Initial Assessment of a Novel Radioactive Tin-117m Stent in Porcine Coronary Arteries

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Background: Tin-117m (^{117m}Sn) is a novel conversion electron emitting radioisotope that deposits intense energy in a very short range. It can deliver high doses of radiotherapy to a target while minimizing collateral damage to adjacent normal tissue, and has been used clinically in the management of bone pain associated with osteosarcoma. There are several potential cardiovascular applications of ^{117m}Sn, one being an electroplating on stents; since the coronary media is 0.2-0.3mm thick, no adjacent tissue exposure would result.

Objective: To assess the feasibility and coronary artery effects of an ^{117m}Sn-electroplated stent in a clinically relevant animal model.

Methods: 72 stents of 3 types were implanted in pig coronaries: Bare metal stents (BMS, n=14), Tin-only sham electroplated stents (Tin-only, n=15), and three incremental doses of radioactive ^{117m}Sn electroplated stents (Low 30μCi, n=14; Medium 60μCi, n=14; and High 150μCi, n=15). Pigs were terminated at one month for complete histological analysis.

Results: Intimal thickness varied according to stent type with highest level for the Low, Medium and High radioactive stents compared to BMS and Tin-only (0.43±0.06mm, 0.41±0.06mm, and 0.47±0.07mm, vs. 0.17±0.02mm, and 0.26±0.03mm, respectively, $P<0.001$). % area stenosis was higher for radioactive stents compared to BMS and Tin-only (51±6%, 51±4%, and 55±5%, vs. 27±2% and 35±3%, respectively, $P<0.001$).There was consistently a distinct, discrete, dense collagenous ring of tissue which included a densely cellular outer rim, in the perivascular space at the outer adventitial border ~0.2-0.3mm radially outward from ^{117m}Sn stents. This appears to reflect a unique biological effect or 'signature' of this radioisotope in this application.

Conclusions: This study showed that novel radioactive ^{117m}Sn stents were compatible with porcine coronary artery implant. Although these devices exacerbated rather than inhibited in-stent neointima formation, unique histological effects were observed that support further investigation of ^{117m}Sn effects in the circulatory system to understand the interaction of this unique conversion electron energy with the vascular tissue.