



# Aortic Valve Preservation\* Surgery

Retaining the living aortic valve

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No disclosures





# AVR in the young patient

- AVR is a well established and reproducible procedure
  - Allows placement of a mechanical or bioprosthetic valve
  - ► TAVR has proven to be an extremely disruptive technology → huge increase in bioprosthetic AVR

- However, valve replacement does result in future morbidity and excess mortality
- This is especially true in the young patient



### Observed and Relative Survival After Aortic Valve Replacement

Per Kvidal, MD,\* Prof. Reinhold Bergström, PhD,‡ Lars-Gunnar Hörte, PM, BA,§ Elisabeth Ståhle, MD, PhD†

Uppsala and Stockholm, Sweden

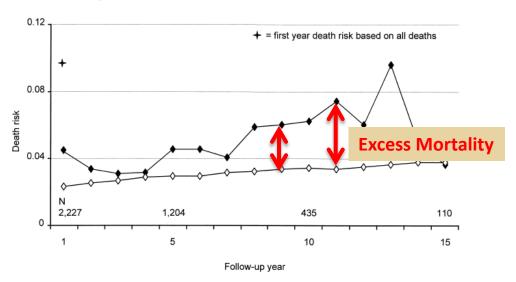


Figure 2. The annual observed (solid diamonds) and expected (open diamonds) death risk after primary AVR in patients who survived the first postoperative month (n = 2,227). The numbers (N) of patients at risk and the first year death risk are given.

Kvidal et al. JACC 2000



### MECHANICAL AVR IN THE YOUNG

Long-term outcomes after elective isolated mechanical aortic valve replacement in young adults

Ismail Bouhout, MSc, <sup>a</sup> Louis-Mathieu Stevens, MD, PhD, <sup>b</sup> Amine Mazine, MSc, <sup>a</sup> Nancy Poirier, MD, <sup>a</sup> Raymond Cartier, MD, <sup>a</sup> Philippe Demers, MD, <sup>a</sup> and Ismail El-Hamamsy, MD, PhD<sup>a</sup>

1997-2006: 469 isolated mechanical AVR <65 years

Mean follow-up: 9.1 ± 3.5 years

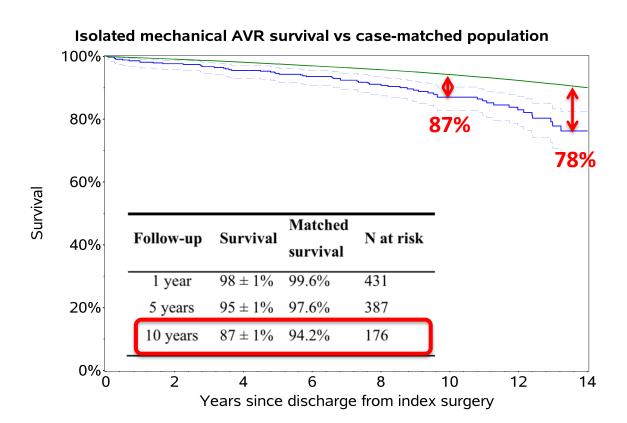
Follow-up 95% complete (4099 patient-years)

