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# Minimally Invasive Mitral Valve Repair: The New Gold Standard?

Juan P. Umaña, M.D.
Chief Medical Officer
Director, Cardiovascular Medicine
FCI - Institute of Cardiology
Bogota – Colombia

The Society of Thoracic Surgeons

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# Mitral Valve Repair
# “The Gold Standard”

**Nishimura, RA et al.**
**2014 AHA/ACC Valvular Heart Disease Guideline**

## Class I

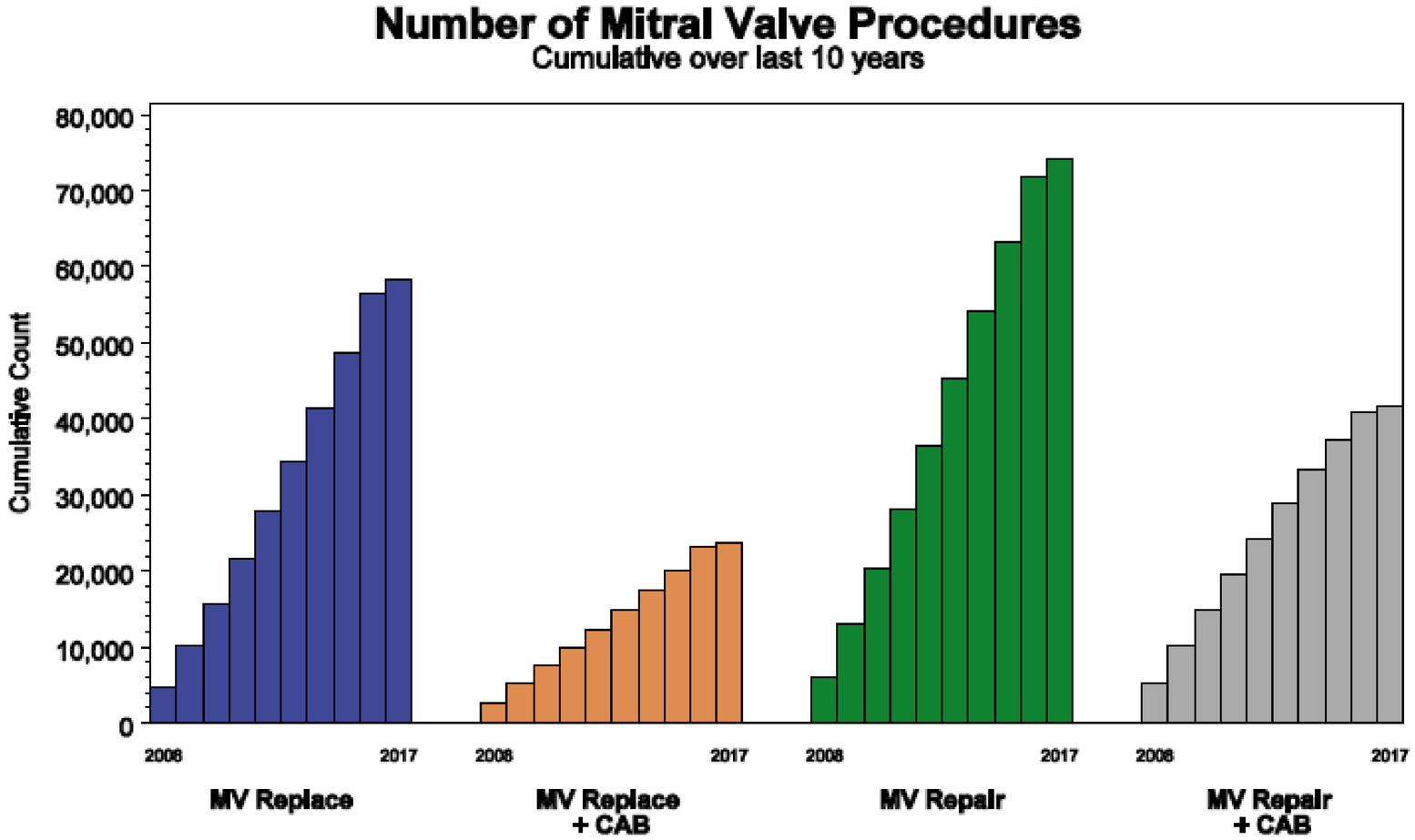
**Mitral valve repair is recommended in preference to mitral valve replacement (MVR) when surgical treatment is indicated for patients with chronic severe primary MR limited to the posterior leaflet (155, 183-198). *(Level of Evidence: B)***

**Mitral valve repair is recommended in preference to MVR when surgical treatment is indicated for patients with chronic severe primary MR involving the anterior leaflet or both leaflets when a successful and durable repair can be accomplished (195-197, 199-203). *(Level of Evidence: B)***

## Class IIa

**Mitral valve repair is reasonable in asymptomatic patients with chronic severe primary MR (stage C1) with preserved LV function (LVEF >60% and LVESD <40 mm) in whom the likelihood of a successful and durable repair without residual MR is greater than 95% with an expected mortality rate of less than 1% when performed at a Heart Valve Center of Excellence**

