Intracardiac Surgery in the Beating Heart

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No disclosures
Beating Heart Intracardiac Procedures

• Advantages
  – Avoids CPB
  – Facilitates evaluation of repair (valves, septal defects)
  – Potential for smaller incisions and faster recovery
  – Ideal for device deployment

• Challenges
  – Requires real-time intracardiac imaging technology
  – Instrument navigation
    • Collisions, tissue injury, cardiac motion
  – Reconstruction is difficult
Technology requirements for procedures

- Imaging
- Navigation
- Instruments
- Devices

- Catheter based technology
- Open surgical reconstruction
- Beating Heart Surgery
Catheter Based Techniques

- Device deployment
- Limited reconstruction
Transthoracic : per-cardiac approach

- Direct access
- Rigid instruments for reconstruction
- Dexterity
- Intracardiac:
  - Imaging critical
Intracardiac reconstruction
“beating heart” surgery

- Hand held instruments
- 3D ultrasound guided navigation
- Multipurpose devices
Instrument tip control:
Beating heart motion compensation

• Required to avoid tissue injury
• For precision reconstruction
• To apply force

• e.g. VSD closure, mitral valve repair, tissue ablation
What about peripheral access:

**Tele-robotic**

- Avoids trans cardiac approach
- Provides dexterity
- Precise tool tip control
- Ability to apply force
“Steerable needle”
tele-robotic system
3D echo imaging
Instrument tool tip:

**End effectors**

Simple devices

Complex tools:
MEMS devices

Tissue approximation

Tissue removal
MEMS for tissue approximation inside beating heart
PFO Creation
Other MEMS devices

Tissue shredder
Technology requirements for procedures

- Imaging
- Navigation
- Instruments
- Devices

Catheter based technology

Open surgical reconstruction

Beating Heart Surgery
Acknowledgements

Image Guided Intracardiac Beating Heart Surgery
NHLBI HL073647 (July 2003 – June 2013)

• Children’s Hospital, Dept. of Cardiac Surgery, Harvard Medical School - Pedro J. del Nido, M.D.
• Harvard University, School of Engineering and Applied Sciences, - Robert Howe PhD,
• Boston University, Dept. Aerospace and Mechanical Engineering, - Pierre Dupont, PhD
• Philips Medical Systems, Ultrasound Division - Ivan Salgo M.D.,M.S.,
Thank you
Summary

• Beating heart surgery can be done but requires:
  – Specialized Intracardiac imaging
  – Novel devices and instruments
  – Specialized Robotics has a potential role

• Technology can be hand held vs. tele-operated

• End effectors (tool tip devices) can be simple or complex multipurpose apparatus
Intracardiac imaging is critical

• Visualize tissue and instruments
  – 3D echo, fluoro, co-registered imaging