Mean age: 53.2 ± 9.2

Bouhout et al. JTCVS 2014



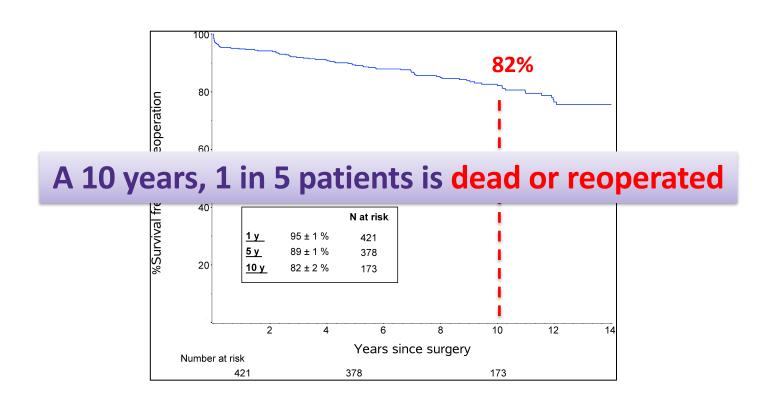
## SURVIVAL – MECHANICAL AVR



Bouhout et al. JTCVS 2014



### SURVIVAL FREE FROM REOPERATION



Bouhout et al. JTCVS 2014



# Repair rationale

- AVR is associated with excess mortality and patients' fall off expected life curve
  - This is true even with mechanical AVR
- This survival deficit is especially true in young patients!
- Aortic valve repair allows for restoration of the "living aortic valve complex" and potentially decreases long-term morbidity/mortality seen with AVR
  - No anticoagulation
  - Durable



## 2010s





### Unicuspid valve repair-what technique, which patch for which patient?

### Shunsuke Matsushima, Ch

Correspondence to: Hans-Joachim Schä Homburg, Germany, Email: h-i.schaet



The uniquenid and unicommiss rare anomaly but frequently re in childhood and young adulth balloon/surgical valvuloplasty-Aortic valve replacement with a standard treatment in adulth satisfactory in young individuals approach should be particularly have proposed UAV repair by mmissure of normal heig and thus applying the technique

The patient is a 3-year-old boy and regurgitation after several by transesophageal echocardiogra UAV with only the posterior The basal ring is 12 mm in diwith bicuspidization is planned.

### Surgical techniques

The aortic size is measure echocardiography. Root remov replacement seem reasonable of Valsalva ≥43 mm and the European Journal of Cardio-Thoracic Surgery 53 (2018) 1101-1107 doi:10.1093/eicts/exy176

Cite this article as: Lansac E, de Kerchove L. Aortic valve repair techniques: state of the art. Eur.J Cardiothorac Surg 2018;53:1101-

### Aortic valve repair techniques: state of the art Emmanuel Lansac<sup>a,\*</sup> and Laurent de Kerchove<sup>b</sup>

European Journal of Cardio-Thoracic Surgery 50 (2016) 350-360 doi:10.1093/eict</exwern

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\* Corresponding author. Department e-mail: emmanuel lansac@imm.fr (

Keywords: Aortic valve sparing • Remodelling • Reimplantation

### INTRODUCTION

Aprtic valve (AV) repair is now to prosthetic valve replaceme from aortic insufficiency (Al) or from aortic insufficiency (Al) or pioneering cohors have achie comes, up to 20 years, with ex Moreover, active ongoing rees improvements in the surgical triation using circumderential ain ment of valve configuration u As they have accumulated ex standardized their approaches producibility and disseminator. The 2017 European Associat European Society of Cardiologic recommend a "Heart Team displiable, non-califed stricupies (BAV) insufficiency in whom A twe to valve replacement (explaneer).

(BAV) insufficiency in whom A tive to valve replacement ( According to results from the Heart Disease [5], patients with Al, which represents the mo Western countries, account fo Al cases. These patients are

### TERMINOLOGY

provided the following definit used in AV repair surgery (Figs

 Valve type is defined by the on the number of function dence): (i) a tricuspid valve sures; (ii) a BAV has 2 fully d raphe on the fused cusp, als

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ORIGINAL ARTICLE

### Long-term results of external aortic ring annuloplasty for aortic valve repair

### Emmanuel Lancac\*\* Isahelle Christelle Diakov\*, Leila Mar Suzani

- Corresponding author. Department of Cardia fax: +33-1-56616523; e-mail: emmanuel/ansa
- Received 5 October 2015: received in revised fi

OBJECTIVES: An untreated dilated aorti OBJECTIVES: An untreased disasted acrist-pid or tricuspid valve. Aortic annulopla: This study analyses long-term results of valve repair according to each phenotiusing an external aortic ring to reduce a patients with root aneurysm underwent onary grafts with an external open ring external open ring annuloplasty. Preope