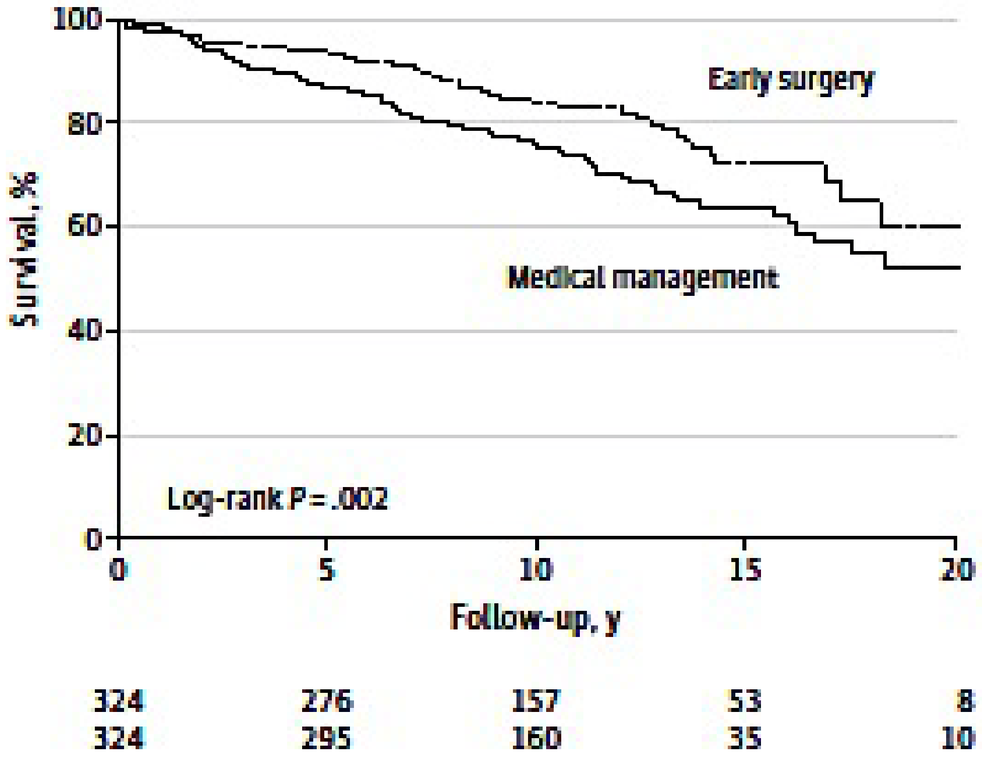
# Mitral Valve Procedures - Trends



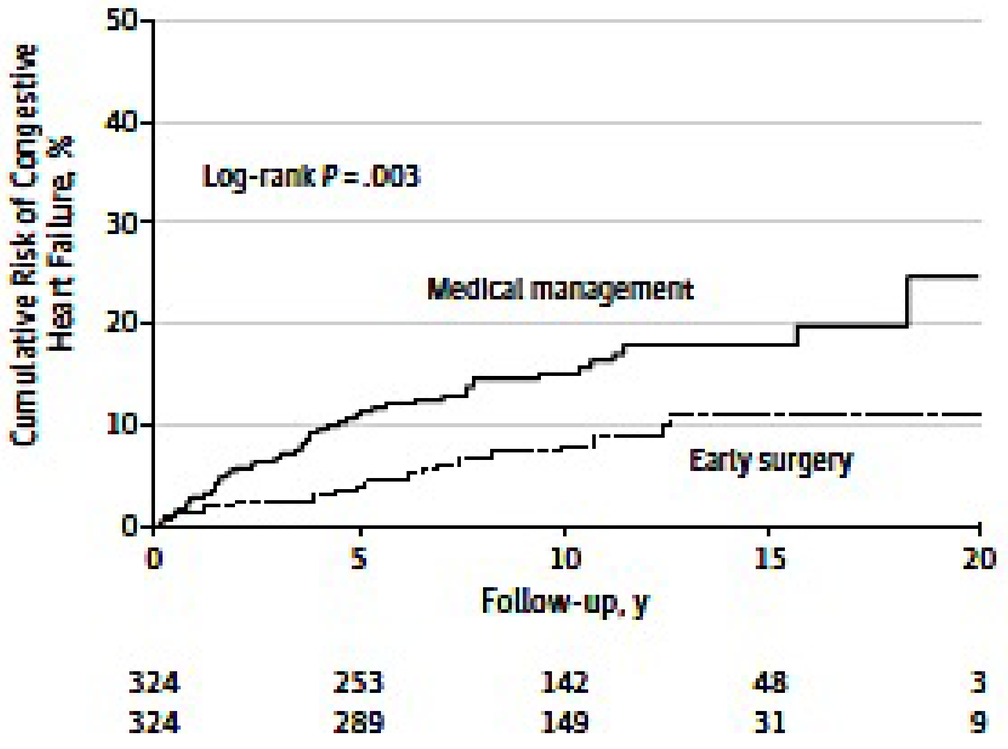

Adult Cardiac Surgery Database. Executive Summary 10 years. STS Period ending 3/31/2017. 3/30/2017 Executive Summariy contents

# Early Mitral Valve Repair
## Clear Benefit

Survival Benefit




Risk of CHF




**Suri RM et al, Association Between Early Surgical Intervention vs Watchful Waiting and Outcomes for Mitral Regurgitation Due to Flail Mitral Valve Leaflets. JAMA 2013; 310(6):609**

# Trends in Mitral Valve Surgery in the United States: Results From The Society of Thoracic Surgeons Adult Cardiac Database

James S. Gammie, MD, Shubin Sheng, PhD, Bartley P. Griffith, MD, Eric D. Peterson, MD, J. Scott Rankin, MD, Sean M. O'Brien, PhD, and James M. Brown, MD

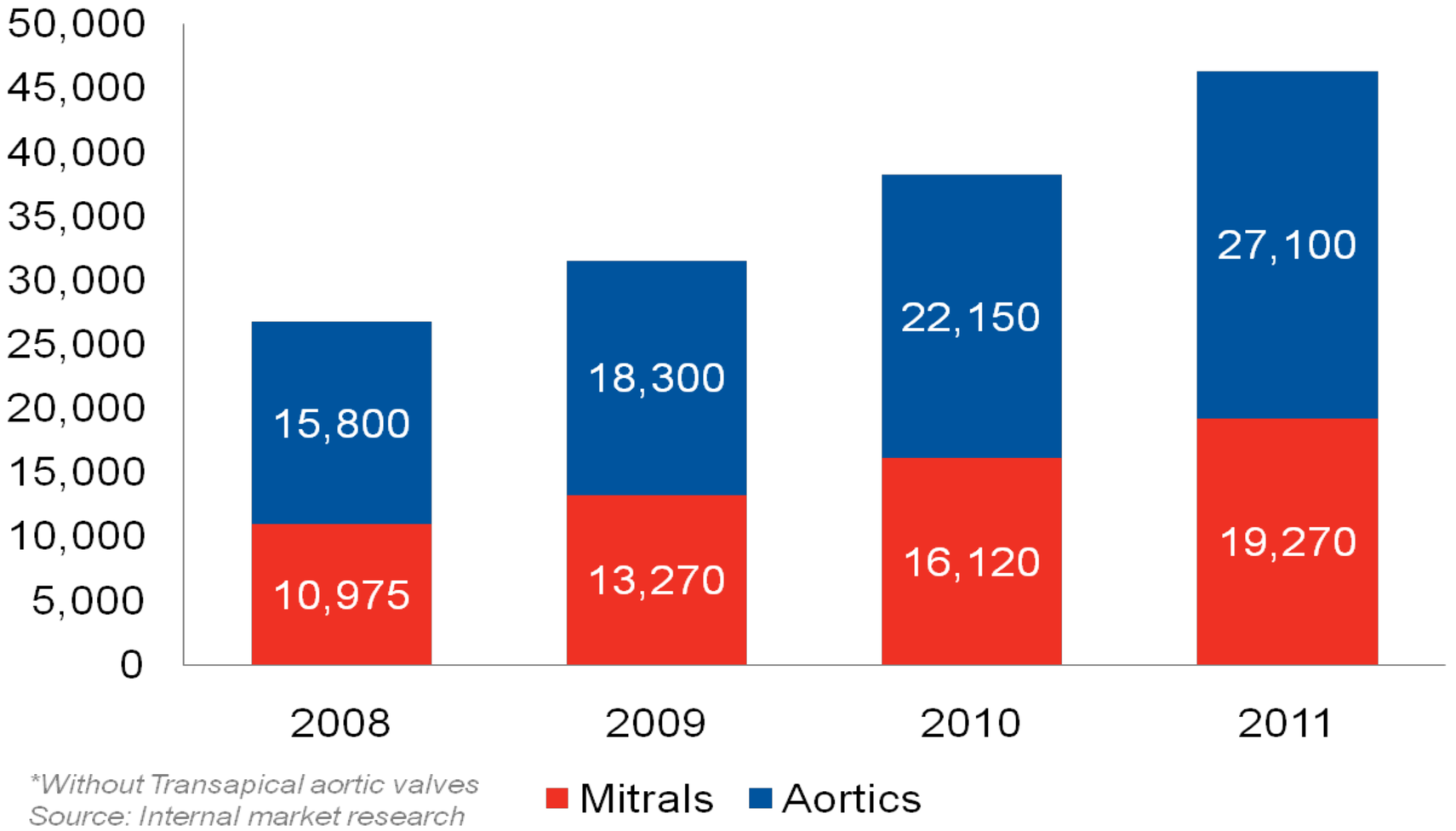
Division of Cardiac Surgery, University of Maryland Medical Center, Baltimore, Maryland; Duke Clinical Research Institute, Durham, North Carolina; and Centennial Medical Center, Vanderbilt University, Nashville, Tennesse

