Fibrin glue system for adjuvant brachytherapy of brain tumors with 188Re and 186Re-labeled microspheres.

Authors: Hafeli UO, Pauer GJ, Unnithan J, Prayson RA

Publication Date: 2007

Abstract:

Brain tumors such as glioblastoma reappear in their original location in almost 50% of cases. To prevent this recurrence, we developed a radiopharmaceutical system that consists of a gel applied immediately after surgical resection of a brain tumor to deliver local radiation booster doses. The gel, which strongly adheres to tissue in the treatment area, consists of fibrin glue containing the beta-emitters rhenium-188 and rhenium-186 in microsphere-bound form. Such microspheres can be prepared by short (2 h or less) neutron activation even in low neutron flux reactors, yielding a mixture of the two beta-emitters rhenium-188 (E(max)=2.1 MeV, half life=17 h) and rhenium-186 (E(max)=1.1 MeV, half life=90.6h). The dosimetry of this rhenium-188/rhenium-186 fibrin glue system was determined using gafchromic film measurements. The treatment efficacy of the radioactive fibrin glue was measured in a 9L-glioblastoma rat model. All animals receiving the non-radioactive fibrin glue died within 17+/-3 days, whereas 60% of the treated animals survived 36 days, the final length of the experiment. Control animals that were treated with the same amount of radioactive fibrin glue, but had not received a previous tumor cell injection, showed no toxic effects over one year. The beta-radiation emitting rhenium-188/rhenium-186-based gel thus provides an effective method of delivering high doses of local radiation to tumor tissue, particularly to wet areas where high adhesive strength and long-term radiation (with or without drug) delivery are needed.