A rapid and simple automation of [I-123]mIBG for clinic application

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1. Introduction

Radioiodinated meta-iodobenzylquanidine (mIBG) as a functional analog of norepinephrine has been used in the clinical and diagnostic management of neroendocrine tumors like pheochromocytoma and neuroblastomas.[1] In particular, [I-123]mIBG has diagnosed successfully as SPECT (Single Photon Emission Computed Tomography) imaging agent in nuclear medicine. The imaging ability of [I-123]mIBG is due to two effects of biological activity related to tumor and good physical terms (a half-life of 12.3 hours and a gamma energy of 140KeV). Therefore, we can easily expect that a use of [I-123]mIBG will expand in Korean Hospitals. At that point, we are interested in an automatic and rapid preparation of [I-123]mIBG with good quality for clinic application.[2][3]

2. Methods and Results

The precursor for [I-123]mIBG used in this study was purchased from ABX company. All chemicals including solvents were used as purchased without further purification. Iodine-123 was produced by Xe gas target system (Nordion, Canada) with 30MeV medical cyclotron (IBA co.), which was used the ^{124}Xe(p, 2n) reaction and was measured with a radioactive dose calibrator (Capintec co.). The radionuclide was characterized by Multichannel Analyzer using HPGe detector (Ortec co.). The radiochemical purity was used with RadioTLC system (AR-2000, Bioscan co.) in thin layer chromatography.

2.1 Preparation of I-123

The Xe-124 gas target for I-123 production was irradiated by the proton beam of 28 MeV. The nuclear reaction of Xe-124 was carried out as follows; ^{124}Xe → ^{123}Cs → ^{123}Xe → ^{123}I in Xe-124 gas state. The beam irradiation time of I-123 production was based on the amount of radioactivity. After beam off the Xe-124 gas target needs a waiting time of approximately 8 hours due to the nuclear reaction of ^{123}Xe → ^{123}I. This gas target was washed with a solution of 0.01M NaOH. This solution including I-123 passed through short column, and then the final product (Na[^{123}I]) was collected into mother vial.

2.2 Preparation of KIT

The kit for automation method was composed of some reagents. The copper (II) and tin (II) can lead to iodide exchange in a specific molecular. The ascorbic acid is used to protect the iodide bond decay by radioactivity in a molecular. The sterile PBS buffer (pH=7.4) is used to preserve the pH of product for clinic application. In the end the kit for [I-123]mIBG was made of four vials such as copper (II), tin (II), ascorbic acid and PBS buffer.

2.3 [I-123]mIBG automation method

I-123 solution (160-230 mCi/ 0.7mL of 0.01 NaOH) from target was ready with mIBG precursor (2 mg) and above kit. All reagents with the exception of PBS buffer put into reaction vials in automatic module. This module was converted from FDG automatic module (Broken system).In particular an new automatic program for [I-123]mIBG set up FDG module which was modified to the position of valves and lines. The radio-labeling time was 30 mins at 110℃. After labeling the product with buffer solution passed very quickly through alumina column and sterile filter. The radiochemical yield was over 50%. The totally reaction time for iodide labeling was within 40 mins.

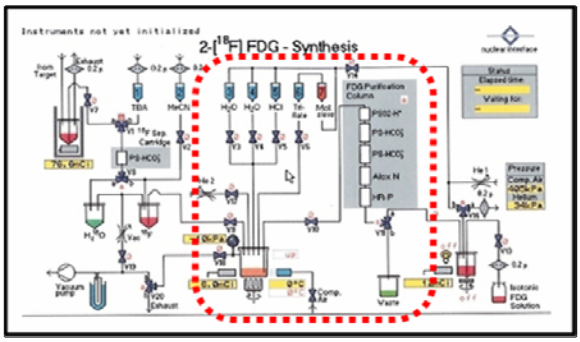

Fig. 1. An automation method of [I-123]mIBG using FDG module was made of new program (33 steps) and tuning parts (in red circle).

2.4 Quality Control of [I-123]mIBG

The radiochemical purity by radioTLC scanner was over 97%. In HPLC results (μ -Bondapack, 3.9Ⅹ300 mm, 10μ m, Waters co.) the product was at 9.55 mins and free iodide was at 3.48 mins in the rate of 1 mL/min (ACN:DW:TFA=26:74:1).[4] The pH of product exactly was 7.4. After 72 hours the stability of radiochemical purity was over 90% regardless of indoor temperature.

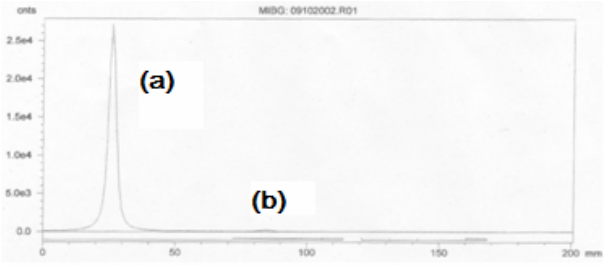

Fig. 2. (a) [I-123]mIBG, (b) Na[I-123] in the results of radioTLC scanner.

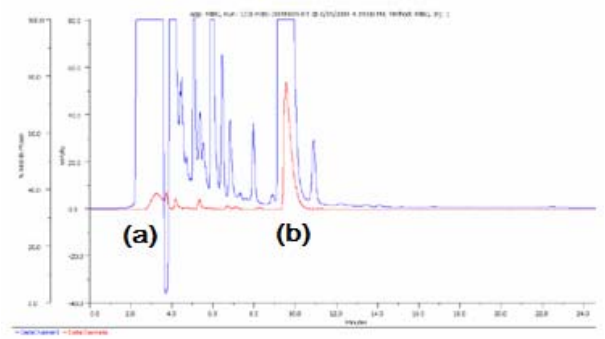

Fig. 3. (a) RI data of Na[I-123], (b) RI data of [I-123]mIBG, and others was UV spectrums (ascorbic acid) by the analytic data of RI-HPLC.

3. Conclusions

We could successfully prepare the [I-123]mIBG by modified FDG module, reagents kit, and new program. This labeling method could repeatedly use several times as clinical application and have high safety against radioactivity.

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