

**Il timing della terapia chirurgica
In quali casi è lecito attendere?
Intervento precoce: quando ricorrervi?**

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Evolving Epidemiology of Infective Endocarditis

MAJOR TRENDS

- More valvular prostheses → prosthetic valve endocarditis
- More intravascular devices → device-related endocarditis
- More antibiotic resistance among the etiologic organisms
- More patients with major comorbid conditions (diabetes, dialysis-dependent renal failure, drug abuse, AIDS)
- More patients with hospital-acquired endocarditis
- More patients with staphylococcal infections

MORTALITY

- EI in pts receiving hemodialysis → 56 % at 1 year
- EI in pts with prosthetic valve E → up to 46 %
- Nosocomial cases → up to 68 %

MAJOR CONTRIBUTING FACTORS TO THESE HIGH MORTALITY RATES

- Staphylococcus Aureus (antibiotic-sensitive or resistant)
- Coagulase-negative Staphylococci
- Staphylococcus Lugdunensis



Infective Endocarditis

Heterogeneous and uncommon syndrome

- Etiology
- Pathophysiology
- Localization
- Morphology
- Extension

Clinical variability

- Asymptomatic
- Nonspecific signs
- No cardiac-related
- Heart failure → Cardiogenic shock
- Sepsis → Septic shock

Different treatment and prognosis



Why surgery in case of Endocarditis

- Eradication of all infected and necrotic tissues
- Repair of anatomic defects caused by tissue destruction
- Suturing / anchoring for the prosthetic valve

Why early surgery in pts with aortic valve Endocarditis

- Prevention of systemic embolism
- Prevention of death caused by heart failure
- Prevention of irreversible damage caused by severe infection



Recommendations for Surgery for Prosthetic Valve Endocarditis

Indication	Class
1 Early prosthetic valve endocarditis (first 2 months or less after surgery)	I
2 Heart failure with prosthetic valve dysfunction	I
3 Fungal endocarditis	I
4 Staphylococcal endocarditis not responding to antibiotic therapy	I
5 Evidence of paravalvular leak, annular or aortic abscess, sinus or aortic true or false aneurysm, fistula formation, or new-onset conduction disturbances	I
6 Infection with gram-negative organisms or organisms with a poor response to antibiotics	I
7 Persistent bacteremia after a prolonged course (7 to 10 days) of appropriate antibiotic therapy without noncardiac causes for bacteremia	IIa
8 Recurrent peripheral embolus despite therapy	IIa
9 Vegetation of any size on or near the prosthesis	IIb

ACC/AHA Practice Guidelines
Circulation 1998; 98: 1949-84



acute endocarditis - role of cardiac surgery

Indication for surgery in pts with IE

Evidence based

Emergency indication for cardiac surgery (same day)

- * Acute AR with early closure of mitral valve A
- * Rupture of a sinus Valsalva aneurysm into the right heart chamber A
- * Rupture into the pericardium A

Urgent indication for cardiac surgery (within 1-2 days)

- * Valvular obstruction A
- * Unstable prosthesis A
- * Acute AR or MR with heart failure, NYHA III-IV A
- * Septal perforation A
- * Evidence of annular or aortic abscess, sinus or aortic true or false aneurysm, fistula formation, or new onset conduction disturbances A
- * Major embolism + mobile vegetation > 10 mm + appropriate antibiotic therapy < 7-10 days B
- * Mobile vegetation > 15 mm + appropriate antibiotic therapy < 7-10 days C
- * No effective antimicrobial therapy available A

Elective indication for cardiac surgery (earlier is usually better)

- * Staphylococcal prosthetic valve endocarditis B
- * Early prosthetic valve endocarditis (\leq 2 mo after surgery) B
- * Evidence of progressive paravalvular prosthetic leak A
- * Evidence of valve dysfunction and persistent infection after 7-10 days of appropriate antibiotic therapy, as indicated by presence of fever or bacteremia, provided there are no noncardiac causes for infection A
- * Fungal endocarditis caused by a mold A
- * Fungal endocarditis caused by a yeast B
- * Infection with difficult-to-treat organisms B
- * Vegetation growing larger during antibiotic therapy > 7 days C

Olaison

Cardiol Clin

2003; 21: 235-51

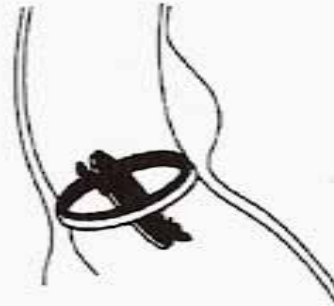


Complications of Endocarditis



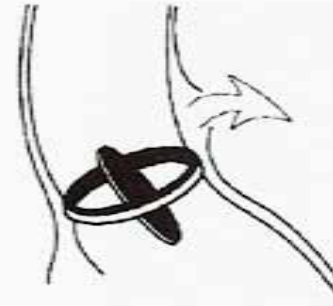
Abscess

1. Protracted sepsis
2. 1st AV block
3. Normal valve function
4. CHF may or may not be present



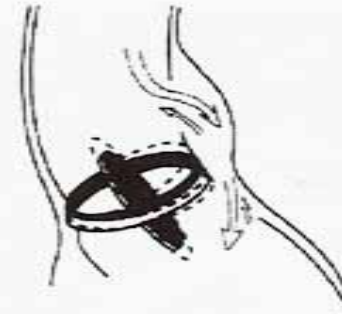
Abscess & Vegetation(s)

1. Protracted sepsis
2. 1st AV block
3. Valve obstruction or regurgitation
4. New or worsening CHF



Ruptured Abscess

1. Sepsis may improve
2. 1st AV block and/or incomplete RBBB
3. ↑ Forward velocities, i.e., relative stenosis
4. New or worsening CHF



Ruptured Abscess & Valve Dehiscence

1. Sepsis may or may not improve
2. 1st or higher AV block, or incomplete RBBB, or complete BBBs
3. Severe perivalvular leak, variable valve stenosis
4. Significant worsening CHF



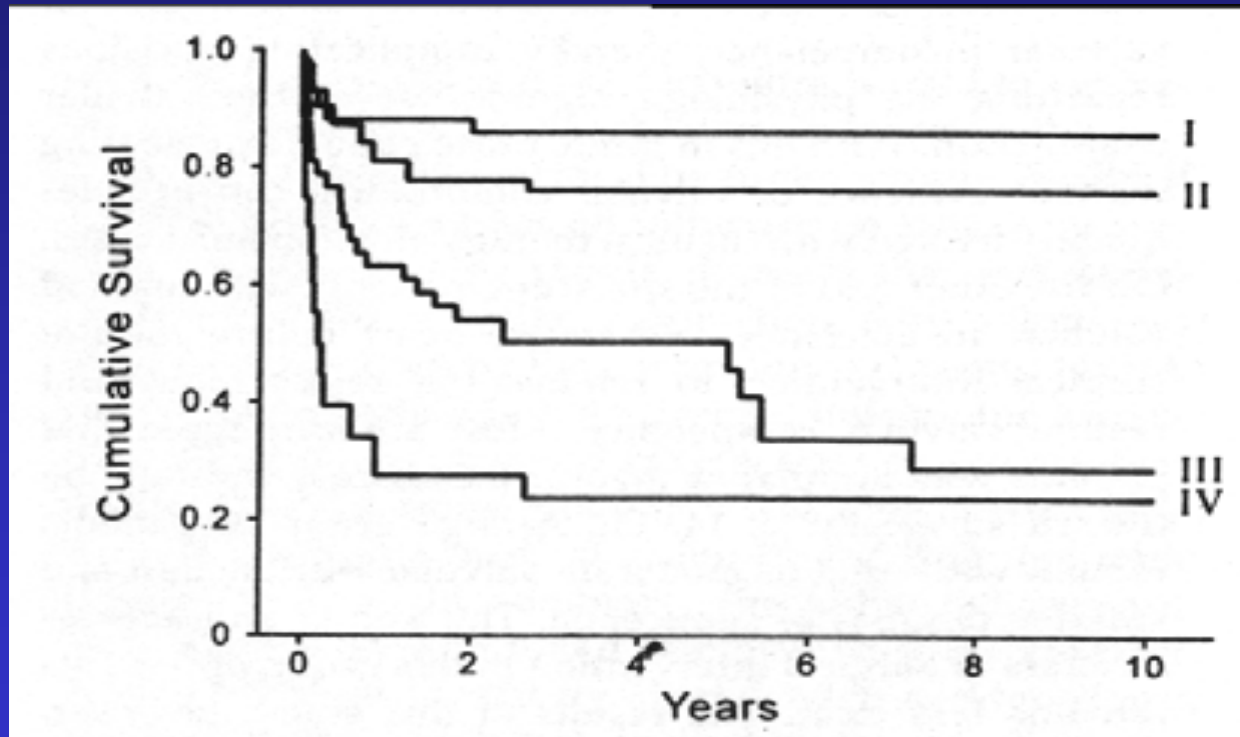
Congestive Heart Failure

- ★ Main indication for surgery (22 – 71%)
- ★ Secondary to valvular or prosthesis dysfunction
- ★ Acute vs gradual onset
- ★ Aortic valve insufficiency can progress rapidly → sudden acute deterioration
- ★ ↑ operative mortality from 6 – 11% to 17 – 33%
- ★ Re-infection of implanted valves 2 – 3 %
- ★ ↑ surgical risk with ↑ severity and ↑ interval since evidence (surgery delay → permanent ventricular dysfunction)



Congestive Heart Failure

Survival vs NYHA



Vlessis AA Ann Thorac Surg 1996; 61: 1217-22




Microbiologic considerations

Surgery is recommended:

- PVE due to *Staphylococcus Aureus* and fungi (*Candida*, *Aspergillus*)
- Resistant pathogens as vancomycin-resistant enterococci
- Left-sided IE due to gram-negative organisms
- Persistent bacteremia (positive blood cultures for >1 week after appropriate antibiotic therapy)
- Pseudomonas species (high mortality 73% > 30 years)
- NVE due to fungi ?



