Theragnostic potential of Sn-117m for the molecular targeting and therapy of vulnerable plaque

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Objectives: The high-LET conversion electron emitter Sn-117m ($t^{½}$ 14d, γ 159keV, 86%) shows promise for molecular imaging and treatment of vulnerable plaques (VP). We report on studies undertaken to evaluate its efficacy in reducing inflammation and VP.

Methods: Sn-117m conversion electrons are mono-energetic and have a discreet range in tissue of about 290 μm, which corresponds to the wall thickness of human coronary arteries that contain VP. The therapeutic advantage to deposit energy throughout the arterial wall with virtually no effect to surrounding tissue is unique. An electroplated Sn-117m stent was developed for atherosclerotic coronary arteries. Effects on vessel wall inflammation from various doses (0, 30, 60, and 150 μCi) were studied in hyperlipidemic rabbits. Additionally, studies were performed in an ApoE mouse VP model where [Sn-117m]-DOTA-annexin (TA) doses up to 3.4 μCi were delivered systemically.

Results: Immunohistochemical analysis of macrophages and smooth muscle cells demonstrated that inflammation in the Sn-117m stented segments was dramatically reduced in a dose-dependent fashion. For systemically injected TA, histology demonstrated that the plaque composition had less macrophages and greater smooth muscle cells in each dose group as compared to the control.

Conclusions: These results demonstrate Sn-117m as a means to reduce inflammation following stenting, and when delivered systemically as TA, this theragnostic radionuclide may provide a non-invasive means to image VP as well as to reduce the vulnerability of the plaque rupture in coronary arteries.