**Isolated MV repair (n=28,140) operative mortality was 1.2%.**

**For asymptomatic patients, operative mortality was 0.6%.**

Gammie JS et al, Ann Thorac Surg 2009;87:1431

# World Trends in MIVS

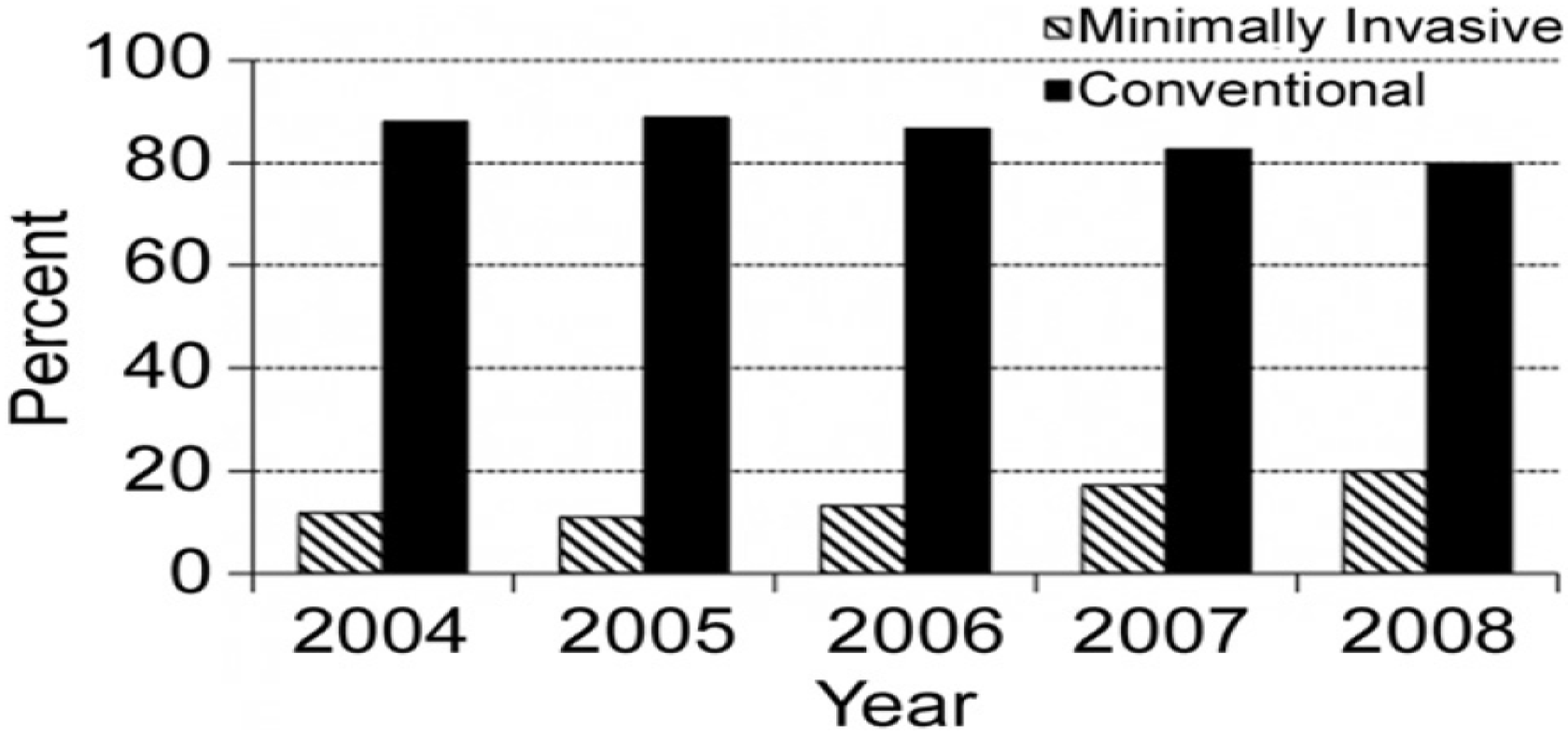



*Without Transapical aortic valves
Source: Internal market research

**Aortic CAGR: 16%***

**Mitral CAGR: 17%**

# Trends in MIVS
## Society of Thoracic Surgeons Database



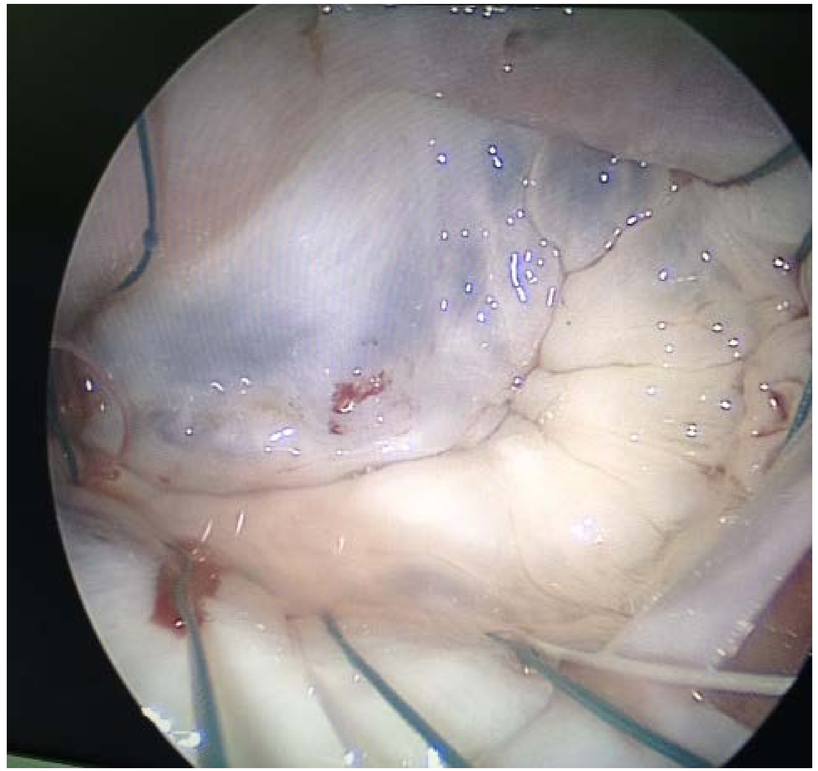

Gamie et al, **Less-invasive mitral valve operations: trends and outcomes from the Society of Thoracic Surgeons Adult Cardiac Surgery Database Ann Thorac Surg 2010;90:1401–10**

# Minimally Invasive Valve Surgery
## Benefits to the Patient

- ✧Less pain
- ✧Shorter hospital stay
- ✧Lower blood loss
- ✧Faster recovery and return to normal activity
- ✧Greater satisfaction

# Minimally Invasive Valve Surgery
## Benefits to the Surgeon

- ✧Excellent visualization of structures
- ✧Clear sterile field perception
- ✧More direct access to the mitral valve



# The Law of Conservation of Pain
(As applied to Minimally Invasive Surgery)

**Pain is neither created nor destroyed, it is *transferred* from the *Patient* to the *Surgeon***

*Michael Argenziano, M.D.*

# Initial Concerns

## *Less-Invasive Mitral Valve Operations: Trends and Outcomes from the STS Adult Cardiac Surgery Database*

- ✧Equivalent mortality
- ✧Longer CPB and cross-clamp times
- ✧Higher repair rates in MIS group
- ✧Lower blood transfusions
- ✧**Significantly higher stroke rate**



Gammie, et al, **Less-invasive mitral valve operations: trends and outcomes from the Society of Thoracic Surgeons Adult Cardiac Surgery Database Ann Thorac Surg 2010;90:1401–10**

# Minimally Invasive vs. Conventional Mitral Valve Surgery:
## *A Meta-Analysis and Systematic Review*

- ✧Similar mortality between MIVS and conventional
- ✧MIVS has higher incidence of:
  - ✧Aortic Dissection, CVA & Phrenic paralysis
- ✧MIVS is superior in:
  - ✧POP AF
  - ✧Mediastinal drainage
  - ✧Patient´s satisfaction and pain



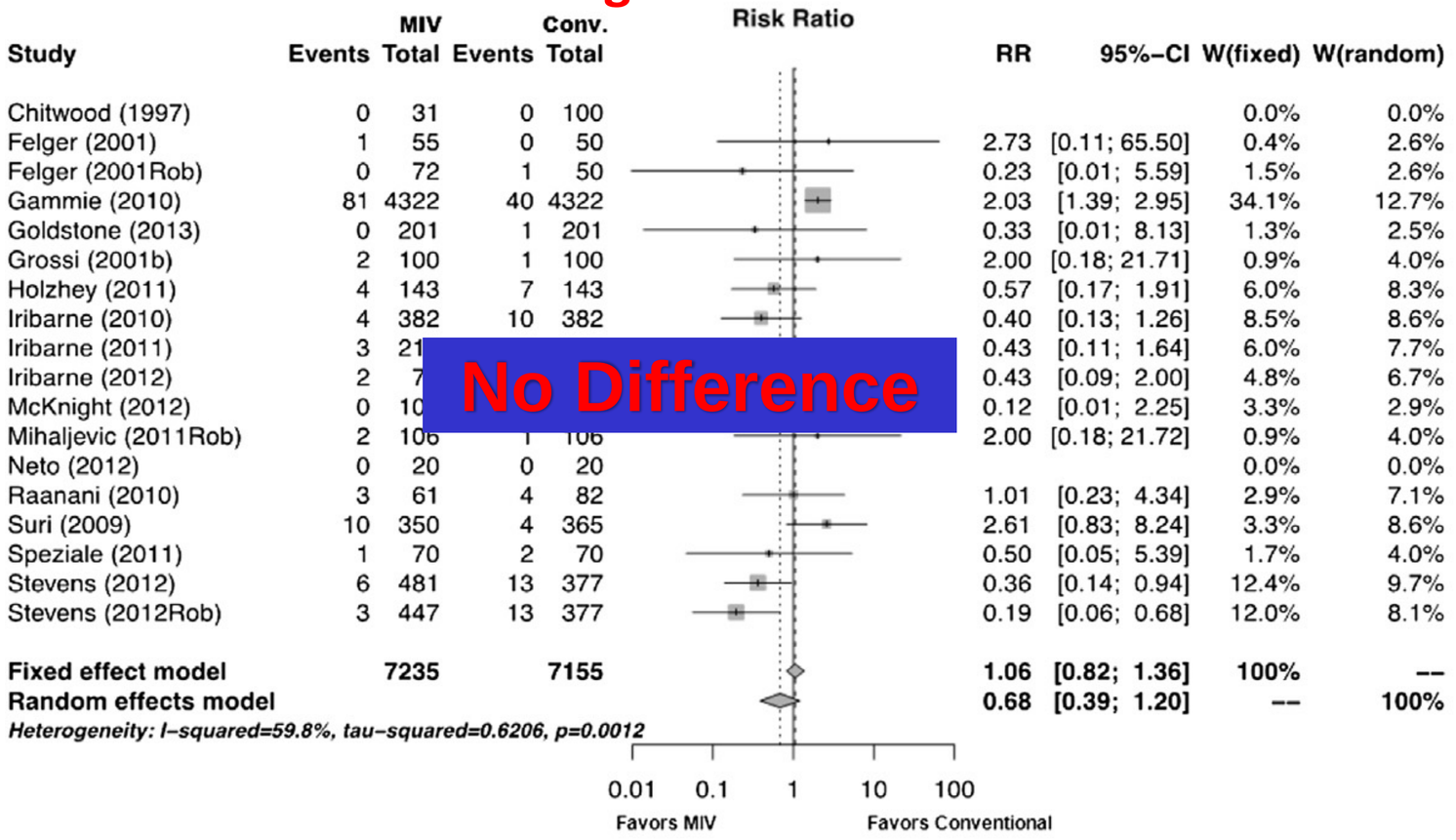
Cheng DC. *Innovations* • 2011

# Mitral Valve Surgery Right Lateral Minithoracotomy or Sternotomy?

- ✧30-day mortality equivalent for MIS and CS
- ✧Lower blood loss
- ✧Longer CPB and clamp times
- ✧Higher incidence of vascular complications

