



VI CONGRESSO NAZIONALE DI ECOCARDIO CHIRURGIA

Il distacco aseptico di protesi

Enrico Citterio
Cardiochirurgia ICH

ISTITUTO CLINICO
HUMANITAS ICH

Il distacco asettico di protesi

- ◆ Definizione:
 - Flusso retrogrado anomalo tra l'anello protesico e l'anulus valvolare nativo
- ◆ Tipo:
 - Immediato, riscontro intra-operatorio
 - Tardivo, durante il follow-up
- ◆ Sintomi principali:
 - Scompenso
 - Emolisi

Il distacco asettico di protesi

Dimensioni del problema

Ampia variabilità dei valori di incidenza

- ✦ MITRALE : 1.2% - 12.5%
- ✦ AORTA: 1% - 3.5%

Tra le cause più frequenti di re-intervento su protesi valvolare (seconda solo alla sostituzione di bioprotesi degenerata)

Il distacco aseptico di protesi

- ✦ Piccole aree di “leak paraprotetico” visibili ai controlli ECO-TE intra-operatori possono essere relativamente frequenti
- ✦ Non costituiscono un distacco significativo emodinamicamente
- ✦ Sono generalmente legati al tramite di passaggio dei fili di sutura
- ✦ Regrediscono generalmente nel post-operatorio

Prevalence and clinical significance of incidental paraprosthetic valvar regurgitation: a prospective study using transoesophageal echocardiography

Heart 2003;89:1316–1321

A Ionescu, A G Fraser, E G Butchart

Table 1 Prevalence of paraprosthetic jets at the early transoesophageal echocardiographic study by valve type and position

Prosthesis type	Paraprosthetic jets		Total
	Absent	Present	
<u>Aortic</u>			
Carpentier-Edwards			
Pericardial	34	2 (6%)	36
Porcine	8	0	8
Medtronic Hall	74	1 (1%)	75
St Jude	105	11 (10%)	116
Ultracor	33	2 (6%)	35
Total	254	16 (6%)	270
<u>Mitral</u>			
Medtronic Hall	25	12 (32%)	37
St Jude	43	17 (28%)	60
Ultracor	10	9 (47%)	19
Total	78	38 (33%)	116

CARDIOVASCULAR MEDICINE

Prevalence and clinical significance of incidental paraprosthetic valvar regurgitation: a prospective study using transoesophageal echocardiography

A Ionescu, A G Fraser, E G Butchart

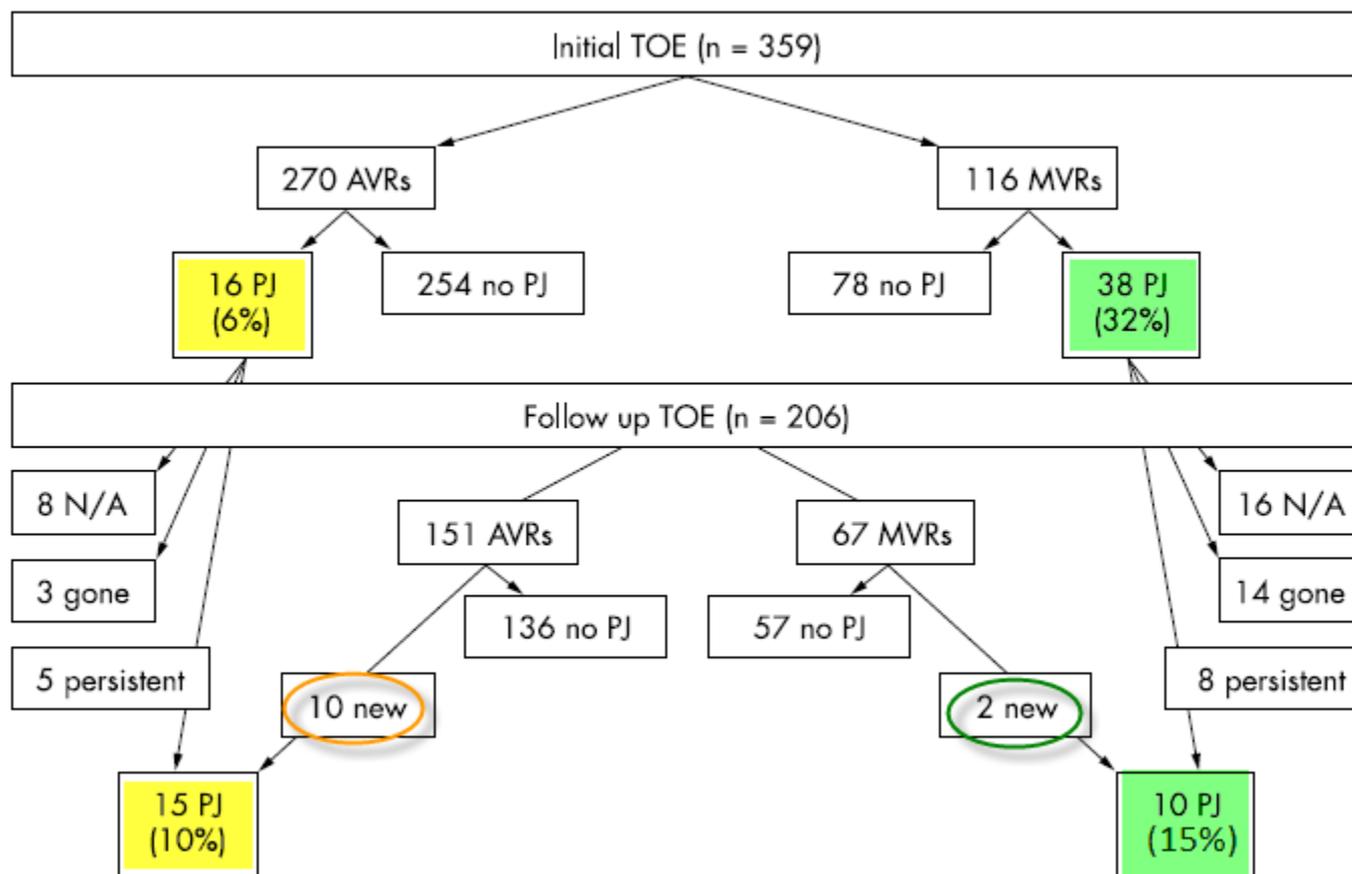


Figure 1 Prevalence and course of incidental paraprosthetic regurgitation. AVR, aortic valve replacement; MVR, mitral valve replacement; N/A, not available; PJ, paraprosthetic jet; TOE, transoesophageal echocardiogram.

Il distacco asettico di protesi

Cause

- ◆ Anatomia dell'anulus valvolare
- ◆ Tecnica chirurgica di impianto
- ◆ Fragilità tessuto anulare
- ◆ Stress meccanico
- ◆ Errore chirurgico

Il distacco asettico di protesi

Mitral valve periprosthetic leakage: anatomical observations in 135 patients from a multicentre study

Giuseppe De Cicco^{a,*}, Claudio Russo^b, Antonella Moreo^b, Cesare Beghi^c, Carlo Fucci^a, Piersilvio Gerometta^d, Roberto Lorusso^a

^a Cardiac Surgery Unit, Civic Hospital, Brescia, Italy

^b Department of Cardiovascular Surgery, De Gasperis Centre, Niguarda Ca' Granda Hospital, Milan, Italy

^c Department of Cardiac Surgery, University of Parma, Parma, Italy

^d Department of Cardiac Surgery, Humanitas Gavazzeni Clinic, Bergamo, Italy

MVR: 5832 pts.  distacco asettico: 135 (2.3%)

Aortic Valve Periprosthetic Leakage: Anatomic Observations and Surgical Results

Giuseppe De Cicco, MD, Roberto Lorusso, MD, PhD, Andrea Colli, MD, Francesco Nicolini, MD, Claudio Fragnito, MD, Teresa Grimaldi, MD, Bruno Borrello, MD, Alessandro Maria Budillon, MD, Tiziano Gherli, MD, and Cesare Beghi, MD

Cardiac Surgery Unit, Civic Hospital, Brescia, Department of Cardiac Surgery, University of Parma, Parma, and Department of Cardiology, University of Modena and Reggio Emilia, Modena, Italy

AVR: 1696 pts.  distacco asettico: 39 (2.3%)

Mitral valve periprosthetic leakage: anatomical observations in 135 patients from a multicentre study

Giuseppe De Cicco^{a,*}, Claudio Russo^b, Antonella Moreo^b, Cesare Beghi^c, Carlo Fucci^a, Piersilvio Gerometta^d, Roberto Lorusso^a

^a Cardiac Surgery Unit, Civic Hospital, Brescia, Italy

^b Department of Cardiovascular Surgery, De Gasperis Centre, Niguarda Ca' Granda Hospital, Milan, Italy

^c Department of Cardiac Surgery, University of Parma, Parma, Italy

^d Department of Cardiac Surgery, Humanitas Gavazzeni Clinic, Bergamo, Italy

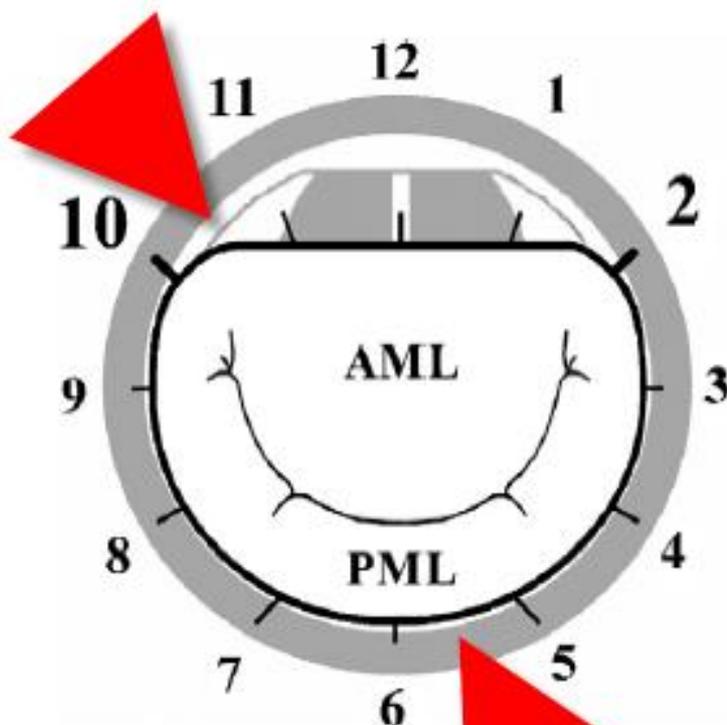


Fig. 1. Partition of mitral annulus adopting 12 segments format representing the virtual relationship between native mitral annulus and implanted prosthesis. AML: anterior mitral leaflet; PML: posterior mitral leaflet.

Il distacco asettico di protesi

Valvola mitrale

✦ Anatomia

Fibrosa meno rappresentata nel settore posteriore dell'annulus, aumentata fragilità

✦ Dinamica

Aumentato stress meccanico regione anulare posteriore-mediale e antero-laterale

✦ Tecnica chirurgica

Regione anulare antero-laterale scomoda
Annulus posteriore punti superficiali

Effects of Prosthetic Valve Placement on Mitral Annular Dynamics and the Left Ventricular Base

TAKESHI KOMODA,* ROLAND HETZER,* HENRYK SINIAWSKI,* JOHANN OELLINGER,** ROLAND FELIX,** CHIKAO UYAMA,† AND HAJIME MAETA‡

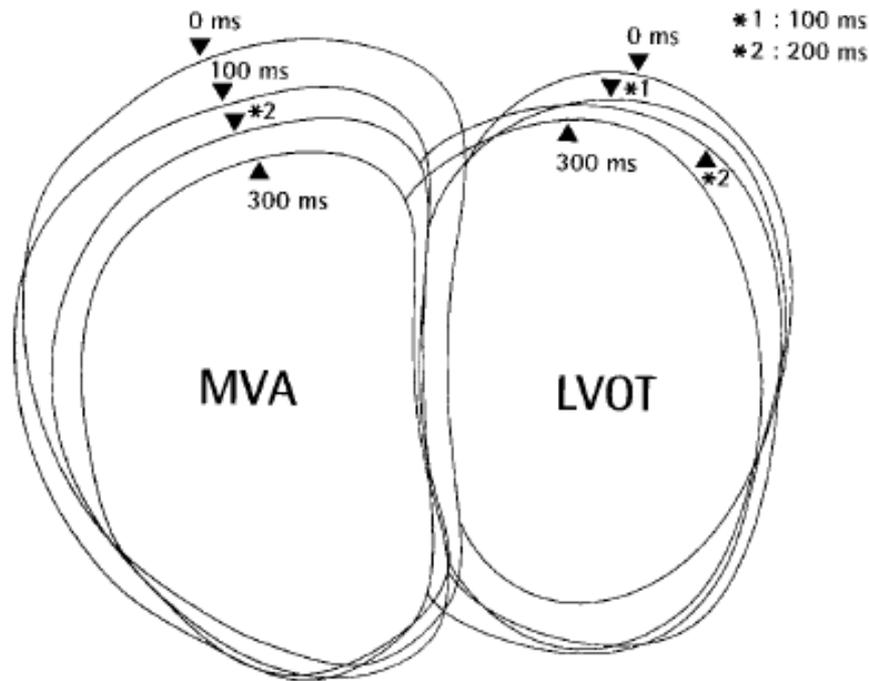


Figure 4. Systolic change of the LV base in a normal subject in frontal view, observed from the left atrium. The contraction of the outer contour of the LV base is seen in this view. The MVA contracts and does not interfere with the region of the LVOT orifice.

