

# XXIX Giornate Cardiologiche Torinesi

ADVANCES IN CARDIAC ARRHYTHMIAS  
AND GREAT INNOVATIONS IN CARDIOLOGY

Turin, October 27-28, 2017  
Centro Congressi Unione Industriale

***WHAT HAS CHANGED IN CARDIAC SURGERY?***

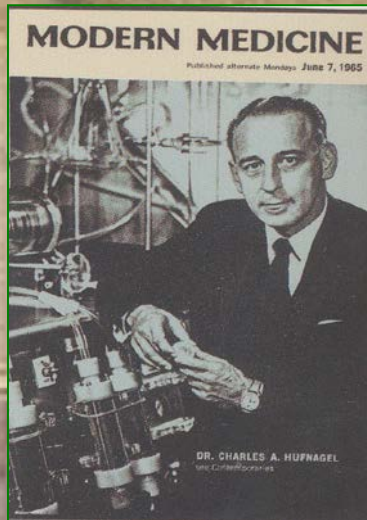
***Biological or mechanical  
valve prosthesis?***

**Dr.ssa Chiara Comoglio  
Dr Riccardo Casabona**

**Maria Pia Hospital - Torino**

**GVM Care & Research**





**SURGERY**

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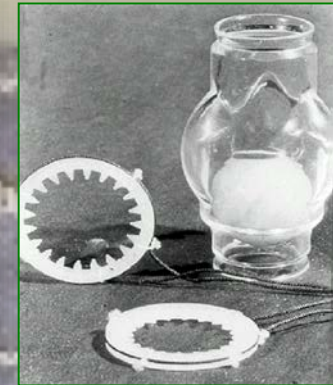
VOL. 35 MAY, 1954 No. 5

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**Original Communications**

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**SURGICAL CORRECTION OF AORTIC INSUFFICIENCY**  
CHARLES A. HUFNAGEL, M.D.,\* W. PROCTOR HARVEY, M.D.,\*\*  
PIERRE J. RABIL, M.D.,\*\*\* AND THOMAS F. McDERMOTT, M.D.\*\*\*\*  
WASHINGTON, D. C.  
*(From the Georgetown University Medical Center)*



**TREATMENT OF AORTIC INSUFFICIENCY BY  
THE HUFNAGEL VALVE  
WITH FOUR ILLUSTRATIVE CASES**

By A. W. FAWCETT, F.R.C.S.  
*Thoracic Surgeon, The Royal Infirmary, Sheffield*  
and B. S. DHILLON, F.R.C.S.  
*Surgical First Assistant and Registrar to the Thoracic Surgical Unit*

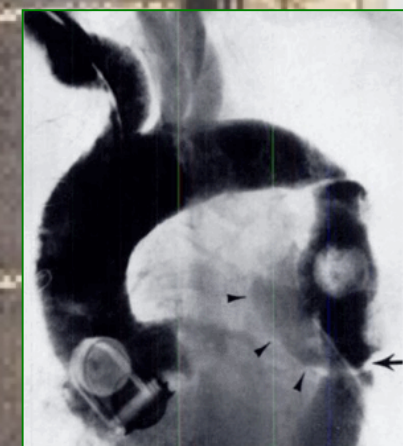


Postgrad Med J. 1956 September; 32(371): 438-443.

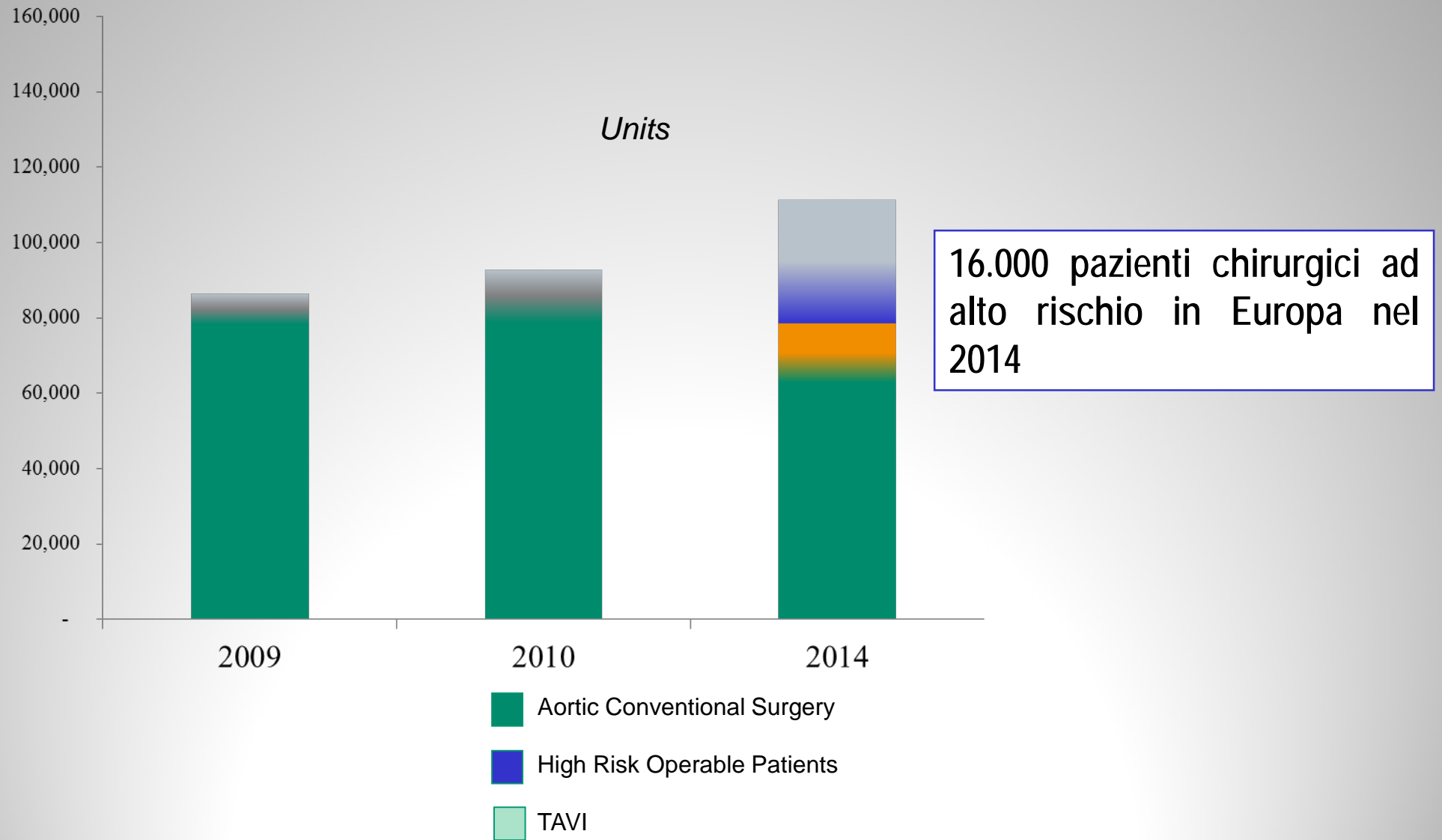
**The Hufnagel Valve: A Forgotten Entity**

Joseph Kaufman,<sup>1</sup> Julio Palmaz,<sup>1</sup> Albert Weinschelbaum,<sup>1</sup> and David Woodruff<sup>2</sup>

AJR 139:1010-1012, November 1982



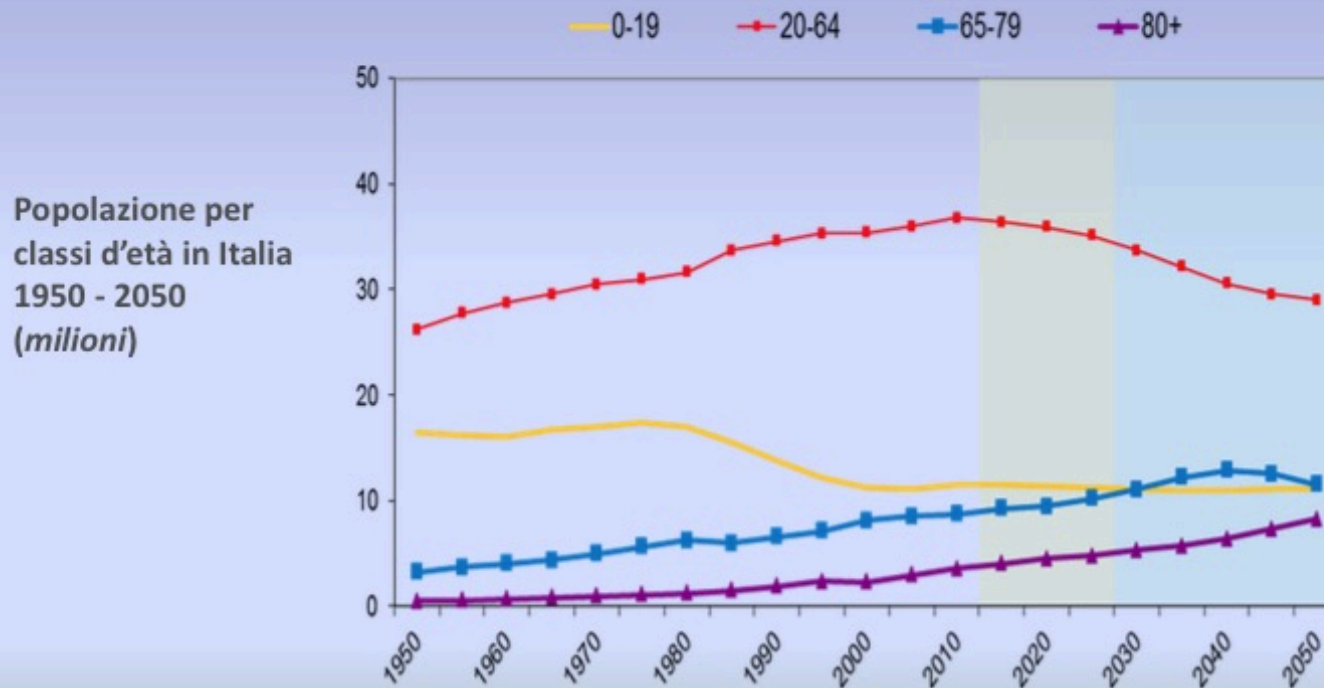
# Pazienti che ricevono una protesi aortica Europa



