The evaluation of this function is carried out by the measurement of radioisotope uptake. Radiopharmaceutical (labeled with $^{131}$I, $^{123}$I or $^{99m}$Tc) is administered orally or intravenously. Then the radioisotope quantity collected in thyroid is measured. The thyroid uptake can be determined as the ratio of measured to administered radioactivity.

The use of $^{131}$I ($T_{1/2}=8.05$ days, $E_r=0.364$ MeV) or $^{123}$I ($T_{1/2}=13$ hours, $E_r=0.159$ MeV) causes greater radiological effect (effective dose) to patient than can be obtain from radiopharmaceuticals labeled with $^{99m}$Tc ($T_{1/2}=6$ hours, $E_r=0.140$ MeV). Therefore some authors compare the applicability of both radioisotopes in thyroid function diagnosis [4-5].

Also in these studies we intend to compare applicability of a simple scintillation probe against gamma camera used to measure the $^{99m}$TcO$_4^-$ (pertechnetate) uptake in thyroid.

Experimental procedures

The study was performed for patients with hyperthyroidism. The known quantity of administered radioactivity (60 MBq for patient of 70 kg weight), which depends on the weight of patient, was introduced intravenously as solution of about 1 ml volume. After 20 min the radioactivity of thyroid was measured with a scintillation probe SSU-70-2 (produced by POLON, Poland) as well as with a gamma camera Nuclide AP (produced by MEDISO, Hungary) with a pinhole collimator. The thyroid uptake (TU) was calculated as the
ratio of measured ($MR$) to administered radioactivity ($AR$) according to the following formula:

$$TU = \frac{MR - BG}{AR}$$  \hspace{1cm} (1)

where $BG$ is measured background, and

$$AR = BAR - AAR$$  \hspace{1cm} (2)

where $BAR$ is the radioactivity of solution in syringe (before injection to patient) and $AAR$ is the radioactivity of syringe after the injection.

**Results**

Images from gamma camera were obtained on a 64x64 matrix in AP projection for all 30 patients with average age of 52 years. The examples of registered images are presented in Fig. 1.

In Table 1, the comparison of $^{99m}\text{TcO}_2$ uptake in thyroid resulting from a gamma camera measurement against results from a scintillation probe is collected.

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**Fig. 1.** Example of registered images from gamma camera Nucline AP:

a) thyroid goiter without nodules (37 years old patient, woman)

b) nodular goiter of thyroid (35 years old patient, woman)
Discussion of results

The difference in the thyroid $^{99m}$TcO$_2$ uptake determined with a gamma camera and a scintillation probe was not greater than 2.3%. Therefore, the scintillation probe for thyroid $^{99m}$TcO$_2$ uptake measurement may be used alternatively to the gamma camera as a simple and efficient technique.

References


