A New Sheath for Highly Curved Steerable Needles

Maxwell Emerson, Tayfun Efe Ertop, Margaret Rox, Mengyu Fu, Inbar Fried, Janine Hoelscher, Alan Kuntz, Josephine Granna, Jason Mitchell, Michael Lester, Fabien Maldonado, Erin Gillaspie, Jason Akulian, Ron Alterovitz, Robert J. Webster III

* Vanderbilt University, Nashville, TN 37203, USA
† Vanderbilt University Medical Center, Nashville, TN 37212, USA
‡ University of North Carolina at Chapel Hill, NC 27599, USA
§ University of Utah, Salt Lake City, UT 84112, USA

Problem

- Transendoscopic deployment of steerable needles requires longer needles and longer sheaths
- Existing sheaths do not work well due to friction, stiffness, etc.

Multi-Material Sheath Concept

- Transmission section: 1m high density polyethylene (PET)
  - Axially-Rigid and transmits motion well through endoscope
- Distal section: 150mm stainless steel braided Pebax 40D
  - Low bending stiffness

Clinical Application

Workflow: (a) Bronchoscope deployed (b) Puncture bronchial wall (c) Deploy steerable needle (d) Slide sheath over needle (e) Retract needle, leaving sheath

CT scan of ex-vivo inflated porcine lung with steerable needle system deployed to target.

CT scan of deployed sheath in ex-vivo inflated porcine lung

References