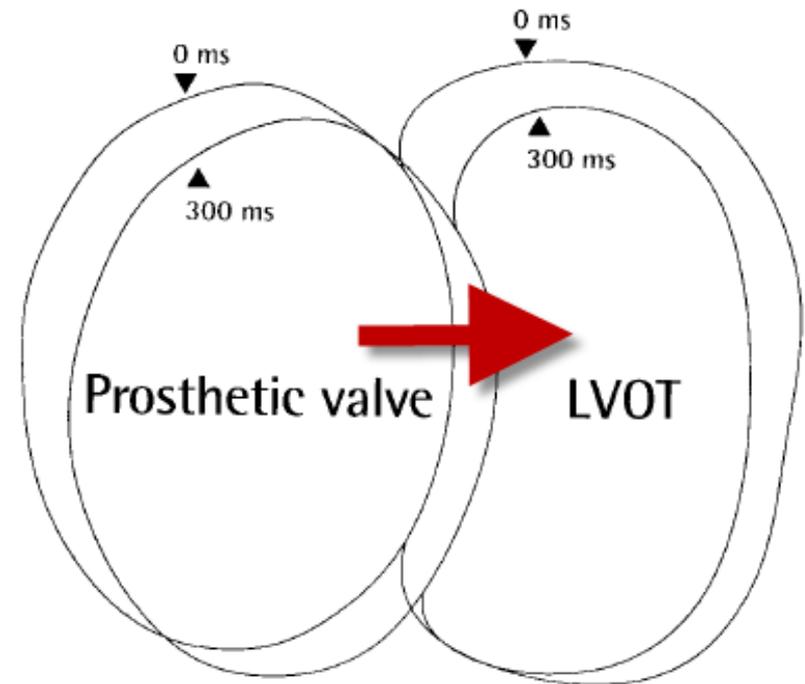
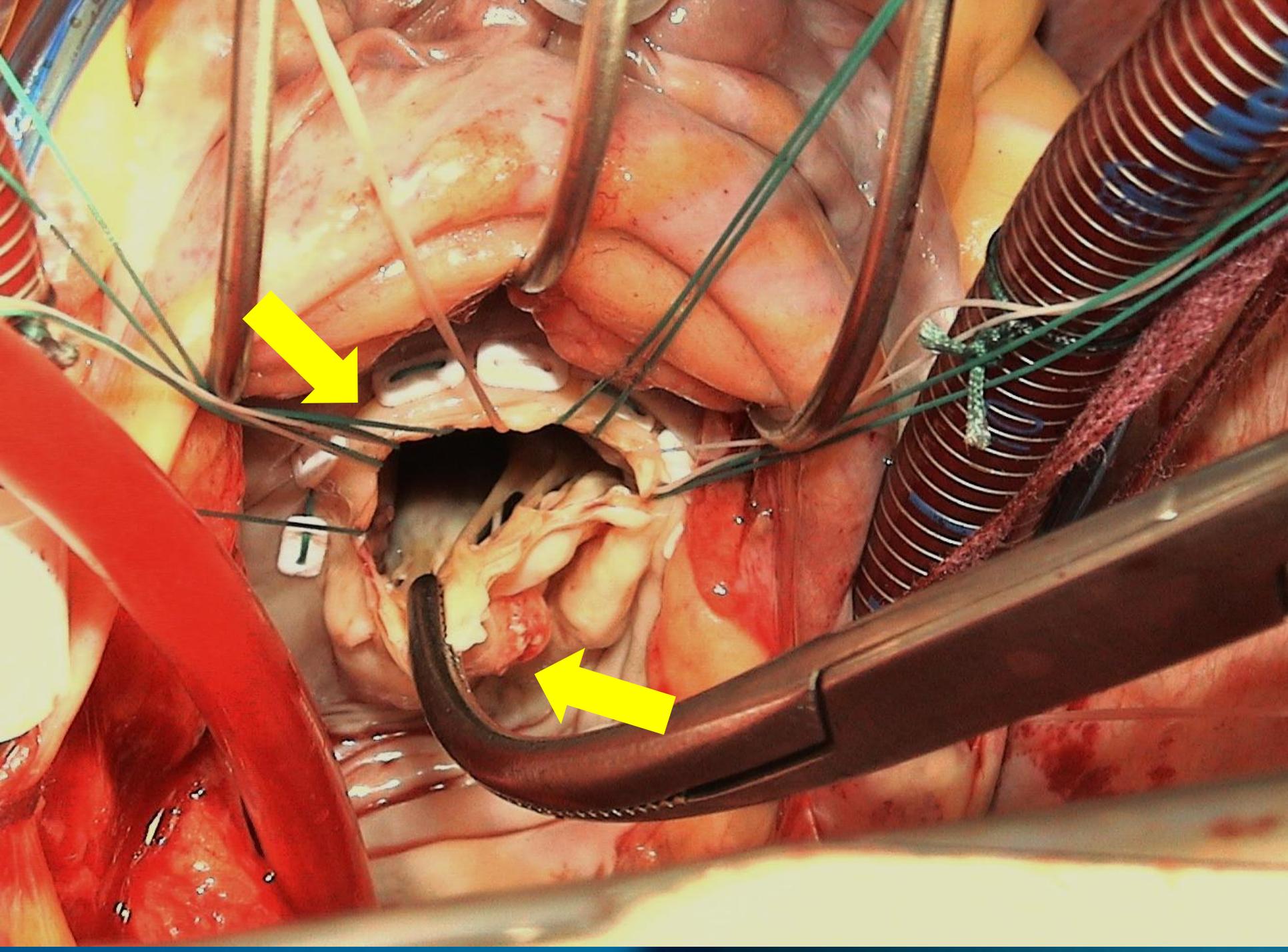
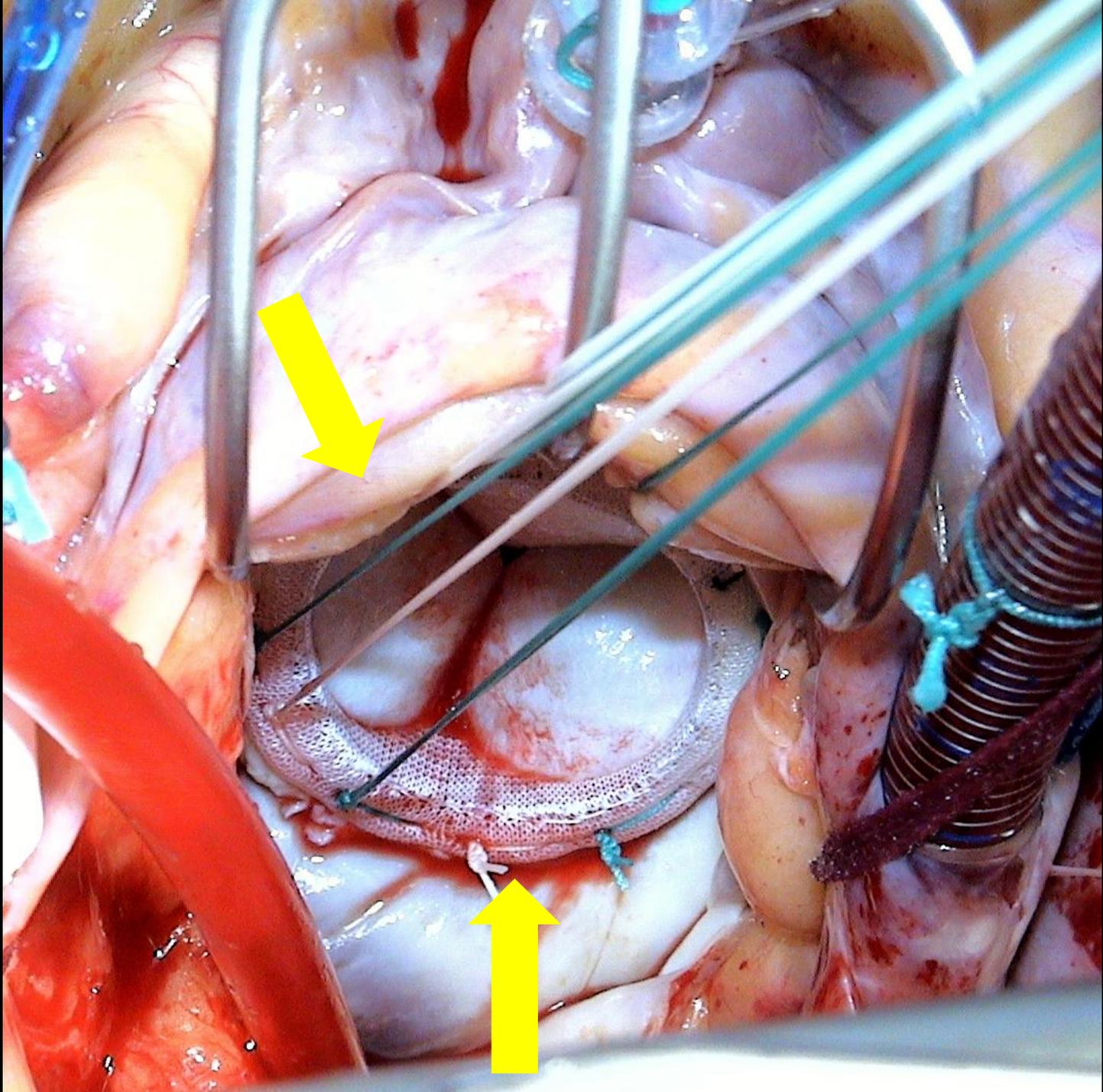


Figure 5. Frontal view of the LV base in a patient after mitral valve replacement with a mechanical valve prosthesis, observed from left atrium. Images of the LVOT orifice and the prosthetic valve at 0 ms and 300 ms delay are shown. The LVOT becomes narrow during systole due to the invasion of the prosthetic valve into the region of the LVOT orifice.





Aortic Valve Periprosthetic Leakage: Anatomic Observations and Surgical Results

Giuseppe De Cicco, MD, Roberto Lorusso, MD, PhD, Andrea Colli, MD, Francesco Nicolini, MD, Claudio Fragnito, MD, Teresa Grimaldi, MD, Bruno Borrello, MD, Alessandro Maria Budillon, MD, Tiziano Gherli, MD, and Cesare Beghi, MD

Cardiac Surgery Unit, Civic Hospital, Brescia, Department of Cardiac Surgery, University of Parma, Parma, and Department of Cardiology, University of Modena and Reggio Emilia, Modena, Italy