## L'evoluzione demografica in Italia

Un paese di anziani:

nel 2050 gli ultrasessantacinquenni rappresenteranno un terzo della popolazione, dal 20% attuale, e gli ultraottantenni cresceranno dall'attuale 5,8% al 13,6%.



Fonte: Istat- Demo



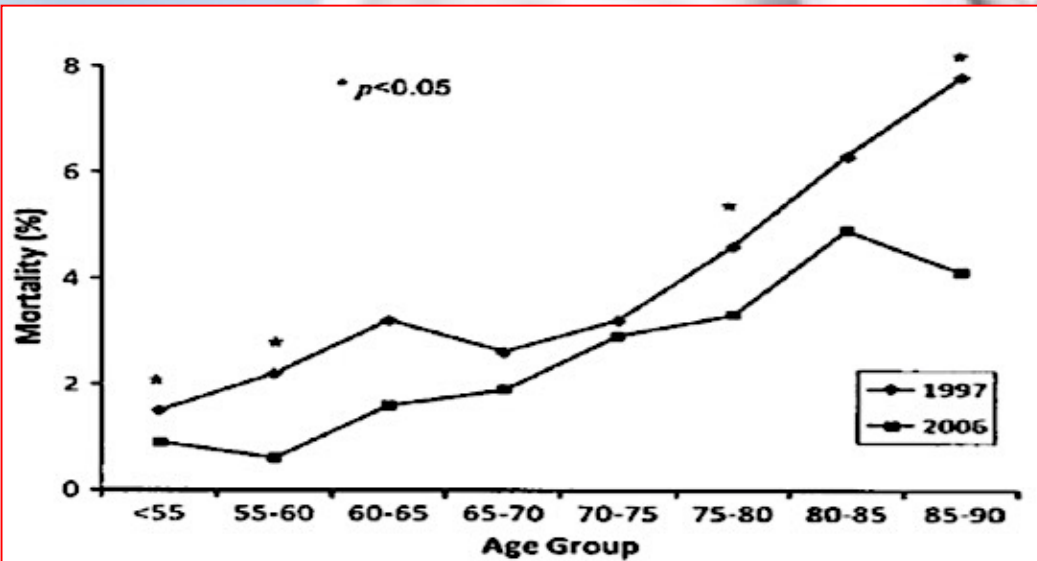
# Aortic Valve Replacement in Octogenarians: Risk Factors for Early and Late Mortality

Spencer J. Melby, MD, Andreas Zierer, MD, Scott P. Kaiser, BS, Tracey J. Guthrie, RN, Jason D. Keune, BA, Richard B. Schuessler, PhD, Michael K. Pasque, MD, Jennifer S. Lawton, MD, Nader Moazami, MD, Marc R. Moon, MD, and Ralph J. Damiano, Jr, MD

Division of Cardiothoracic Surgery, Department of Surgery, Washington University School of Medicine and Barnes-Jewish Hospital, St. Louis, Missouri

Ann Thorac Surg 2007

## Morbidity And Mortality Decrease Applying Recent Advances Of Cardiosurgical Techniques



**Fig. 3.1** Mortality versus age in aortic valve replacement. Mortality was age dependent in 1997 and 2006. Mortality was less in 2006 than in 1997. Asterisk indicates  $p < 0.05$  (Reprinted from Brown et al. [13] Copyright 2009, with permission from Elsevier)

### Questions

- How severe is VHD?
- What is the aetiology of VHD?
- Does the patient have symptoms?
- Are symptoms related to valvular disease?
- Are any signs present in asymptomatic patients that indicate a worse outcome if the intervention is delayed?
- What are the patient's life expectancy<sup>a</sup> and expected quality of life?
- Do the expected benefits of intervention (versus spontaneous outcome) outweigh its risks?
- What is the optimal treatment modality? Surgical valve replacement (mechanical or biological), surgical valve repair, or catheter intervention?
- Are local resources (local experience and outcome data for a given intervention) optimal for the planned intervention?
- What are the patient's wishes?

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## 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Rick A. Nishimura, Catherine M. Otto, Robert O. Bonow, Blase A. Carabello, John P. Erwin III, Robert A. Guyton, Patrick T. O'Gara, Carlos E. Ruiz, Nikolaos J. Skubas, Paul Sorajja, Thoralf M. Sundt III and James D. Thomas

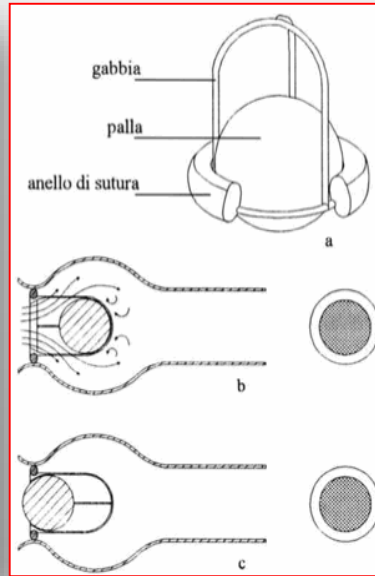
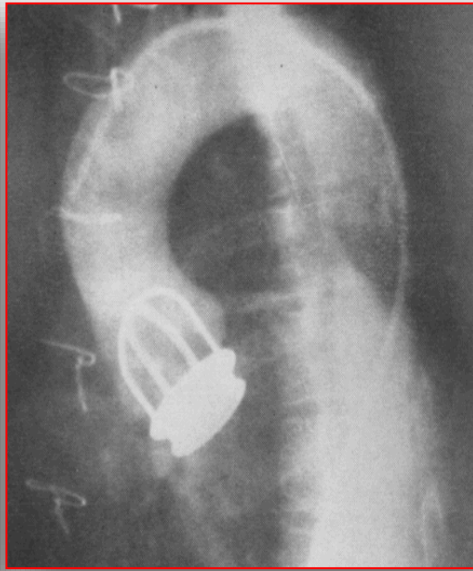
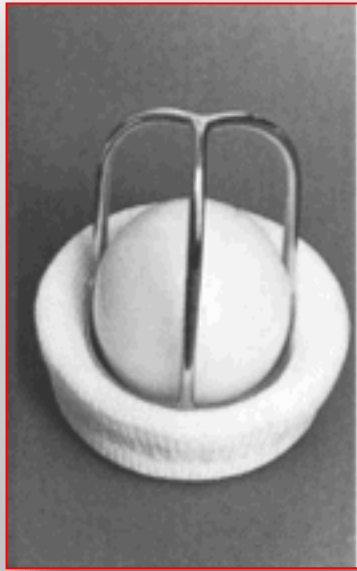
### Summary of Recommendations for Prosthetic Valve Choice

Recommendations	COR	LOE
Choice of valve intervention and prosthetic valve type should be a shared decision process	I	C
A bioprosthesis is recommended in patients of any age for whom anticoagulant therapy is contraindicated, cannot be managed appropriately, or is not desired	I	C
A mechanical prosthesis is reasonable for AVR or MVR in patients <60 y of age who do not have a contraindication to anticoagulation	IIa	B
A bioprosthesis is reasonable in patients >70 y of age	IIa	B
Either a bioprosthetic or mechanical valve is reasonable in patients between 60 y and 70 y of age	IIa	B
Replacement of the aortic valve by a pulmonary autograft (the Ross procedure), when performed by an experienced surgeon, may be considered in young patients when VKA anticoagulation is contraindicated or undesirable	IIb	C

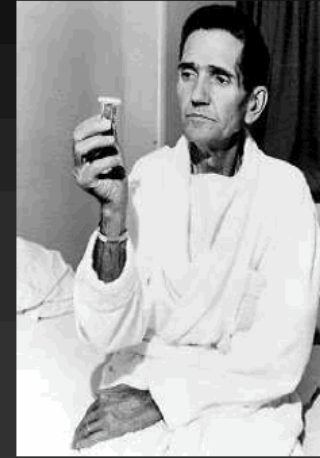


# Types of Artificial Heart Valves: mechanical

1960 HARKEN-SOROFF aortic prosthesis - STARR-EDWARDS mitral valve



## Starr Edwards



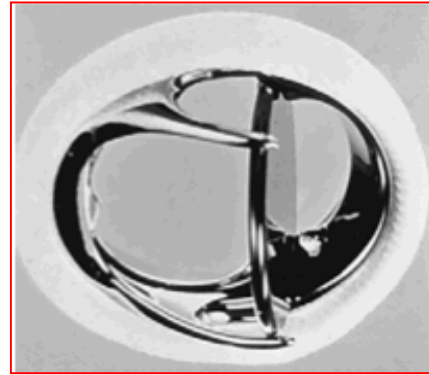
- Philip Admunson, stenosi mitralica;
- 02/09/1960, la prima sostituzione valvolare mitralica nell'uomo coronata da successo;
- Sopravvisse per 15 anni, morì per caduta accidentale mentre verniciava casa.

