

The Effect of the Surefire Antireflux Catheter on Downstream Particulate Distribution: Preliminary Results From 4 Patients

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Purpose:

The Surefire Infusion System (SIS; Surefire Medical, Westminster, CO) is a coaxial microcatheter system with a pliant expanding tip designed to limit retrograde flow of administered intra-arterial embolic agents and resultant nontarget embolization (NTE).¹

A recent study suggests that the SIS may achieve relative arterial hypotension downstream to the catheter tip when compared with an end-hole catheter, potentially altering microsphere distribution.²

We present the first in vivo direct patient comparison of particulate distribution using both the SIS and standard end-hole microcatheter via a two step, same-day injection of technetium-99m (Tc-99m) macro-aggregated albumin (MAA) as a microsphere surrogate.

Methods:

Four patients with primary or secondary liver cancer underwent two sequential low-particulate infusions of Tc-99m MAA on the same day.

One infusion was performed using the SIS and the other using a conventional end-hole microcatheter.

Saved images were used to ensure comparable catheter positioning for both infusions.

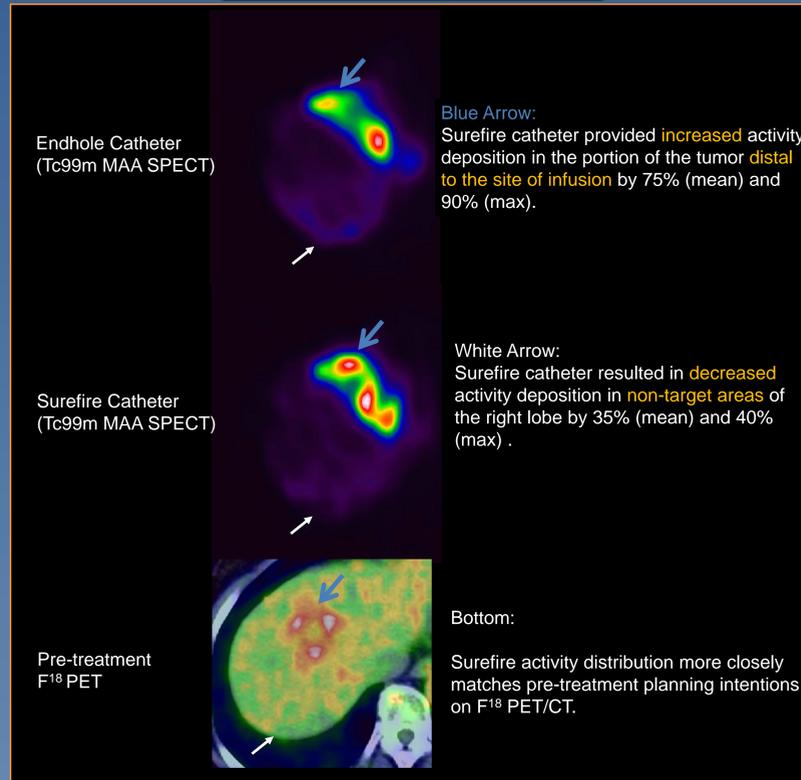
Single-photon emission computed tomography (SPECT) imaging was obtained following each infusion, and the MAA distribution was analyzed and compared to each patient's initial FDG PET/CT or contrast enhanced CT to assess relative particle distribution.^{3,4}

To eliminate the effects of residual activity on the SPECT images acquired after each step, the initial infusion administered < 3 mCi and < 30,000 MAA particles, followed by the second infusion with ~ 16 mCi and about 150,000 MAA particles administered (both infusions administered non-embolic particle doses).

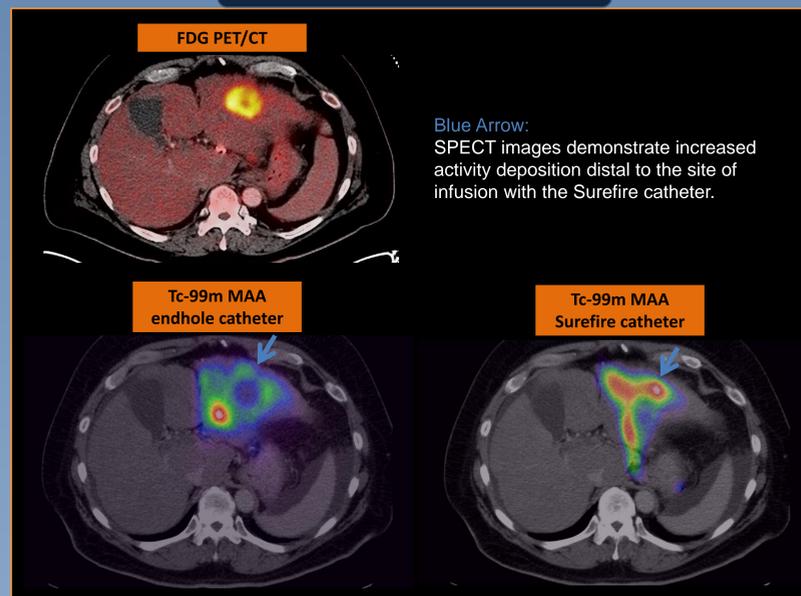
Table 1:

	Standard End-Hole Catheter	Surefire Infusion System (SIS)
Patient 1: Mean Activity	480.1	840 (75% increase)
Patient 1: Max Activity	635.2	1218 (92% increase)
Patient 2: Mean Activity	389.4	516 (33% increase)
Patient 2: Max Activity	536	763 (42% increase)
Patient 3: Mean Activity	871.7	1362 (56% increase)
Patient 3: Max Activity	492.2	1661 (237% increase)
Patient 3: Mean Activity	1229.4	2204 (79% increase)
Patient 3: Max Activity	754.4	2594 (244% increase)
Patient 4: Mean Activity	106	184 (74% increase)
Patient 4: Max Activity	150.4	269 (79% increase)

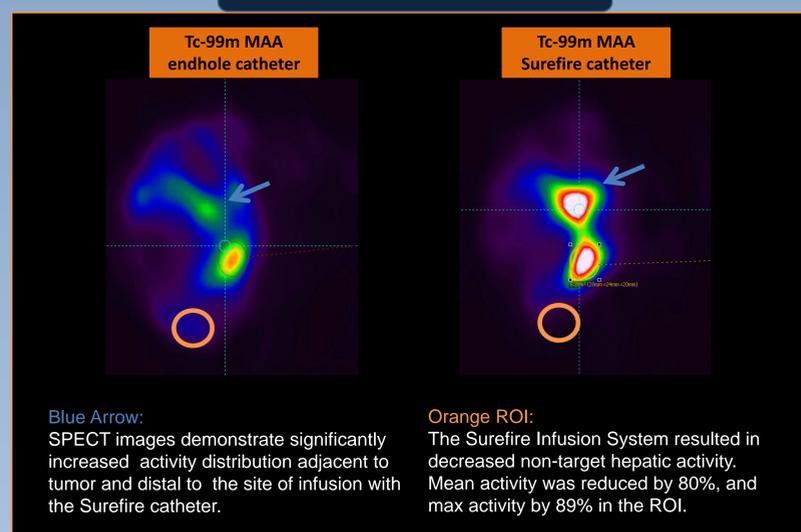
Patient 1:



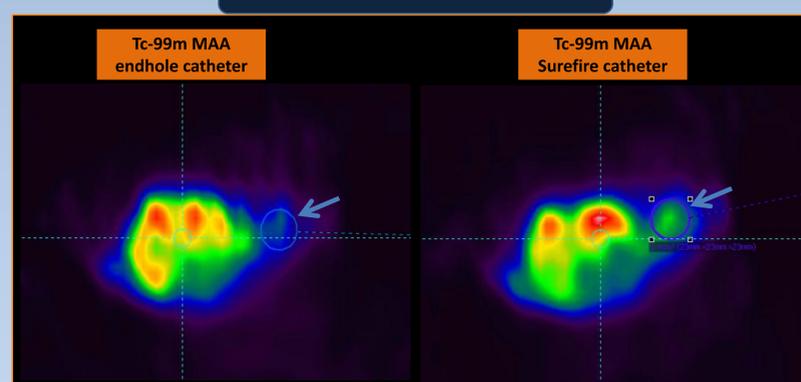
Patient 2:



Patient 3:



Patient 4:



Results:

SPECT images from all 4 patients demonstrate qualitatively increased penetration of MAA distal to the site of infusion using the SIS when compared with a standard end-hole catheter.

Quantitative evaluations corroborate these findings, with some distal regions receiving between 33% to more than 200% greater relative activity when the SIS was used.

No extra-hepatic NTE was identified in either patient subset; however, two patients (1 and 3) showed markedly reduced NTE to normal hepatic parenchyma when the SIS was used.

Dose reduction to non-target hepatic parenchyma with the SIS ranged from 40% to almost 90% in some areas.

Conclusions:

These preliminary data demonstrate the validity of this dual-infusion technique, which is analogous to widely utilized same-day cardiac perfusion and renal imaging protocols.

Both qualitative and quantitative assessment of SPECT images and comparison with baseline contrast-enhanced computed tomography (CT) and positron emission tomography / computed tomography (PET/CT) images indicate an improvement in MAA penetration into (and distal to) the target lesion with the SIS.

Although all four patients demonstrated improvement in distal penetration and two patients showed reduction in NTE to normal hepatic parenchyma, the degree of improvement is highly dependent on tumor type and size.

The number of patients included in the study is too small to provide appropriate statistical power.

Additional patients and further studies will be needed to demonstrate quantitative improvements which can be supported by statistical analysis.

References:

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2. Rose SC, Kikolski SG, Chomas JE. Downstream Hepatic Arterial Blood Pressure Changes Caused by Deployment of the Surefire AntiReflux Expandable Tip. *Cardiovasc Intervent Radiol*. 2012 Dec 19.
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4. D'Arienzo M, Chiamarida P, Chiacchiararelli L, et al. 90Y PET-based dosimetry after selective internal radiotherapy treatments. *Nucl Med Commun* 2012; 33:633-640.