Periannular abscess

- ★ Sensitivity: TTE **18 – 63%** TEE **76 – 100%**
- ★ Rate: NVE **10 – 40%** PVE **45 – 100%**
- ★ More common in AV than MV or TV
- ★ Various location, extension, dimension and progression
- ★ Potential evolution to pseudoaneurysm, rupture into other heart chambers (fistula) or in pericardium
- ★ Extension to Koch's triangle  heart block
- ★ Etiology: more frequently *Staph. aureus*
- ★ Early surgery indicated
- ★ Surgery more demanding



Vegetations and risk of systemic embolization

★ Vegetations: 13 – 78% (by TTE or TEE)

★ Embolization: 10 – 50%: -³/₄ before starting antibiotics

- The risk ↓↓ after 2 weeks of antibiotic therapy:

- Higher risk for mitral vegetations

- 15 % after 1 week

- Lower risk for aortic vegetations

- 1 % after 4 weeks

★ 25% of fatalities or irreversible sequelae

★ 50 – 65% CNS > 90% middle cerebral artery

- Risk factors**
- Vegetation • 10 mm
 - “ mobile
 - “ on mitral anterior leaflet
 - Staph. Aureus or fungal infection



Vegetations and risk of systemic embolization

Indications for Surgery

- ★ 2 or more major embolic events during therapy (urgent in first 2 weeks)
- ★ Persistence of vegetation after systemic embolic event
- ★ Anterior mitral leaflet vegetation (if > 10 mm)
- ★ Increase in size of vegetation despite appropriate antibiotic therapy
- ★ Very large (> 15 mm) and mobile vegetations
- ★ Associated heart failure or valvular dysfunction
- ★ Possible conservative surgery



Splenic abscess

Splenic infarction common complication left-sided IE (~ 40%)

- * → splenic abscess (~ 5%)
- * *Streptococci Viridans* / *Staphylococcus Aureus* (40%)
Enterococci (15%)
- * Ongoing sepsis → CT or MRI → splenic abscess
- * Antibiotics no effective
- * Splenectomy before valve replacement
percutaneous drainage or aspiration in selected cases



Neurological complications

- ★ TIA, Stroke, Hemorrhage, Meningitis
- ★ Incidence: **15 – 40%**

Concerns for Surgery

- Risk for intracranial bleeding during CPB
- Risk with anticoagulation (short- and long-term)
- ⇒ Preoperative CT scan of brain
- ⇒ Cerebral angiography when suspected rupture of mycotic aneurysm
- ↑ operative mortality when hemorrhagic, not ischemic infarct
- ↑ risk of neurologic deficits exacerbation for weeks

2 – 3 weeks between neurologic event and surgery:

- surgery delayed 10 - 14 days in non-hemorrhagic stroke
- surgery delayed as long as possible in hemorrhagic stroke



Mycotic aneurysms

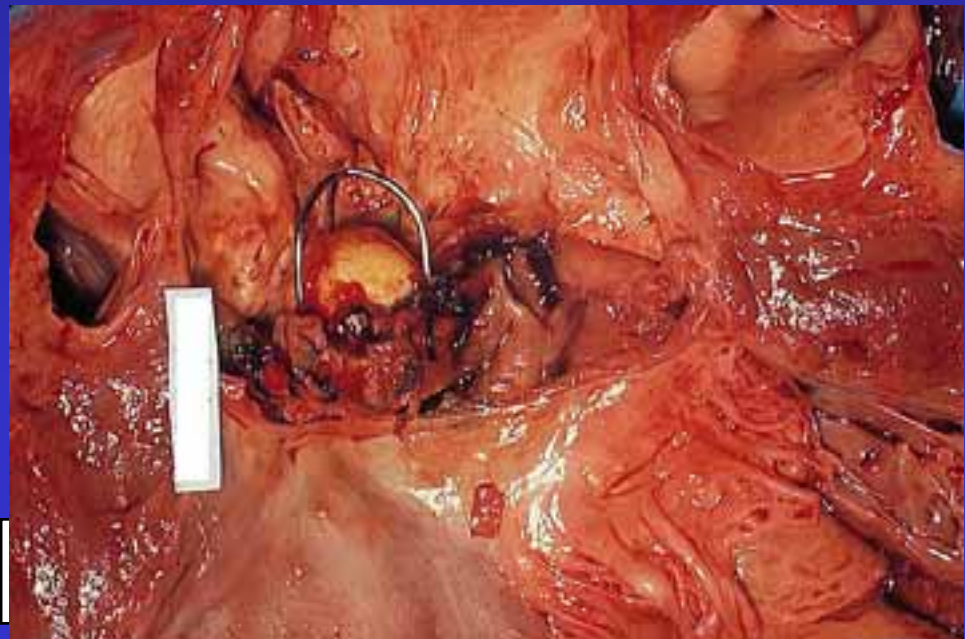
- ★ Uncommon complication
- ★ Septic embolization of vegetations of arterial vasa vasorum
→ infection spread through the intima and the vessel wall
- ★ Arterial branching points sites of MA
- ★ Intracranial arteries, visceral arteries, extremities arteries
- ★ Intracranial MA → mortality 60% (unruptured 30%, ruptured 80%)
- ★ Incidence 1 to 5% (underestimated because asymptomatic and resolved with antimicrobial therapy)
- ★ Streptococci ~ 50%, S. Aureus ~ 10%
- ★ Distal middle cerebral artery branches most often involved
- ★ CTA or MRA similar sensitivity and specificity (90 to 95%)
- ★ ICMA may heal with medical therapy
- ★ No prognostic data available (risk for imminent rupture)



Prosthetic valve endocarditis

- ★ Medical therapy rarely effective
- ★ Perivalvular invasion common and early
- ★ Staph. coagulans-neg **30%**, Staph. aureus **20%**
- ★ Prosthesis dehiscence **60%**
- ★ Recrudescence PVE after surgery **6 – 15%**