- FLUSSO PERIFERICO E TURBOLENTO
- ALTO GRADIENTE TRANSPROTEICO
- ALTA TROMBOGENICITA'

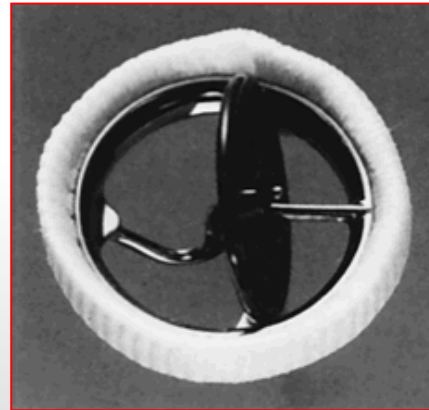


# Mechanical prosthesis: single-disc

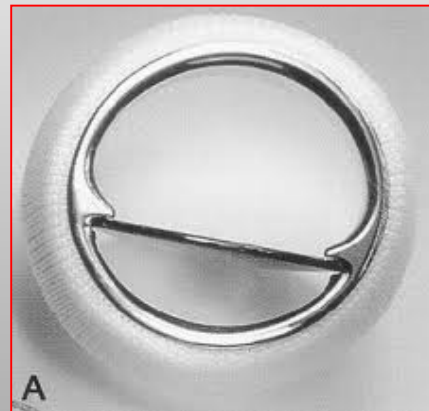
1967 - LILLEHEI-KASTER



1968 BJORK-SHILEY e  
1982 BJORK-SHILEY C-C



1977 MEDTRONIC



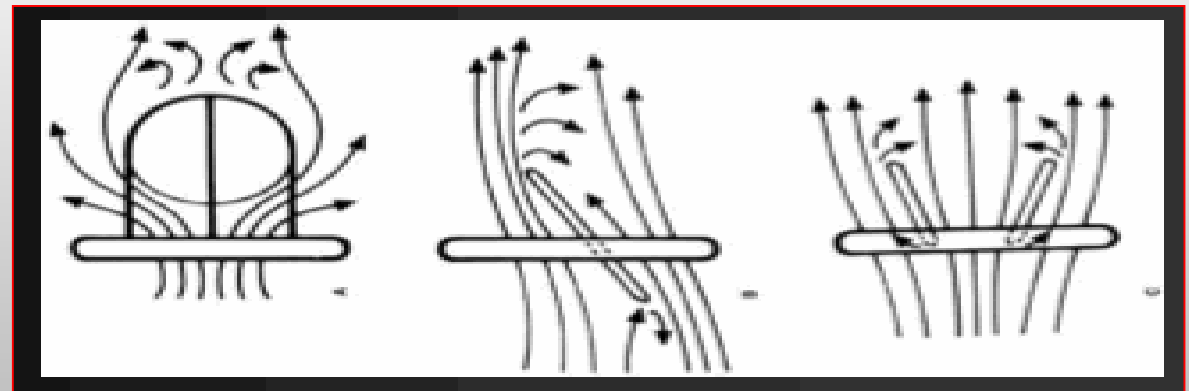
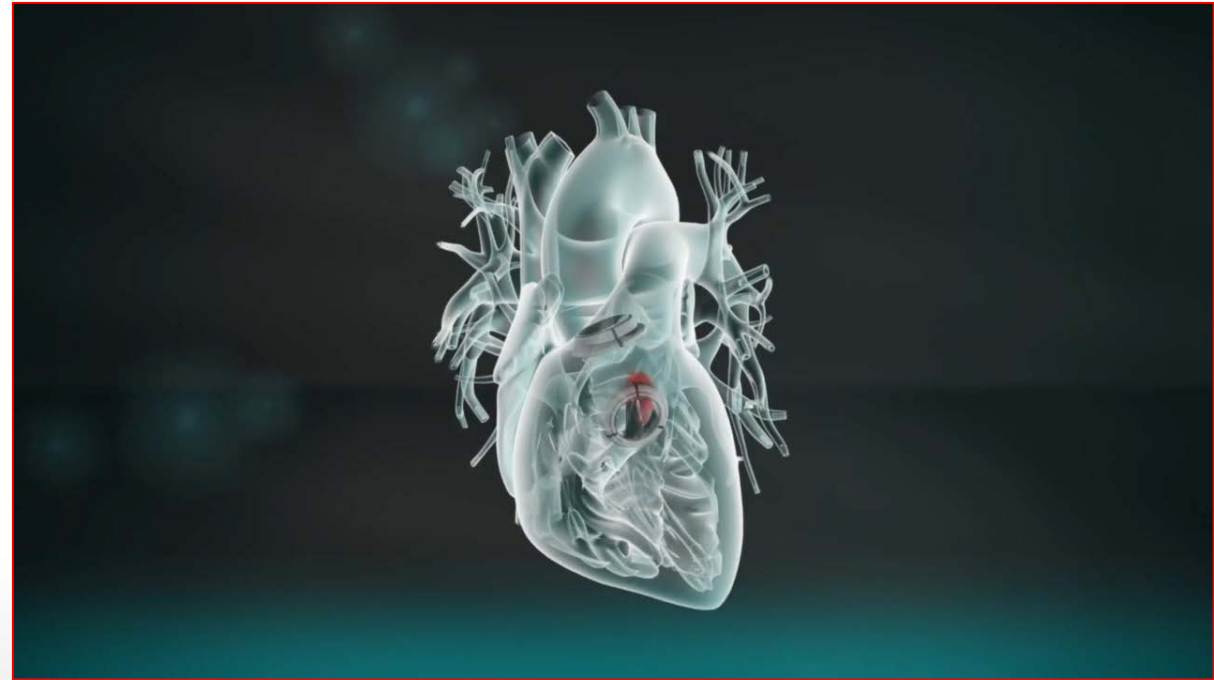
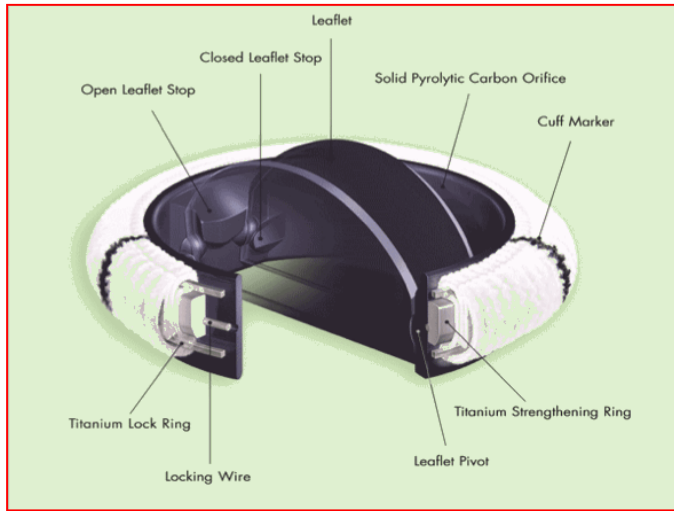
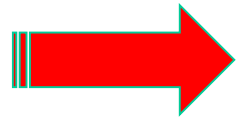
1978 OMNISCIENCE I  
1982 OMNISCIENCE II





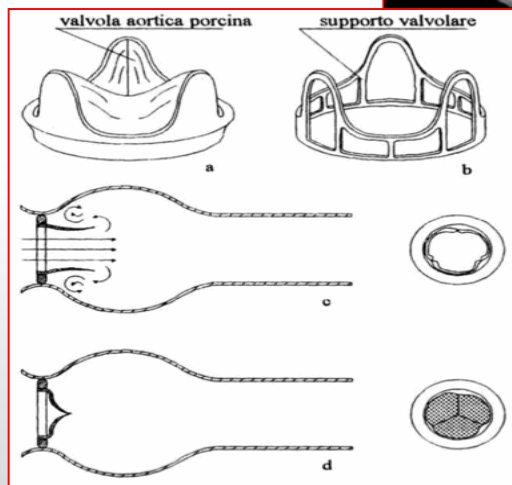
# Mechanical prosthesis BILEAFLET

1977

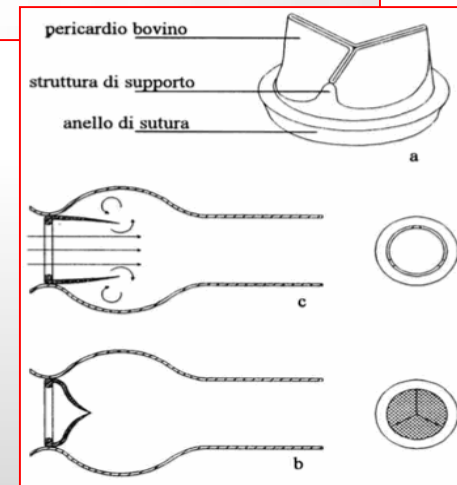


# Biological prosthesis since 1970

## VALVOLE PORCINE



## VALVOLE PERICARDIO BOVINO



## Stentless dal 1991



# Ideal valve



1. Good hemodynamic
2. Quiet
3. Require no anticoagulation
4. Last for life time
5. Cheap
6. Easy to implant



Two historic randomized clinical trials compared outcomes after valve replacement with a first-generation porcine heterograft and the original Bjork-Shiley tilting-disc mechanical valve:

*The Edinburgh Heart Valve Trial*, conducted between 1975 and 1979 with an average follow-up of 12 years

*The Veteran Affairs (VA) Cooperative Study on Valvular Heart Disease*, conducted between 1979 and 1982 with an average follow-up of 15 years.