RESULTS: Cusp repair was performed in 40.1 ± 37.8 months (0-145.5). The actua among each phenotype, being 90.5% fo between the bicuspid and tricuspid valv and 93.1% for root aneurysms, 92.9 and freedom from reoperation, respectively 100%. For isolated AI, an additional sin CONCLUSIONS: External aortic ring an results for each ascending aorta phenoty

Keywords: Aortic valve repair • Aortic v

### INTRODUCTION

Although more than 80% of indication ment are for dystrophic aortic insufficie the Society of Thoracic Surgeons datab of patients received a valve-sparing pri the question of reproducibility and te

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Principles of aortic valve repair

Gebrine El Khoury, MD, and Laurent de Kerchove, MD

During the past 15 years, important advances in the field of aortic valve repair have transformed it from an in-frequent and anecdotal exercise to a feasible and attractive alternative to valve replacement in selected patients with pure aortic insufficiency. These advances include a deeper understanding of the functional anatomy of the aortic valve and pathophysiologic mechanisms of aortic insufficiency; the development of surgical techniques to restore normal geometry to the aortic root and to restore the cusp coaptation; and the development of a common terminology that can be used by all clinicians to describe the lesions, discuss repair techniques, and compare immediate and long-term outcomes after aortic valve repair. This article attempts to describe the important prin ciples of aortic valve repair by focusing on functional anatomy, surgical techniques for cusp repair, and outcome By analogy with mitral valve repair, we include in the term aortic valve repair not only the repair of the cusp but also the valve-sparing root replacement or any kind of functional aortic annulus stabilization. (J Thorac Cardiovasc Surg 2013;145:S26-9)

During the past 15 years, important advances in the field of aortic valve (AV) repair have transformed it from an infrequent and anecdotal exercise to a feasible and attractive alternative to valve replacement in selected patients with pure aortic insufficiency (AI). These advances include a deeper understanding of the functional anatomy of the AV and the pathophysiologic mechanisms of AI; the development of surgical techniques to restore normal geometry to the aortic root and to restore cusp coaptation; and the development of a common terminology that can be used by all clinicians to describe the lesions, discuss repair techniques and compare immediate and long-term outcomes after AV repair. This article attempts to describe the important principles of AV repair by focusing on functional anatomy, surgical techniques for cusp repair, and outcome. By analogy with mitral valve repair, we include in the term AV repair not only the repair of the cusp but also valve-sparing root replacement or any kind of functional aortic annulus

### ANATOMY OF THE AV AND THE FUNCTIONAL

The AV leaflets insert into the aortic annulus proximally at the aortoventricular junction (AVJ) and distally at the sinotubular junction (STJ). As a functional entity, the AV consists of the STJ and the AVJ, which together form the

From the Divisions of Cardiothoracic and Vascular Surgery, Université Carholique de Louvain, Cliniques Universitaires Saint-Luc, Brussels, Belgium. Disclosures: Des El Khoury and de Kerchove have nothing to disclose with regard to

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Read at The American Association for Thoracic Surgery Aortic Symposium,
New York, New York, April 26-27, 2012.

functional aortic annulus (FAA; Figure 1), and the valve cusps. The integrity of both functional components (the cusps and the FAA) is the basis for good valvular function. and alteration in either of these components is frequently as sociated with alteration in the other. Thus a fundamental principle in AV repair is that both lesions of the cusps and lesions of the FAA should be addressed at the time of valve

El Khoury and de Kerchove

In a normal AV, although cusp coaptation relatively con-stantly reaches the midlevel between the AVJ and the STJ, a certain degree of individual variation exists in the length of coaptation, ranging from 2 to 6 mm. Although a coaptation of 2 mm is enough to ensure valve competence in an FAA of normal size, longer coaptation may represent some sort of coaptation reserve in the event of FAA dilatation. This anatomic feature, in combination with the individual compliance of the cusp tissues, explains the multiple clinical presentations with regard to the correspon dence between the degree of FAA dilatation and the severity of AI. FAA dilatation undoubtedly induces propressive AI: however, significant AI can already be seen with a moderately dilated FAA (40 mm), whereas son tients have little or no AI even with a severely dilated FAA (>55 mm). The concept of coaptation reserve, quantified by the coaptation length, is one of the parameters that can provide an estimate of the likely evolution of preopers postoperative AI when further dilatation of the FAA is