Sünderman et al. 2014

## Neurologic Events




| Study | MIV Events | MIV Total | Conv. Events | Conv. Total | RR | 95%–CI | W(fixed) | W(random) |
|---|---|---|---|---|---|---|---|---|
| Chitwood (1997) | 0 | 31 | 0 | 100 | | | 0.0% | 0.0% |
| Felger (2001) | 1 | 55 | 0 | 50 | 2.73 | [0.11; 65.50] | 0.4% | 2.6% |
| Felger (2001Rob) | 0 | 72 | 1 | 50 | 0.23 | [0.01; 5.59] | 1.5% | 2.6% |
| Gammie (2010) | 81 | 4322 | 40 | 4322 | 2.03 | [1.39; 2.95] | 34.1% | 12.7% |
| Goldstone (2013) | 0 | 201 | 1 | 201 | 0.33 | [0.01; 8.13] | 1.3% | 2.5% |
| Grossi (2001b) | 2 | 100 | 1 | 100 | 2.00 | [0.18; 21.71] | 0.9% | 4.0% |
| Holzhey (2011) | 4 | 143 | 7 | 143 | 0.57 | [0.17; 1.91] | 6.0% | 8.3% |
| Iribarne (2010) | 4 | 382 | 10 | 382 | 0.40 | [0.13; 1.26] | 8.5% | 8.6% |
| Iribarne (2011) | 3 | 21 | | | 0.43 | [0.11; 1.64] | 6.0% | 7.7% |
| Iribarne (2012) | 2 | 7 | | | 0.43 | [0.09; 2.00] | 4.8% | 6.7% |
| McKnight (2012) | 0 | 10 | | | 0.12 | [0.01; 2.25] | 3.3% | 2.9% |
| Mihaljevic (2011Rob) | 2 | 106 | 1 | 106 | 2.00 | [0.18; 21.72] | 0.9% | 4.0% |
| Neto (2012) | 0 | 20 | 0 | 20 | | | 0.0% | 0.0% |
| Raanani (2010) | 3 | 61 | 4 | 82 | 1.01 | [0.23; 4.34] | 2.9% | 7.1% |
| Suri (2009) | 10 | 350 | 4 | 365 | 2.61 | [0.83; 8.24] | 3.3% | 8.6% |
| Speziale (2011) | 1 | 70 | 2 | 70 | 0.50 | [0.05; 5.39] | 1.7% | 4.0% |
| Stevens (2012) | 6 | 481 | 13 | 377 | 0.36 | [0.14; 0.94] | 12.4% | 9.7% |
| Stevens (2012Rob) | 3 | 447 | 13 | 377 | 0.19 | [0.06; 0.68] | 12.0% | 8.1% |
| **Fixed effect model** | | **7235** | | **7155** | **1.06** | **[0.82; 1.36]** | **100%** | **--** |
| **Random effects model** | | | | | **0.68** | **[0.39; 1.20]** | **--** | **100%** |

*Heterogeneity: I–squared=59.8%, tau–squared=0.6206, p=0.0012*



**Sunderman SH,** Sromicki J, Rodriguez H, Seifert B, Holubec T, Falk V, Jacobs S. Mitral valve surgery:Right lateral minithoracotomy or sternotomy? A systematic review and meta-analysis. J Thorac Cardiovasc Surg 2014

# What Is the Role of Minimally Invasive Mitral Valve Surgery in High-Risk Patients?

## A Meta-Analysis of Observational Studies

Moscarelli et al.

- ✧Comparable early mortality
- ✧Lower transfusion requirement
- ✧Less atrial fibrillation
- ✧Lower stroke

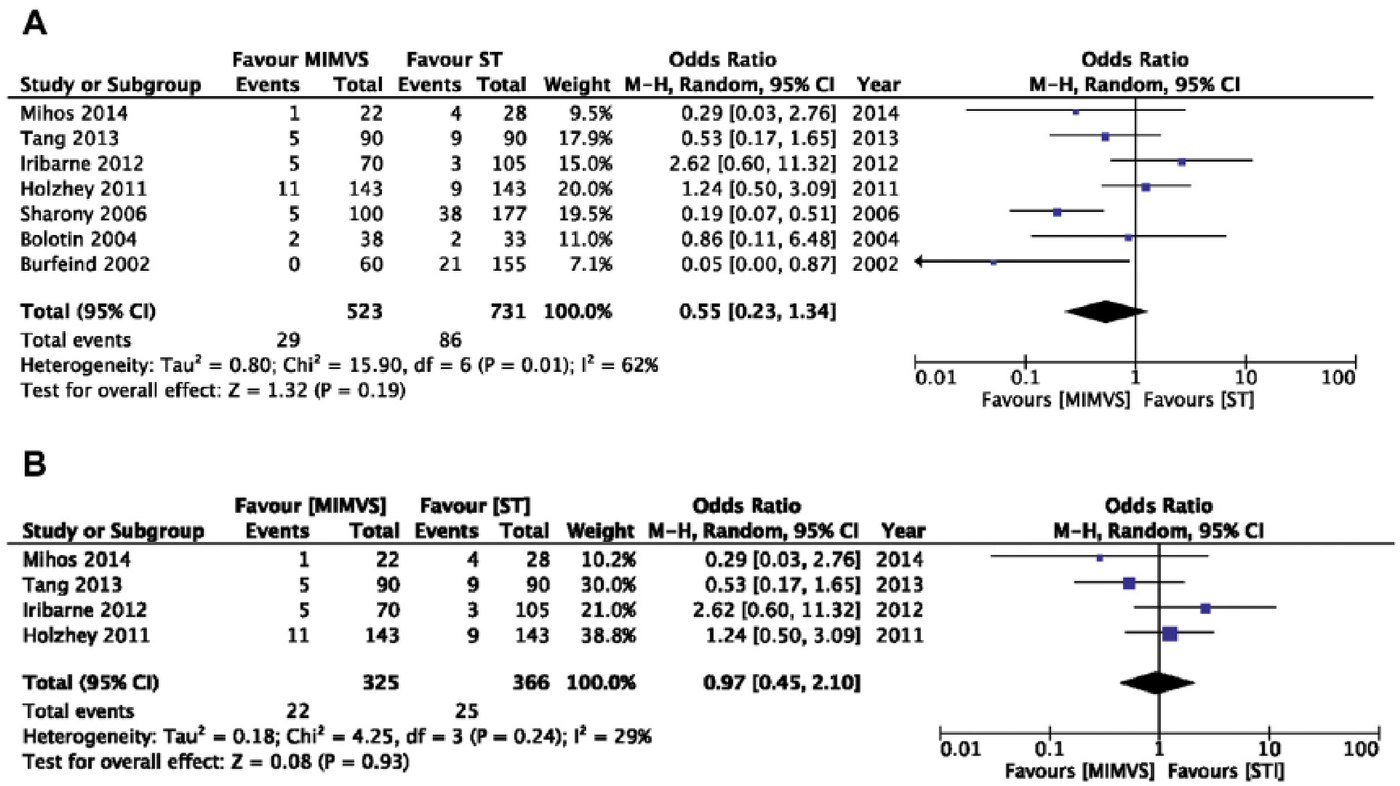
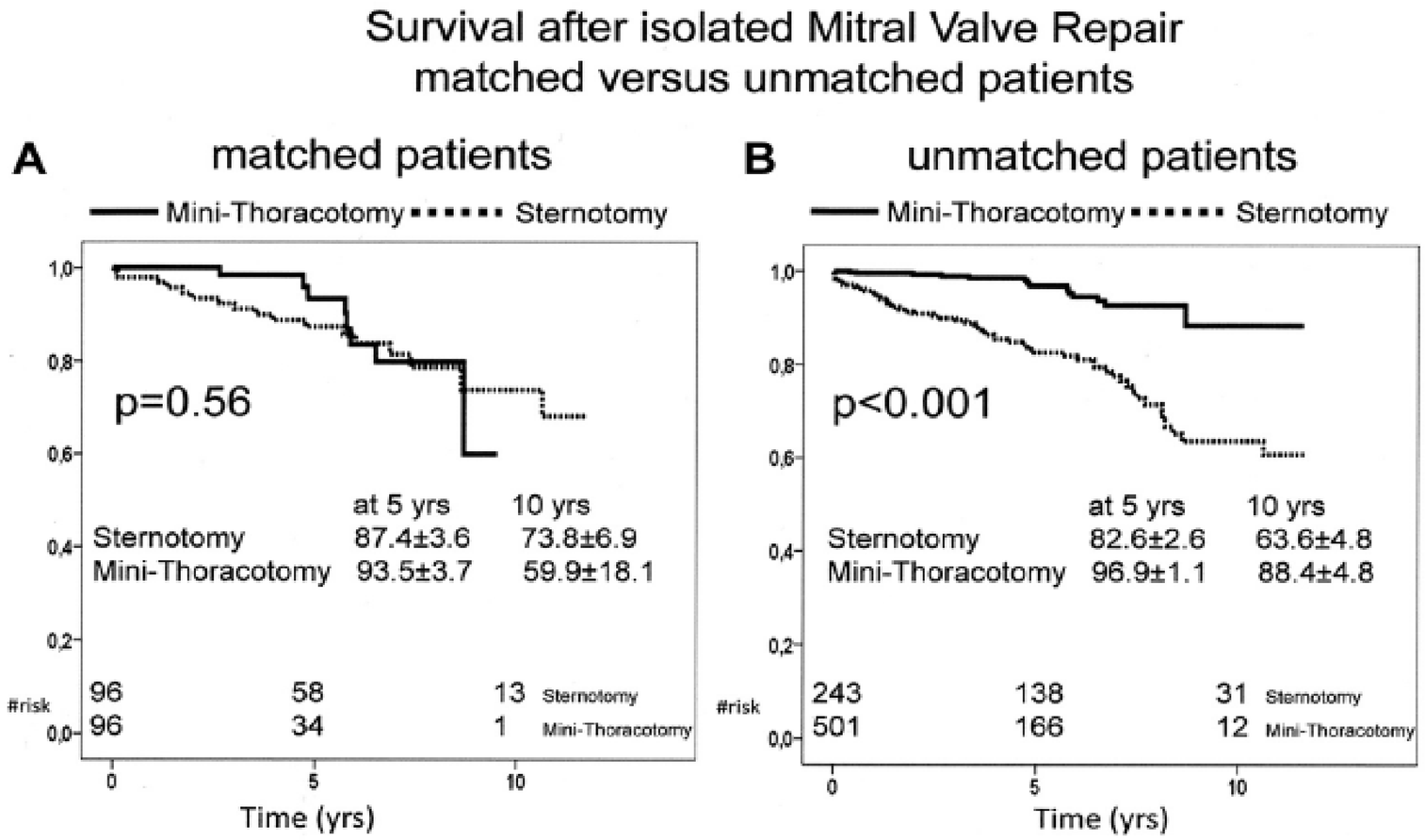



