EFFECTIVE METHOD TO MINIMIZE MOLYBDENUM CONTENT OF ^{99}MOLYBDENUM-^{99m}TECHNETIUM GENERATOR ELUATE

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Introduction

^{99m}Tc is the work horse of every nuclear medicine department. It is obtained by the elution of a ^{99}Molybdenum-^{99m}Technetium (^{99}Mo-^{99m}Tc) generator. Molybdenum-99 ($t_{1/2}$ = 66 h) decays by beta emission to ^{99m}Tc (87%) and ^{99}Tc (13%), emitting photons of 740 and 778 keV.[1] Ideally, ^{99m}Tc eluates contain no radionuclide impurity. However, as a consequence of generator aging or possible occurrence of a mechanical defect, ^{99}Mo may also be extracted from the column during this elution process (Molybdenum breakthrough), becoming a contaminant in the eluate to be administered to the patient. The presence of ^{99}Mo in the radiopharmaceutical solution injected in the patient represents an unnecessary radiation dose to the patients; the dose coefficient for ^{99}Mo is about 50 times higher than that of ^{99m}Tc. The International Atomic Energy Agency (IAEA) safety standard recommends that any eluate containing more than 0.15 uCi of Mo-99 / mCi of Tc-99m should no be injected to human.[2] In the USA, a licensee is also required to perform the test and retain records in accordance with 10CFR35.204. Molybdenum break through (MBT) must also be determined at least for the first elution of a particular generator.[3, 4]

Recently we received a ^{99}Mo-^{99m}Tc generator having ^{99}Mo breakthrough (MBT) with considerably high ^{99}Mo activity in eluate. Using an old ^{99}Mo-^{99m}Tc generator as a resin column, we successfully reduced the ^{99}Mo content of eluate by passing it through this old generator.

Method

We first eluted Generator with high ^{99}Mo (Generator A) and assayed the eluate for ^{99m}Tc and ^{99}Mo activity using a standard well counter dose calibrator. This eluate was then passed through an old generator (Generator B) and the eluate from Generator B was assayed for ^{99}Mo and ^{99m}Tc activity. In this way, the excess ^{99}Mo was successfully removed but with a reduction in ^{99m}Tc activity as described by Isaac and Fred in 1968.[5]

In an attempt to recover the ^{99m}Tc retained Generator B, 20ml of saline at pH 4.0 was passed through Generator B about I hour after the previous elution. In this way the ^{99m}Tc held by this generator was recovered with a bonus of a few millicuries (mCi) as well (Table1).

Elution	^{99m}Tc Activity (mCi)	^{99}Mo Activity (uCi/mCi of ^{99m}Tc)	Generator
1	414	18	A
1a	223	0.006	B
1b	198	0.004	B

a – Elution from Generator B with eluate from Generator A.

b – Second elution of Generator B with saline 1 hr after a.

Summary

^{99}Mo breakthrough (MBT) is a serious issue in daily nuclear medicine clinical practice as it results in significant radiation exposure to the patients and nuclear medicine staff as well. In addition, it also degrades the image quality due to scattering. Therefore, every eluate should be checked for MBT to avoid its consequences. And if found, than passing this eluate through an old generator (as resin column) is an easy and effective remedy to minimize the ^{99}Mo content.

References

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