Surgical Mininvasive Approach for Mitral Repair

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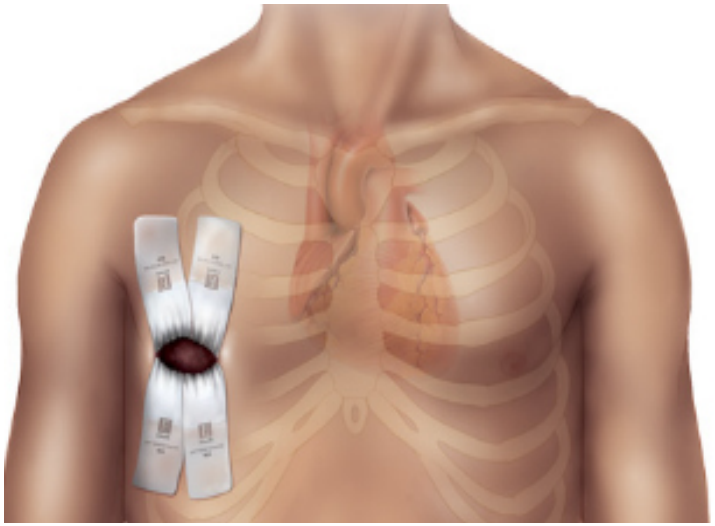
Minimally invasive mitral valve surgery
PORT-ACCESS TECNIQUE



- Reduce surgical trauma
- Minimize disruption of the chest wall
- Provide a safe and reproducible approach to CPB and myocardial protection

- Be applicable to the majority of patients and procedures
- Provide same safety and efficacy as conventional cardiac surgery

Minimally invasive mitral valve surgery

Minimally Invasive Versus Conventional Open Mitral Valve Surgery

A Meta-Analysis and Systematic Review

MINI vs ST similar mortality rates

30 days 1.2% vs 1.5% - **1 year** 0.9% vs 1.3% - **3 years** 0.5% vs 0.5% - **9 years** 0.2% vs 0.7%

Advantages

- Decreased bleeding
- Reduced transfusions
- Shorter ICU and hospital stay
- Shorter ventilation time
- Reduced time to return to normal activity
- Reduced surgical pain
- Better cosmesis

Disadvantages

- Increased risk of stroke
- Increased risk of aortic dissection
- Increased ECC and aortic clamp time
- Groin infections/complications

Cheng et al, Innov 2011;6:66-76 – Falk et al, Innov 2011;6:84-103

Minimally invasive mitral valve surgery

Minimally invasive versus conventional mitral valve surgery: A propensity-matched comparison

Lars G. Svensson, MD, PhD,[a] Fernando A. Atik, MD,[a] Delos M. Cosgrove, MD,[a] Eugene H. Blackstone, MD,[a,b] Jeevanantham Rajeswaran, MSc,[b] Gita Krishnaswamy, MS,[b] Ung Jin, MD,[a] A. Marc Gillinov, MD,[a] Brian Griffin, MD,[c] José L. Navia, MD,[a] Tomislav Mihaljevic, MD,[a] and Bruce W. Lytle, MD[a]

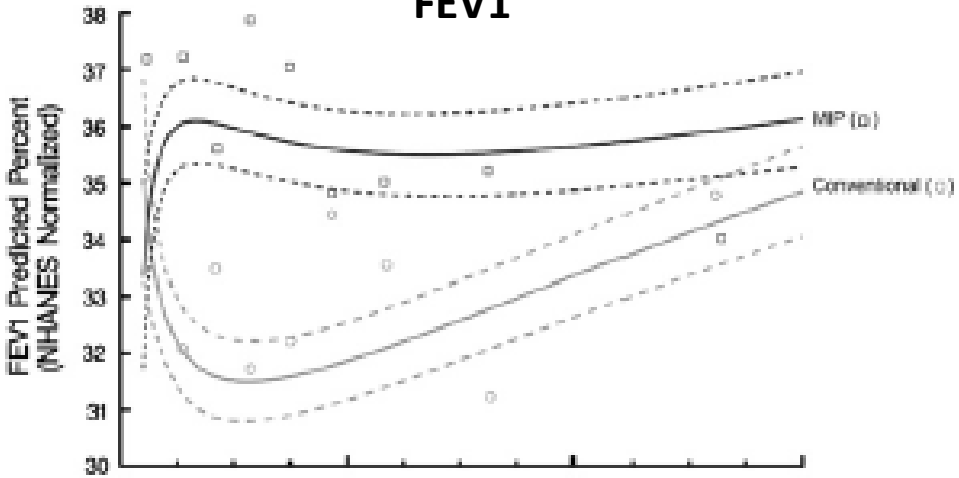
- Min Invasive = 2124
- Sternotomy = 1047
- Propensity matched showed no difference in mortality
- MI: less blood, < pain