*Fig 2. Forest plots of minimally invasive mitral valve surgery (MIMVS) versus standard sternotomy (ST): (A) overall early mortality and (B) high-quality studies. (CI = confidence interval.)*

Moscarelli, Fattouch, Casula, Speziale, Lancellotti, and Athanasiou. What Is the Role of Minimally Invasive Mitral Valve Surgery in High-Risk Patients? A Meta-Analysis of Observational Studies. Ann Thorac Surg 2016;101:981–9)

# **Right Minithoracotomy Versus Full Sternotomy for Mitral Valve Repair**: A Propensity Matched Comparison

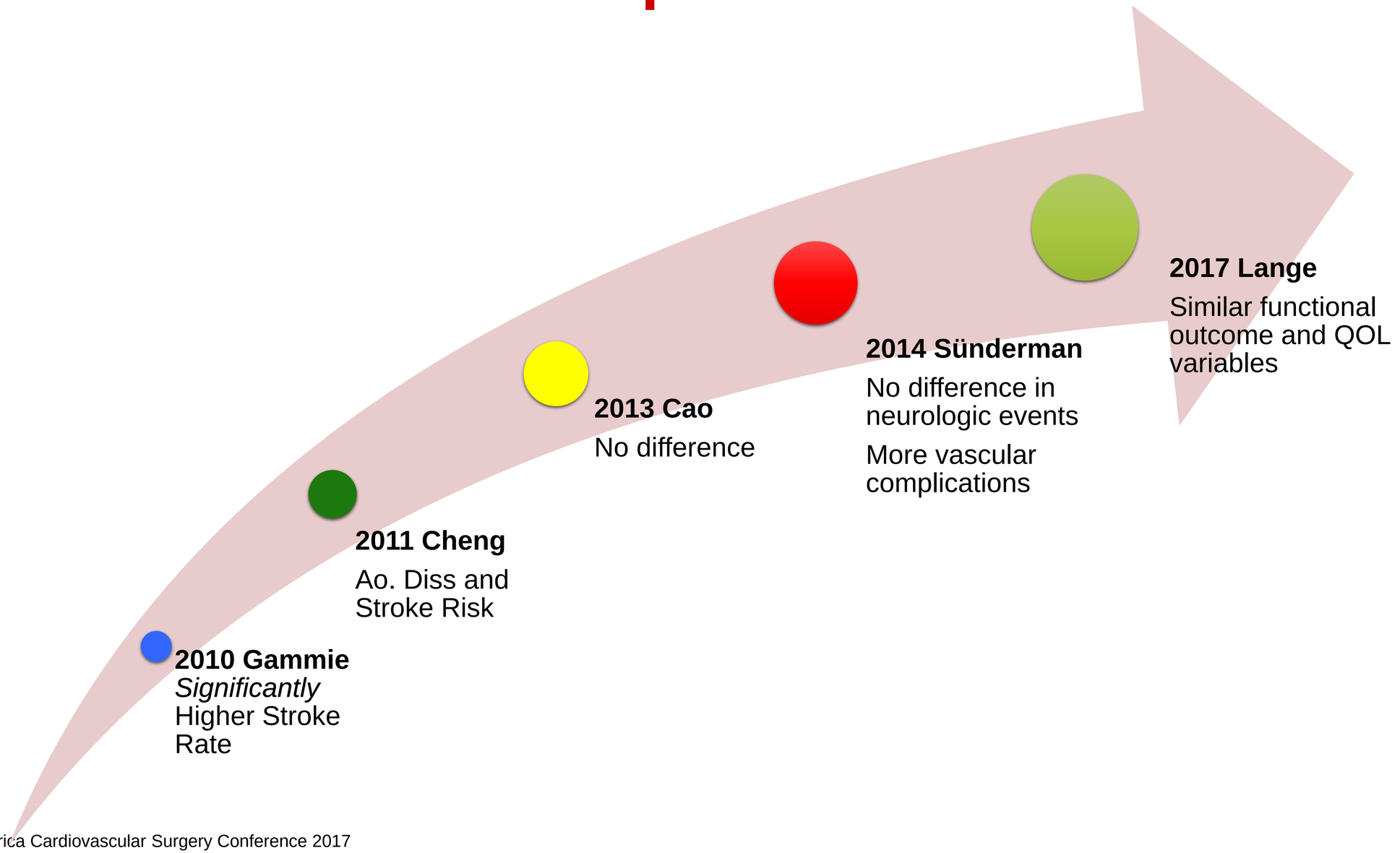
Lange et al.