## *The Edinburgh trial*

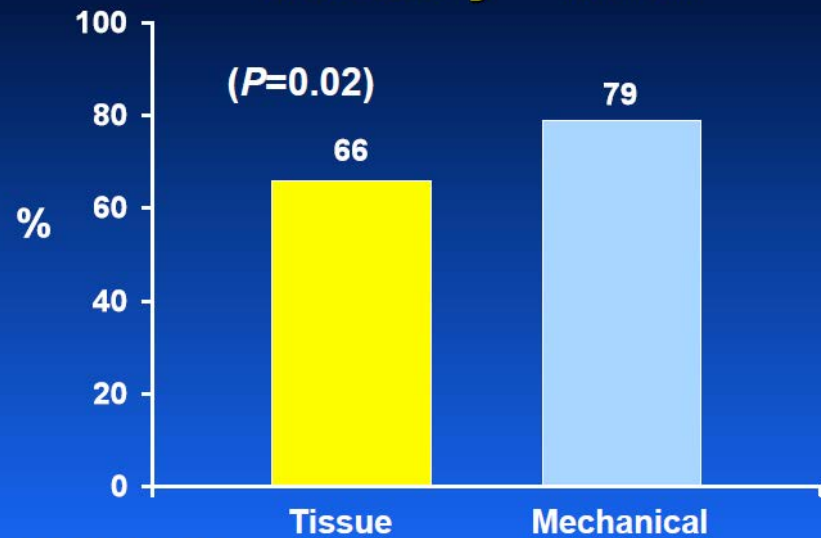
a small survival advantage associated with a mechanical valve in the aortic but not in the mitral position

*both trials* showed:

- increased bleeding associated with mechanical valves
- increased reoperation with tissue valves;
- structural failure of tissue valves and overall thromboembolic complications were greater after mitral than after aortic valve replacement.

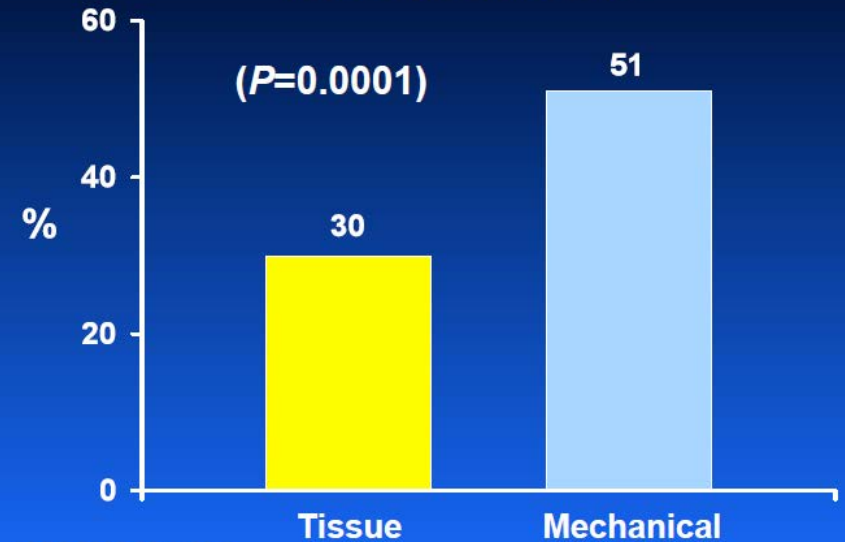


## Survival 15 Yr Postop VA Study – AVR



JACC 2000;36:1152-8

## Bleeding During 16 Yr Follow-up Aortic Valve



JACC 2000;36:1152-8

The investigators found that patients younger than 65 years who received a bioprosthetic valve had a greater rate of primary valve failure for both aortic valve replacements (AVR) and mitral valve replacements (MVR) 15 years after implantation compared with similarly aged patients with mechanical valve replacements (bioprosthetic vs mechanical 26% vs 0%, P, 0.001 for AVR and 44% vs 4%, P, 0.001 for MVR).

This large randomized control study demonstrates the excellent durability of mechanical heart valves compared with bioprosthetic heart valves.



Clinical study: cardiac surgery

Journal of the American College of Cardiology

Outcomes 15 years after valve replacement with a mechanical versus a bioprosthetic valve: final report of the Veterans Affairs randomized trial ☆

Karl Hammermeister MD,

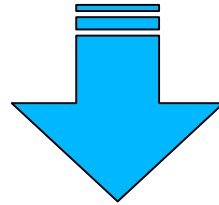


## Mechanical valve advantages

The most important of which is their greater durability (20–30 years), their greater durability translates into lower reoperation rates among these patients

# Mechanical valve disadvantages

Blood flow around the mechanical valve results in high shear stresses, which can result in platelet activation and a higher risk for thrombosis on the valve surface and a subsequent risk for embolism.



## COUMADIN --WARFARIN

**The Journal of Thoracic and Cardiovascular Surgery**

**Patient outcome after aortic valve replacement with a mechanical or biological prosthesis: Weighing lifetime anticoagulant-related event risk against reoperation risk**

Martijn W. A. van Geldorp,

Although warfarin use is efficacious in reducing thrombosis risk, it heightens hemorrhagic risk

*... 60-year-old male with a mechanical valve replacement has a lifetime risk of bleeding of 41% compared with a 12% risk in a similar patient with a bioprosthetic valve replacement*

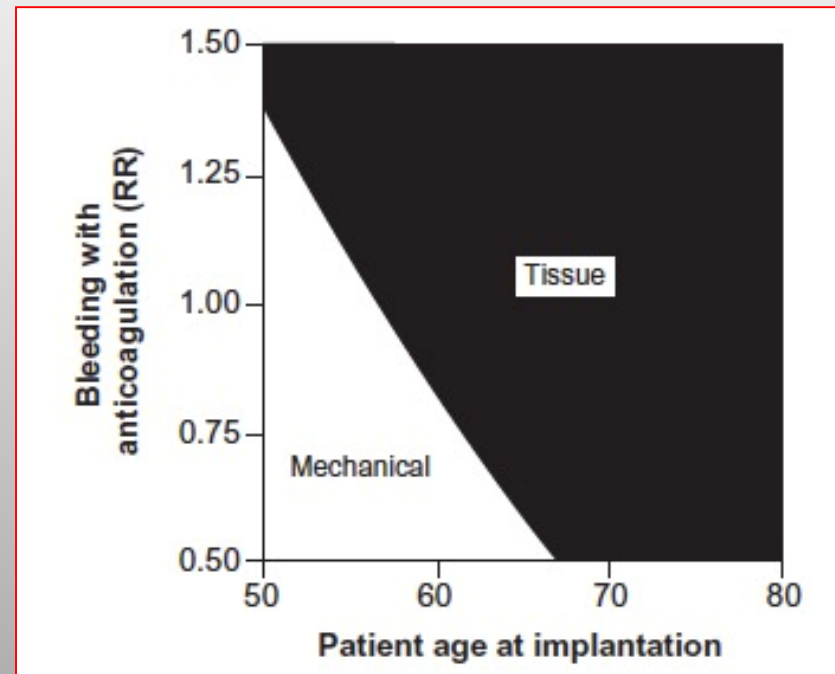
# Anticoagulation and bleeding

## Assessment of a bleeding risk index in two cohorts of patients treated with oral anticoagulants.


the risk of bleeding from anticoagulant therapy increases as patients age.

1996

Patients with mechanical valves on anticoagulation therapy who are older than 60 years are nearly 7 times more likely to bleed than patients younger than 60. The increased risk of bleeding with a mechanical valve replacement in older patients further supports avoiding mechanical valves in this population.







# Choice of Prosthetic Heart Valve in Adults

## An Update

Shahbudin H. Rahimtoola, MB, FRCP, DSc (Hon)

2010

Therapeutic levels of warfarin are difficult to achieve and maintain, due to both barriers to adherence and the variety of interactions that warfarin has with other medications and diet. A recent study underscored this difficulty by demonstrating that **only 62%** of those patients with a mechanical valve on **anticoagulation** medication are found within the **appropriate** international normalized ratio (INR) range, even in the setting of adequate medication adherence.