Relatively longer CPB and aortic clamping time

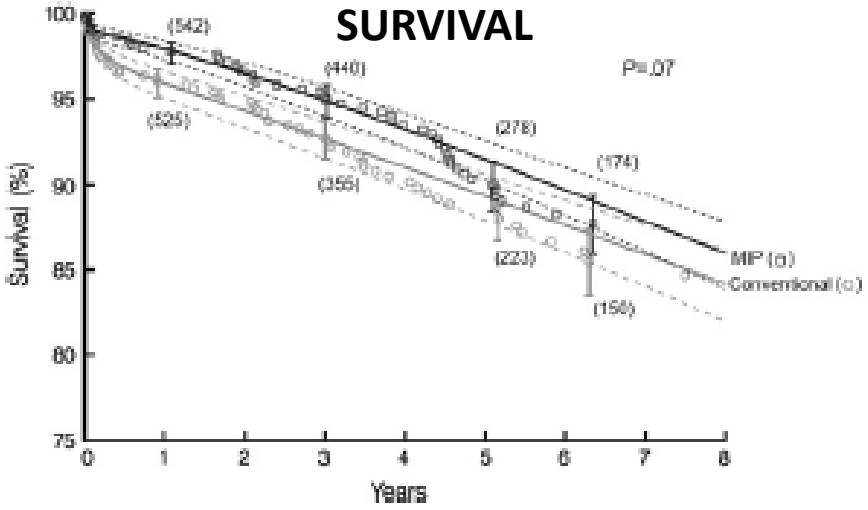
Svensson et al, JTCS. 2010;139:926-32

Minimally invasive mitral valve surgery

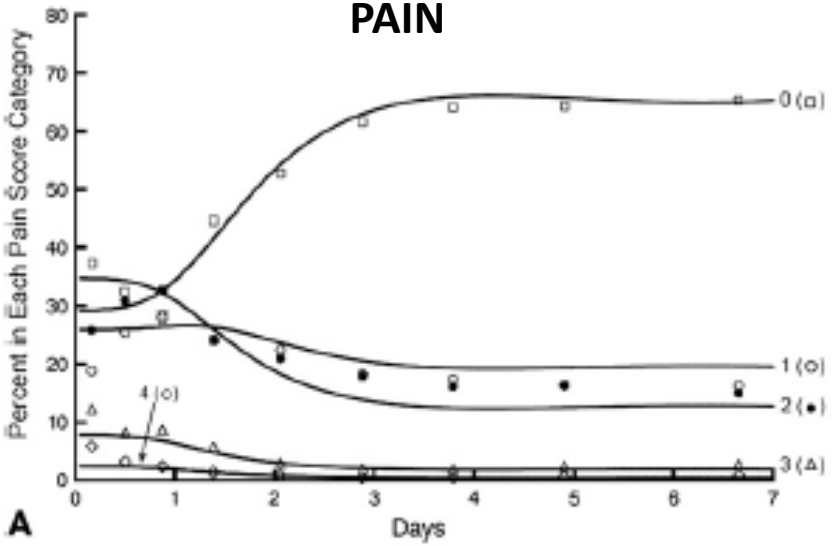
FEV1

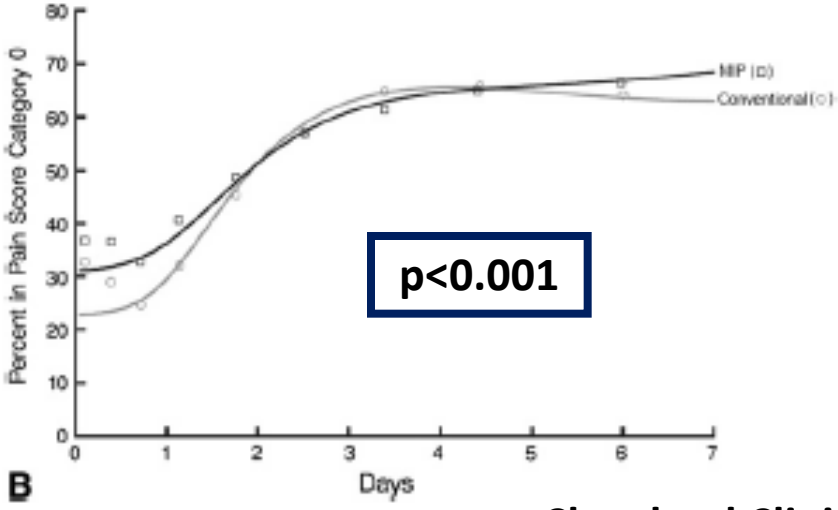


SURVIVAL