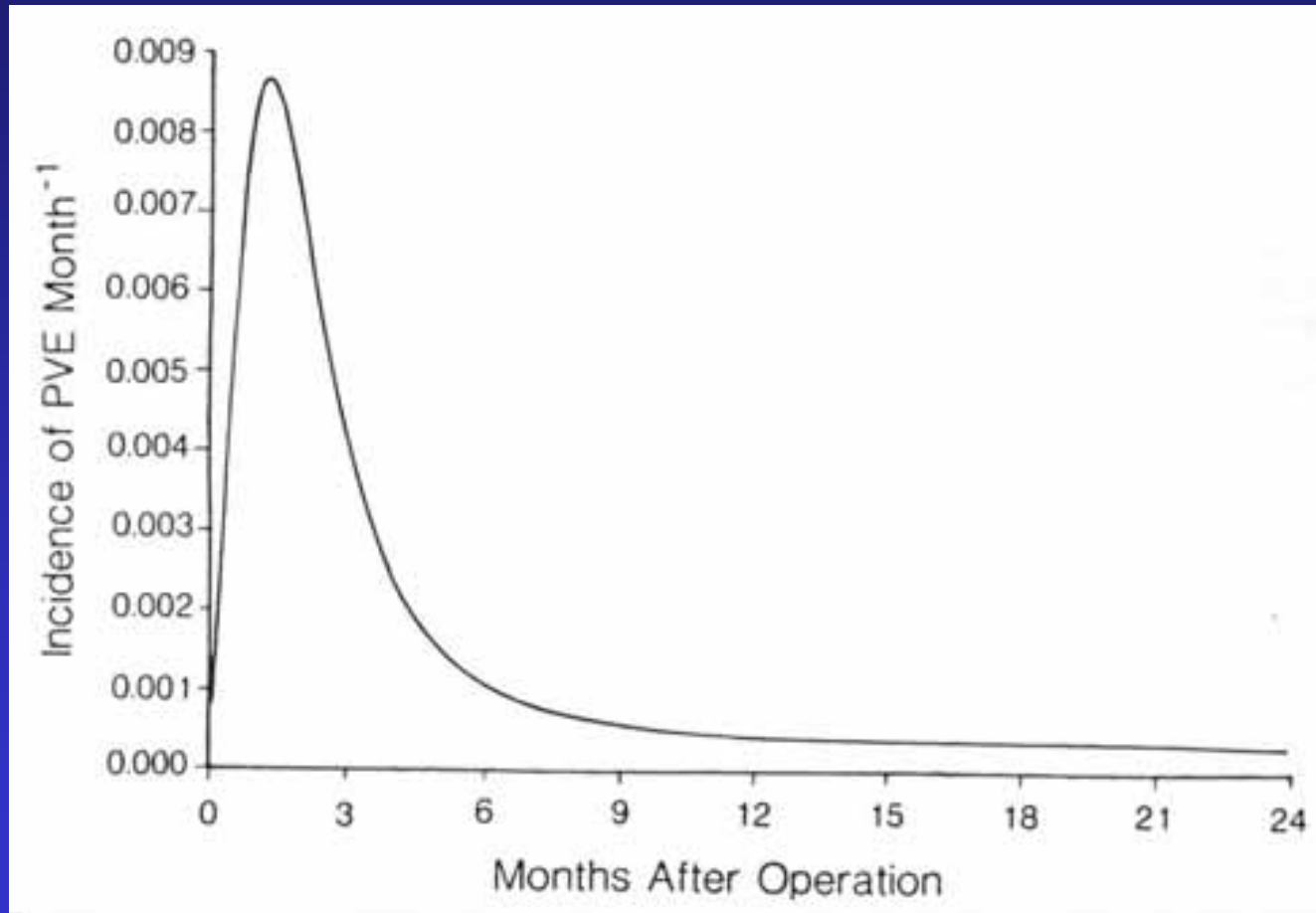
Prosthetic valve endocarditis

Indications for Surgery

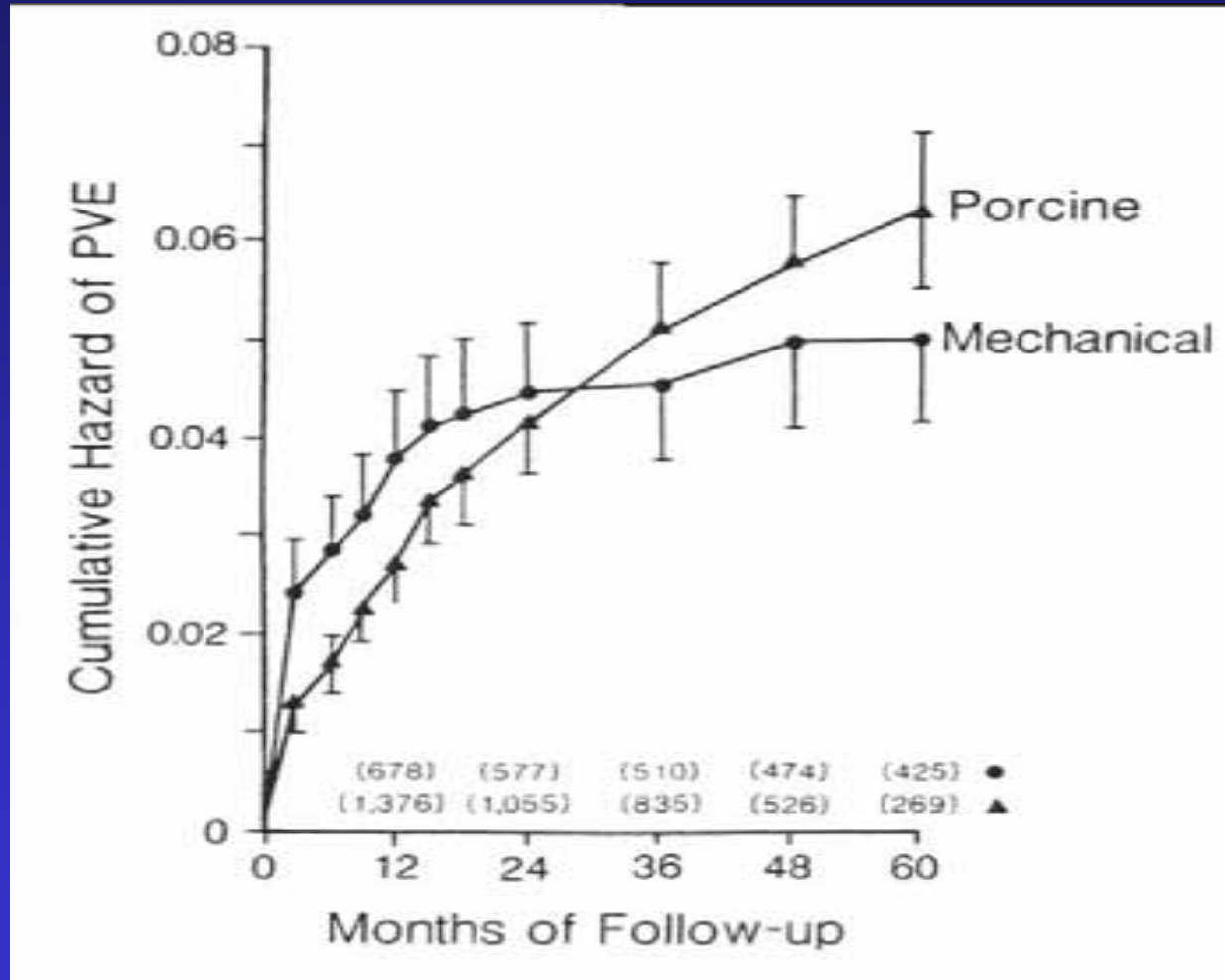
- ★ Early PVE (< 12 months after valve replacement)
- ★
- ★ Early PVE due to other Coagulase-negative Staphylococci and
- ★ Infection after successful therapy
- ★ Complicated PVE (obstruction, dehiscence)



Prosthetic valve endocarditis



Prosthetic valve endocarditis



Calderwood SB Circulation 1985



Prosthetic valve endocarditis: who needs surgery? A multicentre study of 104 cases

G Habib, C Tribouilloy, F Thuny, et al.

Heart 2005 91: 954-959

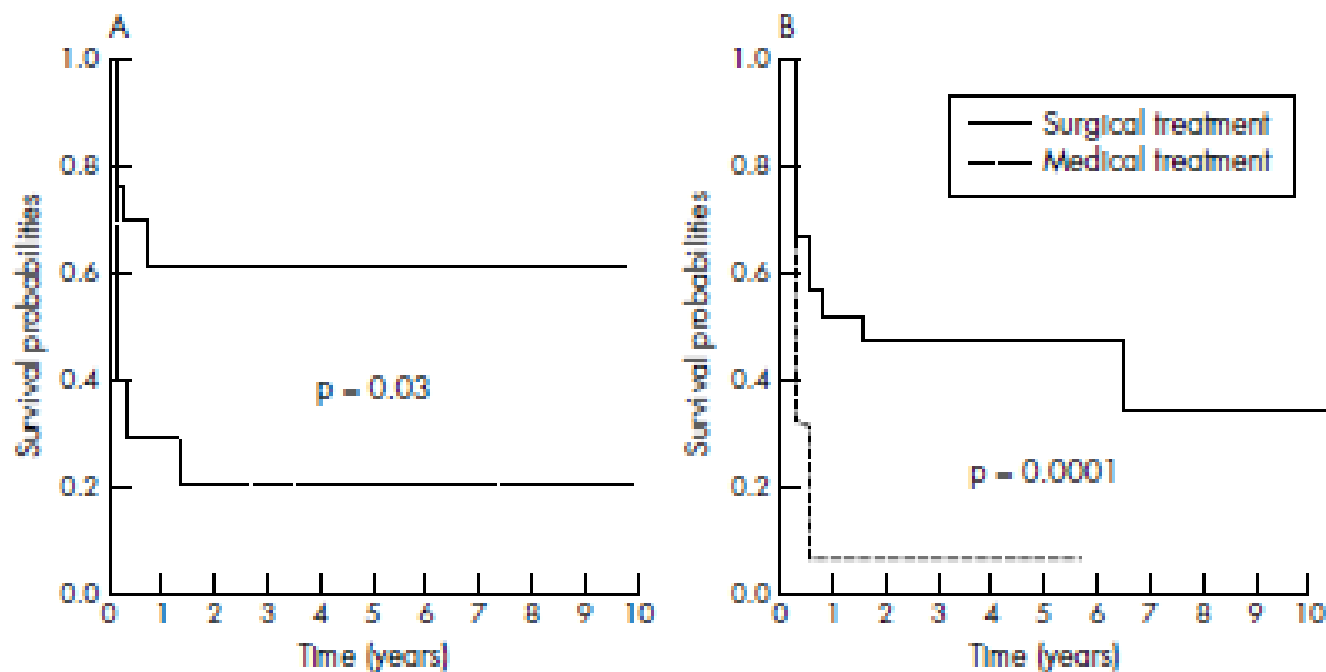
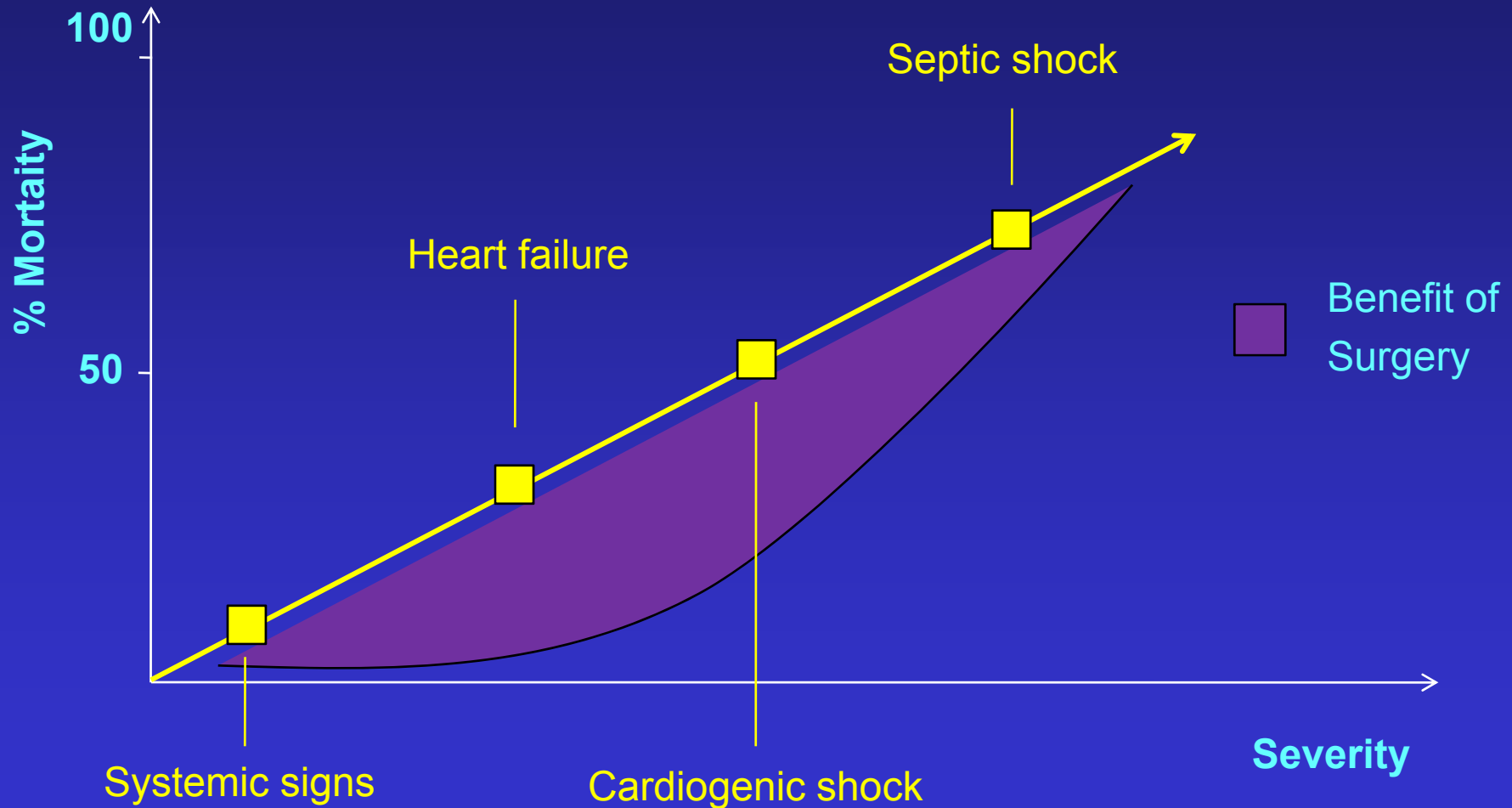