Journal of the American College of Cardiology

## **Thromboembolic and Bleeding Complications in Patients With Mechanical Heart Valve Prostheses**

S.C. Cannegieter, MD; F.R. Rosendaal, MD; E. Briët, MD

*Circulation 1994*

### Incidence of major embolism after mechanical valve replacement

#### Absence of antithrombotic therapy

4% per year - plus 1.8% per year risk of valve thrombosis

#### Antiplatelet therapy

2.2% per year - plus 1.6% per year risk of valve thrombosis

#### Warfarin therapy

1% per year

0.8% per year with an aortic valve

1.3% per year with a mitral valve

plus 0.2% per year risk of valve thrombosis

#### Incidence of major bleeding in patients treated with warfarin

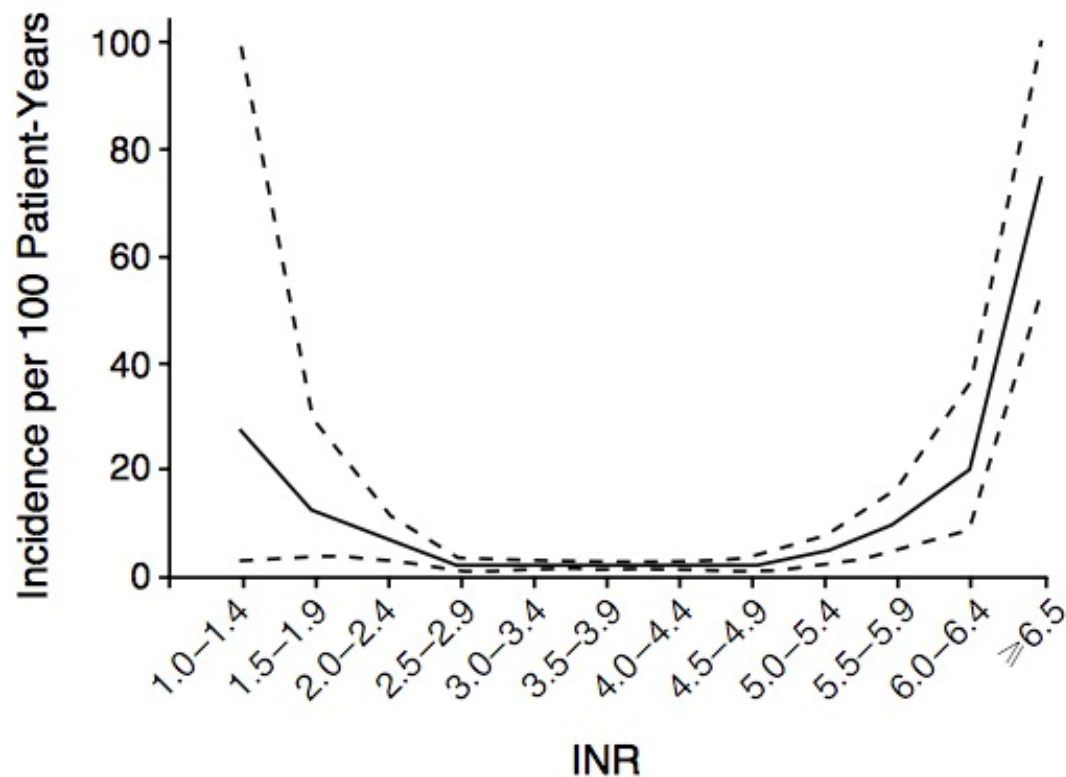
1.4 per 100 patient-years.

# OPTIMAL ORAL ANTICOAGULANT THERAPY IN PATIENTS WITH MECHANICAL HEART VALVES

S.C. CANNEGIETER, M.D., F.R. ROSENDAAL, M.D., A.R. WINTZEN, M.D., F.J.M. VAN DER MEER, M.D., J.P. VANDENBROUCKE, M.D., AND E. BRIËT, M.D.

## Adverse Events Are Common with Mechanical Valves

INR-Specific Incidence Of All Adverse Events



The NEW ENGLAND  
JOURNAL of MEDICINE



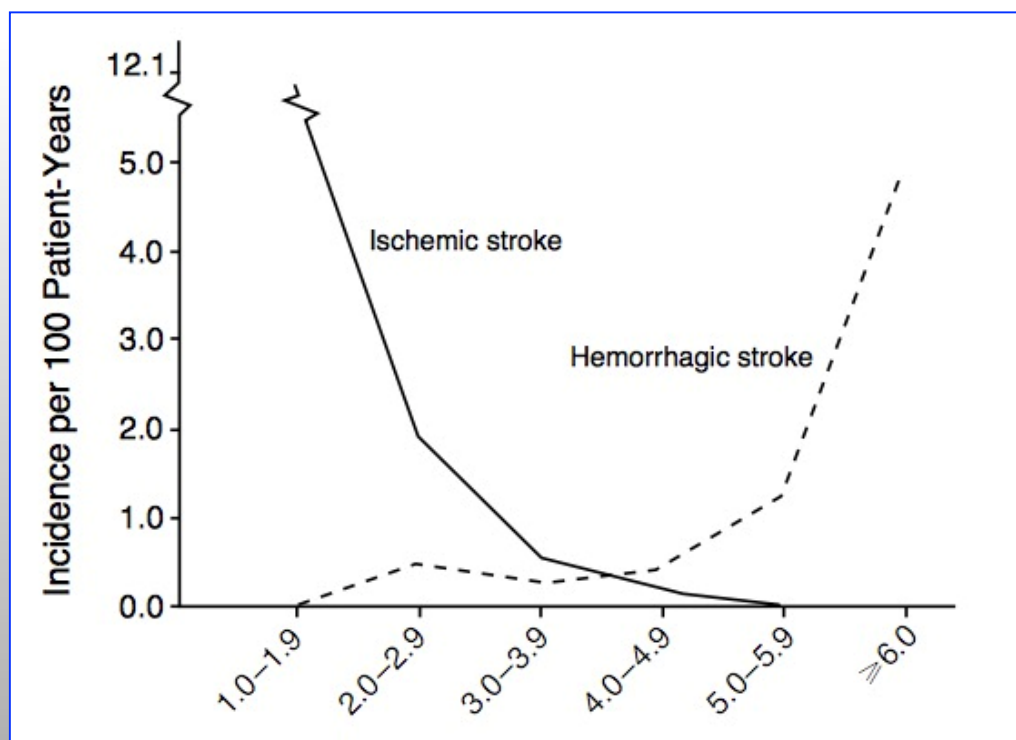
# OPTIMAL ORAL ANTICOAGULANT THERAPY IN PATIENTS WITH MECHANICAL HEART VALVES

S.C. CANNEGIETER, M.D., F.R. ROSENDAAL, M.D., A.R. WINTZEN, M.D., F.J.M. VAN DER MEER, M.D., J.P. VANDENBROUCKE, M.D., AND E. BRIËT, M.D.


## Adverse Events Are Common with Mechanical Valves

INR-Specific Incidence Of All Adverse Events

Incidence of Ischemic and Hemorrhagic Stroke According to INR Category.



The NEW ENGLAND  
JOURNAL of MEDICINE

- 
- A white horse with its wings spread, standing on a dark surface. The horse is the central focus of the image, with its wings fully extended to the sides. The background is dark and out of focus.
- You'll Never Need Another Operation
  - You can Live without Restrictions
  - Risks of TE are Minimal
  - Coumadin is Not a Problem

**Myths about Mechanical Valves**



***WHAT HAS CHANGED IN CARDIAC SURGERY?***

***Biological or mechanical  
valve prosthesis?***



The main advantage  
with bioprosthesis



**The Journal of Thoracic and Cardiovascular Surgery**

**Patient outcome after aortic valve replacement with a mechanical or biological prosthesis: Weighing lifetime anticoagulant-related event risk against reoperation risk**

Martijn W. A. van Geldorp,

**Conclusion:** Even for patients aged 60 years, event-free life expectancy is better with a bioprosthesis. Although the chance of reoperation is higher, the lifetime risk of bleeding is lower compared with a mechanical prosthesis. Comparing lifetime event risks between different types of valve prostheses provides more insight into patient outcome after aortic valve replacement and aids patient selection and counseling.

## **Prognosis After Aortic Valve Replacement With a Bioprosthesis Predictions Based on Meta-Analysis and Microsimulation**

J. P. A. Puvimanasinghe, 2010

Accordingly, patients with bioprosthetic valves have a significantly decreased risk of bleeding.

### The bioprosthetic valve also has disadvantages

The process of structural valve deterioration is poorly understood but is thought to result from the accumulation of calcium and lipids on the valve surface.

Improvements in second-generation bioprosthetic valves have reduced the rapidity of deterioration compared with first-generation valves, but structural valve deterioration remains a major disadvantage for bioprosthetic valves.<sup>10</sup>

For most patients with a bioprosthetic valve, structural valve deterioration begins around 5 years post-implantation and rapidly increases.

