MINIMALLY INVASIVE AVR

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MINIMALLY INVASIVE AVR

In cardiac surgery
Minimally invasive
has been defined
as
“a small chest incision”
that does not include
a full median
sternotomy or a
classic thoracotomy.

Parasternal incision
Mini sternotomy
• Reverced- L
• Reverced-C
• Manubrium – limited sternotomy
• Half- lower sternotomy

Right Anterior Small Thoracotomy
MINIMALLY INVASIVE AVR

Smaller incision, (Minimally Access) AVR
± groin cannulation?

Less surgical trauma
± IMA division
± Costochondral resection
± rib spreading
± opening pleural cavities

Need for CPB
No CPB, no cross-clamping of the aorta, no intracardiac air, no thromboembolism, no blood flow to the brain from the conduit
MINIMALLY ACCESS AVR

Every smaller incision than the classic full sternotomy *since CPB is required*

Should be defined as a

*minimally-access AVR*

and not as a

minimally-invasive AVR procedure
MINIMALLY INVASIVE AVR

The only surgical procedure that has

-smaller incision
-no CPB
-less surgical trauma

is

Transcatheter Aortic Valve Implantation
RIGHT PARASTERNAL INCISION

- 10 cm incision
- Excision of 3rd and 4th costal cartilages
- Femoral A+V cannulation.
- Cosmetically more acceptable
- Lower potential for wound infection
- Less difficulty for the reoperation

Cosgrove D, Sabik J. Minimally Invasive Approach for Aortic Valve Operations
MINI-STERNOTOMY (LOWER HALF)

Mobilize pectoralis and intercostal muscle

Cautery

Modified Favaloro retractor

Aneurysm clamp

Aorta

Dotty D, DiRousso G, Doty J.
Mini sternotomy for cardiac surgery

MINI-STERNOTOMY( LOWER HALF)
J - UPPER STERNOTOMY

Aris A. et al
Mini sternotomy versus median sternotomy for aortic valve replacement
Manubrium–limited sternotomy decreases blood loss after aortic valve replacement surgery
MINIMALLY ACCESS AVR

RAST

MINI STERNOTOMY
MINIMALLY ACCESS AVR

Presumed Benefits:

- Cosmesis
- Reduced surgical trauma
- Blood loss
- Less pain
- Preserved lung function
- Shorter ICU and hospital stay
- Rapid return to functional activity
- Less use of rehabilitation recourses
- Reduced cost
MINIMALLY ACCESS AVR

*Potential Disadvantages:*

- Adequate Exposure?
- Ease of operation – ease of conversion
- Compromised myocardial protection
- Longer CPB and CCT
- Difficulties with air-removal
- Inadequate mediastinal and pleural drainage
- Increased risk of PVL
- Risk of conversion to full sternotomy
- Effects of femoral versus aortic cannulation
CONVERSION TO FULL STERNOTOMY

• 2.6%- 4.0% for upper and lower sternotomy

• Reason for conversion
  • Bleeding
  • Ventricular dysfunction
  • Poor exposure

Important cause of mortality and morbidity
MINIMALLY ACCESS AVR

Although there is evidence of significant greater CPB and ACCT MA- AVR

In specialized centers is a safe alternative to classic AVR with some benefits:

- in ventilation time
- ICU stay
- total hospital stay

This might not translate into reduction in operative mortality or primary and secondary events
Minimal Access Aortic Valve Replacement: Is It Worth It?

Bari Murtuza, PhD, FRCS, John R. Pepper, FRCS, Rex DeL Stanbridge, FRCS, Catherine Jones, BSc, MBBS, Christopher Rao, MBBS, Ara Darzi, KBE, FRCS, and Thanos Athanasiou, PhD, FETCS

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Controversy surrounds the use of minimal access aortic valve replacement (AVR). This meta-analytical study quantified the effects of minimal access AVR on morbidity and mortality compared with conventional AVR and evaluated study heterogeneity and robustness of the findings using sensitivity analysis. Overall, meta-analysis suggested marginal benefits in perioperative mortality (4,667 patients; odds ratio, 0.72; 95% confidence interval, 0.51-1.00; p = 0.05), intensive care unit stay, total hospital stay, and ventilation time in the minimal access AVR group, although cross-clamp, cardiopulmonary bypass, and total operation times were longer. Study heterogeneity and apparent benefits in perioperative mortality were related to study quality, although results for intensive care unit and hospital stay were maintained according to the sensitivity analysis. This suggests that minimal access AVR can be offered on the basis of patient choice and cosmesis rather than evident clinical benefit.