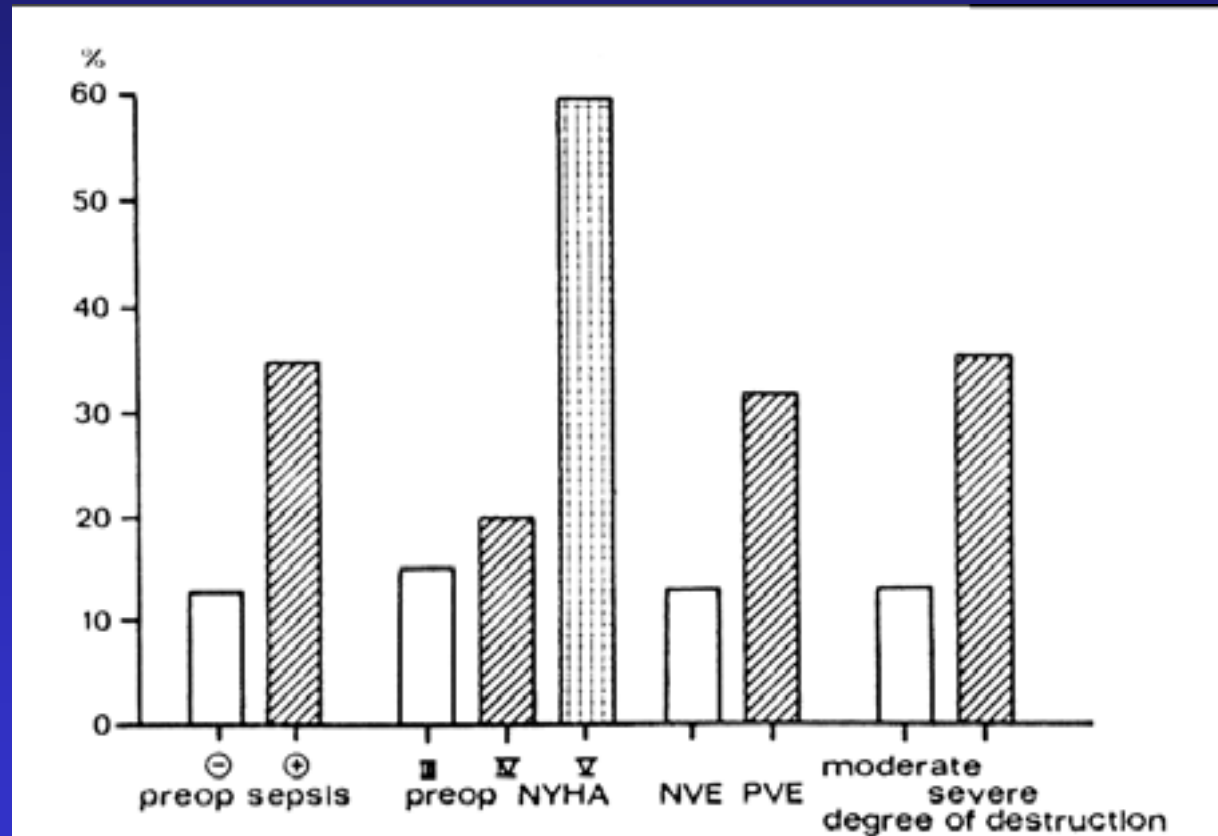
Figure 1 Long term survival of patients with (A) staphylococcal prosthetic valve endocarditis (PVE) and (B) complicated PVE treated either medically or surgically.