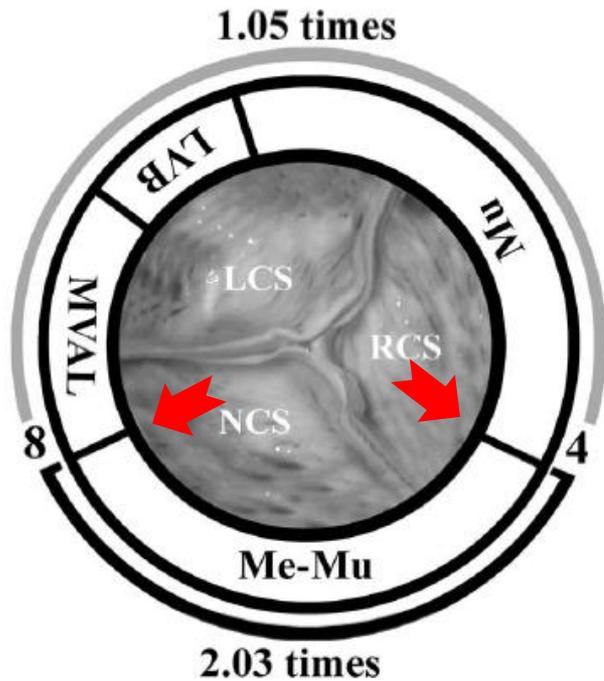
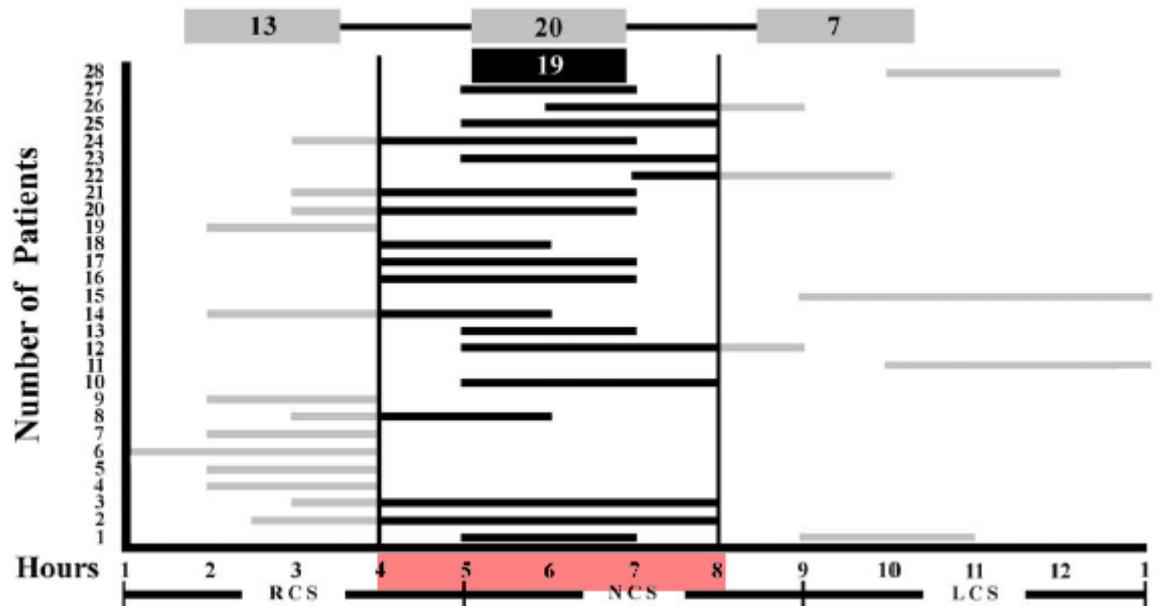
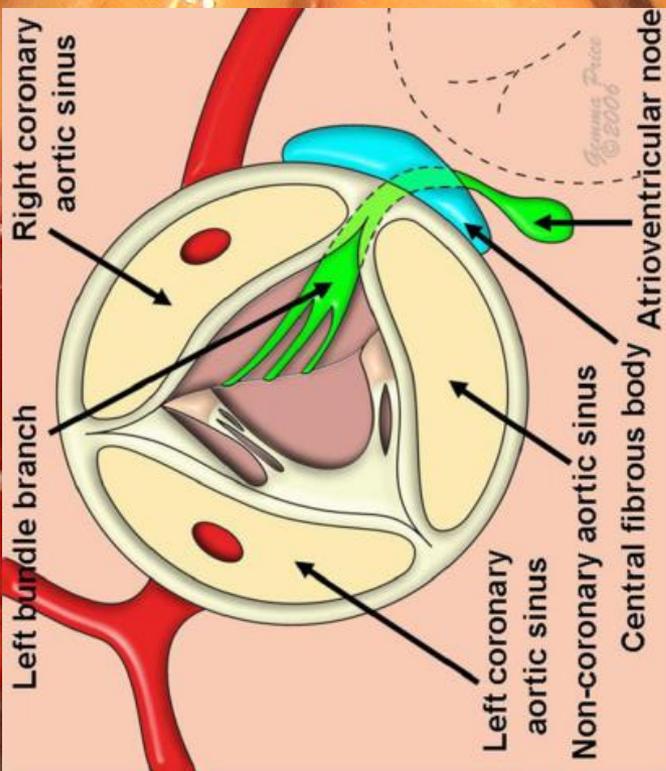
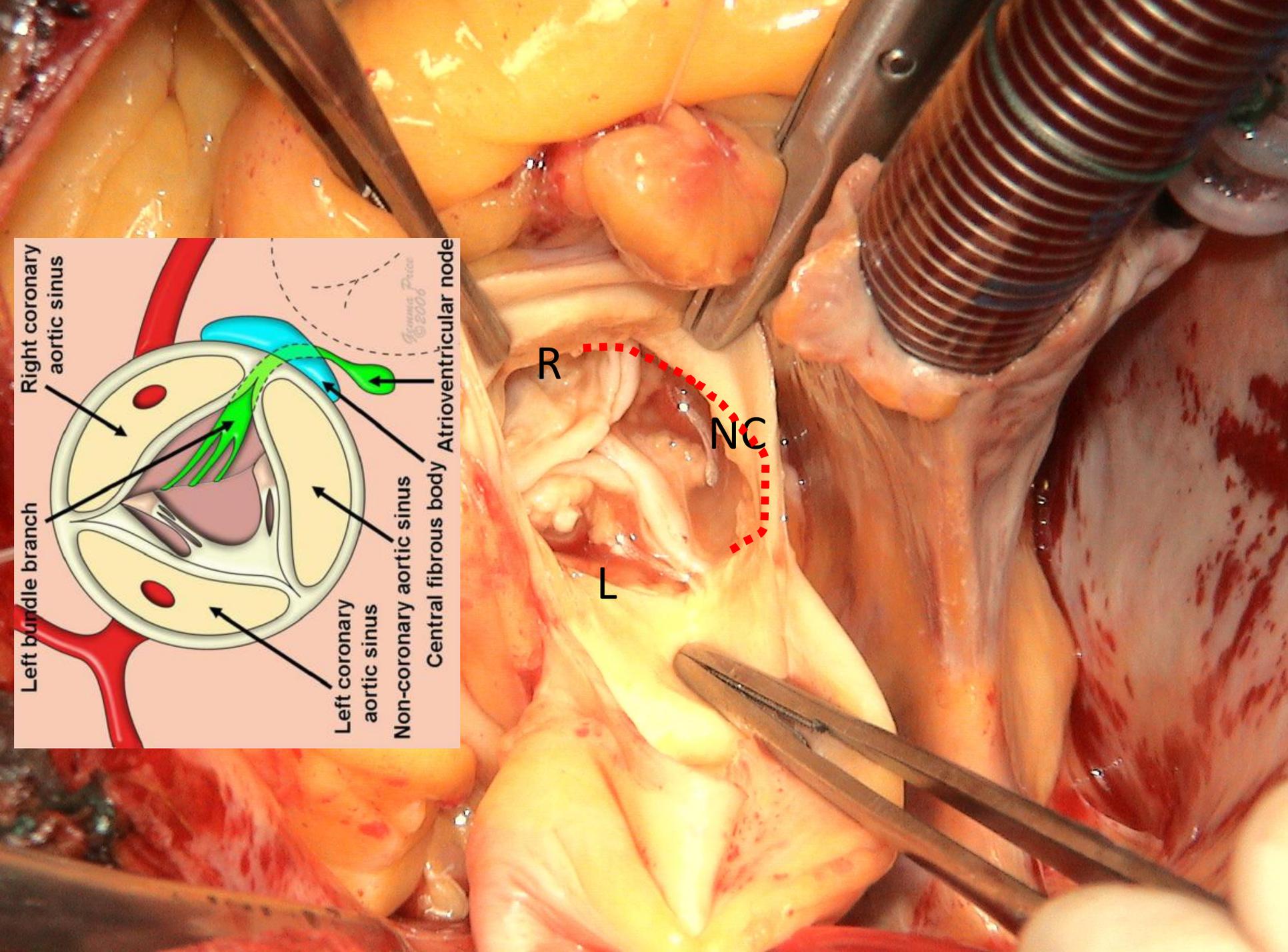


Fig 3. Relationship between the sector of periprosthetic leakage occurrence and the anatomy of the aortic annulus. (LCS = left coronary sinus; LVB = lateral aspect of left ventricular base; Me-Mu = muscular-membranous part of septum; Mu = muscular part of septum; MVAL = mitral valve anterior leaflet; NCS = noncoronary sinus; RCS = right coronary sinus.) (Modified from Sud A, et al, *Ann Thorac Surg*; 1984;38:76-9 [9], with permission.)





Il distacco asettico di protesi

Valvola aortica

- ✦ Debolezza anatomica intrinseca della regione del seno NC (diversa origine embriologica)
- ✦ Maggiore rigidità della regione inter-trigonale
- ✦ Regione sottoposta a maggiore stress dinamico durante il ciclo cardiaco
- ✦ Maggiore tensione sui punti di sutura

Meccanismo del distacco

(verifica intra-operatoria)

- ✦ Lacerazione dell'annulus anatomico
- ✦ Allentamento del filo di sutura
- ✦ Infezione
- ✦ Presenza di materiale interposto appartenuto alla vecchia protesi (in caso di recidiva di re-intervento)

Il distacco aseptico di protesi

La tecnica di sutura condiziona una diversa
incidenza di distacco aseptico di protesi?

- ✦ Sutura a punti staccati

 - Punti singoli

 - Evertenti

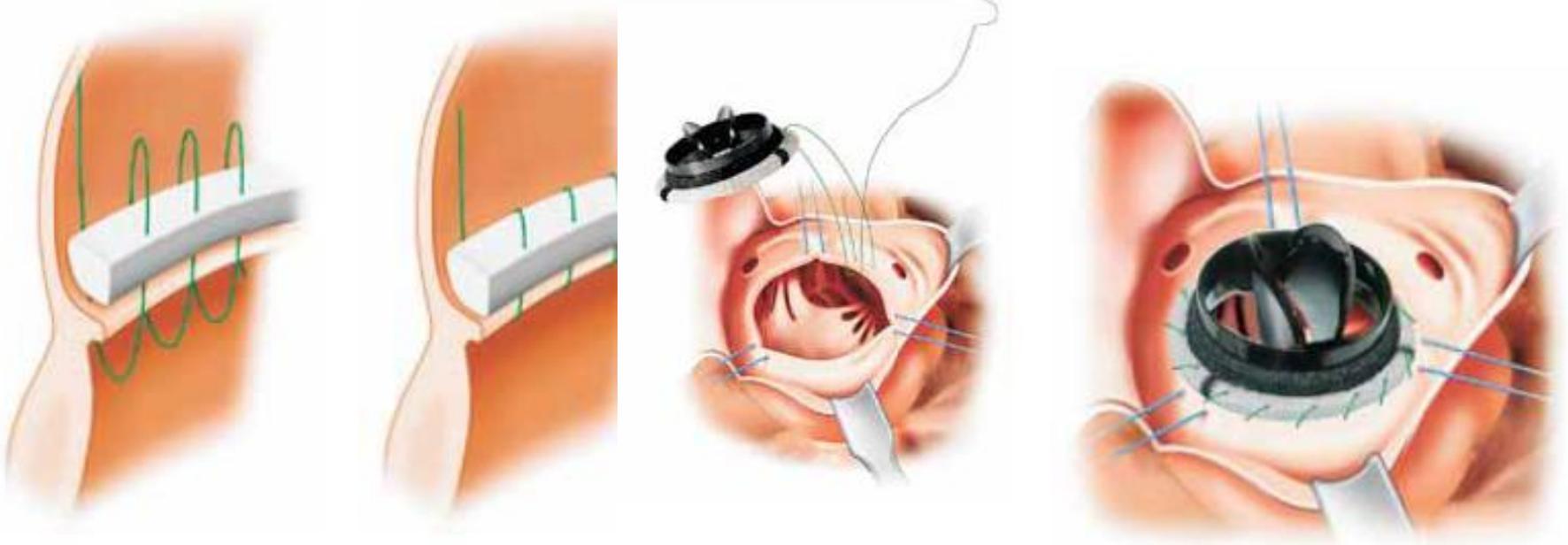
 - Non-evertenti

 - “Pledgets” di rinforzo

- ✦ Sutura continua (semi-continua)

Tecniche cardiocirurgiche di sostituzione valvolare

Sutura continua “running suture”