RIGHT ANTERIOR THORACOTOMY AORTIC VALVE REPLACEMENT IS ASSOCIATED WITH LESS COST THAN STERNOTOMY-BASED APPROACHES: A MULTI-INSTITUTION ANALYSIS OF 'REAL WORLD' DATA.

RODRIGUEZ ETAL, MALAISRIE SC, MEHALL JR, MOORE M, SALEMI A, AILAWADI G, GUNNARSSON C, WARD AF, GROSSI EA; ON BEHALF OF THE ECONOMIC WORKGROUP ON VALVULAR SURGERY. 'SAINT THOMAS HEART, NASHVILLE, TN, USA.'

ABSTRACT
ABSTRACT BACKGROUND: LARGE INSTITUTIONAL ANALYSES DEMONSTRATING OUTCOMES OF RIGHT ANTERIOR MINI-THORACOTOMY (RAT) FOR ISOLATED AORTIC VALVE REPLACEMENT (ISOAVR) DO NOT EXIST. IN THIS STUDY, A GROUP OF CARDIAC SURGEONS WHO ROUTINELY PERFORM MINIMALLY INVASIVE ISOAVR ANALYZED A CROSS-SECTION OF US HOSPITAL RECORDS IN ORDER TO ANALYZE OUTCOMES OF RAT AS COMPARED TO STERNOTOMY. METHODS: THE PREMIER DATABASE WAS QUERIED FROM 2007-2011 FOR CLINICAL AND COST DATA FOR PATIENTS UNDERGOING ISOAVR. THIS DE-IDENTIFIED DATABASE CONTAINS BILLING, HOSPITAL COST, AND CODING DATA FROM >600 US FACILITIES WITH INFORMATION FROM >25 MILLION INPATIENT DISCHARGES. EXPERT RULES WERE DEVELOPED TO IDENTIFY PATIENTS WITH RAT AND THOSE WITH ANY STERNAL INCISION (ASTERN). PROPENSITY MATCHING CREATED GROUPS ADJUSTED FOR PATIENT DIFFERENCES. THE IMPACT OF SURGICAL APPROACH ON OUTCOMES AND COSTS WAS MODELED USING REGRESSION ANALYSIS AND, WHERE INDICATED, ADJUSTING FOR HOSPITAL SIZE AND GEOGRAPHICAL DIFFERENCES. RESULTS: AVR WAS PERFORMED IN 27,051 PATIENTS. ANALYSIS IDENTIFIED ISOAVR BY RAT (N=1572) AND BY ASTERN (N=3962). PROPENSITY MATCHING CREATED TWO GROUPS OF 921 PATIENTS. RAT WAS MORE LIKELY PERFORMED IN SOUTHERN HOSPITALS (63% VS 36%; P<0.01), TEACHING HOSPITALS (66% VS 58%; P<0.01) AND LARGER HOSPITALS (47% VS 30%; P<0.01). THERE WAS SIGNIFICANTLY LESS BLOOD PRODUCT COST ASSOCIATED WITH RAT ($1381 VS $1912; P<0.001). AFTER ADJUSTING FOR HOSPITAL DIFFERENCES, RAT WAS ASSOCIATED WITH LOWER COST THAN ASTERN ($38,769 VS $42,656; P<0.01). CONCLUSIONS: OUTCOMES ANALYSES CAN BE PERFORMED FROM HOSPITAL ADMINISTRATIVE COLLECTIVE DATABASES. THIS REAL WORLD ANALYSIS DEMONSTRATES COMPARABLE OUTCOMES AND LESS COST AND ICU TIME WITH RAT FOR AVR.