Role of surgery in infective endocarditis



Risk factors for surgery

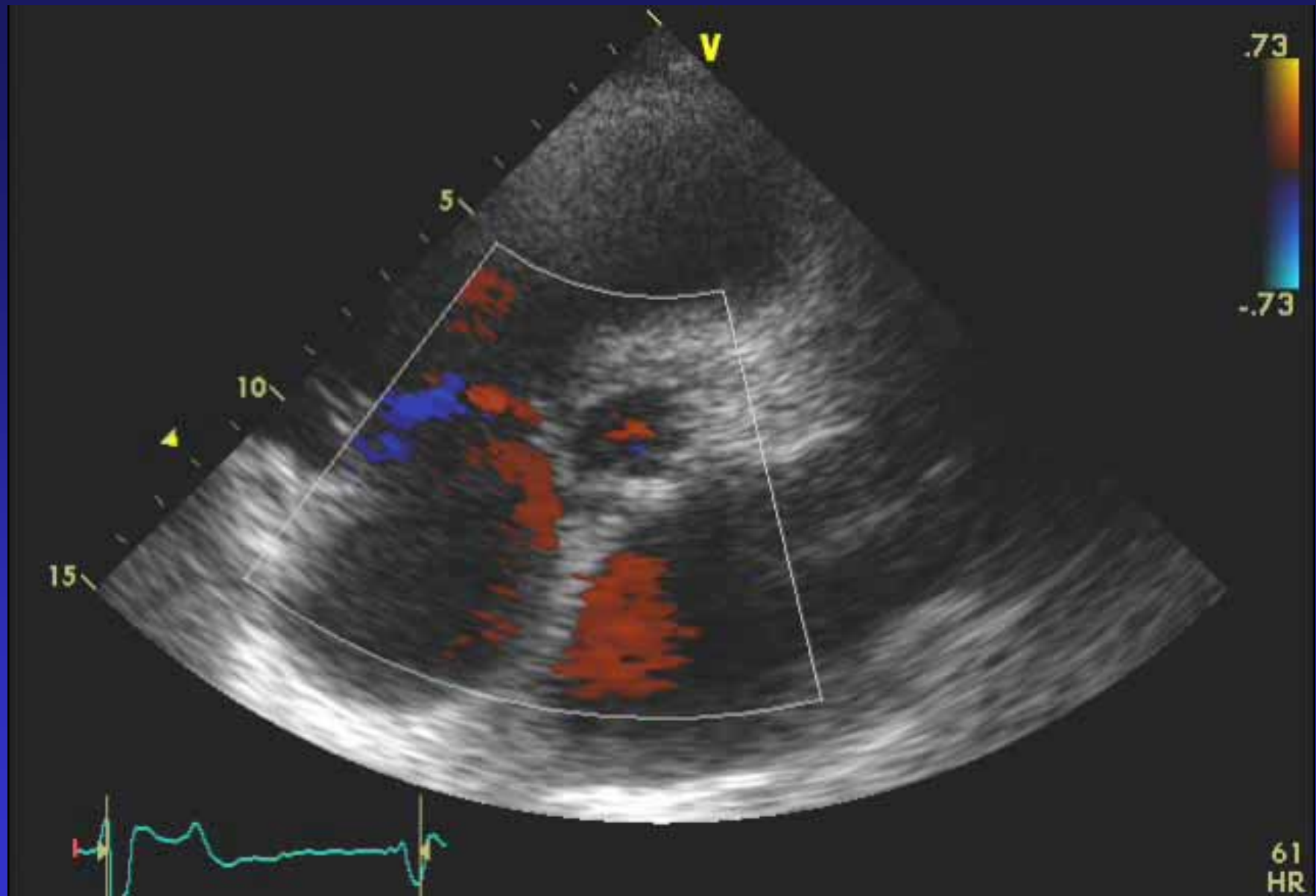


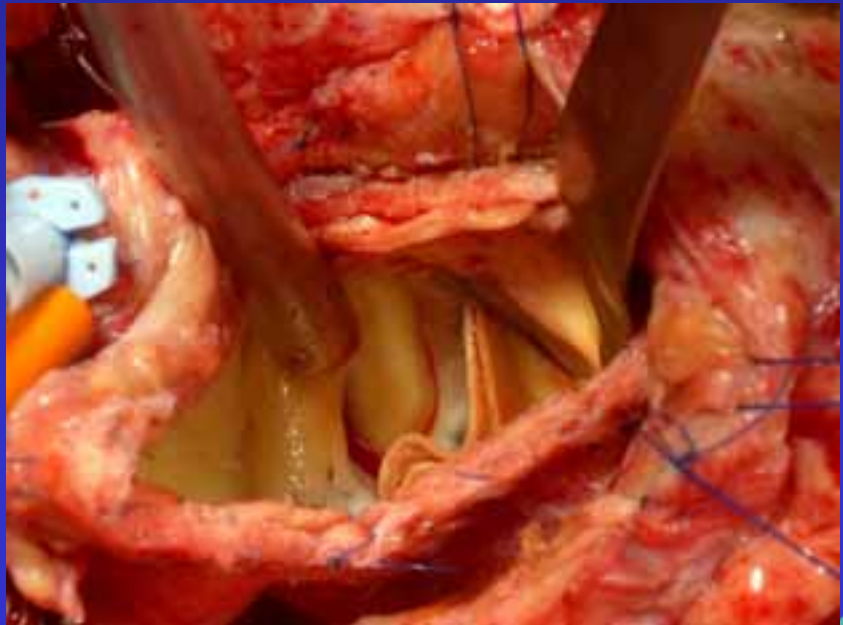
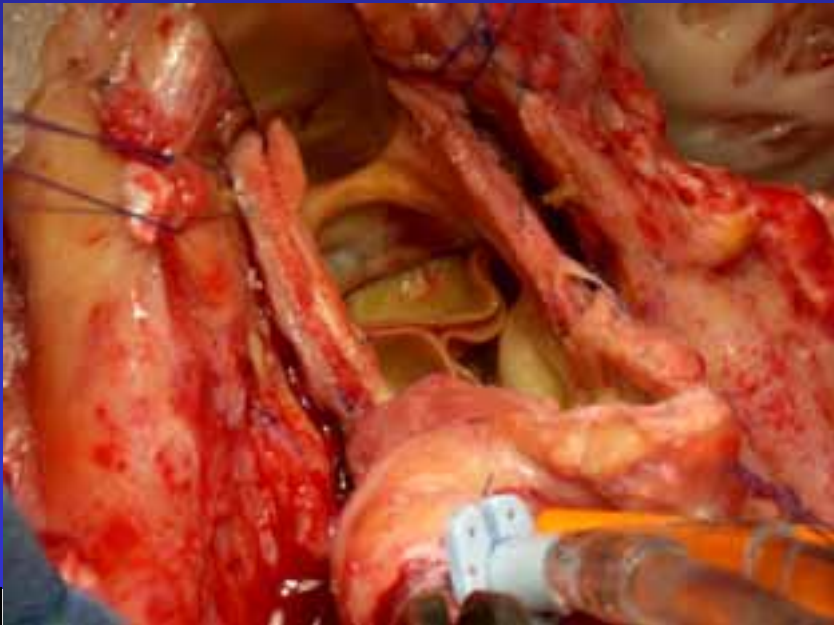
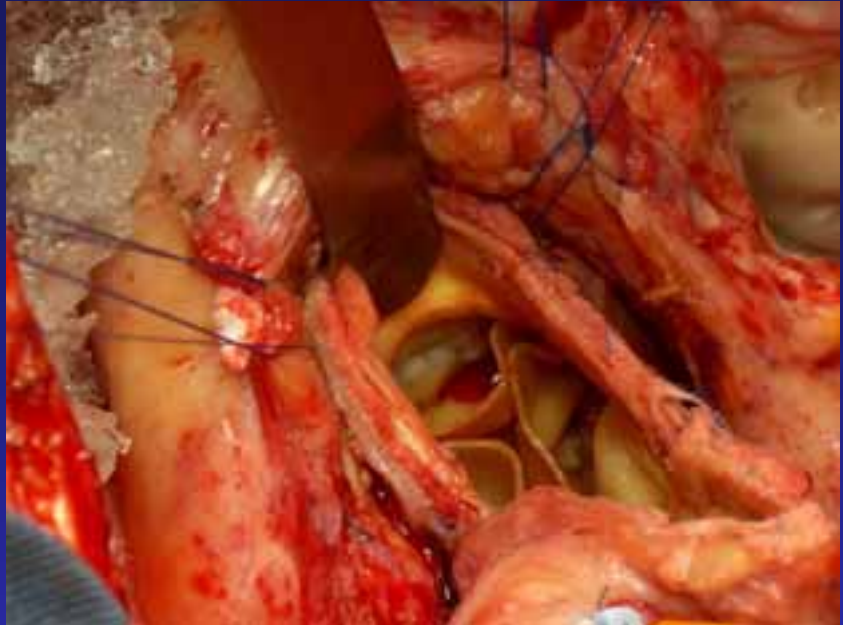
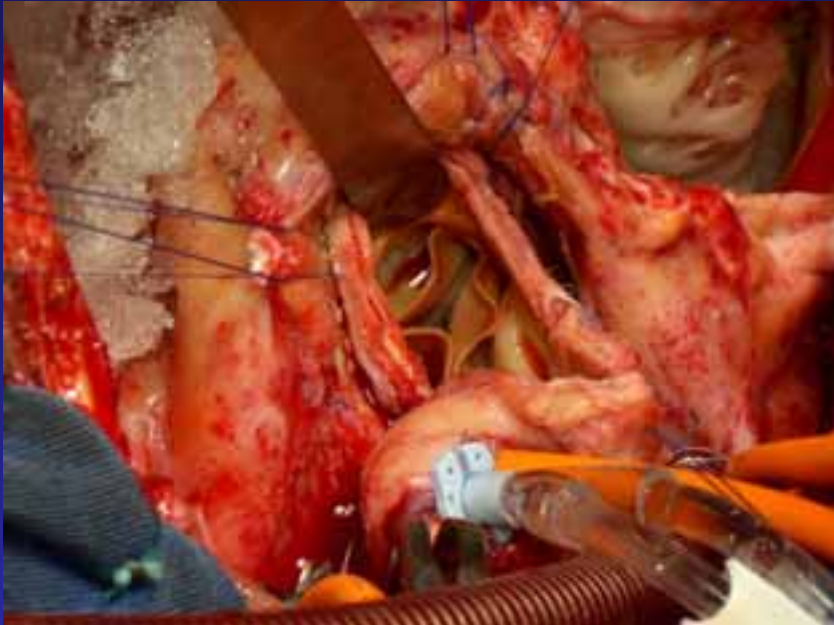
Watanabe G J Thorac Cardiovasc Surg 1994

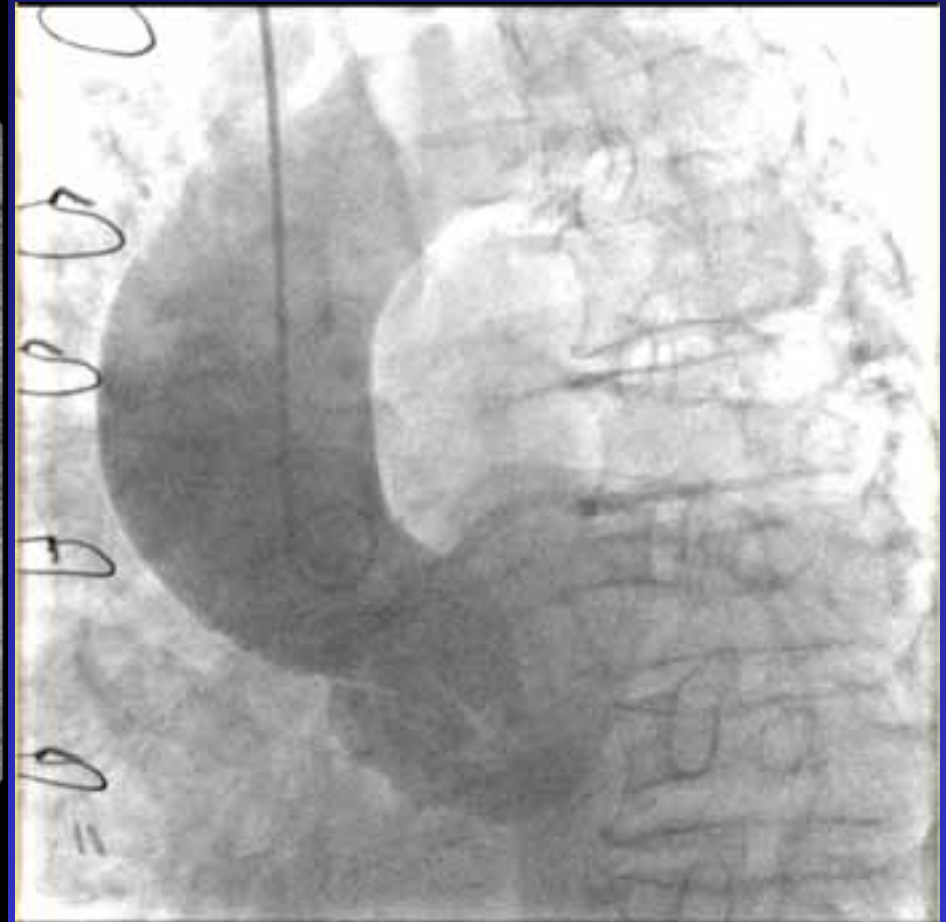
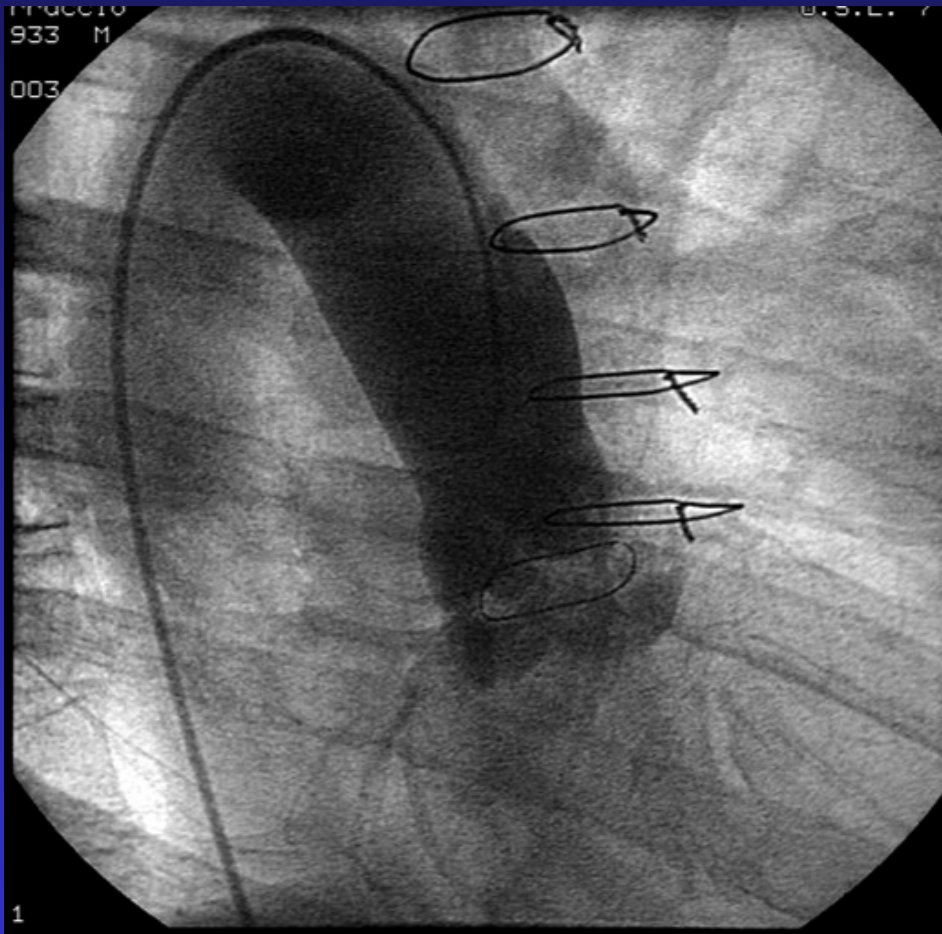