Esecuzione semplice e rapida

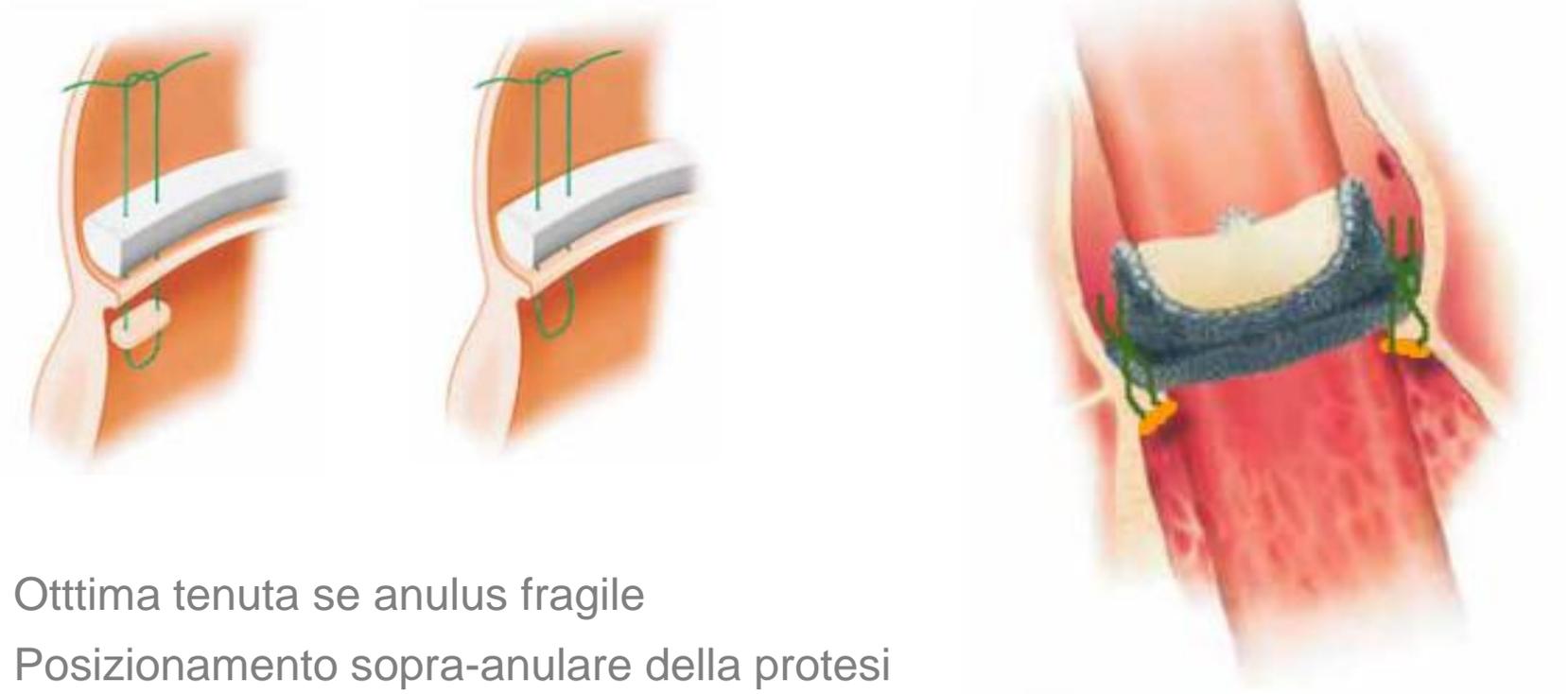
Ottimizza rapporto diametro anulus/protesi

Non indicata se anulus fragile (decalcificazione complessa, endocardite)

Peggioramento area di “leak” in caso di distacco

Tecniche cardiocirurgiche di sostituzione valvolare

Sutura punti staccati ad “U” non evertente c/s pledget
non-everting “mattress suture”



Ottima tenuta se anulus fragile

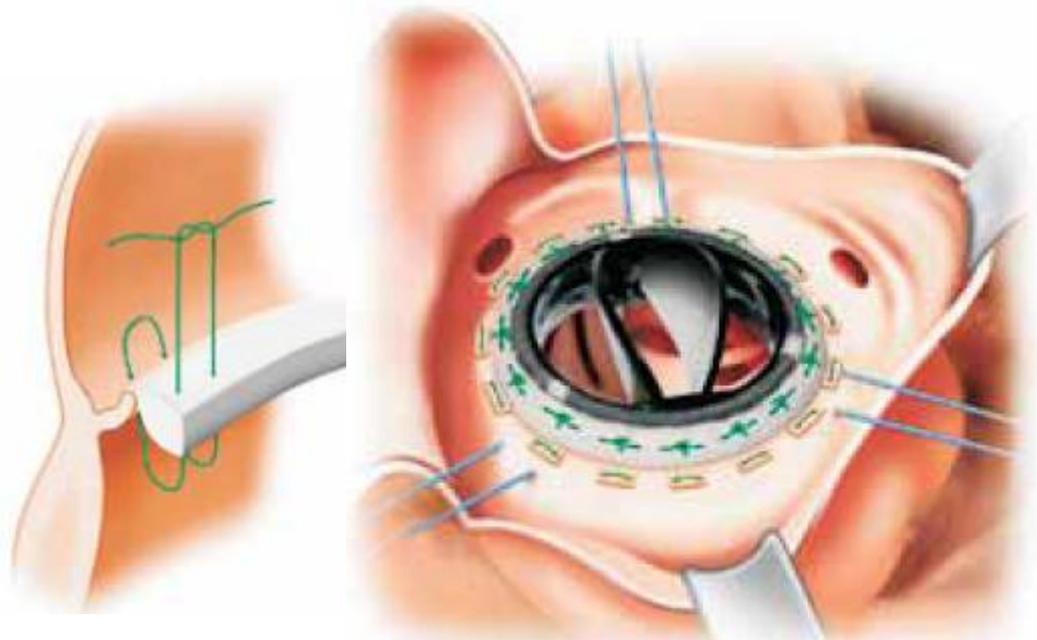
Posizionamento sopra-anulare della protesi

Pledgets intra-ventricolari

Tecniche cardiologiche di sostituzione valvolare

Sutura evertente a punti staccati ad “U” c/s pledget
“everting mattress suture”

Utilizzata per protesi intra-anulari
Sutura molto robusta
Possibile riduzione calibro anulare
Non adatta per calibri anulari
piccoli
Ottima tenuta emostatica per
impianto di tubi valvolati

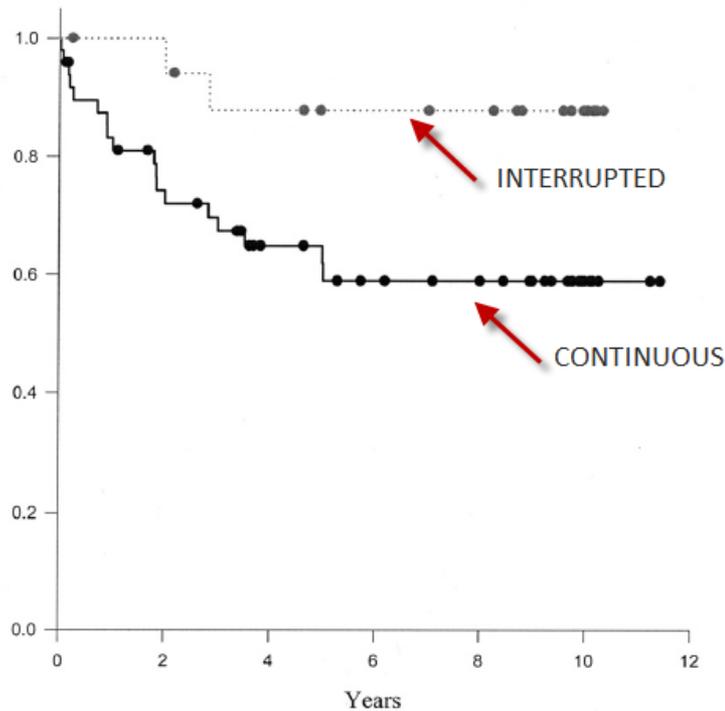


Effect of Valve Suture Technique on Incidence of Paraprosthetic Regurgitation and 10-Year Survival

Sukumaran K. Nair, FRCS (C Th), Gauraang Bhatnagar, MBBS, Oswaldo Valencia, MD, and Venkatachalam Chandrasekaran, FRCS (C Th)

(Ann Thorac Surg 2010;89:1171-9)

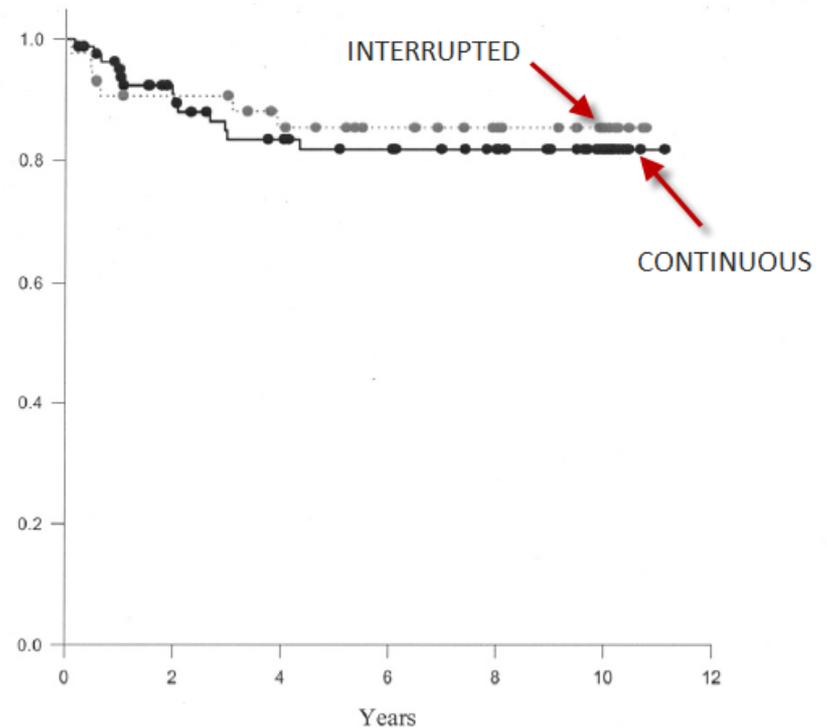
Department of Cardiothoracic Surgery, St George's Hospital NHS Trust, London, United Kingdom © 2010 by The Society of Thoracic Surgeons



Freedom from PPR after MVR

SC	49	41	37	35	33	32	31	31	31	31	31	31
IN	18	18	18	16	16	16	16	16	16	16	16	16
Post-op years	0	1	2	3	4	5	6	7	8	9	10	11

SC (Mean 7.511, SE 0.744, CI = 6.053, 8.970)
 IN (Mean 9.378, SE 0.901, CI = 7.612, 11.144)
 Log-Rank Test, p=0.039



Freedom from PPR after AVR

SC	83	77	75	70	70	69	69	69	69	69	69	69
IN	43	39	39	39	37	37	37	37	37	37	37	37
Post-op years	0	1	2	3	4	5	6	7	8	9	10	11

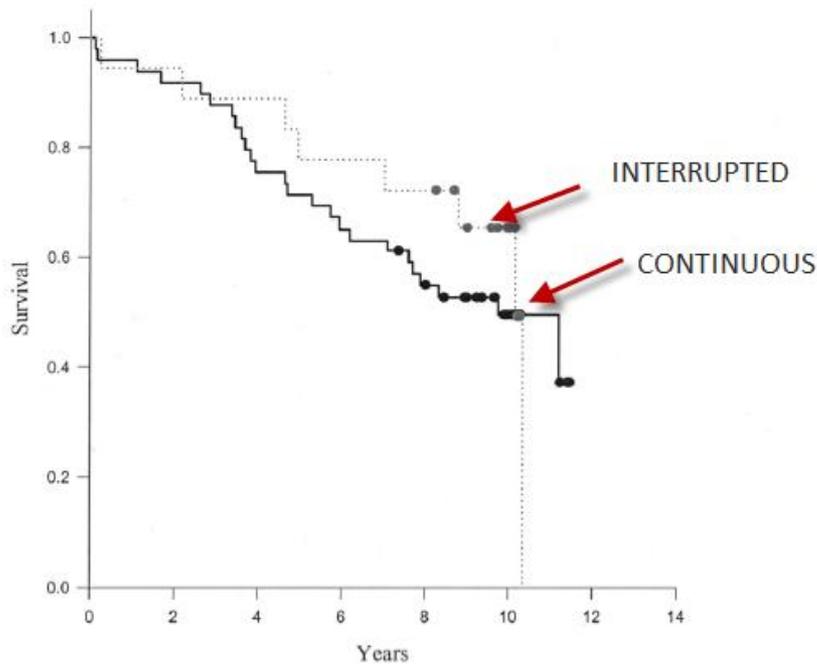
SC (Mean 9.439, SE 0.440, CI = 8.577, 10.300)
 IN (Mean 9.421, SE 0.561, CI = 8.321, 10.521)
 Log-Rank Test, p=0.688

Effect of Valve Suture Technique on Incidence of Paraprosthetic Regurgitation and 10-Year Survival

Sukumaran K. Nair, FRCS (C Th), Gauraang Bhatnagar, MBBS, Oswaldo Valencia, MD, and Venkatachalam Chandrasekaran, FRCS (C Th)

(Ann Thorac Surg 2010;89:1171-9)

Department of Cardiothoracic Surgery, St George's Hospital NHS Trust, London, United Kingdom © 2010 by The Society of Thoracic Surgeons