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A META-ANALYSIS OF MINIMALLY INVASIVE VERSUS CONVENTIONAL STERNOTOMY FOR AORTIC VALVE REPLACEMENT.

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Minimally invasive aortic valve replacement (AVR) is increasingly used as an alternative to conventional AVR, despite limited randomized evidence available. To assess the evidence base, a systematic search identified 50 comparative studies with a total of 12,786 patients. A meta-analysis demonstrated that MINIMALLY INVASIVE AVR IS ASSOCIATED WITH REDUCED TRANSFUSION INCIDENCE, INTENSIVE CARE STAY, HOSPITALIZATION, AND RENAL FAILURE, AND HAS A MORTALITY RATE THAT IS COMPARABLE TO CONVENTIONAL AVR. THE evidence quality was mostly very low. Given the inadequate statistical power and heterogeneity of available studies, prospective randomized trials are needed to assess the benefits and risks of minimally invasive AVR approaches.

SUTURELESS AORTIC VALVES
Magovern-Cromie sutureless prosthetic aortic valve

Implanting the sutureless valve greatly reduced the time the heart was kept chilled and not beating, reversing a 90 percent mortality rate to a 90 percent survival rate.

The Magovern-Cromie valve, invented in the early 1960s, is the oldest documented functioning artificial heart valve found in a patient.

Photo provided by Dr. Amnon Zlotnick

Metal “ball and cage” valve replacement in the aortic position

Graphic, Ed Yozwick; Research, Mark Roth/Post-Gazette
SUTURELESS AORTIC VALVES

• 50% reduction of operative times
• *A ‘real’ alternative to TAVI* especially with minithoracotomy.
• Useful for double (aortic/mitral) or triple (aortic/mitral/tricuspid) valve surgery
• In redo cases with difficult access to the root
• Better sub-valvular rheology
• Absence of pledgets or sutures potential for reducing the incidence of endocarditis
AORTIC VALVE REPLACEMENT THROUGH RIGHT ANTERIOR MINITHORACOTOMY: CAN SUTURELESS TECHNOLOGY IMPROVE CLINICAL OUTCOMES?

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THE IMPACT OF SUTURELESS PROSTHESIS ON THE CLINICAL OUTCOME IN MINIMALLY INVASIVE AORTIC VALVE REPLACEMENT IS STILL UNCLEAR. WE ASSESSED MID-TERM OUTCOMES OF THE SUTURELESS AND CONVENTIONAL VALVES IMPLANTED THROUGH RIGHT ANTERIOR MINITHORACOTOMY.

METHODS:

RESULTS:
CARDIOPULMONARY BYPASS (P < 0.0001) AND CROSS-CLAMPING (P < 0.0001) TIMES WERE SHORTER IN THE SUTURELESS GROUP (S GROUP). WE OBSERVED THE SAME IN-HOSPITAL MORTALITY (1 VERSUS 2; P = 0.62) AND INCIDENCE OF POSTOPERATIVE STROKE AND PACEMAKER IMPLANT BETWEEN THE GROUPS, BUT SHORTER DURATION OF MECHANICAL VENTILATION (6 VERSUS 7 HOURS; P = 0.001) IN THE S GROUP. GENERALLY, LARGER PROSTHESES WERE IMPLANTED IN THE S GROUP (P < 0.0001). FOLLOW-UP WAS LONGER (P < 0.0001) FOR SUTURED VALVES: 52 VERSUS 15 MONTHS (OVERALL MEDIAN, 21 MONTHS). OVERALL KAPLAN-MEIER SURVIVAL RATE WAS 87.2% VERSUS 97.0% (P = 0.33) AND 50% VERSUS 100% (P = 0.02) IN ELDERLY PATIENTS FOR SUTURED VERSUS SUTURELESS PROSTHESES, RESPECTIVELY. FREEDOM FROM REOPERATION AT FOLLOW-UP (P = 0.64) AND TRANSAORTIC GRADIENTS (12 VERSUS 11 MM HG; P = 0.78) DID NOT DIFFER IN THE TWO GROUPS.