- B. C. , female, 79 yrs
- **10.10.2007**: aortic valve replacement with a Sorin™ Freedom Solo 23 mm stentless pericardial prosthesis and tricuspid annuloplasty according to De Vega
- **25.01.2008**: fever and echocardiographic evidence of a vegetation on the anterior mitral leaflet and a communication between the annulus of the aortic prosthesis and right atrium with left to right shunt without involvement of the prosthesis
- **12.02.2008**: closure of the communication, mitral edge to edge plasty and tricuspidal paracommissural plasty









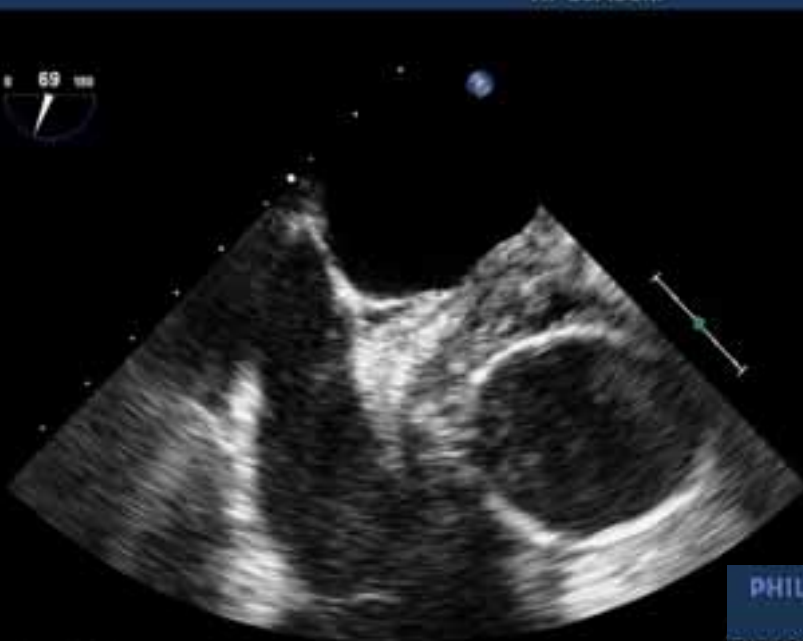
PHILIPS

19/11/2009 14:05:06 TIS0.1 MI 0.5

X7-2t/AdultI

FR 52Hz
9.0cm

ZD
64%
C 50
P Off
Gen



Temp. PAZ.: 37.0C
Temp. TEE: 39.6C

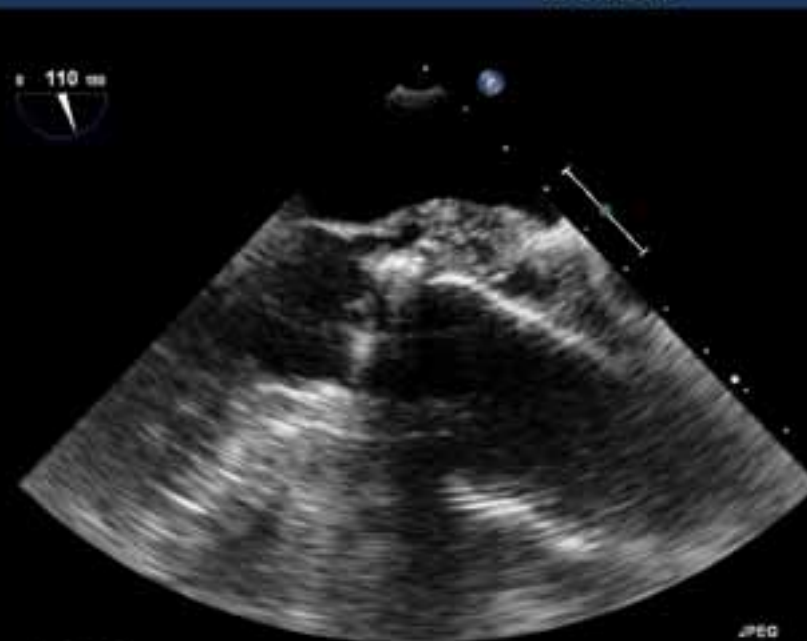
PHILIPS

19/11/2009 14:13:32 TIS0.1 MI 0.7

X7-2t/AdultI

FR 52Hz
10cm

ZD
70%
C 50
P Off
Gen



Temp. PAZ.: 37.0C
Temp. TEE: 39.4C

79 bpm



Udine experience (1990 – 2010)

Demographics (151 pts)

	<i>Native Valve (NVE)</i> 102 pts	<i>Prosthetic Valve (PVE)</i> 49 pts
Age (yrs) mean	58 ± 15	66 ± 11
range	16 – 87	35 - 84
Sex M / F	70 / 32	34 / 15
NYHA ≥ III	72%	67%
Vegetations	72%	31%
Perivalvular extension	28%	85%
F-u range (mo)	1 - 239	1 - 216



Surgical procedures

* MVR / MVP	35	* Mechanical prosthesis	67
* AVR	92	* Biological	“ 86
* AVR+ MVR / MVP	25	* Stentless	“ 37
* Bentall ± MVR	5	* Homograft	5
* AAR ± AVR	4		
* PM electrodes removal	3		