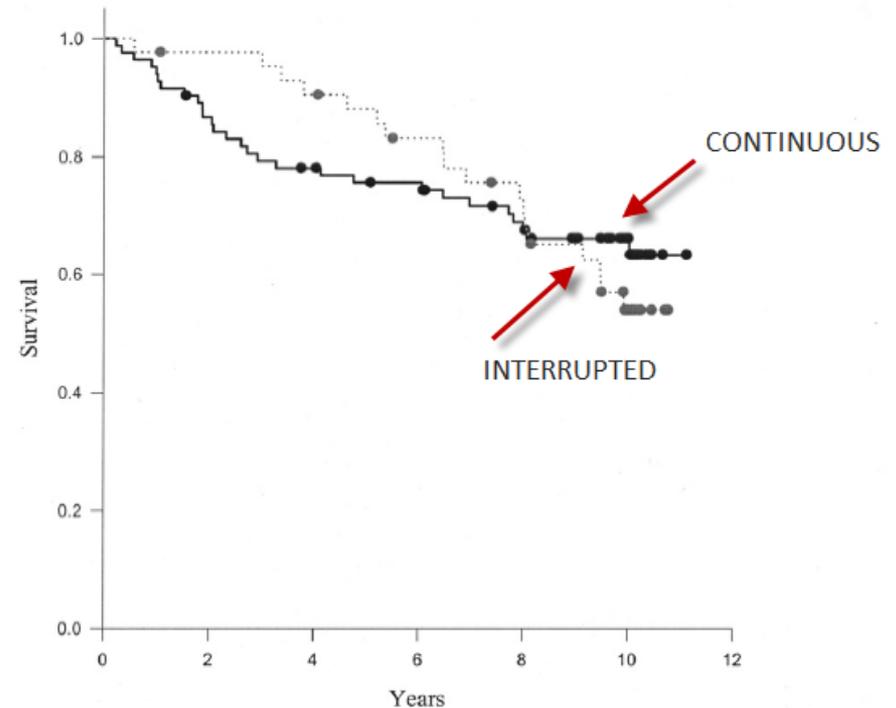
Survival after MVR

SC	49	47	45	43	37	35	32	31	27	26	25	24
IN	18	17	17	16	16	14	14	14	13	12	12	10
Post-op years	0	1	2	3	4	5	6	7	8	9	10	11

SC (Mean 8.056, SE 0.557, 95% CI = 6.966, 9.147)

IN (Mean 8.397, SE 0.788, 95% CI = 6.852, 9.942)

Log-Rank Test, $p=0.613$



Survival after AVR

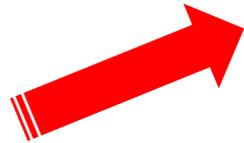
SC	83	78	72	66	65	63	63	60	58	56	56	55
IN	43	42	42	42	42	39	38	36	33	32	29	25
Post-op years	0	1	2	3	4	5	6	7	8	9	10	11

SC (Mean 8.495, SE 0.442, 95% CI = 7.629, 9.361)

IN (Mean 8.844, SE 0.433, 95% CI = 7.996, 9.691)

Log-Rank Test, $p=0.650$

Il distacco aseptico di protesi



Sovraccarico di volume

Dilatazione ventricolare
Scompenso

Leak peri-protetico



Emolisi
Anemizzazione

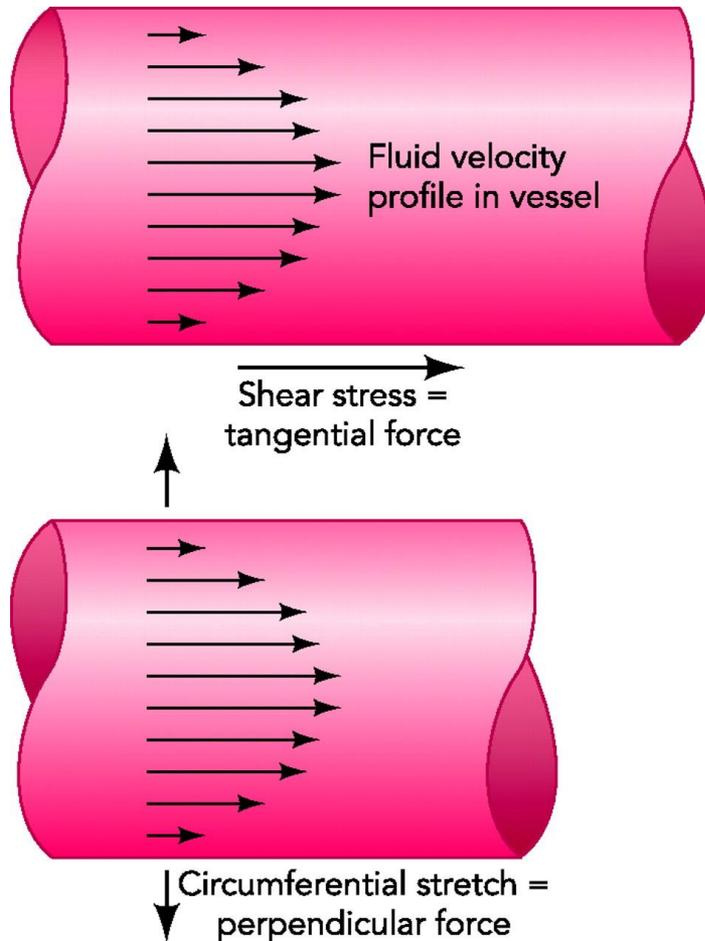
Trasfusioni ripetute

Indici di emolisi

- ✦ Anemia
- ✦ Incremento LDH
- ✦ Riduzione aptoglobina
- ✦ Incremento bilirubina Indiretta
- ✦ Emoglobinuria/emosideruria
- ✦ Incremento reticolociti

Forces created by flowing blood

Fluid flow within a tube creates two types of forces: **shear stress**, which is a force tangential to the vessel wall, and **pressure**, which creates a circumferential stretch perpendicular to the vessel wall.



Il distacco asettico di protesi

Meccanismi che generano emolisi

Shear Stress
(dynes/cm²)

Frammentazione



Collisione



Accelerazione rapida



Free jet



Decelerazione lenta



PHILIPS

CARAVAGGIO ELDA

13/12/2011

13:15:17

TIS0.1

MI 0.5

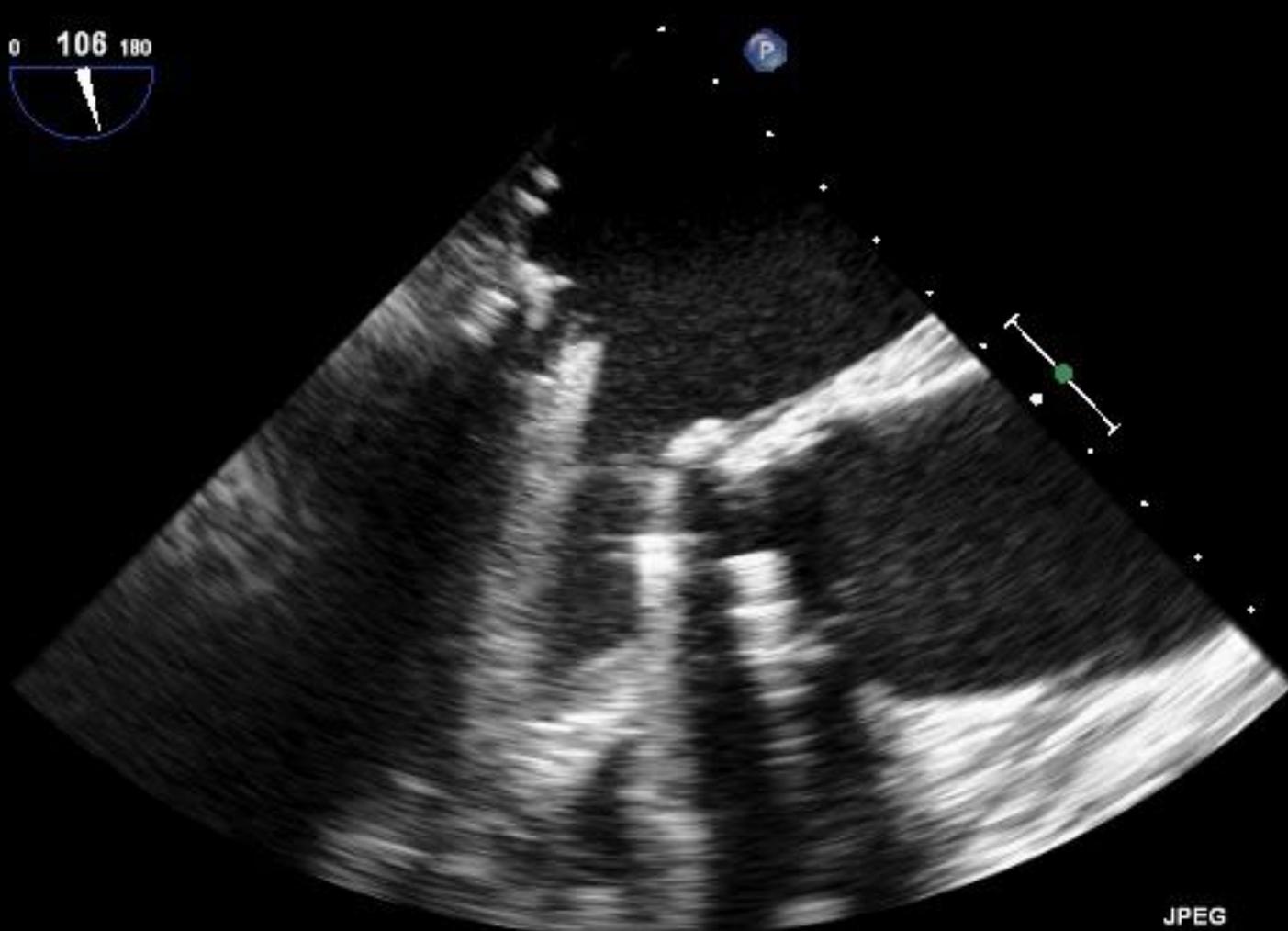
1510959

X7-2t/Adultl

FR 52Hz
12cm

M4

2D
70%
C 50
P Off
Gen



JPEG

Temp. PAZ.: 37.0C
Temp. TEE< 37.0C

62 bpm

PHILIPS

CARAVAGGIO ELDA

13/12/2011

13:16:48

TIS0.8 MI 0.4

1510959

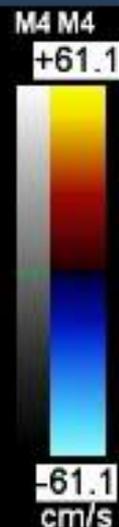
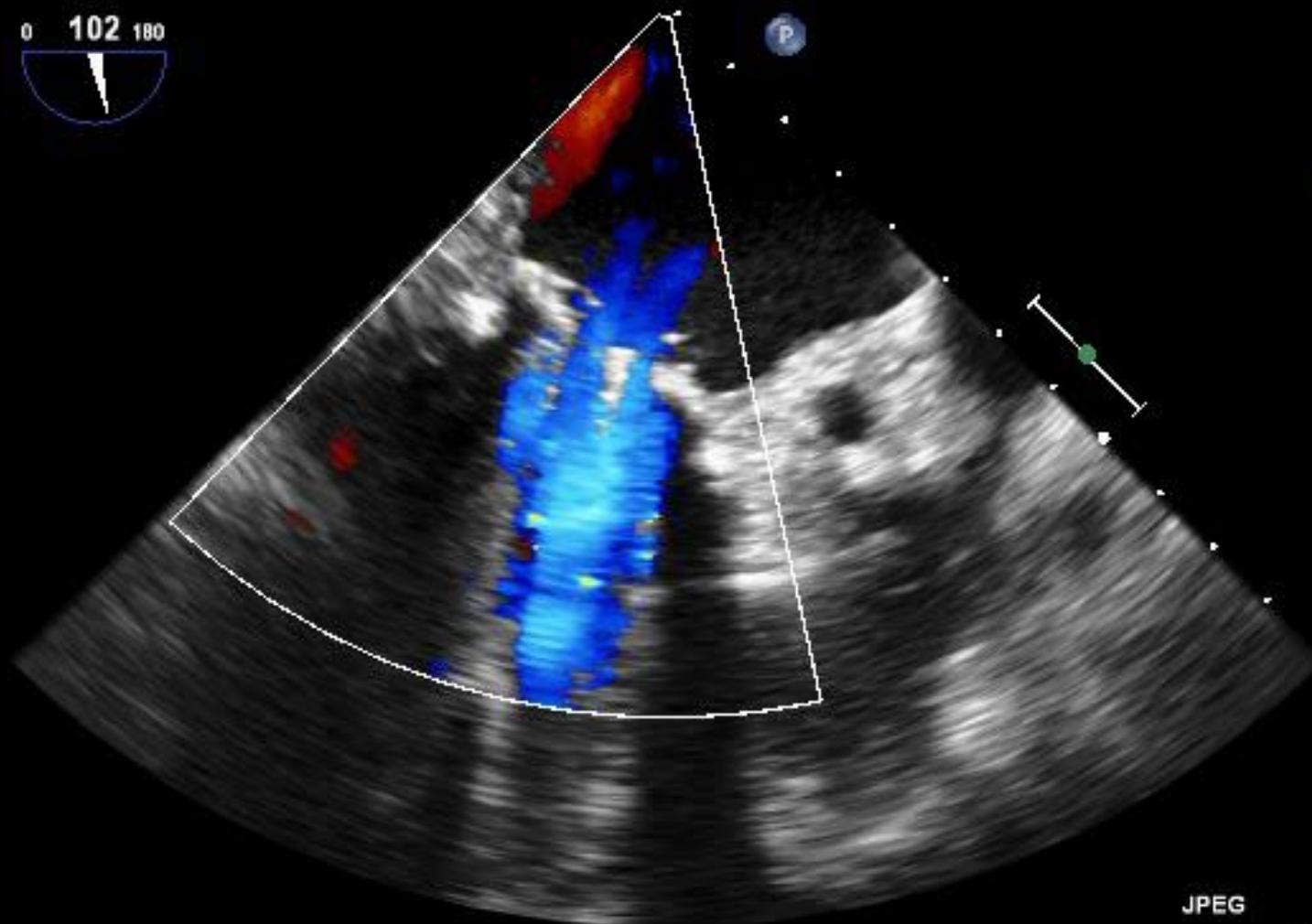
X7-2t/Adultl

FR 14Hz
12cm

2D
72%
C 50
P Off
Gen



CF
59%
4.4MHz
WF Alto
Med.