### FUNCTIONAL CLASSIFICATION OF AI

A functional classification of AI should ideally identify all the contributing lesions of the cusps and the FAA, enable a reconstructive approach to the AV, and help to discrimi-nate patients in whom a durable repair is achievable. We previously described such a classification of AI1 that encompasses all the different causes of AI; provides a com-mon language to be used by surgeons, cardiologists, and echocardiographers; helps the surgeon in choosing repai

- Significant interest in aortic valve repair
- Many techniques described
- Most of literature coming from Europe
- Good medium-term results with both trileaflet and BAV repairs



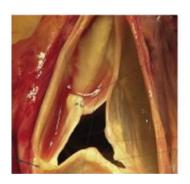
# Principles of Aortic Valve Repair

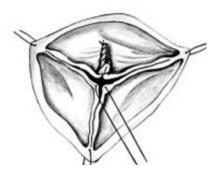
### Annuloplasty

- External subannular ring (e.g. Lansac ring)
- ► Internal ring (HAART)
- Suture annuloplasty
- Valve sparing root replacement (David V)

### Leaflet Repair

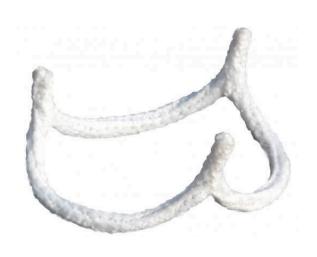
- Plication
- Nodule release
- De-calcification
- ► BAV cleft closure
- Fenestration repair