PAIN





Svensson et al, JTCS. 2010;139:926-32

Cleveland Clinic

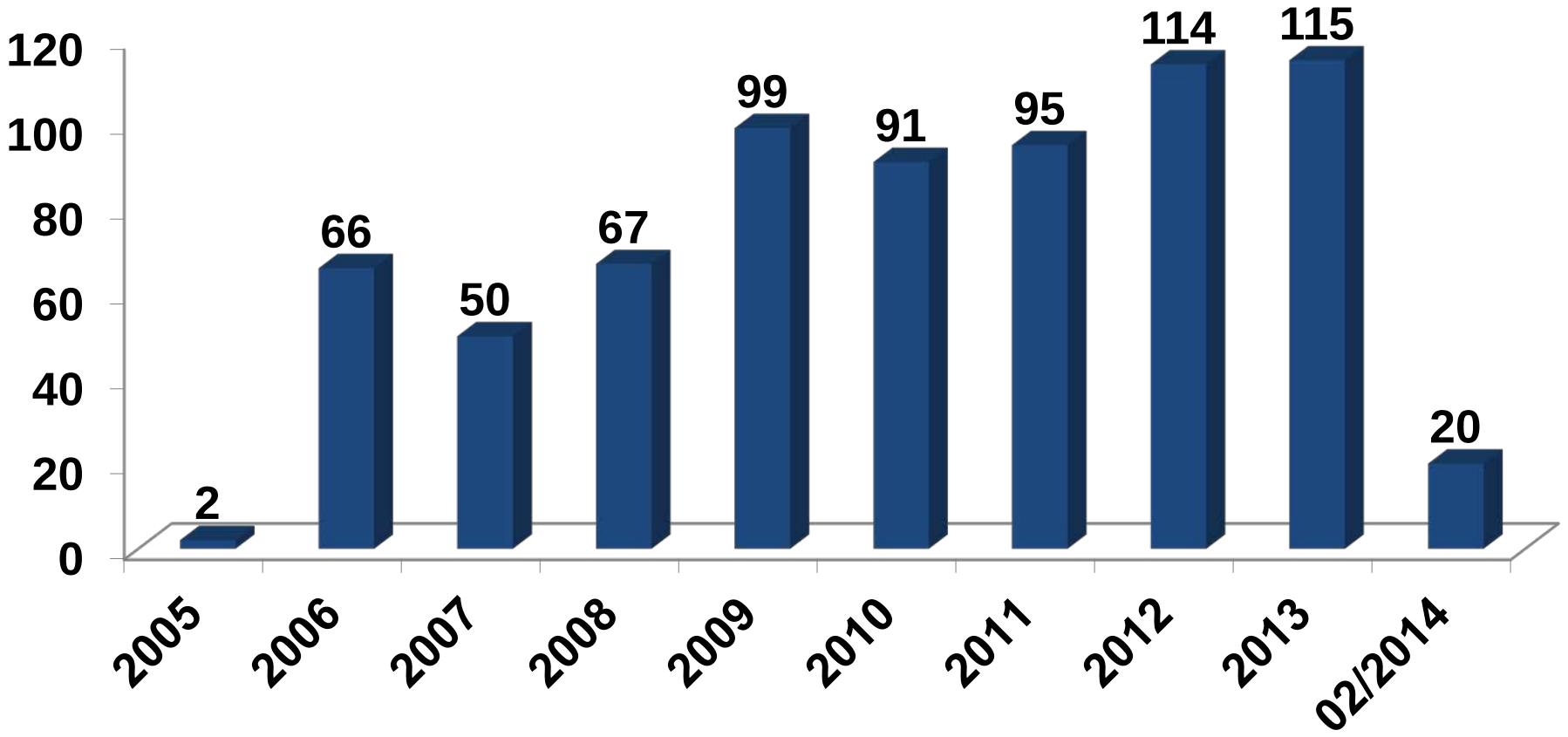
Minimally invasive mitral valve surgery

Turin overall MIS Port Access global experience

2005 – Feb 2014

Minimally invasive mitral valve surgery