Temp. PAZ: 37.0C
Temp. TEE: 39.1C

JPEG

56 bpm

PHILIPS

CARAVAGGIO ELDA

13/12/2011

13:28:24

TIS0.6 MI 0.8

1510959

X7-2t/AdultI

FR 19Hz

9.0cm

Volume completed 20 180

3D 13%

3D 23dB

CF

65%

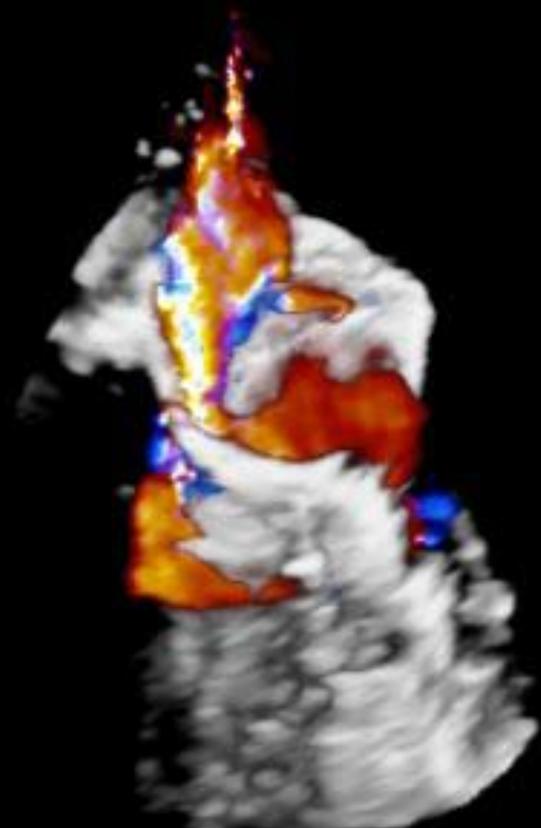
4.4MHz



M4 M4

+61.6

-61.6



Temp. PAZ.: 37.0C

Temp. TEE: 38.8C

JPEG

81 bpm

PHILIPS

CARAVAGGIO ELDA

13/12/2011

13:24:44

TIS0.2 MI 0.5

1510959

X7-2t/AdultI

FR 5Hz

9.8cm

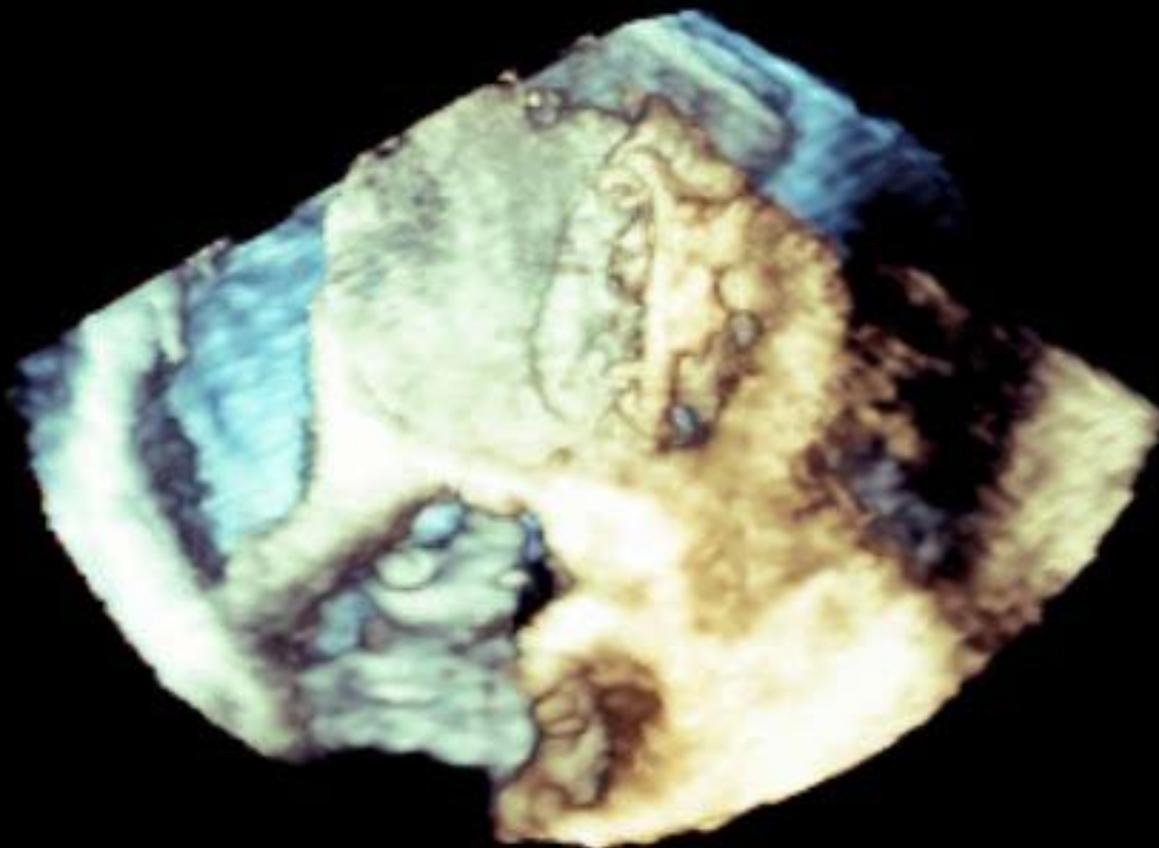
M4

Live 3D

3D 25%

3D 16dB

Gen



JPEG



Temp. PAZ.: 37.0C

Temp. TEE: 40.2C

55 bpm

Different Clinical Outcome of Paravalvular Leakage After Aortic or Mitral Valve Replacement

In Jeong Cho, MD^a, Jeongeun Moon, MD^a, Chi Young Shim, MD, PhD^a, Yangsoo Jang, MD, PhD^a, Namsik Chung, MD, PhD^a, Byung-Chul Chang, MD, PhD^b, and Jong-Won Ha, MD, PhD^{a,*}

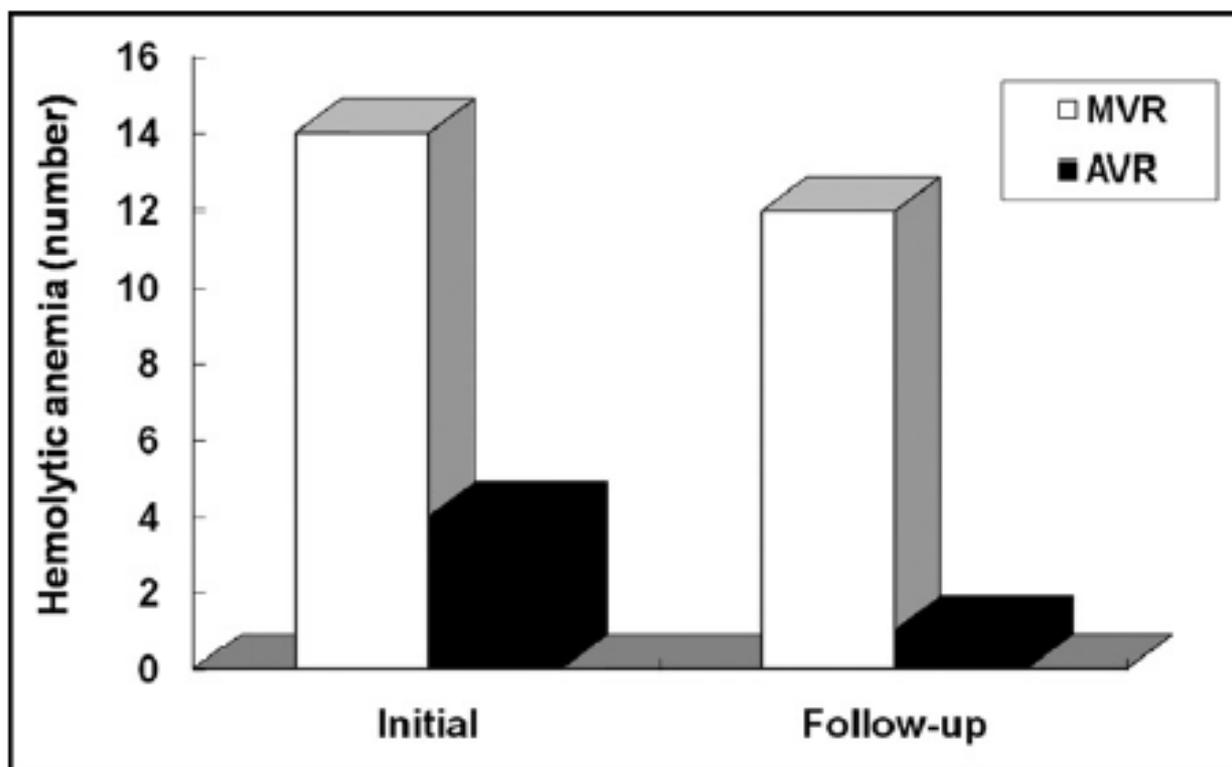


Figure 2. Changes in hemolytic anemia at the time of diagnosis of PVL and at follow-up. Hemolytic anemia was spontaneously recovered in 75% of the patients (n = 3) with PVL after AVR but in only 14.3% of the patients (n = 2) with PVL after MVR.

Different Clinical Outcome of Paravalvular Leakage After Aortic or Mitral Valve Replacement

In Jeong Cho, MD^a, Jeonggeun Moon, MD^a, Chi Young Shim, MD, PhD^a, Yangsoo Jang, MD, PhD^a, Namsik Chung, MD, PhD^a, Byung-Chul Chang, MD, PhD^b, and Jong-Won Ha, MD, PhD^{a,*}

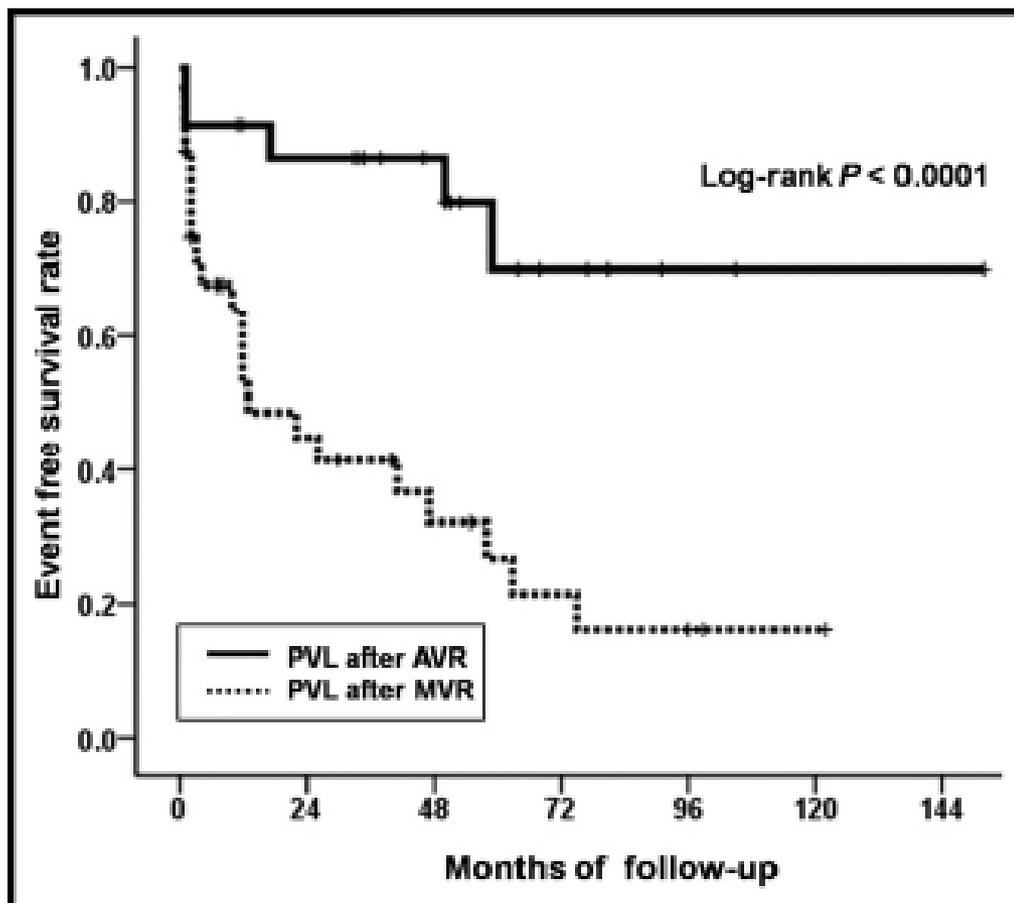


Figure 1. Kaplan-Meier curves showing differences in event-free survival between patients with PVL after AVR and that after MVR.

