# AbstractID: 10284 Title: Feasibility of Using Radioactive Bone Cement to Treat Vertebral Metastases

**Purpose:** To evaluate the feasibility of using radioactive bone cement to deliver therapeutic radiation to the vertebral body without undue risk to the spinal cord, i.e. vertebral brachytherapy.

**Method and Materials:** CT-scan based Monte Carlo N-Particle radiation transport models, consisting of a three-dimensional rectangular lattice of 0.625×0.625×1.25-mm voxels, were created of a T-12 human cadaveric vertebra. Trabecular and cortical bone were both represented by a spectrum of thirty complementary volume fractions of solid cortical bone and bone marrow, and all soft tissue was represented as a single material. A cylindrical volume of radioactive bone cement was simulated within the model, and two candidate radioisotopes were studied: P-32 and Sr-89. Thirty million particle histories were simulated (MCNPX v.2.5.0) to characterize the dose distribution within the vertebral body.

**Results:** The dose distributions for both radioisotopes were axisymmetric about the cement implant and rapidly decreased with increasing distance from the cement. Initial activities of 0.94 mCi and 0.51 mCi for P-32 and Sr-89, respectively, would deliver >300 Gy to bone within 1.6 mm of the cement implant and >80 Gy to bone within 2.8 mm, while keeping the dose at 3.4 mm under 45 Gy.

**Conclusion:** The predicted dose distributions show that a therapeutic radiation dose would be delivered to all bone within ~3 mm of the cement without undue risk to tissue beyond 3.4 mm (such as the spinal cord), indicating preliminary feasibility of this technique. With further development, this technology may yield a clinically-feasible procedure that would eliminate the need for 10 radiotherapy sessions, making it convenient for the patient, while potentially improving the clinical outcome by delivering a higher dose to the tumor and a lower dose to the spinal cord than conventional radiotherapy.

**Conflict of Interest (only if applicable):** Research sponsored by Bone-Rad Therapeutics, Inc.