

RETENTION AND RADIATION FIELD OF A SN-117M COLLOIDAL SUSPENSION IN CANINE INTRA-ARTICULAR INJECTIONS

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Introduction

Radiosynoviorthesis (a.k.a. radiosynovectomy) is a well-established therapy in arthritis and involves an intra-articular injection of a suspension of radioactive particles to treat synovitis. Conventional isotopes include Y-90, Re-186, Er-169 and P-32. A new isotope being developed for this application is Sn-117m ($t_{1/2}$ 14d, γ 159 keV, 86%). This isotope is well suited to treat smaller arthritic joints since the therapeutic conversion electrons (~140 keV, 112%) have a range of about 300 μm which allows for treatment of the synovium without affecting the surrounding tissues. Retention of the colloidal Sn-117m >99% in the synovial cavity is highly desirable.

Method

At the College of Veterinary Medicine, University of Missouri, five normal purpose-bred hounds were injected with 2.5 mCi (92.5 MBq) of a homogeneous preparation of Sn-117m colloid (~6 μm diameter) in the intra-articular space of the left elbow. This dosage was used in the safety study as it was determined to be at/above the calculated highest limit of commercial treatment. Urine, blood, feces and synovial fluid samples were taken periodically during the trial and analyzed for radioactive content. The animals were sacrificed after six weeks (3 half-lives) and the amount of radioactivity in the dissected tissues was measured. Other trial measurements included histopathology, PET/MRI, x-ray, autoradiography, dosimetry, synovial fluid analyses, physical examinations (including observation for local and systemic adverse effects) and radiation field. Specifically, radiation field measurements were performed at 5 cm and 1 m from the injection site in order to determine release qualification.

Results

Average joint retention of the colloid was 99.1% of the administered dose at three-half-lives. When integrated over the study period the activity in blood, urine and feces was <0.1%. The majority of the extra-synovial activity was found in the liver (<0.7%), spleen (<0.1%), and left prescapular lymph node (<0.03%). Some of the leakage might be attributed to the multiple synovial fluid taps performed over the duration of the trial. Radiation fields at 1m were typically around 300 $\mu\text{R/h}$ (3 $\mu\text{Sv/h}$) and well below the usual animal release criterion established at 500 $\mu\text{R/h}$ (5 $\mu\text{Sv/h}$). This indicates that in future, treated dogs can be immediately released into the general population after injection.

Conclusions

These results demonstrate a high degree of retention of the Sn-117m homogeneous colloid delivered intra-articularly. Other than minimal transient leakage possibly due to synovial punctures the results are consistent with a gradual removal of the colloid through the lymphatic system. Radiation fields are low enough to permit immediate release of treated dogs. The high joint retention and low radiation field supports the use of Sn-117m colloid in treating arthritis.

Keywords: radiosynoviorthesis, Sn-117m, colloid, arthritis