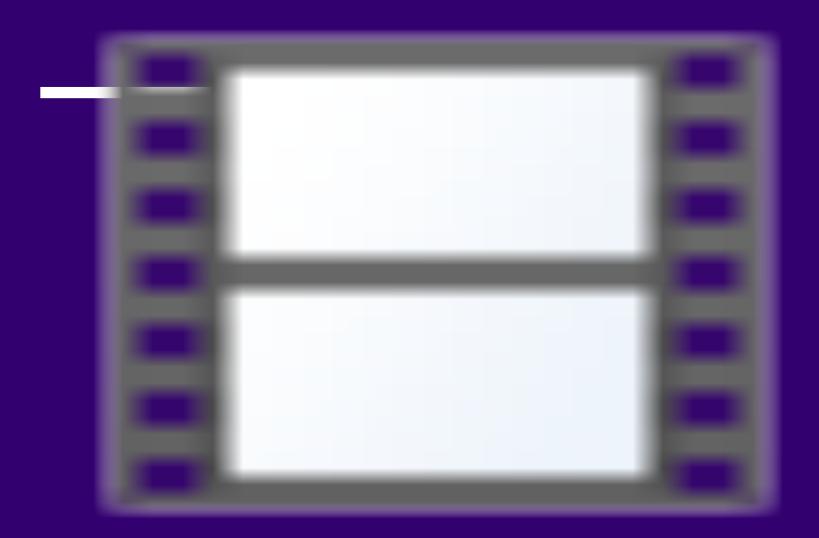
# Standardization- HAART ring

Annuloplasty ring for TAV and BAV repairs



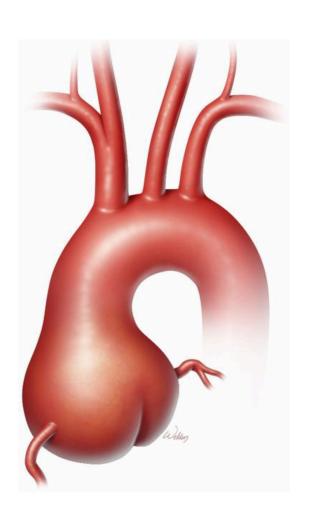








### What about aortic root aneurysms?



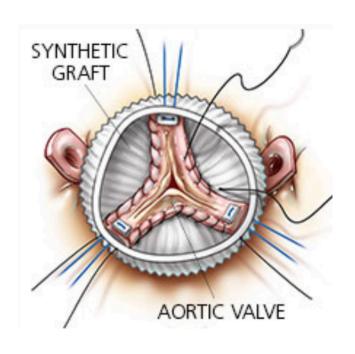


Bentall procedure





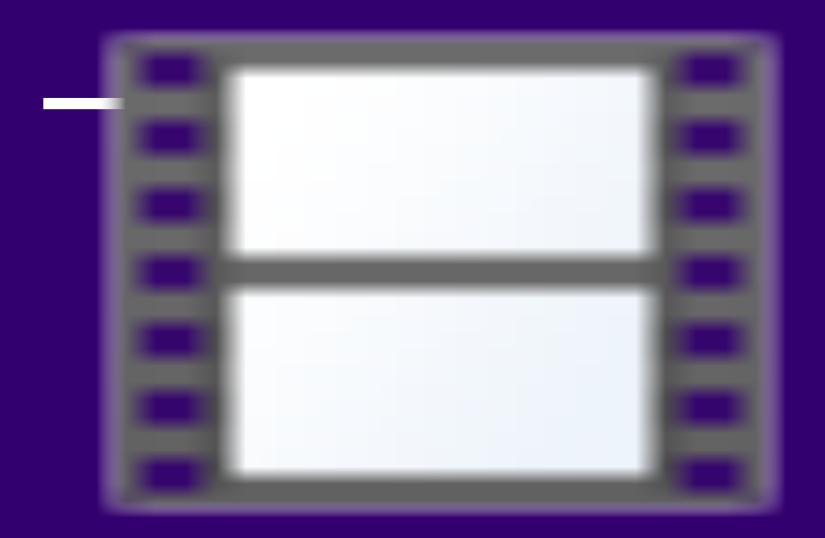
### Valve Sparing Root Replacement (VSRR)



