

Handling Of A Tungsten-188/Rhenium-188 Generator System For Vessel Treatment Using A Balloon Dilatation Catheter : Radiation Protection And Dosimetry

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Purpose

The aim of this work is to report about radiation protection experiences with the handling of a W-188/Re-188 generator and elutriation system and about dosimetry using Re-188 in a balloon dilatation catheter for endovascular treatment of vessels.

Method

Rhenium-188 is obtained as sodium perrhenate from a W-188/Re-188 generator system. Several modifications were necessary (variation of flow and pressure, correction of first runnings, minimizing the supplies, etc.) to obtain continuous elutriations with content concentration (8-10 GBq/ml) and yield (about 65%).

The elutriated Re-188 is used in nuclear medicine therapy for endovascular irradiation. For this purpose a balloon dilatation catheter is inserted into the vessel and filled with the radionuclide up to a length of 2-3 cm. Dose rates >5 Gy/min have to be achieved for proper treatment. The dose distribution is controlled with film and polymer-gel dosimeters, the latter being interpreted by using magnetic resonance imaging. Dose distribution measurements are compared with calculations, which are based on a special software for vessel irradiation (IVBDOC, Oak Ridge Associated Universities) as well as on Monte Carlo simulation.

Result and Conclusion

Radiation protection problems are derived from the rather high dose rates near the 37GBq-generator (1 mSv/h on the surface of the shielding, 200 µSv/h in a distance of 20 cm) and from the elutriation system, which could not be shielded easily. Furthermore, the complex system with mains, stopcocks and syringes gave rise to radioactive contaminations. Suitable radiation protection measures for the safe use of the W-188/Re-188 generator and elutriation system require special individually constructed shieldings made of polystyrene and lead as well as a planned arrayed, leakage-tested device. W-188 impurity was measured to be less than 2×10^{-8} .

Absorbed radiation doses to the internal vessel walls demanded for the treatment can be obtained with the balloon catheter method when 2-10 GBq/ml Re-188 are used. The results of our measurements are in good agreement with calculated dose profile calculations.

At least the risk concerning undesirable exposure of the patients remains because of the but unlikely leakage of the catheter.