Image Guided Interventions: What an Interventionalist Wants
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R01EB012031, R01CA194533, R41CA183327, R21EB020283

What does an interventionalist want?

• To know the past, the present, and the future of a disease state in a specific patient
• To navigate through the body atraumatically and autonomously
• To provide treatments to target organs and tissues without off-target side effects

What does an interventionalist want?

• To know the past, the present, and the future of a disease state in a specific patient
  – Physio-anatomic Atlases, Deep Learning, Radiogenomics, Multimodality Imaging, Portable Imaging
• To navigate through the body atraumatically and autonomously
  – Robotics, Device Engineering, Materials Science, Omnicompatible Devices for Multimodality Interventions
• To provide treatments to target organs and tissues without off-target side effects
  – Physico-chemical Actuation, HIFU, Chemofiltration, Theranostics
ZSFG XMR: Biplane Angio & 3T MRI

FPCT versus DWI MRI

Fiorella et al, JNIS 2014
Bringing MRI to the Interventional Suite: Need Devices Compatible with X-Ray and MRI

Emergency Stroke Treatment Now

Emergency Stroke Treatment in the Near Future

Images courtesy of Joey English, MD, PhD
17 mo F with retinoblastoma

- T2 MRI
- Contrast Enhanced T1 MRI

Selective Ophthalmic Artery
IA Chemotherapy

Endovascular Drug Filtration

Hetts et al. R01CA194533
Results in vivo

- 85%, 74%, and 83% decrease in relative pre-versus post-fitter Dox concentrations at times 3, 10, and 30 min, respectively.
- Total exposure: AUC/kg (peripheral blood) 97 ng·min/ml·kg.
- 78% less than control with sham membrane.

Patel et al., J Med Devices, 2014

PET-MR Zr$^{89}$ Iron Oxide Nanoparticles

Melphalan Detection by CEST-MRI
MARC: Remote Control Catheter Steering for Interventional MRI

Catheter Navigation at 1.5T

Navigation into left renal artery
Imaging and Drug Delivery Using Theranostic Nanoparticles

Janib et al. Adv Drug Delivery Reviews, 2010

High Intensity Focused Ultrasound to Thermally Release Drugs

https://sites.wustl.edu/ultrasoundlab/research/

MR Guided HIFU BBBD: Spatial Accuracy


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