# Which biologic valve should we select for the 45- to 65-year-old age group requiring aortic valve replacement?

F. Dagenais, MD, P. Cartier, MD,<sup>†</sup> P. Voisine, MD, D. Desaulniers, MD, J. Perron, MD, R. Baillot, MD, G. Raymond, MD, J. Métras, MD, D. Doyle, MD, and P. Mathieu, MD

THE JOURNAL OF  
**THORACIC** AND  
**CARDIOVASCULAR SURGERY**

2005

There are trends in the United States and Europe toward the increasing use of tissue rather than mechanical valves and toward the use of bioprostheses in progressively younger patients



# Age and Valve Size Effect on the Long-Term Durability of the Carpentier-Edwards Aortic Pericardial Bioprosthesis

Ann Thorac Surg 2001,

Michael K. Banbury, MD, Delos M. Cosgrove III, MD, Jennifer A. White, MS, Eugene H. Blackstone, MD, Robert W. M. Frater, MD, and J. Edward Okies, MD

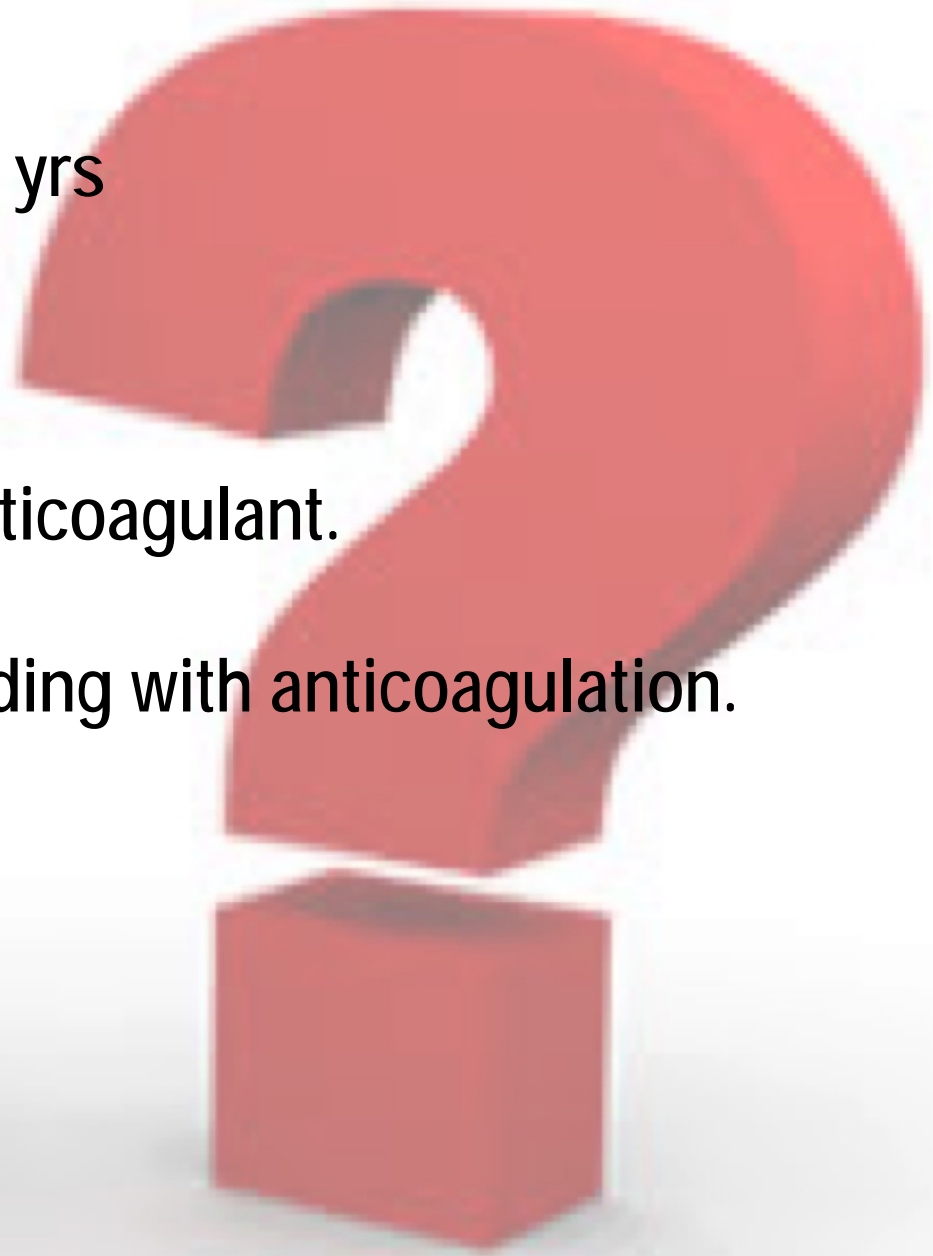
## Freedom from structural valve deterioration

- Carpentier-Edwards pericardial aortic valve (age 65)
  - 94% at 10 years
  - 77% at 15 years
  - 10% chance that a 65-year-old patient would require reoperation before 80 years
- Third-generation bioprostheses may be even more durable, with
  - 92.8% at 12 years (mean age of 54 years)

In addition, advances in myocardial protection and cardiac surgical techniques have led to lower risks at reoperation, making the prospect of redo valve surgery less dangerous.

# Why bioprosthesis ?

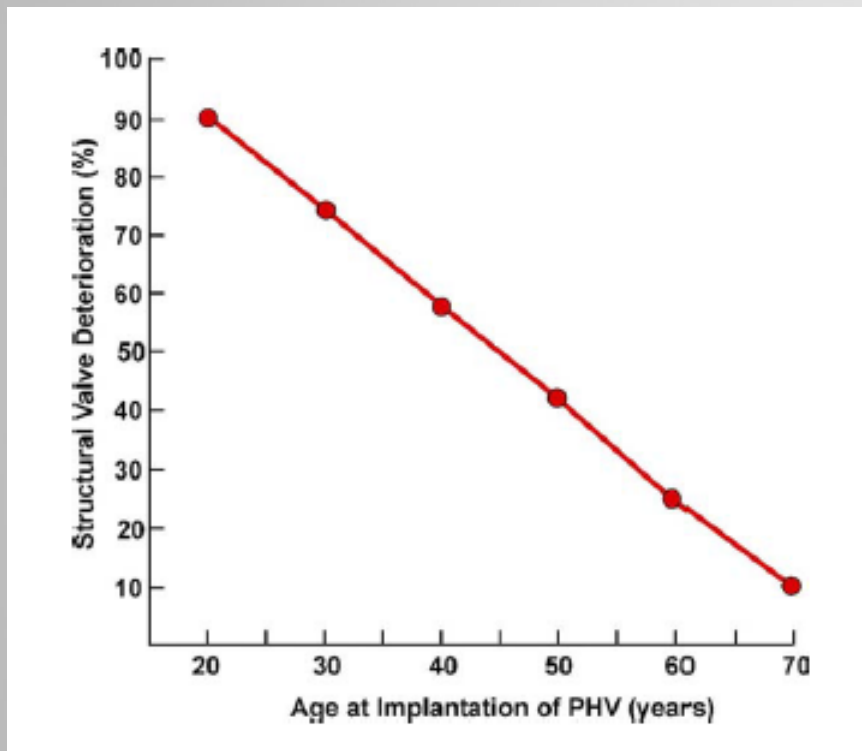
- Expected life expectancy < 10-12 yrs
- Anticoagulation contraindicated.
- Patient cannot or will not take anticoagulant.
- Patient at increased risk for bleeding with anticoagulation.
- INR difficult to control
- Poor compliance



# Late incidence and determinants of reoperation in patients with prosthetic heart valves<sup>☆</sup>

Marc Ruel<sup>a,b,\*,‡</sup>, Alexander Kulik<sup>a</sup>, Fraser D. Rubens<sup>a</sup>, Pierre Bédard<sup>a</sup>, Roy G. Masters<sup>a</sup>, Andrew L. Pipe<sup>a</sup>, Thierry G. Mesana<sup>a</sup>

- *Età*



SVD of Biological Valves at 15 to 20 Years  
Based on Patient Age at Time of PHV Implantation

- *Insufficienza renale*
- *Iperparatiroidismo*
- *Ipertensione sistemica*
- *Ipertrofia Vsx*
- *Funzione Vsx depressa*
- *Size della protesì*

**Predittori di degenerazione strutturale delle bioprotesi**

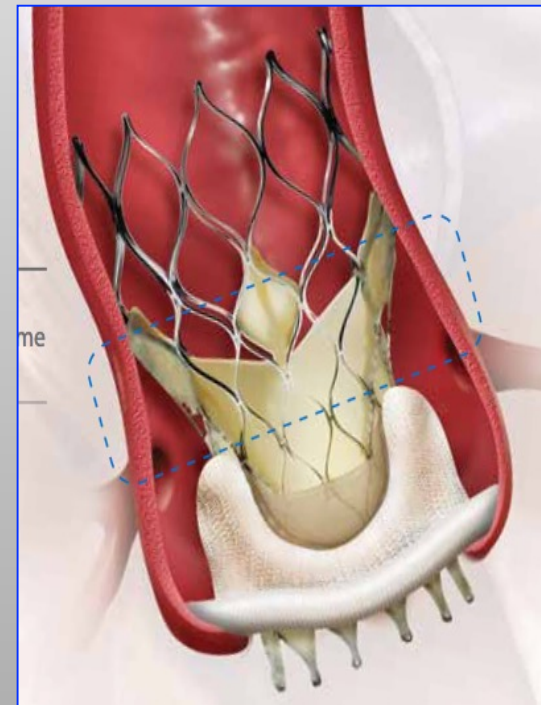


# Reasons for increasing use of Bioprosthesis

- Newer generation bioprosthesis are more durable and better.
- Reoperation rates for patients over 65 years of age are particularly low with modern stented bioprostheses,
- Patients undergoing AVR today are older population than those studied in the randomized trials.
- Young patients undergoing aortic valve surgery are often reluctant to accept warfarin therapy and the activity constraints associated with anticoagulants.
- There are some non randomized but relatively large comparative trials that have shown apparent survival benefit for patients receiving bioprostheses, particularly for those over the age of 65 years
- The risks of reoperation have continued to decrease, redo less dangerous, TAVI valve-in-valve