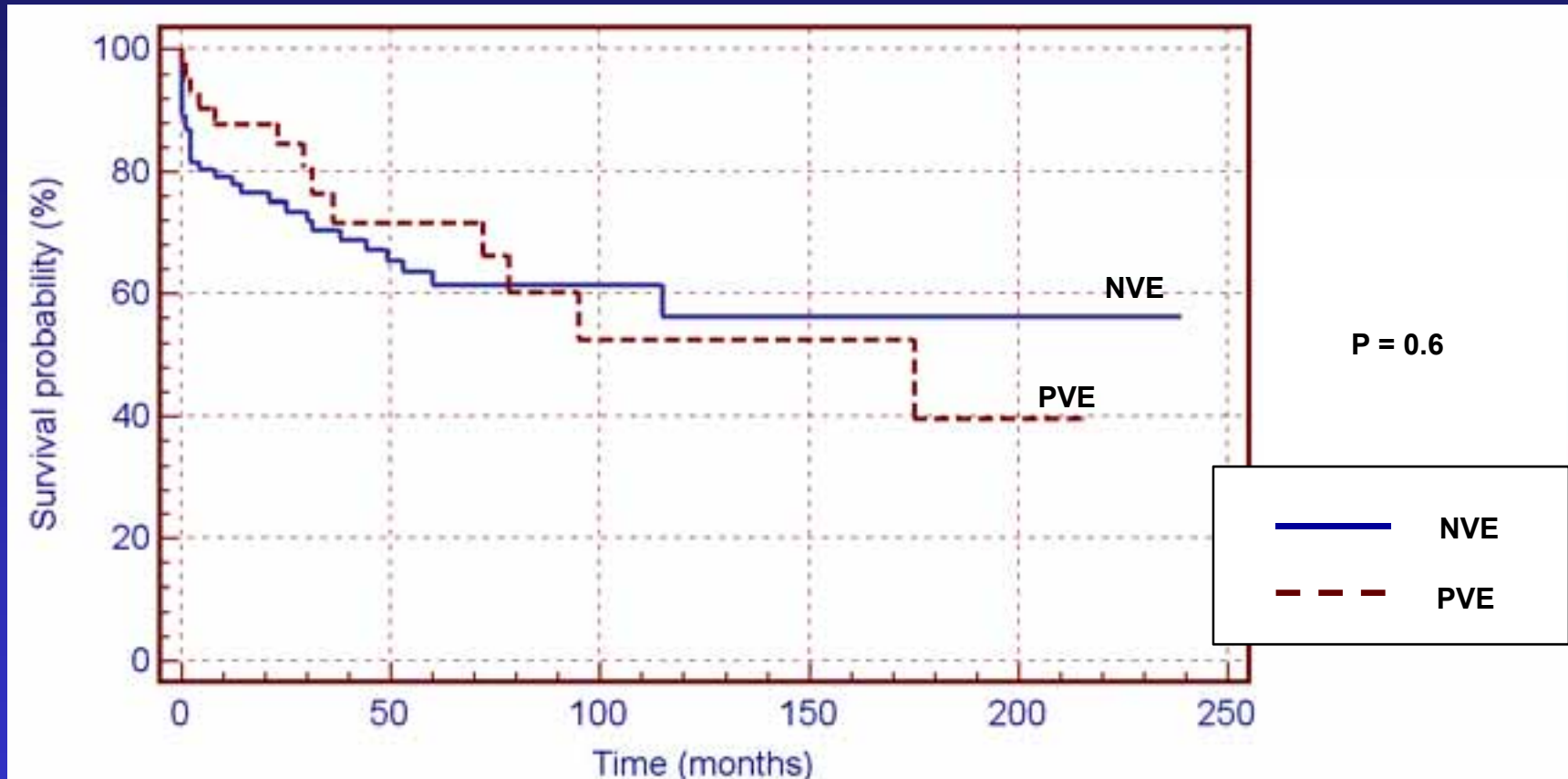


Bacteriology

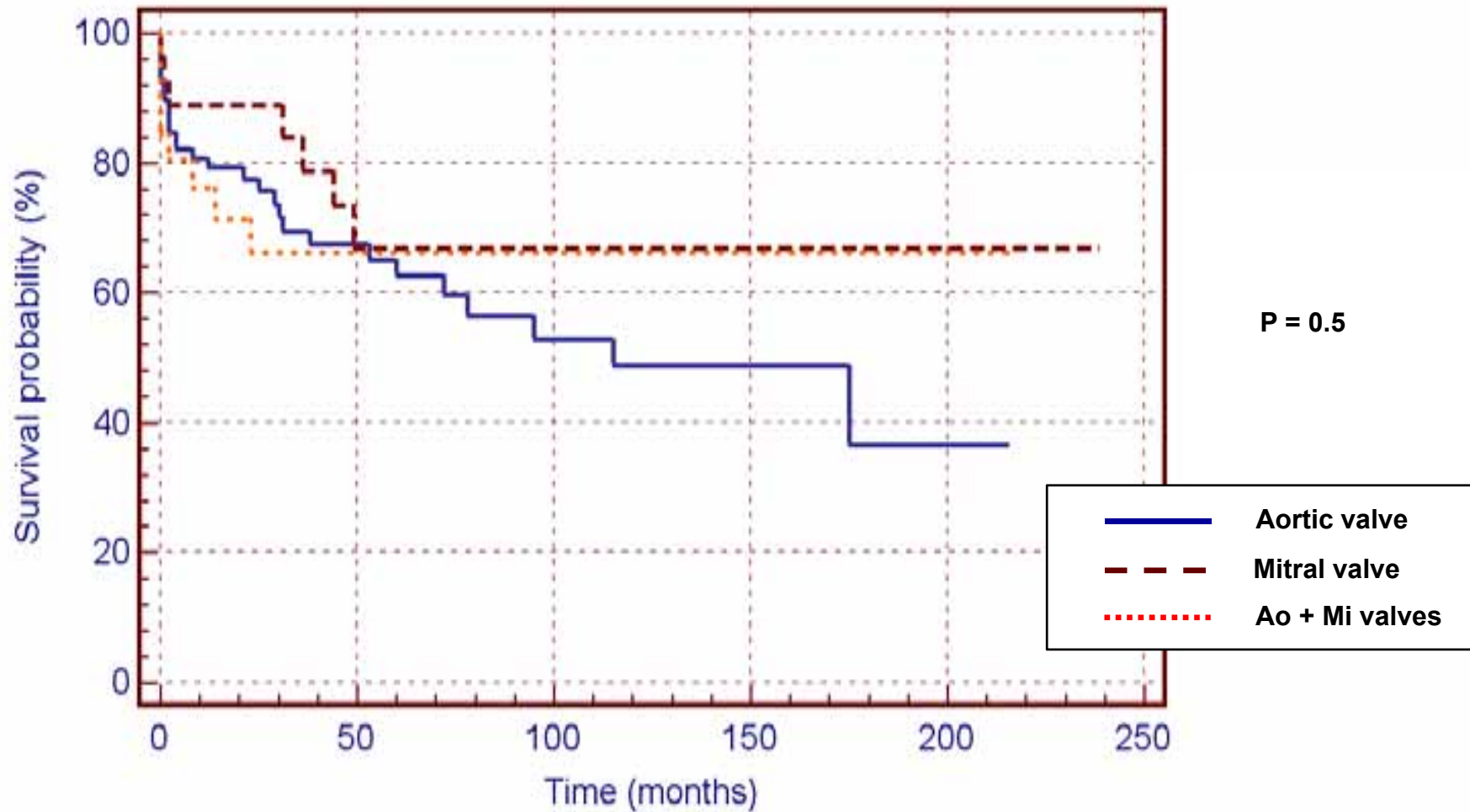
STREPTOCOCCI	45
★ viridans	8
★ sanguis	8
★ agalatae	4
★ bovis	8
STAPHYLOCOCCI	45
★ aureus	19
★ coagulans neg	12
★ lugdunensis	4
OTHERS	28
★ Pseudomonas	1
★ Enterococci	20
★ Corynebacterium	2
Culture negative or unavailable	33



Actuarial Survival vs Valve (1)



Actuarial Survival vs Valve (2)



Aortic Prosthetic Endocarditis

Patients Demographics (21 pts)

Age (yrs) mean	69 ± 11
range	44 - 84
Sex M / F	16 / 5
Time since AVR (mos)	69 ± 94
NYHA ≥ III (%)	52
Septic shock (%)	18
Infection < 60 days (%)	23



Aortic Prosthetic Endocarditis

Results

Early mortality (%)	19
Late mortality (%)	0
Follow-up (mos)	17 ± 18
1-yr survival (%)	78 ± 10
5-yr survival (%)	78 ± 10
5-yr freedom from relapse (%)	90 ± 8
NYHA Class I / II (%)	100





