The New Era of Minimally Invasive Cardiac Surgery

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Traditional Approach to Cardiac Surgery

- Full median sternotomy
- Cardiopulmonary bypass
- Arrested heart

Traditional Approach to Cardiac Surgery

Advantages of Traditional Approach

Sternotomy:

- Has withstood the test of time
- All surgeons comfortable with it
- Provides full access to:
  - Pericardium
  - All chambers of the heart and great vessels
  - All 4 valves
  - All coronary arteries

Advantages of Traditional Approach

On-pump, arrested heart:

- Provides ideal operating conditions
- Allows surgical team full control of circulation and oxygenation

Disadvantages of Traditional Approach

Sternotomy:

- Pain
- Increased blood loss
- Prolonged healing time (2-3 months)
- Sternal wound complications
- Cosmetically unappealing
Disadvantages of Traditional Approach

On-pump, arrested heart:
- Stroke risk
- Injury to other organs (kidneys, lungs, etc.)
- Ventricular dysfunction
- Bleeding/blood transfusions

Minimally Invasive Approaches

Advantages of Minimally Invasive Approach
- Better cosmesis
- Less pain
- Less blood loss
- More rapid healing (2-4 weeks)
- Minimization/avoidance of sternal wound complications
- Avoid deleterious effects of CPB/arrested heart

Advantages of Minimally Invasive Approach
- Reduced postop morbidity
- Shortened postop ICU and total hospital length of stay
- More cost-effective (?)
Minimally Invasive Cardiac Surgery at Lancaster General Hospital

• Via right anterolateral minithoracotomy:
  – Mitral valve surgery
  – Tricuspid valve surgery
  – Atrial septal defect repair
  – Atrial tumor resection (e.g. myxoma)

• Aortic valve replacement via upper ministernotomy

Minimally Invasive Cardiac Surgery at Lancaster General Hospital

• da Vinci robotic-assisted minimally invasive direct coronary artery bypass (MIDCAB)

• Hybrid coronary revascularization

• Transcatheter aortic valve implantation (TAVI)

Minimally Invasive Mitral Valve Surgery

• Approach via 6-8 cm right anterior minithoracotomy in 4th intercostal space

• Venous cannulation for CPB via right common femoral vein

• Arterial cannulation via right common femoral artery or ascending aorta

• Mitral valve repair or replacement performed using specialized equipment and long-shafted instruments

Minimally Invasive Mitral Valve Surgery

Contraindications:

• Morbid obesity

• Previous right lung surgery or infection

• Severe LV dysfunction

• Other significant valve or coronary disease

Minimally Invasive Mitral Valve Surgery

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Minimally Invasive Aortic Valve Replacement

• Approach via 6-8 cm upper ministernotomy incision
• Standard central aortic and right atrial cannulation
• Provides direct access to ascending aorta and aortic valve
• AVR performed using standard instrumentation

Minimally Invasive Aortic Valve Replacement

Contraindications:

• Morbid obesity
• Severe LV dysfunction
• Significant other valve or coronary disease

Minimally Invasive AVR

Partial upper ministernotomy:
**Who is a candidate?**

- A patient who needs bypass to LAD (not a small, calcified, or intramyocardial vessel)
- EF > 30%
- No significant lung disease or pulmonary HTN
- No previous left chest surgery
- Not morbidly obese
- Not in the midst of an acute MI

**The epitome of minimal invasiveness:**

- No sternotomy
- No cardiopulmonary bypass

**Disadvantages:**

- Not everyone is a candidate
- Steep learning curve
- Anastomosis more difficult than sternotomy approach
- Operation itself more costly than nonrobotic approach (but lower LOS and complication rates)
What is a “Hybrid” Procedure?

• A conventional open cardiovascular surgical procedure which is supported by sophisticated x-ray imaging
• An interventional procedure which is supported by conventional surgery

Why Hybrid OR / Hybrid Procedures?

• Combine the benefits of the OR, cath lab, and interventional radiology suite to optimize and improve patient care and clinical outcome
• Perform procedures not previously possible due to infrastructure and logistical constraints

What is a Hybrid OR?

It is both a:

• Cardiovascular operating room
  
  and a:

• Cardiac catheterization laboratory

  All in one big room!

Components of a Hybrid OR
Typical Procedures in Hybrid OR

- **Cardiothoracic Procedures**
  - Coronary artery disease:
    - Hybrid coronary interventions
    - High-risk catheter-based coronary intervention (unprotected left main disease, other complex and high-risk morphology)
    - On-table angiography for quality control in coronary artery bypass grafting
  - Valve disease:
    - Endovascular, catheter-based interventions on the heart valves
    - Aortic valve disease
    - Mitral valve disease
  - Congenital heart disease:
    - Pulmonary valve disease
    - Integrated surgical and catheter-based procedures for atrial septal defect II, ventricular septal defect repair, and coarctation of the aorta
  - Thoracic aortic disease:
    - Stenting or stent-graft placement to the thoracic aorta
  - Heart failure/cardiac rhythm disturbances:
    - Cardiac pacemaker insertion
    - Automatic implantable cardioverter-defibrillator insertion
    - Insertion of devices for biventricular pacing
    - Hybrid procedures for treatment of atrial fibrillation
    - Endomyocardial biopsy

- **Medtronic: Talent and Valiant**

- **Bolton Medical Relay**
Hybrid Coronary Revascularization

Concomitant Hybrid Minimally Invasive AVR/PCI

By 2030, 20% of the U.S. Population Will Be Over Age 65

Many Patients with Severe AS Are Not Surgically Treated

Rationale For Transcatheter Therapy

- High risk / Inoperable
- Age
- Depressed LVEF
- Stroke
- CRI
- Pulmonary insufficiency
- The frailty concept
- Quality of life

Transcatheter Aortic Valve Implantation (TAVI)
Other Routes of Access

- Transaortic
- Transsubclavian

Transapical Deployment

Completion Angiogram

How to build a Hybrid OR?

- Planning!
- Planning!
- Planning!
- Design collaboration between LGH administrators, cardiac surgeons, anesthesiologists, interventional cardiologists, perfusionists, and OR/cath lab staff.

- Nothing like this has ever been built at LGH before!
Potential Impact of Hybrid OR at LGH

- Improve patient outcomes
- Foster sincere multidisciplinary collaboration
- Increase patient volumes
- Regional referral center

Questions?