Update on an Emerging Radiation Free 3D Endovascular Guiding System (IOPS) from Centerline Biomedical:  
How does it work?  
When will we have it?  
How much does it cost?  

Matthew J. Eagleton, MD  
Chief Div Vasc & Endovasc Surgery, Mass General Hospital  
Robert Linton Professor of Surgery, Harvard Medical School  
Boston, MA  

Disclosure  
• Centerline Biomedical: Chairman of the scientific advisory board  

Current Imaging Technology  
• Imaging is the key component to endovascular therapy  
  • Anatomy visualization  
  • Endovascular tool localization  
• With increased complexity of endovascular procedures need corresponding improvements in imaging  

Intra-Operative Positioning System (IOPS)  
• What does it provide?  
  • Interactive 3D Vascular Imaging  
  • EM tracking of endovascular “tools” within the vascular tree and the 3D imaging  

First key component:  
Interactive 3-Dimensional Imaging  

Based on a Mathematical Model for Vascular Image Construction  
• Generated from DICOM CT data  
• The model was tested by assessing the relative geometry of the aortic branches  

Algorithm is Patient Specific, Automatic, and can “Understand” Point Specific Anatomy

Second Key Component:
Device localization within the model

EM Tracking System Deployed in Fluoroscopy Suite
Patient-mounted tracking pad maintains registration even in context of gross patient motion

Sensor-Equipped Instruments
Requires a registration process similar to fluoro overlay
What does IOPS provide

- Enhanced three dimensional imaging
- Ability to manipulate the imaging to provide multiple, ideal views
- Ability to track the endovascular tools within the vascular image – correlating directly with in vivo localization

Multiple views attainable – all controlled by the operating physician.
Provides the ideal perspective for that procedure.

Commercial System – Porcine Study

Catheter RRA - IOPS

Catheter RRA - Angio verification

Wire LRA - IOPS
**Status**
- Received 510K approval on June 24, 2019
- Undergoing initiation of clinical roll out
- Cost
  - $200,000 (approximately) for the system
  - Disposable items (catheters, sheaths, wires)
- Advanced R&D ongoing
  - Refinement of sensor-equipped tools
  - Application to additional indications
  - Expansion of modeling capabilities to include specific endografts
  - Advanced algorithm development to anticipate and display vessel deformation
  - Advanced visualization (NIH grant: RHL 139290B)

**Augmented Reality**
- Allows anatomy to be augmented to actual anatomic site interactively

**First in Man (Commercial System) October 16, 2019**

**Head-mounted Displays**
- Holographic visualization

**Holographic Visualization**
- Vascular anatomy is digitally augmented to the realtime display, so anatomy is visible regardless of obstructions – even during endo
- Visual aids provided, including plane of branch vessel
3D Guidance, Navigation, Control

- Operator can read real-time quantitative feedback, without having to look away from work

Virtual Deployment

- Can simulate device geometry post-deployment and inspect from any view angle desired

Conclusion

- Tremendous advancement in endovascular tools
- Working towards advancement in visualization techniques
  - Better visualization and 3-D understanding of the anatomy we are working in
  - Improved visualization of device location within that specific anatomy
  - Improve the performance of our procedures
  - Augment, and maybe replace, fluoroscopy

Intra-Operative Positioning System