(Am J Cardiol 2011;107:280–284)

Il distacco asettico di protesi

Terapia chirurgica

- ✦ Sutura del distacco
- ✦ Sostituzione della protesi

Quando indicato

- ✦ Rigurgito moderato/severo sintomatico
- ✦ Scompenso
- ✦ Emolisi con ripetute emotrasfusioni
- ✦ Leak mitralico F.U. attento anche se moderato

Paravalvular leakage after mitral valve replacement: improved long-term survival with aggressive surgery?☆

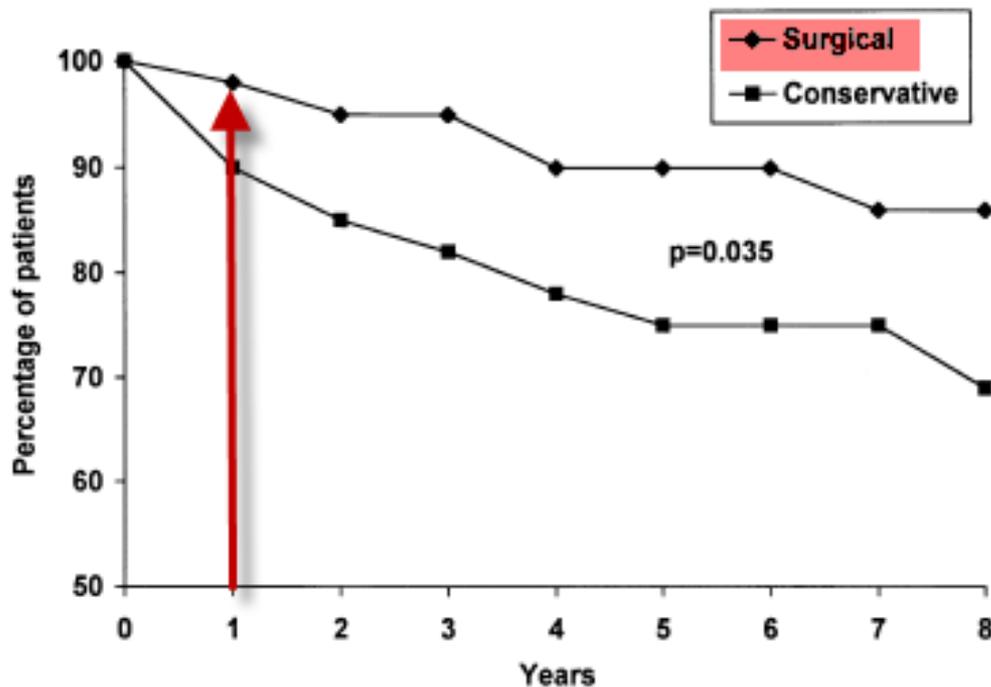
Michele Genoni^{a,*}, Daniel Franzen^a, Paul Vogt^a, Burkhardt Seifert^b, Rolf Jenni^c,
Andreas Künzli^a, Urs Niederhäuser^a, Marko Turina^a

^aDivision of Cardiac Surgery, University Hospital, Ramistrasse 100, CH-8091 Zurich, Switzerland

^bDepartment of Biostatistics ISPM, University Hospital, Ramistrasse 100, CH-8091 Zurich, Switzerland

^cDivision of Echocardiography, University Hospital, Ramistrasse 100, CH-8091 Zurich, Switzerland

Received 7 September 1999; received in revised form 23 November 1999; accepted 29 November 1999



1987 – 1997

96 pts mitral leakage

46 Conservative therapy

Long-term mortality: 26%

50 surgically treated

Operative mortality: 6%

Long-term mortality 12%

Fig. 4. Influence of therapeutic strategy on survival.

FOCUS ISSUE: STRUCTURAL HEART DISEASE

Clinical Research

Long-Term Follow-Up of Percutaneous Repair of Paravalvular Prosthetic Regurgitation

Paul Sorajja, MD,* Allison K. Cabalka, MD,† Donald J. Hagler, MD,† Charanjit S. Rihal, MD*

Rochester, Minnesota

FOCUS ISSUE: STRUCTURAL HEART DISEASE

Clinical Research

Clinical Outcomes in Patients Undergoing Percutaneous Closure of Periprosthetic Paravalvular Leaks

Carlos E. Ruiz, MD, PHD, Vladimir Jelnin, MD, Itzhak Kronzon, MD, Yuriy Dudiy, MD, Raquel Del Valle-Fernandez, MD, Bryce N. Einhorn, Paul T. L. Chiam, MD, Claudia Martinez, MD, Rocio Eiros, MS, Gary Roubin, MD, PHD, Howard A. Cohen, MD

New York, New York

Long-Term Follow-Up of Percutaneous Repair of Paravalvular Prosthetic Regurgitation

Paul Sorajja, MD,* Allison K. Cabalka, MD,† Donald J. Hagler, MD,† Charanjit S. Rihal, MD*
Rochester, Minnesota

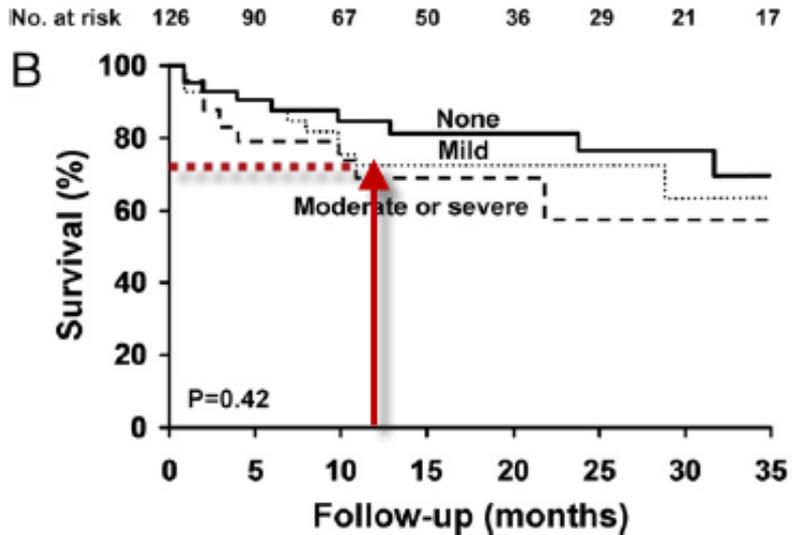
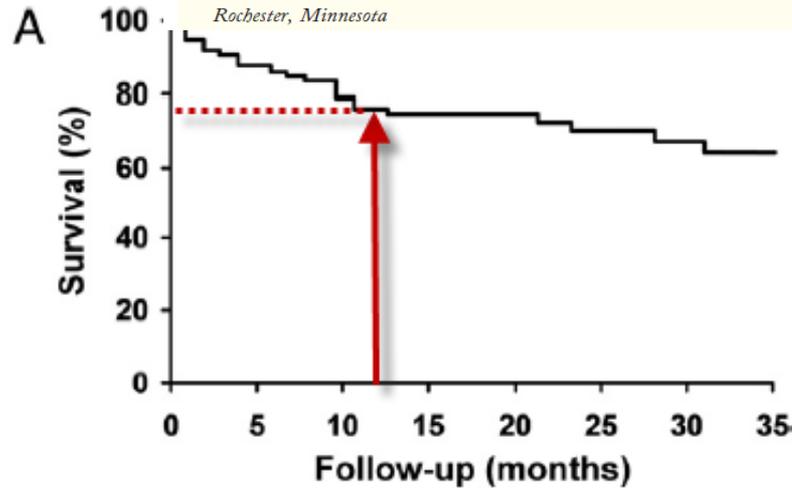
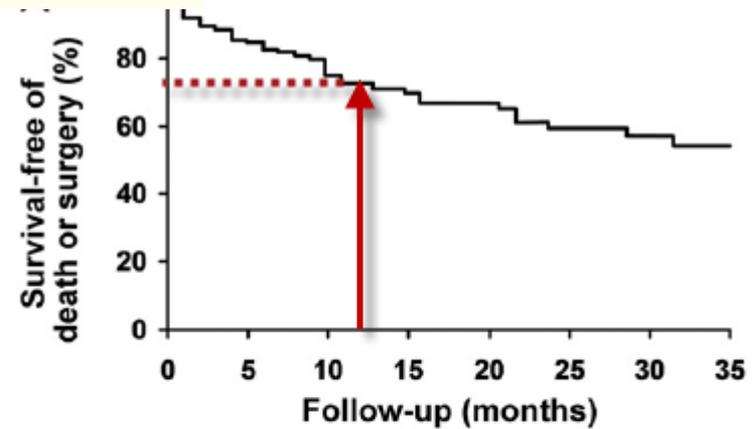


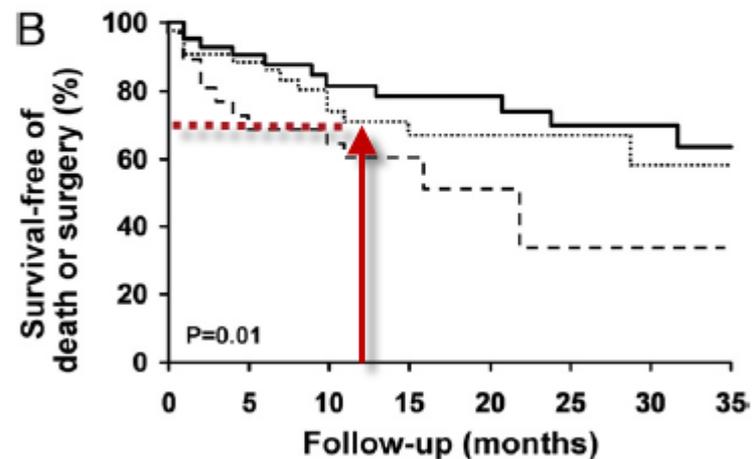
Figure 1

Survival After Percutaneous Repair of Paravalvular Prosthetic Regurgitation

Survival free of all-cause mortality is shown for (A) the entire patient cohort and (B) according to degree of residual paravalvular prosthetic regurgitation.



No. at risk 126 88 67 50 36 29 21 17



None	—	36	25	21	16	12	8	7
Mild	·····	35	26	17	12	10	7	7
Mod or severe	- - -	17	15	12	7	4	3	3

Figure 4

Survival Free of Death or Need for Cardiac Surgery

Survival free of the combined endpoint of death or need for cardiac surgery is shown for (A) the entire patient cohort and (B) according to degree of residual paravalvular prosthetic regurgitation.