CONCLUSIONS:
IN THE PRESENT LIMITED COHORT OF PATIENTS, SUTURELESS PROSTHESES REDUCED OPERATIVE TIMES FOR AORTIC VALVE REPLACEMENT AND THE DURATION OF MECHANICALLY ASSISTED VENTILATION AND MIGHT HAVE INFLUENCED EARLY AND MID-TERM SURVIVAL. LARGER STUDIES ARE NEEDED TO CONFIRM OUR DATA AND COMPARE LONG-TERM OUTCOMES.
TRANSCATHETER AORTIC VALVE IMPLANTATION
TRANSAPICAL AORTIC VALVE IMPLANTATION
TA-AVI
TRANSAPICAL AORTIC VALVE IMPLANTATION

TA-AVI

• No-aorta touch technique
• No passage around the arch
• Front-door approach
• Short distance between operator and aortic annulus. More direct feed—back from the annulus less stored energy in the delivery system
• The lowest access-related complication rate (0.6%) in the GARY in 1000 pts.
TRANSAPICAL AORTIC VALVE IMPLANTATION

TA-AVI

• In the future completely percutaneous approach.
• New closing devices for the apex.
• TA access is proven beneficial for more complex situations
• Valve-in-valve
• Offers access to the mitral valve for MVI.
• Already used for ascending aorta stents
TRANSAAPICAL TAVI SYSTEM

FEELER GUIDED,  
ANATOMICAL  
POSITIONING  

No rapid pacing required during  
prosthesis release & maintains  
hemodynamic flow during  
prosthesis placement  

WIDE RANGE  
OF SIZES  

3 sizes covering  
anull from  
21 to 27 mm  

RETRIEVABLE &  
REPOSITIONABLE  

Puts heart teams  
in control  

LOW PROFILE  
PROSTHESIS  
DESIGN  

Ensures open flow  
to coronaries  

JENAACLIP™  
ANCHORING  
MECHANISM  

Provides active fixation,  
resistance to migration
SYMETIS ACCURATE
Reverce T manubriotomy
or
RAST through the 2\textsuperscript{nd} - 4\textsuperscript{th} intercostal space
TRANSAORTIC AVI

- Sort distance from the aortic ring
- Low cerebrovascular accidents due to absence of navigating wires in the arch (1.3%)
- Easy and quick conversion to full sternotomy
- Surgeons familiarity with the procedure
- No special learning curve needed
TRANSAORTIC AVI

• No need for vessel closure devices
• Maintains left ventricular integrity
• Greater control of device deployment and position
• Lower clinically- relevant PVL (1.5% more than moderate)
• Pacemaker implantation rates (14.5%)
CAROTID ARTERY APPROACH - TAVI

• Safe and less invasive alternative for:
  - patients with respiratory failure
  - Impaired left ventricular function
  - Redo cases with patent LIMA

• Easy exposure

• Less vascular complications

• Proximal common carotid artery is of good size

• Pre-procedural doppler, CTA, cerebral MRI
Which valve for which patient?

Severe Aortic Stenosis

Transapical Access

- Severe Calcification Zone 1
  - Yes: Sapien 3
  - No: Symetis JenaValve Engager

- Severe Calcification Zone 2
  - No: Sapien 3 Symetis JenaValve Engager
  - Yes: JenaValve Symetis

- Low coronary Distance + Small sinuses
  - Bicuspid Valve
  - Valve-in-Valve Bioprosthesis
    - Size ≤ 23mm
    - Size ≥ 25mm
      - Switch to direct aortic CoreValve Evolut 23
      - Sapien 3
Conclusions

• Minimally access AVR is a safe alternative to conventional AVR

• Although it increases operative times is associated with some benefits in blood loses, ICU stay, LOS and ventilation time

• The MA-AVR with sutureless valves is very promising

• Don’t feel bad if you don’t do MA-AVR

• We should feel bad if we stay out of ‘surgical’ TAVI
Thank you