## Transcatheter Valve-in-Valve Implantation for Failed Surgical Bioprosthetic Valves

Ronen Gurvitch, MBBS,\*† Anson Cheung, MD,\* Jian Ye, MD,\* David A. Wood, MD,\*  
Alexander B. Willson, MBBS,\* Stefan Toggweiler, MD,\* Ronald Binder, MD,\* John G. Webb, MD\*  
*Vancouver, British Columbia, Canada; and Melbourne, Victoria, Australia*



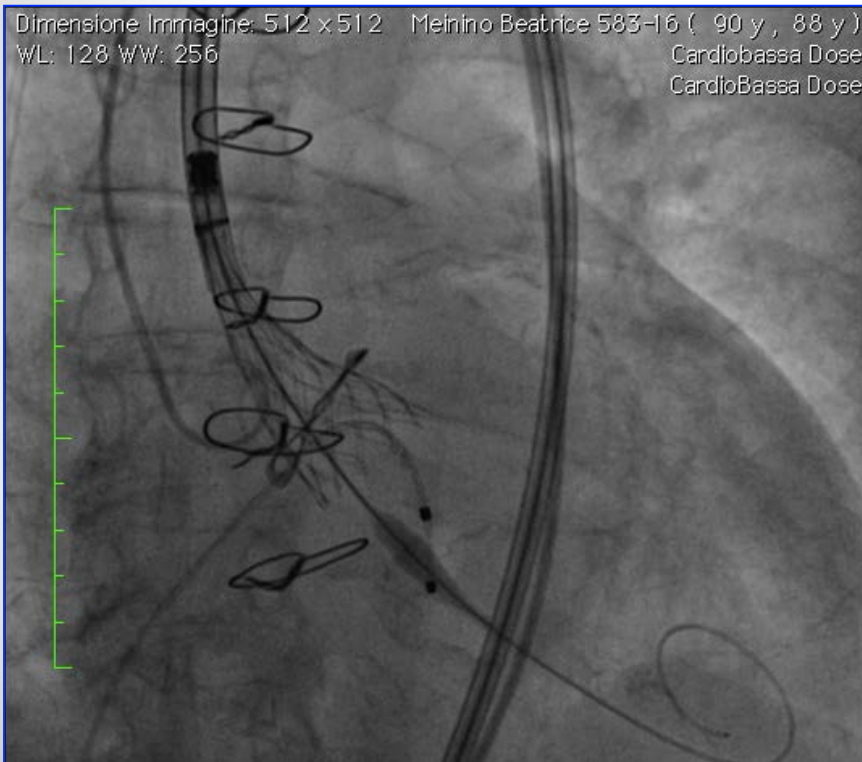
# Cardiologia

## Maria Pia Hospital - Torino

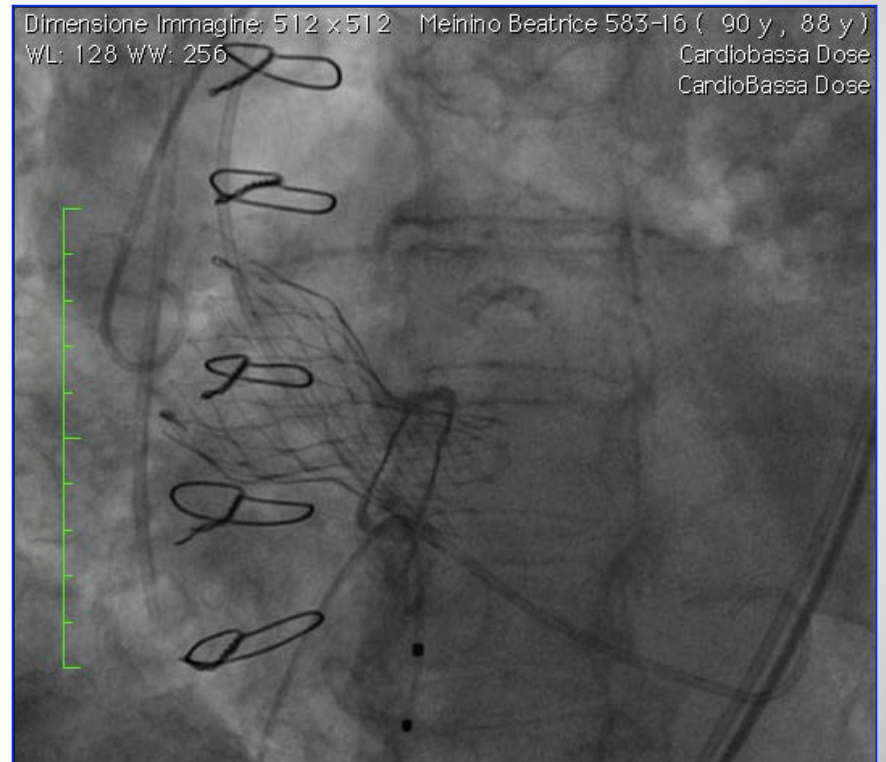
### GVM Care & Research



Dimensione Immagine: 512 x 512 Meirino Beatrice 583-16 ( 90 y , 88 y )  
WL: 128 WW: 256  
Cardiobassa Dose  
CardioBassa Dose

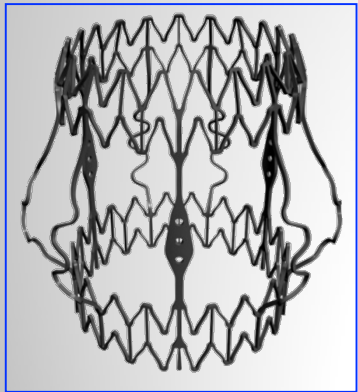


Dimensione Immagine: 512 x 512 Meirino Beatrice 583-16 ( 90 y , 88 y )  
WL: 128 WW: 256  
Cardiobassa Dose  
CardioBassa Dose





# Sutureless



PERCEVAL S

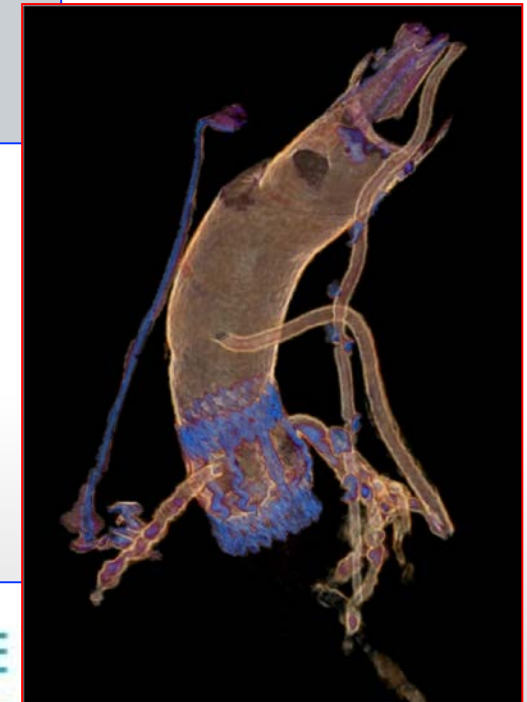
Facile	Tecnica di Impianto Chiara e Rapida Utilizzo tecnica operatoria chirurgica
Efficace	Livello Elevato di Performance Emodinamica Risultati superiori agli standard attuali
Safe	Ridotto Tempo di Ischemia Miocardica Bassa percentuale di complicanze

PERCEVAL S A NEW INNOVATIVE  
SELF-ANCHORING BIOPROSTHESIS:  
THE RESULTS OF THE FIRST 180 PATIENTS,  
AT 2 YEARS FOLLOW-UP

Prof. F. Laborde

Institution: L'Institut Mutualiste Montsouris, Paris - France.

Presentation: EACTS 2010, Geneva - Switzerland.