 Standard of care at UWMC for root aneurysm with repairable aortic valve

- Used in a variety of settings:
  - Al, acute type A dissection, BAV







# **Traditional Al Algorithm**

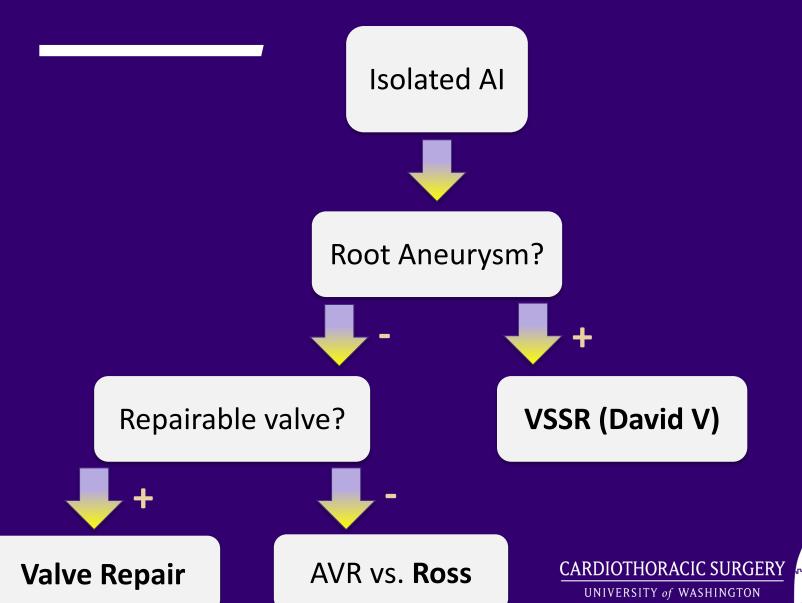
Isolated AI



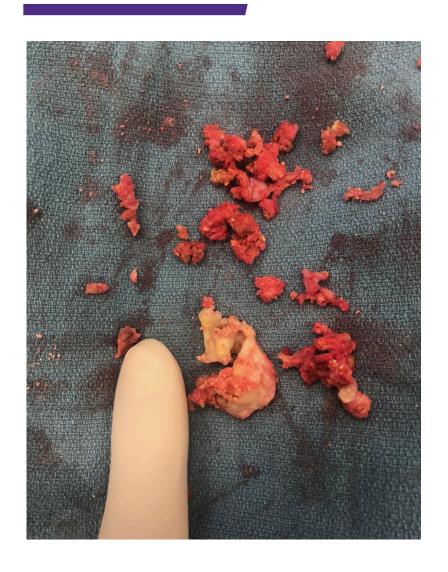
**AVR** 



# **Novel UWMC AI Algorithm**



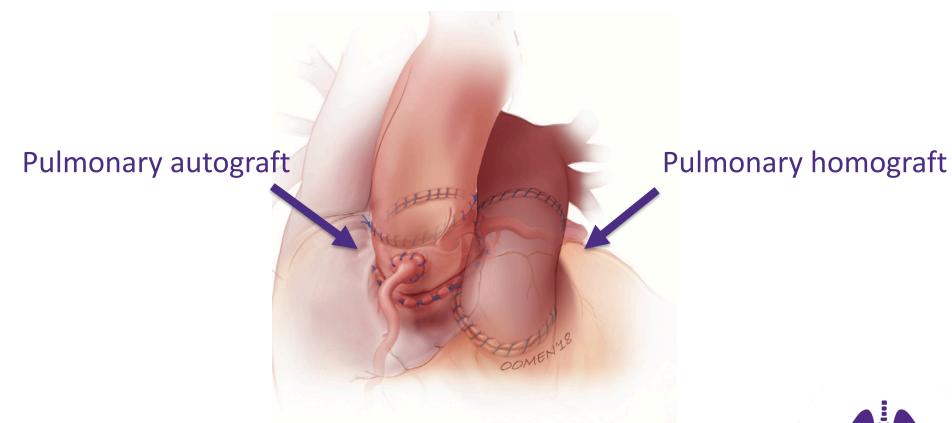
### What about aortic stenosis (AS)?



