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A Personalized Remote Radiation-Tracking Vest for At-Home Monitoring of Lu-177 DOTATATE Therapy

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BACKGROUND: The FDA has approved the Peptide Receptor Radionuclide Therapy (PRRT), Lutathera (177Lu-DOTATATE) with package instructions dictating 4 doses of 200 mCi each for all Neuroendocrine Tumor (NET) patients. This universal prescription may be too much for some patients, leading to radiation damage in kidneys or other organs-at-risk (OARs). For others, 4 doses may be significantly less than can be safely tolerated, leading to sub-optimal treatment and shortened progression-free and overall survival. Tailoring the number of doses to each patient requires repeated nuclear medicine scans (e.g., multiple SPECT or SPECT plus planar) over the course of several days to perform OAR dosimetry. These scans are expensive and burdensome on the patient, often requiring hotel stays near the imaging facility.

METHODS: To alleviate the cost and burden of longitudinal SPECT/planar dosimetry for PRRT, we have developed a low-cost Personalized Remote Radiation-Tracking (PRRT) vest for at-home dosimetry. The PRRT vest contains radiation-monitoring sensors that can compute OAR dosimetry measurements that are reported wirelessly to the healthcare provider. The vest is personalized for each patient, using the patient's qualifying PET/CT scan to determine the optimal placement of sensors within the vest. Our methods mitigate the confounding effects of organ motion, vest mis-positioning, and other effects to ensure accurate dosimetry. We have created accurate computer models of patients wearing the PRRT vest under a variety of physical and biological conditions. The virtual vest was "worn" for 2 minutes each day over the course of several days post-injection. The OAR and NET washout rates were then computed.

RESULTS: The PRRT vest estimated washout rates were within 5% of truth for OARs and within 8% for NETs.

CONCLUSION: Accurate washout rate measurements from the vest mean that accurate at-home dosimetry is possible with the PRRT vest. The PRRT vest is a low-cost dosimetry solution that will enable individualized 177Lu-DOTATATE therapy.