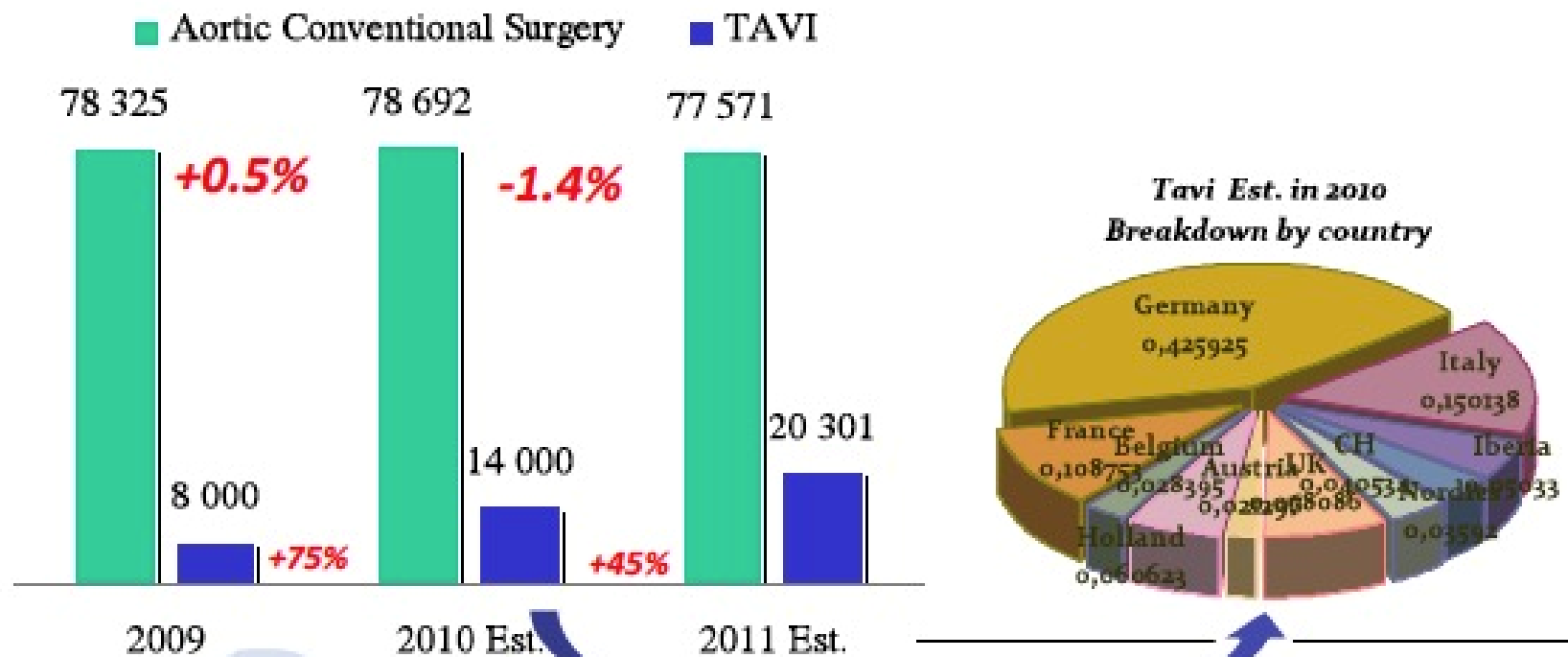


CELEBRATING 10 YEARS OF PERCEVAL CLINICAL USE  
Perceval is designed for Long Term Durability



#MY10YEARS

## Europe Market evolution TAVI vs. Aortic Valve Surgery



Sources: TAVI est. by Morgan Stanley Research Nov 2010, Company Data, Biba Research, National Registries

# 2017 ESC/EACTS Guidelines for the management of valvular heart disease

	Favours TAVI	Favours SAVR
<b>Clinical characteristics</b>		
STS/EuroSCORE II <4% (logistic EuroSCORE I <10%)*		+
STS/EuroSCORE II ≥4% (logistic EuroSCORE I ≥10%)*	+	
Presence of severe comorbidity (not adequately reflected by scores)	+	
Age <75 years		+
Age ≥75 years	+	
Previous cardiac surgery	+	
Frailty <sup>b</sup>	+	
Restricted mobility and conditions that may affect the rehabilitation process after the procedure	+	
Suspicion of endocarditis		+

	Favours TAVI	Favours SAVR
<b>Anatomical and technical aspects</b>		
Favourable access for transfemoral TAVI	+	
Unfavourable access (any) for TAVI		+
Sequelae of chest radiation	+	
Porcelain aorta	+	
Presence of intact coronary bypass grafts at risk when sternotomy is performed	+	
Expected patient–prosthesis mismatch	+	
Severe chest deformation or scoliosis	+	
Short distance between coronary ostia and aortic valve annulus		+
Size of aortic valve annulus out of range for TAVI		+
Aortic root morphology unfavourable for TAVI		+
Valve morphology (bicuspid, degree of calcification, calcification pattern) unfavourable for TAVI		+
Presence of thrombi in aorta or LV		+

	Favours TAVI	Favours SAVR
<b>Cardiac conditions in addition to aortic stenosis that require consideration for concomitant intervention</b>		
Severe CAD requiring revascularization by CABG		+
Severe primary mitral valve disease, which could be treated surgically		+
Severe tricuspid valve disease		+
Aneurysm of the ascending aorta		+
Septal hypertrophy requiring myectomy		+





# 2017 ESC/EACTS Guidelines for the management of valvular heart disease

## Management of atrial fibrillation in patients with VHD

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
<b>Anticoagulation</b>		
NOACs should be considered as an alternative to VKAs in patients with aortic stenosis, aortic regurgitation and mitral regurgitation presenting with atrial fibrillation. <sup>38–41</sup>	<b>IIa</b>	<b>B</b>
NOACs should be considered as an alternative to VKAs after the third month of implantation in patients who have atrial fibrillation associated with a surgical or transcatheter aortic valve bioprosthesis.	<b>IIa</b>	<b>C</b>
The use of NOACs is not recommended in patients with atrial fibrillation and moderate to severe mitral stenosis.	<b>III</b>	<b>C</b>
NOACs are contraindicated in patients with a mechanical valve. <sup>45</sup>	<b>III</b>	<b>B</b>

## Surgical interventions

Surgical ablation of atrial fibrillation should be considered in patients with symptomatic atrial fibrillation who undergo valve surgery. <sup>37</sup>	<b>IIa</b>	<b>A</b>
Surgical ablation of atrial fibrillation may be considered in patients with asymptomatic atrial fibrillation who undergo valve surgery, if feasible, with minimal risk.	<b>IIb</b>	<b>C</b>
Surgical excision or external clipping of the LA appendage may be considered in patients undergoing valve surgery. <sup>46</sup>	<b>IIb</b>	<b>B</b>

# Choice of prosthetic valve

The choice between a mechanical and a biological valve in adults is determined mainly by estimating the risk of anticoagulation-related bleeding and thromboembolism with a mechanical valve versus the risk of structural valve deterioration with a bioprosthesis and by considering the patient's lifestyle and preferences.

Rather than setting arbitrary age limits, prosthesis choice should be discussed in detail with the informed patient, cardiologists and surgeons, taking into account the factors detailed below.

## 2017 ESC/EACTS Guidelines for the management of valvular heart disease

**Choice of the aortic/mitral prosthesis in favour of a mechanical prosthesis; the decision is based on the integration of several of the following factors**

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
A mechanical prosthesis is recommended according to the desire of the informed patient and if there are no contraindications to long-term anticoagulation. <sup>c</sup>	I	C
A mechanical prosthesis is recommended in patients at risk of accelerated structural valve deterioration. <sup>d</sup>	I	C
A mechanical prosthesis should be considered in patients already on anticoagulation because of a mechanical prosthesis in another valve position.	IIa	C
A mechanical prosthesis should be considered in patients <60 years of age for prostheses in the aortic position and <65 years of age for prostheses in the mitral position. <sup>e</sup>	IIa	C
A mechanical prosthesis should be considered in patients with a reasonable life expectancy <sup>f</sup> for whom future redo valve surgery would be at high risk.	IIa	C
A mechanical prosthesis may be considered in patients already on long-term anticoagulation due to the high risk for thromboembolism. <sup>g</sup>	IIb	C

## 2017 ESC/EACTS Guidelines for the management of valvular heart disease

**Choice of the aortic/mitral prosthesis in favour of a bioprosthesis; the decision is based on the integration of several of the following factors**

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
A bioprosthesis is recommended according to the desire of the informed patient.	I	C
A bioprosthesis is recommended when good-quality anticoagulation is unlikely (compliance problems, not readily available) or contraindicated because of high bleeding risk (previous major bleed, comorbidities, unwillingness, compliance problems, lifestyle, occupation).	I	C
A bioprosthesis is recommended for reoperation for mechanical valve thrombosis despite good long-term anticoagulant control.	I	C
A bioprosthesis should be considered in patients for whom there is a low likelihood and/or a low operative risk of future redo valve surgery.	IIa	C
A bioprosthesis should be considered in young women contemplating pregnancy.	IIa	C
A bioprosthesis should be considered in patients >65 years of age for a prosthesis in the aortic position or >70 years of age in a mitral position or those with a life expectancy <sup>c</sup> lower than the presumed durability of the bioprosthesis. <sup>d</sup>	IIa	C





# Conclusion



Improvements in tissue valves and implantation technique may reduce structural valve deterioration, thus improving valve durability and reducing reoperation rates.

Any or all of these innovations would substantially affect the current considerations in prosthetic valve selection.

Optimal valve selection results when the patient and provider carefully consider the advantages and disadvantages of each valve type in the context of the individual patient's age, clinical conditions, values, and lifestyle desires.



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