FOCUS ISSUE: STRUCTURAL HEART DISEASE

Clinical Research

Clinical Outcomes in Patients Undergoing Percutaneous Closure of Periprosthetic Paravalvular Leaks

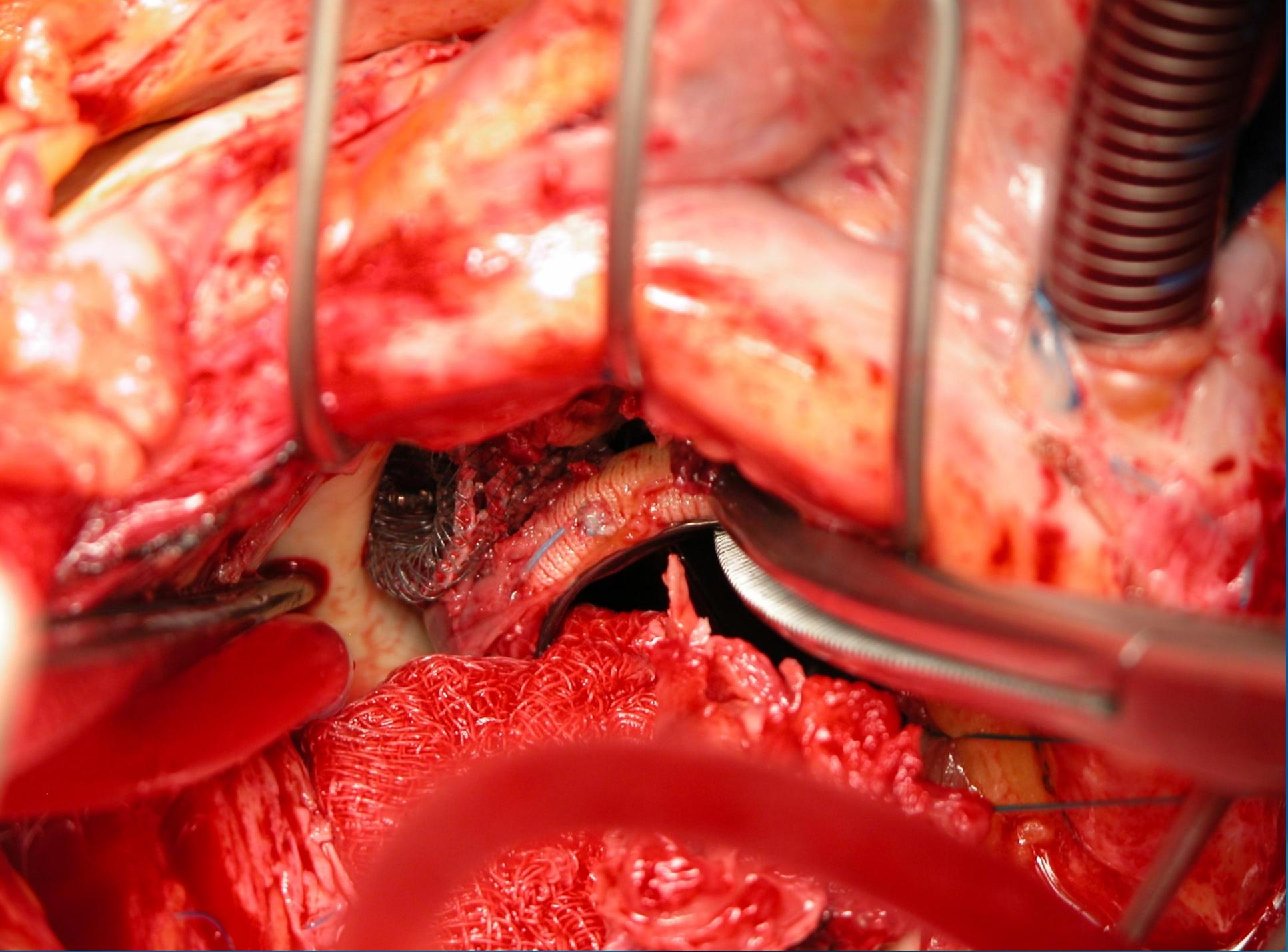
Carlos E. Ruiz, MD, PhD, Vladimir Jelnin, MD, Itzhak Kronzon, MD, Yuriy Dudy, MD, Raquel Del Valle-Fernandez, MD, Bryce N. Einhorn, Paul T. L. Chiam, MD, Claudia Martinez, MD, Rocio Eiros, MS, Gary Roubin, MD, PhD, Howard A. Cohen, MD

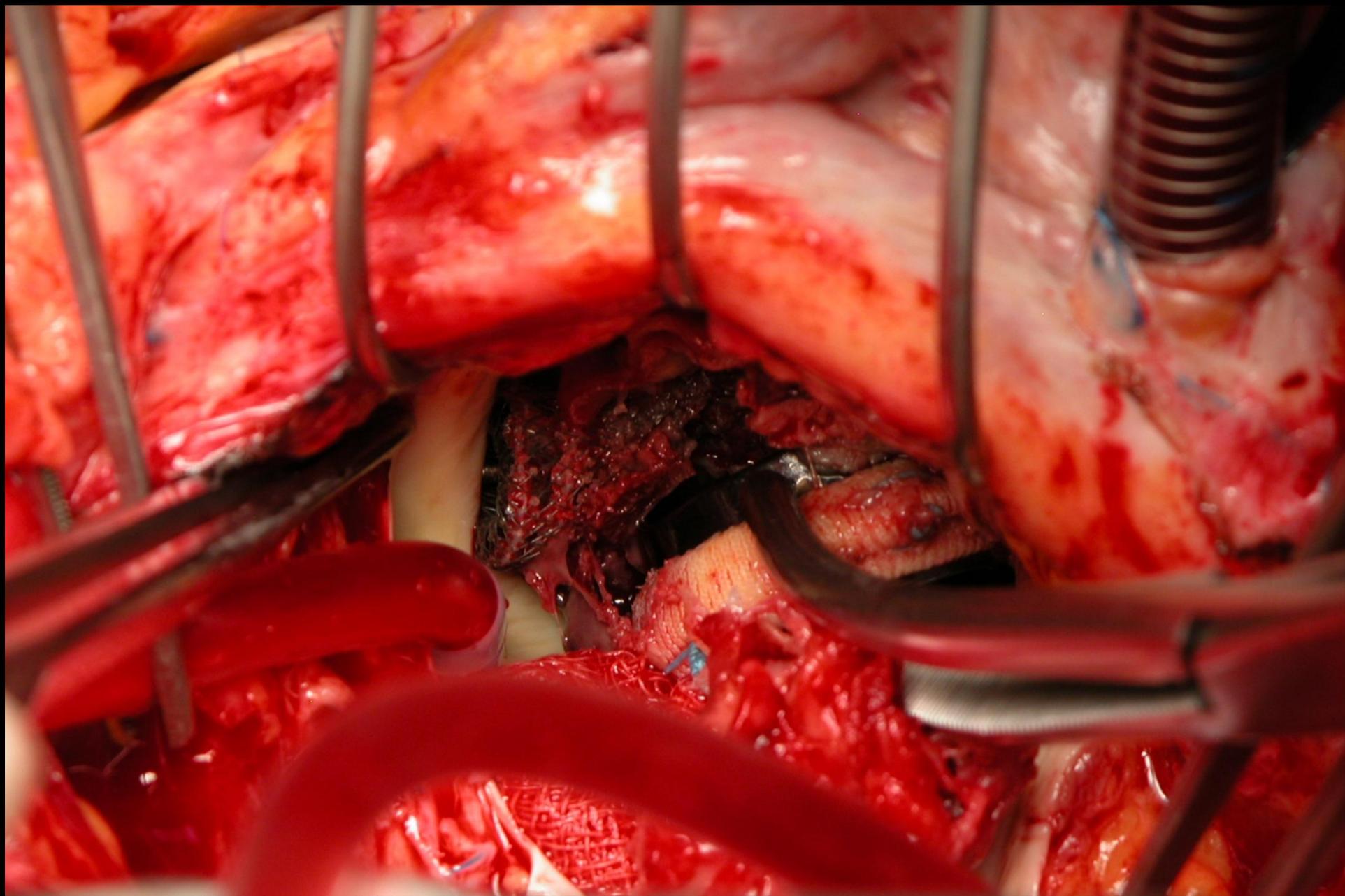
New York, New York

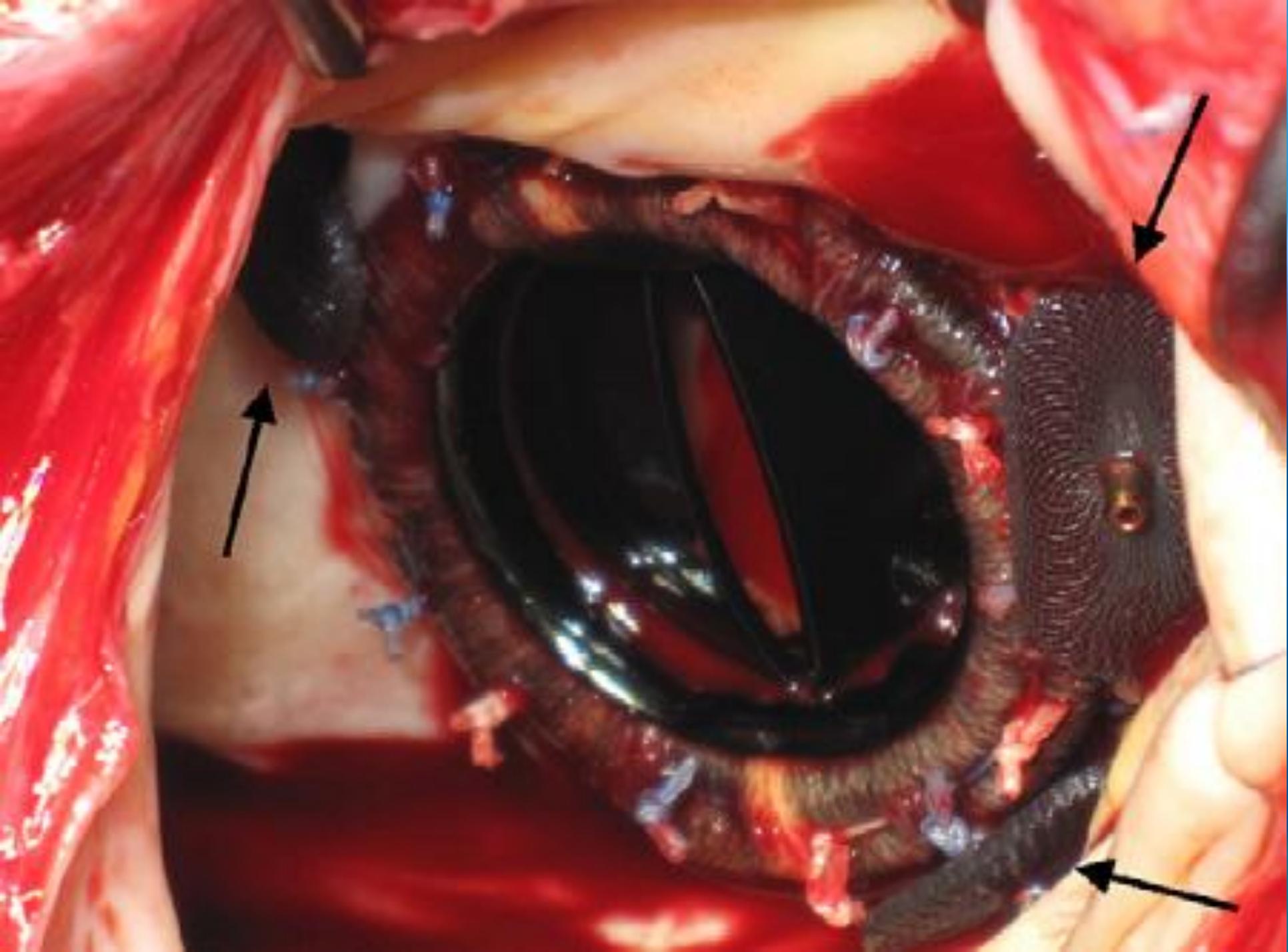
Table 3 Current Publications

First Author (Ref. #)	Year	Type (n)	Patients (n)	Leaks (n)	Technical Success	Clinical Success	Repeat Procedures	Mean Fluoroscopy Time (min)
Hourihan et al. (10)	1992	A	3	3	3 (100%)	2 (67%)	1 (33%)	n/a
Pate et al. (20)	2006	M (9) A (1)	10	10	7 (70%)	4 (57%)	4 (40%)	62
Hein et al. (18)	2006	M (13) A (8)	21	26	24 (92%)	14 (67%)	9 (43%)	31
Shapira et al. (21)	2007	M (9) A (2)	11	13	11 (85%)	6 (54%)	1 (8%)	60
Sorajja et al. (22)	2007	M (14) A (2)	16	19	17 (89%)	12 (75%)	0 (0%)	55
Cortes et al. (19)	2008	M	27	27	17 (63%)	10 (59%)	0 (0%)	n/a
García-Borbolla Fernández et al. (11)	2009	M	8	8	5 (63%)	4 (80%)	0 (0%)	n/a
Nietlispach et al. (25)	2010	A (1) M (4)	5	5	5 (100%)	5 (100%)	0 (0%)	15

A – aortic paravalvular leak; M – mitral paravalvular leak; n/a – not available.







Conclusioni

- ✦ Incidenza maggiore nella protesi mitralica
- ✦ Più frequente se utilizzata sutura semi-continua
- ✦ Sintomi predominanti scompenso ed emolisi
- ✦ Outcome meno favorevole se protesi mitralica
- ✦ Follow-up attento anche per rigurgiti moderati
- ✦ Terapia prevalentemente chirurgica
- ✦ Terapia percutanea in casi selezionati se chirurgia non idonea