PERICARBON FREEDOM 16

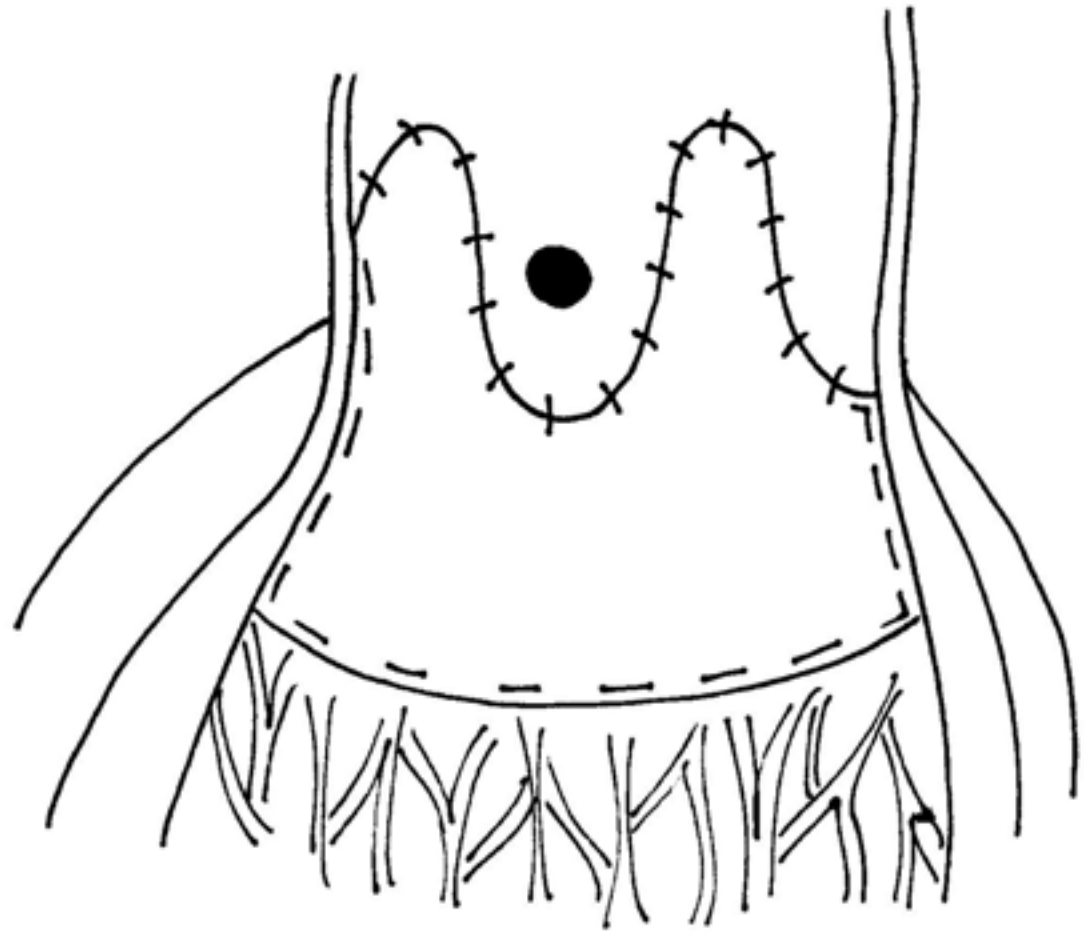


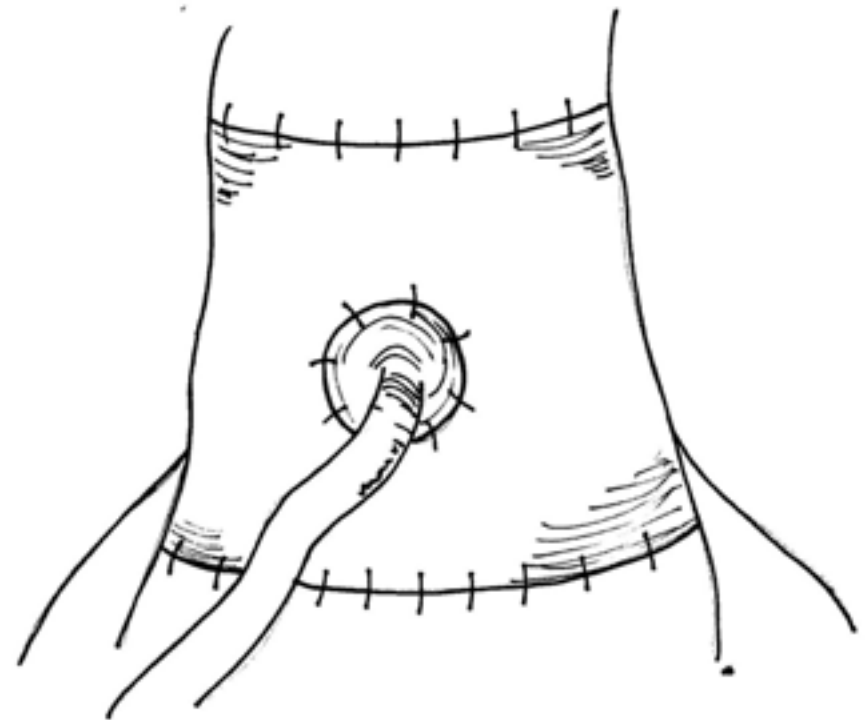
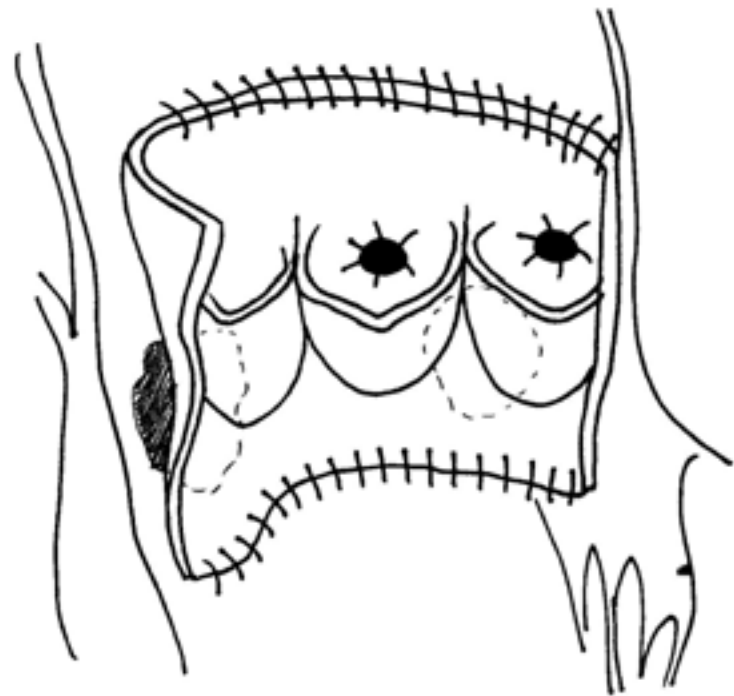
SHELHIGH CONDUIT 4

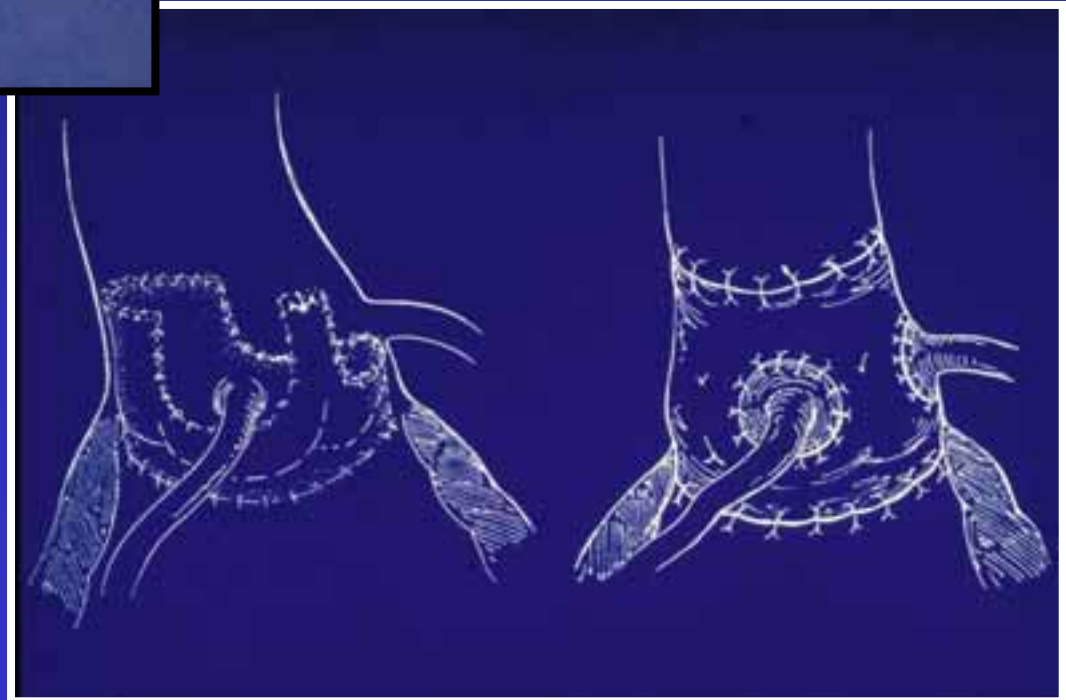


EDWARDS PRIMA PLUS 1









PULMONARY AUTOGRAFT The 'Ross' Operation

Excise Pulmonary Valve... Pulmonary Valve To Aorta... Homograft To Pulmonary Artery...



Heart Transplantation for Q Fever Endocarditis

Carlos Blanche, MD, Dov Freimark, MD, Mar Valenza, MD, Lawrence S. C. Czer, MD, and Trento, MD

Department of Cardiothoracic Surgery, Cedars-Sinai Medical Center, Los Angeles, California

A 25-year-old woman underwent heart transplantation for treatment of Q fever endocarditis.

Heart Transplantation for Intractable Prosthetic Valve Endocarditis

Verdi J. DiSesa, MD, Laurence J. Sloss, MD, and Lawrence H. Cohn, MD

A 25-year-old woman with active systemic lupus erythematosus and infective endocarditis was seen initially with porcine aortic bioprosthetic stenosis, perivalvular regurgitation, and native mitral regurgitation 9 years after aortic valve replacement for lupus endocarditis. Double-valve re-replacement was performed with St. Jude Medical mechanical prostheses. After operation the patient had fever and an elevated white blood cell count. One month later she had evidence of perivalvular regurgitation and intermittent complete heart block. Double-valve re-replacement, with appropriate antibiotics, and she underwent double-valve re-replacement, and she underwent double-valve re-replacement, with appropriate antibiotics, within 2 weeks of congestive heart failure. Cultures were negative.

Heart Transplantation for Complicated and Recurrent Early Prosthetic Valve Endocarditis

Soon J. Park, MD, Henry J. Sullivan, MD, Vassyl Lonchyna, MD, Thomas J. Hinkamp, MD, and Roque Pifarre, MD

Five-year follow-up of a patient who underwent heart transplantation for recurrent early prosthetic valve endocarditis is reported. *J HEART LUNG TRANSPLANT* 1993;12:802-3.



- S. F. , male, 66 yrs
- **25.10.2006**: aortic valve replacement with Carpentier-Edwards Magna 21 mm, mitral valve replacement with Medtronic Mosaic 29 mm, CABG III (LIMA→LAD; saphenous→Diagonal branch; saphenous→RCA). Intraoperatively, heavy calcified ascending aorta and heavy calcification of posterior mitral annulus
- **04.07.2007**: implant of Dacron graft for abdominal aorta dissection.
- Subsequently, onset of fever, IE diagnosis (MSSA) and echocardiographic evidence of mitral leakage due to periannular abscess; prolonged antibiotic therapy (oxacillin + rifampicin → levofloxacin + rifampicin)
- **19.01.2008**: heart transplantation
- **28.10.2010**: a & w



REDUCE MORTALITY

INCREMENTAL ADVANCES IN:

- ★ Prevention**
- ★ Diagnosis**
- ★ Antibiotic therapy**
- ★ Optimization of surgical approach**