Lange, Voss, Kehl, DrRerNat, MazzitelliTassani-Prell,, and Gunther, Right Minithoracotomy Versus Full Sternotomy for Mitral Valve Repair: A Propensity Matched Comparison Ann Thorac Surg2017;103:573–9

# Minimally Invasive *vs* Conventional Mitral Valve Repair



# The Challenge…

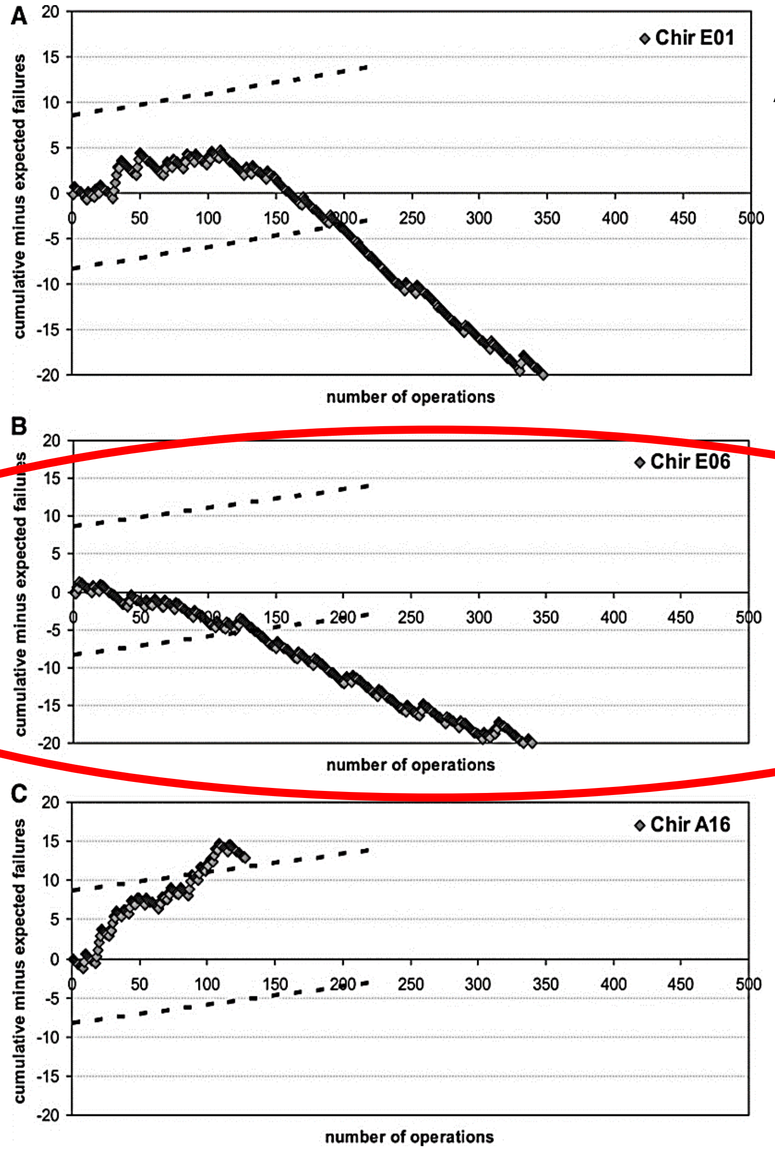
- ✧ AVOID TRANSFERRING THE LEARNING CURVE TO THE PATIENT
- ✧Minimize neurologic complications
- ✧Avoid vascular complications

# Minimally Invasive Mitral Valve Repair

## Learning Curves

75-125 Surgeries to overcome
Learning Curve

>50 Surgeries/Year
to mantain competence




Average Surgeon

Overperforming Surgeon

**MIVS Team?**

Underperforming Surgeon





David M. Holzhey et al. Circulation. 2013;128:483-491

# Minimally Invasive Mitral Valve Surgery is a TEAM SPORT

# The Question

- ✧ Are these results reproducible in smaller centers?
- ✧What about LatAm?
- ✧How to do it?

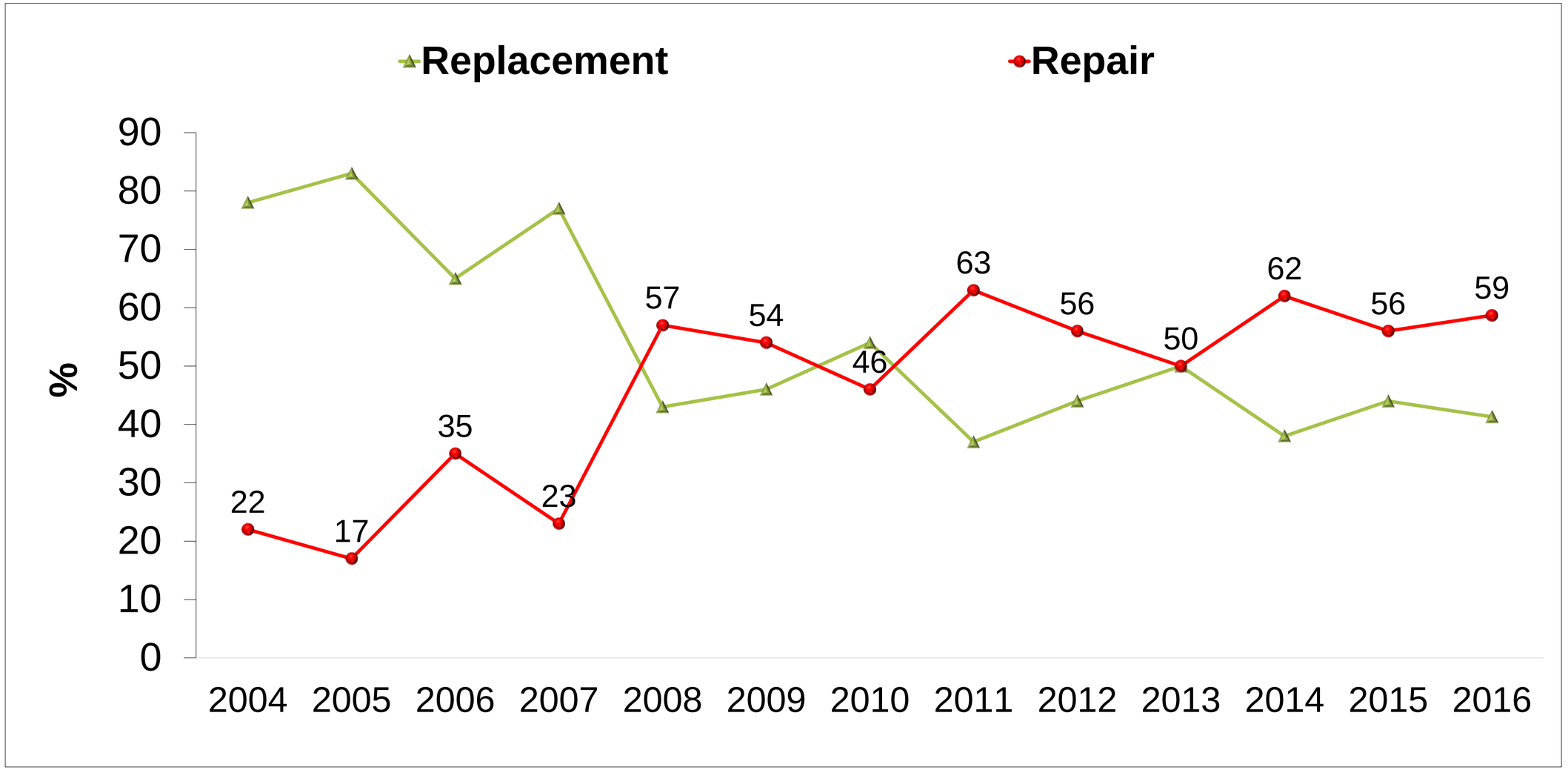
# Patients & Methods

- Historical cohort of patients undergoing mitral valve repair between January 2004 and June 2017
  - Prospective harvest from July 2008

