Minimally Invasive Cardiac Surgery

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Definitions

- MICS (Minimally Invasive Cardiac Surgery)
  - MICS CABG
- MIS (Minimally Invasive Surgery)
  - MIS AVR, MIS MVR
Open heart surgery is any surgery in which the chest is opened and surgery is done on the heart muscle, valves, arteries, or other parts of the heart (such as the aorta). The term "open" means that the chest is "cut" open.
Traditional Open Heart Surgery
CABG - Coronary artery Bypass Surgery

- Most common type of Open Heart surgery
Valve Replacement

Mechanical valve

Tissue valve

Artificial valve is sewn in place

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Minimally Invasive Heart Surgery

- Small incisions in the side of the chest between the ribs. This type of surgery may or may not use a heart-lung bypass machine.
  - OPCAB?

- Minimally invasive heart surgery is used to do some bypass and maze surgeries. It's also used to repair or replace heart valves, insert pacemakers or ICDs, or take a vein or artery from the body to use as a bypass graft for CABG.

- Robotic-assisted surgery.
- Trans-Catheter AVR
MICS CABG
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  - Robotic-assisted surgery.
  - Trans-Catheter AVR
Robotic
TAVR
Why MICS?

- Difficult
- Learning Curve
- Benefits?
Why MICS?

- Comfort
- Cosmesis
- Rehabilitation
Mini-MVR Incision
Mini- MVR
mini-avr
Hemi-Sternotomy
Instruments

Off Pump Surgery

Octopus® NS

Starfish® NS

Thoratrak®
Distals

Starfish Heart Positioner

Octopus Tissue Stabilizer
Minimally Invasive
Minimally Invasive Coronary Artery Bypass Grafting Is Associated With Improved Clinical Outcomes

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Objective: Minimally invasive coronary artery bypass grafting (MICABG) via left minithoracotomy is an alternative to off-pump coronary artery bypass (OPCAB) via sternotomy. Our objective was to evaluate the clinical outcomes after MICABG versus OPCAB.  

Methods: The medical records of patients who underwent MICABG from December 2009 to December 2011 and OPCAB from January 2005 to April 2011 were reviewed. Patients who underwent OPCAB were matched 2:1 to patients who underwent MICABG by age, sex, preoperative ejection fraction, creatinine concentration, as well as history of diabetes and myocardial infarction.  

Results: A total of 130 MICABG patients were matched with 260 OPCAB patients. Mean bypasses in the MICABG and OPCAB groups were 2.1 and 3.2, respectively (P = 0.001). Extubation in the operating room (OR) occurred in 70.0% and 12.7% of patients in the MICABG and OPCAB groups, respectively (P = 0.001). Mean postoperative length of stay was 4 days for the MICABG patients versus 5 days for the OPCAB patients (P = 0.002) and 3.8 days versus 4.6 days for the MICABG patients extubated in the OR compared with those who remained intubated (P = 0.007). There were no 30-day mortalities in the MICABG group and 1 in the OPCAB group (P = 0.999). Thirty-day reinterventions were similar, with 5.4% and 7.4% in the MICABG and OPCAB groups, respectively (P = 0.527).  

Conclusions: Minimally invasive coronary artery bypass grafting is safe and early clinical outcomes are comparable, if not superior in some respects, to OPCAB. Extubation in the OR is feasible, well tolerated, and associated with earlier discharge. Shorter hospital stays may decrease resource use and promote earlier return to activities; however, further research is needed.  

Key Words: Coronary artery bypass grafting, Off-pump coronary artery bypass grafting, Minimally invasive cardiac surgery, Postoperative complications, Outcomes.

Since its development in the mid-1960s, coronary artery bypass grafting (CABG) surgery has helped millions of patients with diseased coronary arteries worldwide.1,2 Although alternative approaches have been proposed over the years, a full sternotomy has remained the gold standard. Off-pump coronary artery bypass (OPCAB) grafting, previously described,3,4 was reintroduced and popularized in the mid to late 1990s5 and has been a significant advancement in coronary surgery in recent years. The results of OPCAB surgery have been largely favorable, especially in experienced hands.3-4 The minimally invasive direct coronary artery bypass operation via a sternal-sparing third-intercostal space left anterior thoracotomy was introduced and popularized in the mid-1990s.5-8 Although the initial results were good,1,2 this operation gradually fell out of favor or was used only because of its limitation to a single-vessel bypass.  

Recently, McGinn et al13 reported their initial experience on 450 consecutive cases in which they performed a minimally invasive coronary artery bypass graft (MICABG) procedure via a small anterior left lateral thoracotomy. Up to 4 bypasses were performed, including the routine performance of direct hand-sewn autologous grafting. They demonstrated feasibility of this approach to multivessel grafting with excellent procedural and short-term outcomes while maintaining the key principles of CABG. Riel et al14 reiterated these findings and also observed some recovery advantages when compared with a matched cohort of OPCAB patients with a similar risk profile. Hoff et al15 subsequently showed the procedure to be safe and effective by studying a series of MICABG patients with completion arteriography.  

In the current study, we compared the clinical outcomes of our initial experience with MICABG with those of OPCAB at our institution.

METHODS  
After institutional review board approval was obtained, the medical records of all patients who underwent MICABG by a single surgeon (PR) from December 2009 through December 2011 were reviewed. This period represents our initial experience with consecutive patients who were selected as good candidates for a MICAB approach. Patients who underwent...
<table>
<thead>
<tr>
<th>Minimally Invasive Coronary Surgery (MICS)</th>
<th>Off-Pump CABG (OPCAB)</th>
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<tbody>
<tr>
<td><strong>Volumes:</strong> 130 (Dec. 2009-Dec 2011)</td>
<td><strong>Volumes:</strong> 456 (Jan. 1 2005 –April 25, 2011)</td>
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<tr>
<td><strong>Demographics/Outcomes:</strong></td>
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<tr>
<td>Ave. Age: 66.4</td>
<td>Ave. Age: 64.9</td>
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<tr>
<td>Ave. Wt: 85.2 Kg</td>
<td>Ave. Wt: 91.3 Kg</td>
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<tr>
<td>Vent Time: 2.8 hours</td>
<td>Vent Time: 12.9 hours</td>
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<tr>
<td>ICU Days: 1.1</td>
<td>ICU Days: 1.5</td>
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<tr>
<td>Post Operative Days: 4.0</td>
<td>Post Operative Days: 5.1</td>
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<tr>
<td>Transfusions: 13%</td>
<td>Transfusions: 25%</td>
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Contraindications

- Emergency cases
- Hemodynamic instability
- Morbid obesity
- Severe PVD
- Low EF
High Risk Patients

Co-morbidities: Includes patients who are at high risk for problems with median sternotomy.

- Long-term steroid use.
- Severe COPD
- Advanced age
- Need for other major operative procedure.
- Severe de-conditioning.
- Patient’s with arthritic or orthopedic problems.
Replacing the median sternotomy with a less invasive approach to open heart surgery may be beneficial in numerous ways... in suitable candidates.