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Validating Tc-99m Radiopharmaceuticals produced from non-conventional Mo supplies

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Single photon emission tomography (SPECT) is the gold standard and well- established clinical diagnostic imaging technique using designated Tc-99m or I-123 pharmaceuticals for cardiac diseases, bone diseases, and thyroid diseases. The conventional method of producing Tc-99m pharmaceuticals is to use the parent nucleus Mo-99 produced in a nuclear power reactor by a fission reaction of U-235. In recent years, due to shut down of Chalk River power reactor in Canada, one of the major suppliers of the Tc-99m, the continuous supply of the pharmaceuticals was adversely interrupted. Therefore, new techniques are being developed to use other techniques to produce the Tc-99m pharmaceuticals. The irradiated enriched Mo discs were received from Missouri University Research Reactor (MURR), which uses neutron activation processes, in which Mo-99 is obtained by the neutron activation (n,gamma reaction) of Mo-98 in a high neutron flux reactor. The radiochemistry lab, at the Winnipeg Health Sciences Centre (HSC), processed the Mo-99 pallets and produced the Tc-99m pharmaceuticals, using some of the instruments and setup used for their clinical productions. Three Tc-99m pharmaceuticals, for brain, cardiac, and bone SPECT imaging were produced and injected intravenously into healthy CD1 mice. The animals were imaged with a hybrid SPECT/CT scanner (NanoScan, Mediso Medical Imaging Systems- Budapest, Hungary). In the control groups, the animals were injected with the same pharmaceuticals produced using the conventional Mo sources. After imaging, the animals were euthanized, and the radioactivity in vital organs, such as heart, lungs, kidneys, intestines, etc., was measured using a well counter. The images were quantified using region of interest analysis on VivoQuant software, provided by the manufacturer. Preliminary quantification results demonstrate agreement between the in-vivo and ex-vivo quantification. The results of the image quantification will be compared to those obtained in the control group, to validate the equivalency of the Tc-99m pharmaceuticals produced by the two techniques.

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