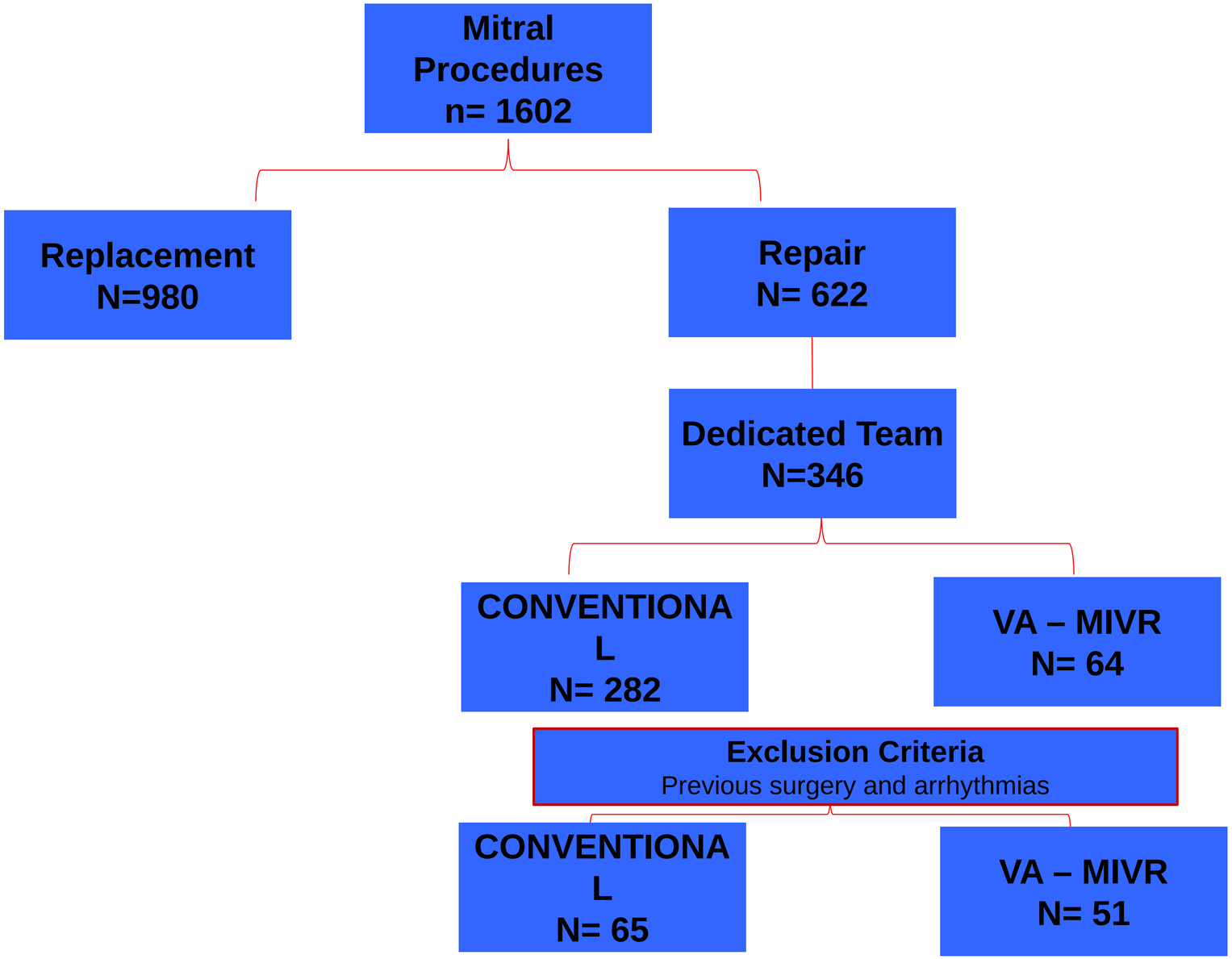
- Inclusion criteria:
  - First-time isolated mitral valve repairs
    - Conventional or minimally invasive
  - Dedicated Team

- Exclusion criteria
  - History of preoperative arrhythmias

# Mitral Valve Procedures



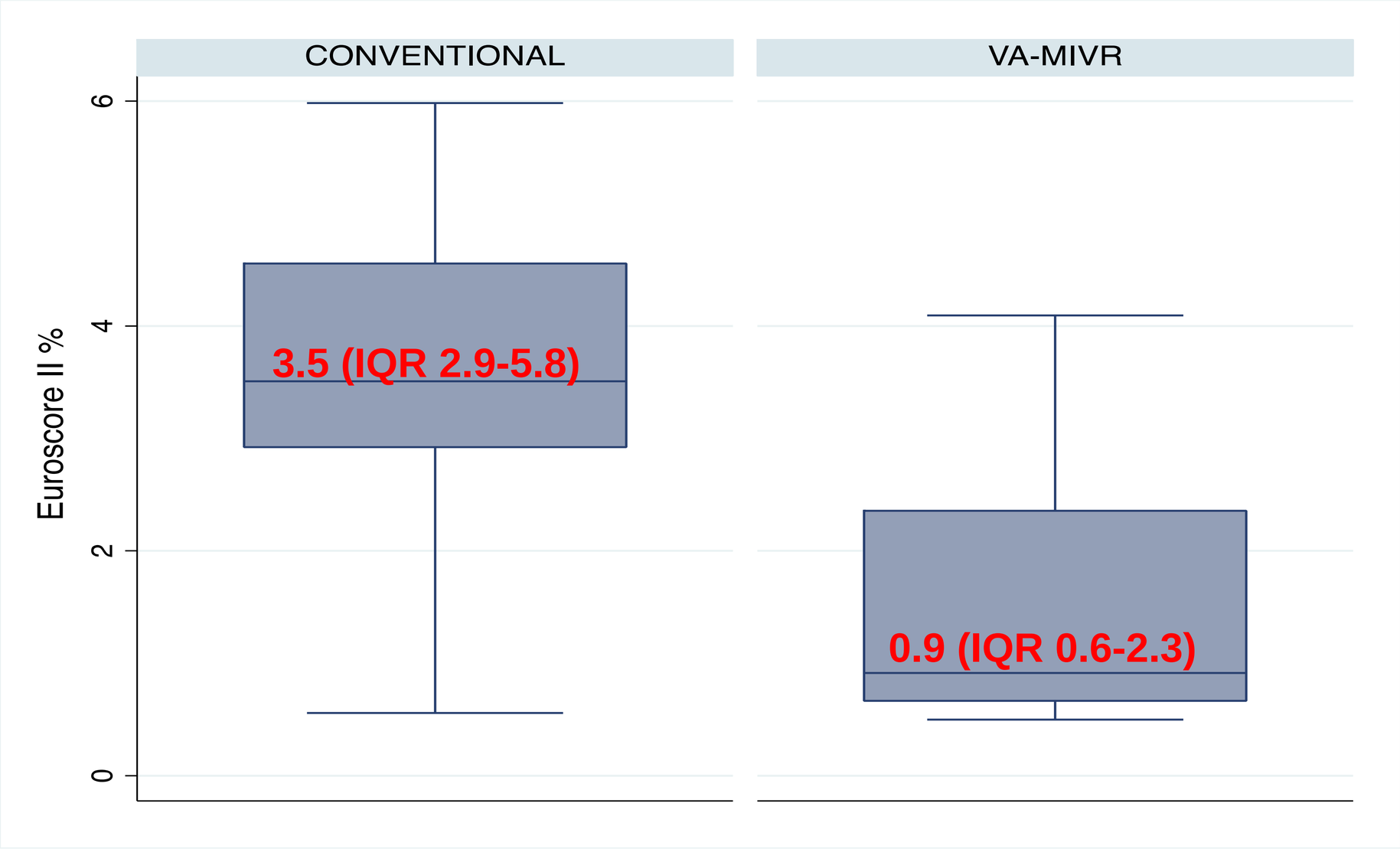
# Sampling Algorithm



# Results – Preoperative Variables

| VARIABLES | CONVENTIONAL | VA-MIVR | P VALUE Differences between groups |
|---|---|---|---|
| Body mass index Median (IQR) | 26.3 (23-29) | 24.3 (22.8-26) | 0.005 |
| Diabetes mellitus n (%) | 1 (1.5) | 0 | 0.374 |
| Hypertension n (%) | 29 (44.6) | 6 (11.7) | 0.0001 |
| Previous myocardial infarction n (%) | 1 (1.5) | 0 | 0.374 |
| Previous stroke n (%) | 2 (3.1) | 0 | 0.206 |
| COPD n (%) | 6 (9.2) | 0 | 0.084 |
| Preoperative Blocker n (%) | 26 (40) | 44(86.3) | 0.0001 |
| Preoperative creatinine Median (IQR) | 0.9 (0.8-1) | 1 (0.9-1.1) | 0.005 |
| Ejection fraction Median (IQR) | 58.5 (46-64) | 60 (55-62) | 0.227 |