In general, valves with significant AS are <u>not</u> repairable

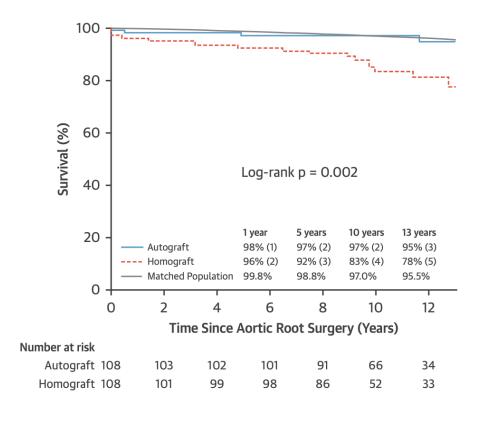


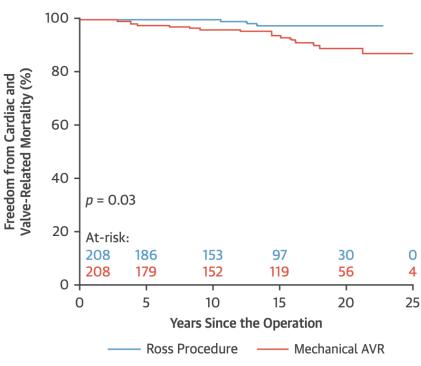
# **Ross Procedure**



CARDIOTHORACIC SURGERY UNIVERSITY of WASHINGTON

### Ross vs. AVR

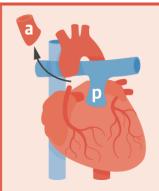




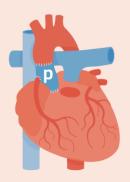
El-Hamamsy et al. Lancet 2010

Mazine et al. Circulation 2016

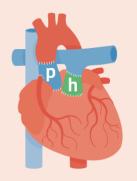




The diseased aortic valve is removed



The pulmonic valve replaces the aortic valve



A homograft replaces the pulmonic valve

### **Advantages**

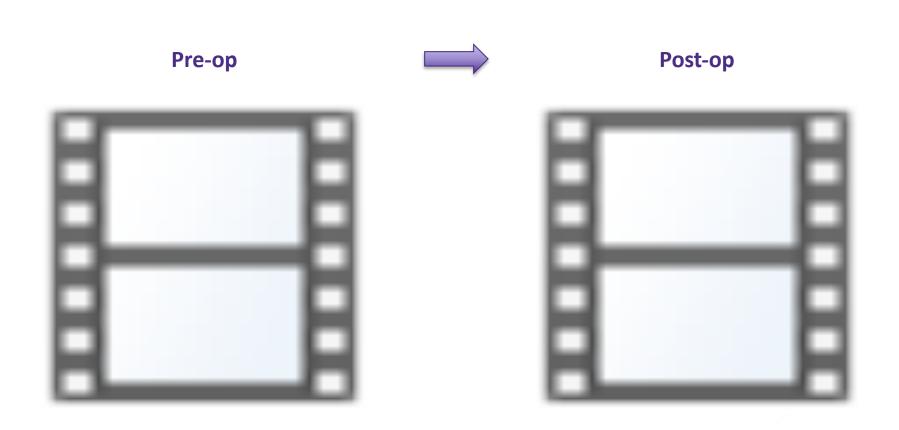
- Excellent long-term survival
- ✓ Excellent quality of life
- Avoidance of anticoagulation
- Superior hemodynamics
- Low rates of valverelated complications

### **Potential Pitfalls**

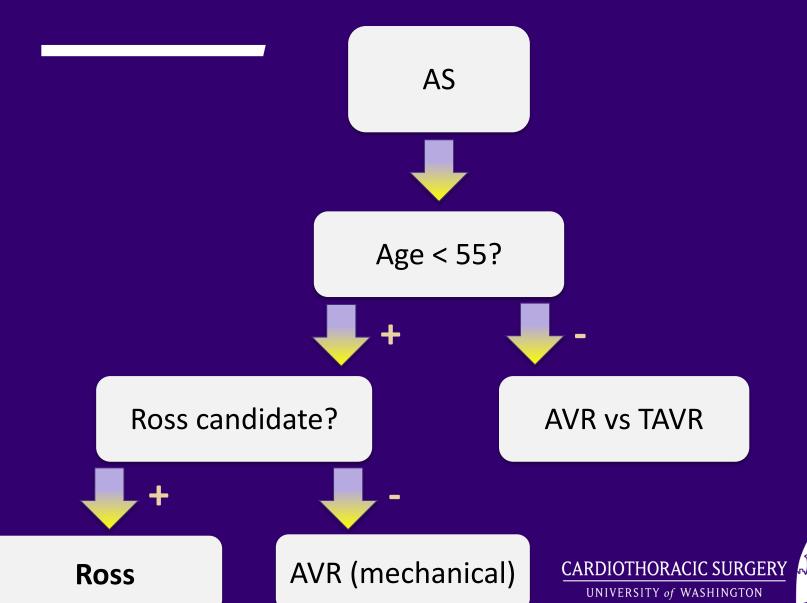
- ▲ Technical complexity
- A Potential long-term failure of two valves
- ♠ Complexity of reoperations



# **Ross at UWMC**



# **Novel UWMC AS Algorithm**



## Conclusions

- AVR has consequences
- Retaining the "living aortic valve complex" with valve repair/VSRR/Ross has value in properly selected patients