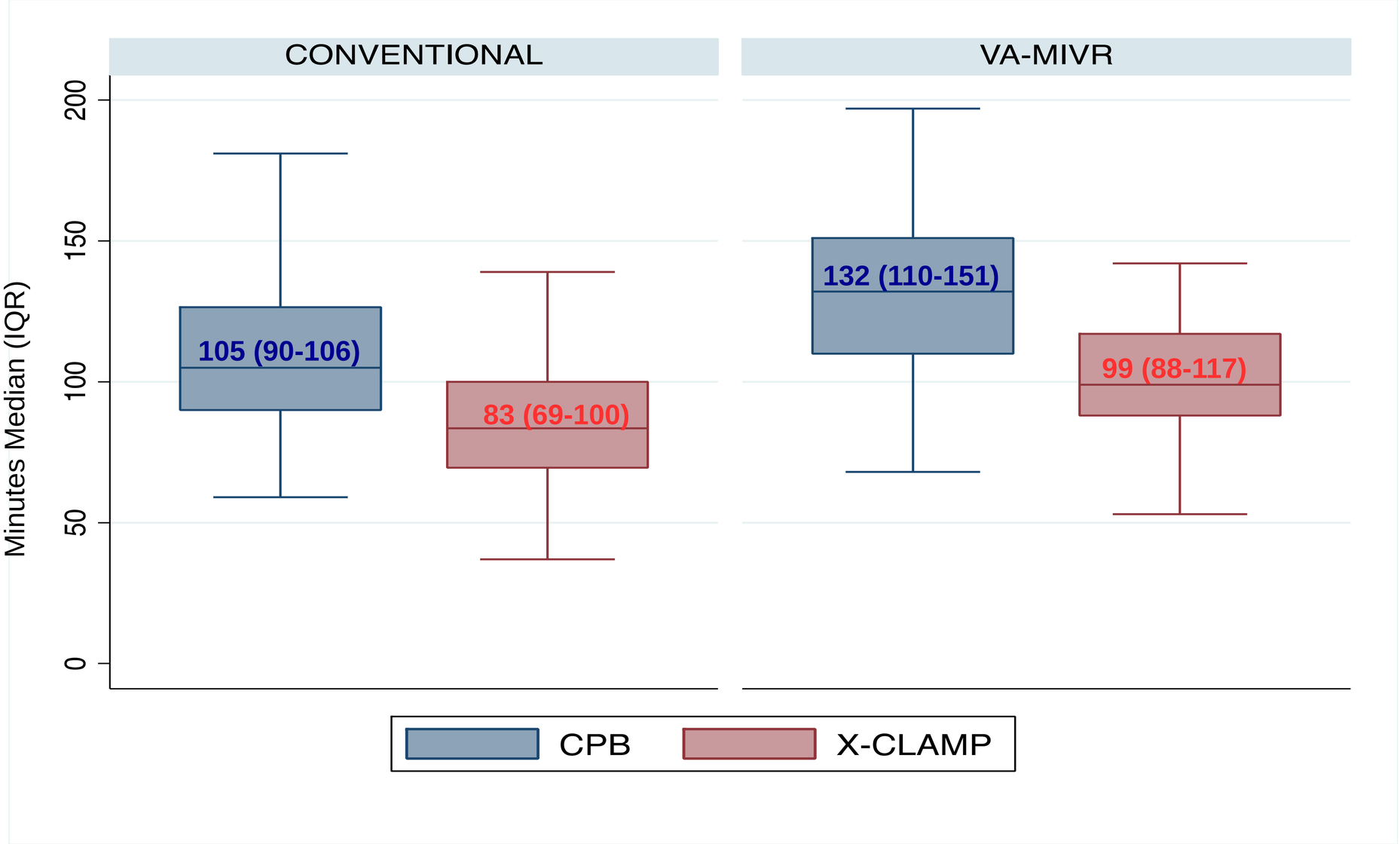
# Preoperative Euroscore II



# Variables Affecting Euroscore II

| VARIABLES | CONVENTIONAL | VA-MIVR | P VALUE Differences between groups |
|---|---|---|---|
| Renal Impairment; n (%) | 29 (44.6) | 20 (39.2) | 0.559 |
| NYHA > II; n (%) | 53(86.9) | 43 (83) | 0.892 |
| Pulmonary hypertension; n (%) | 35 (72.9) | 14 (33.3) | 0.0001 |
| Elective; n (%) | 48 (74.8) | 40 (78.4) | 0.557 |

# Intraoperative Results



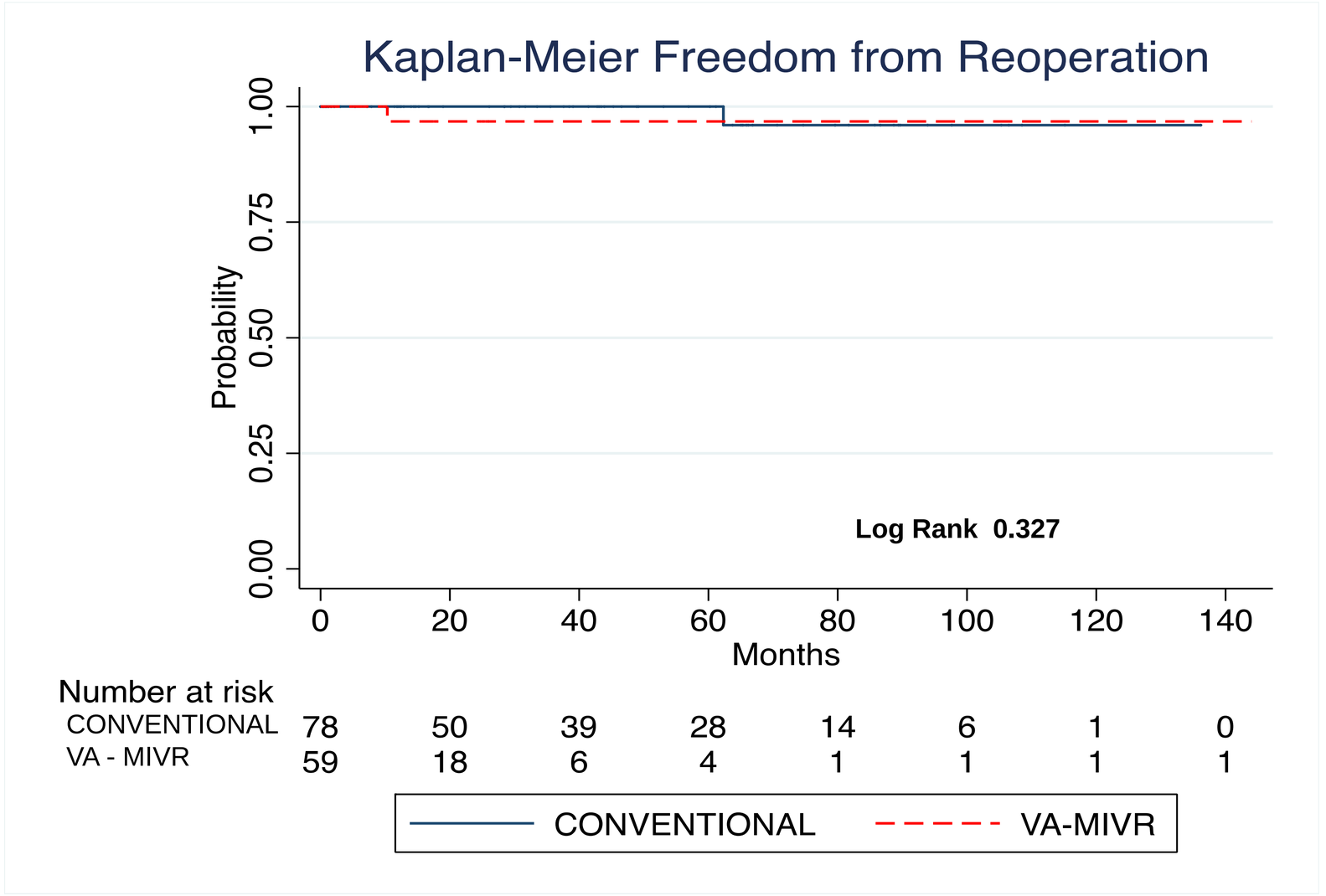
# Primary Outcomes

| VARIABLES | CONVENTIONAL | VA-MIVR | P VALUE Differences between groups |
|---|---|---|---|
| Bleeding requiring reoperation; n (%) | 1 (1.5) | 1 (1,9) | 0.862 |
| Deep wound infection; n (%) | 1 (1.5) | 0 | 0.379 |
| Stroke; n (%) | 1 (1.5) | 1 | 0.862 |
| Mortality (%) | 0 | 0 | - |
| Postoperative AF; n (%) | 5 (7.6) | 3 (5.1) | 0.672 |

# Secondary Outcomes

| VARIABLES | CONVENTIONAL | VA-MIVR | P VALUE Differences between groups |
|---|---|---|---|
| ICU stay (hours); Median (IQR) | 24 (24-72) | 24 (21-24) | 0.0001 |
| Transfusion; n (%) | 35 (38.5) | 1 (1.9) | 0.0001 |
| Hospital stay (days); Median (IQR) | 6.5 (5-12) | 5 (4-8) | 0.005 |

# Freedom from Reoperation



# Conclusion

- ✧MIVS should be performed by surgeons who have already mastered conventional repair techniques
- ✧Outcomes are progressively improving – Already better than conventional surgery?
- ✧Heart Team Approach Flattens Learning Curve
- ✧Establish Heart Valve Centers of Excellence to Increase Case Volume

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# Thank You

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