July 2005 – Feb 2014: 719 procedures



Consecutive unselected patients

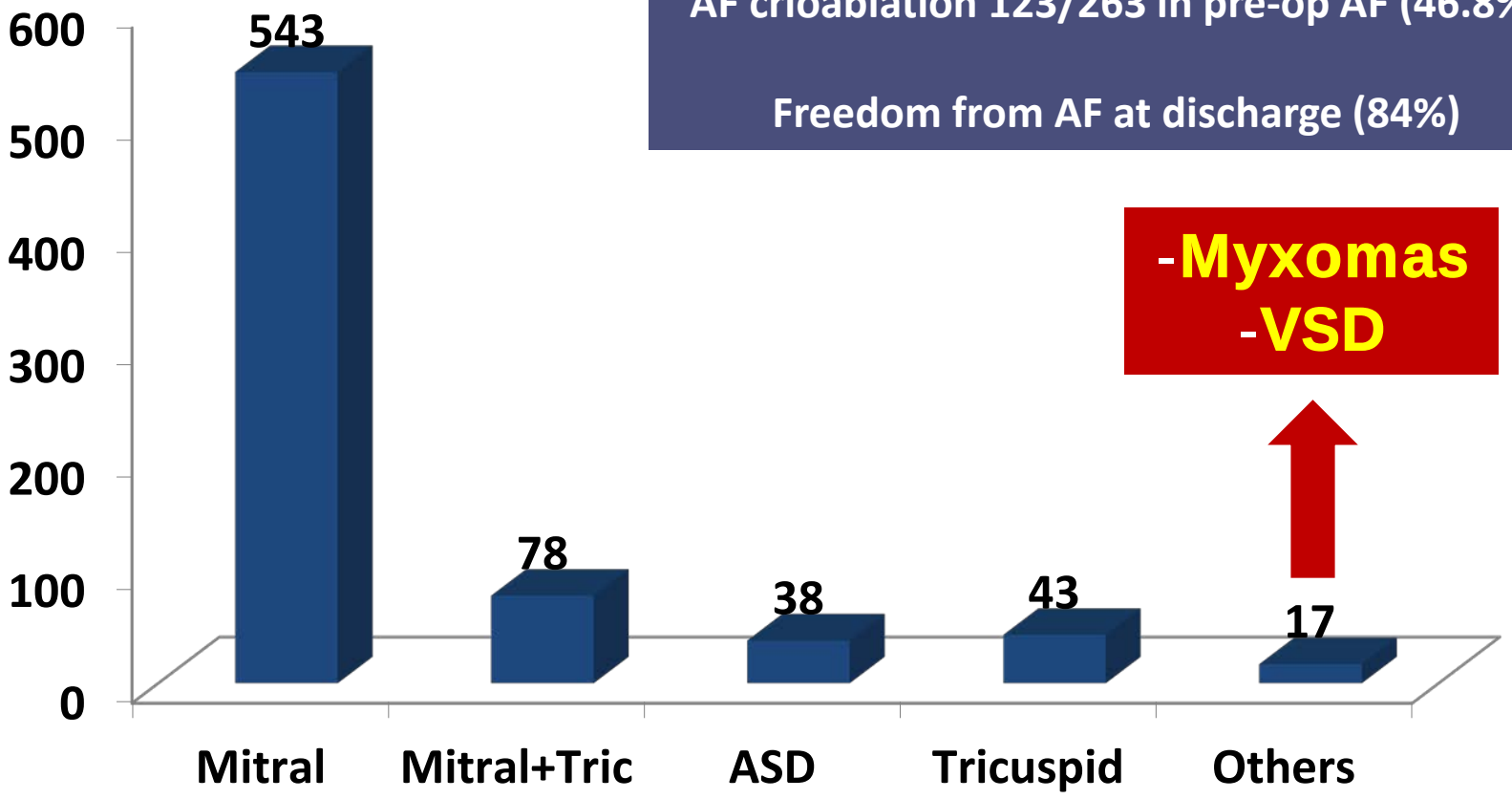
Minimally invasive mitral valve surgery

July 2005 – Feb 2014: 719 procedures

AF crioablation 123/263 in pre-op AF (46.8%)

Freedom from AF at discharge (84%)

-Myxomas
-VSD

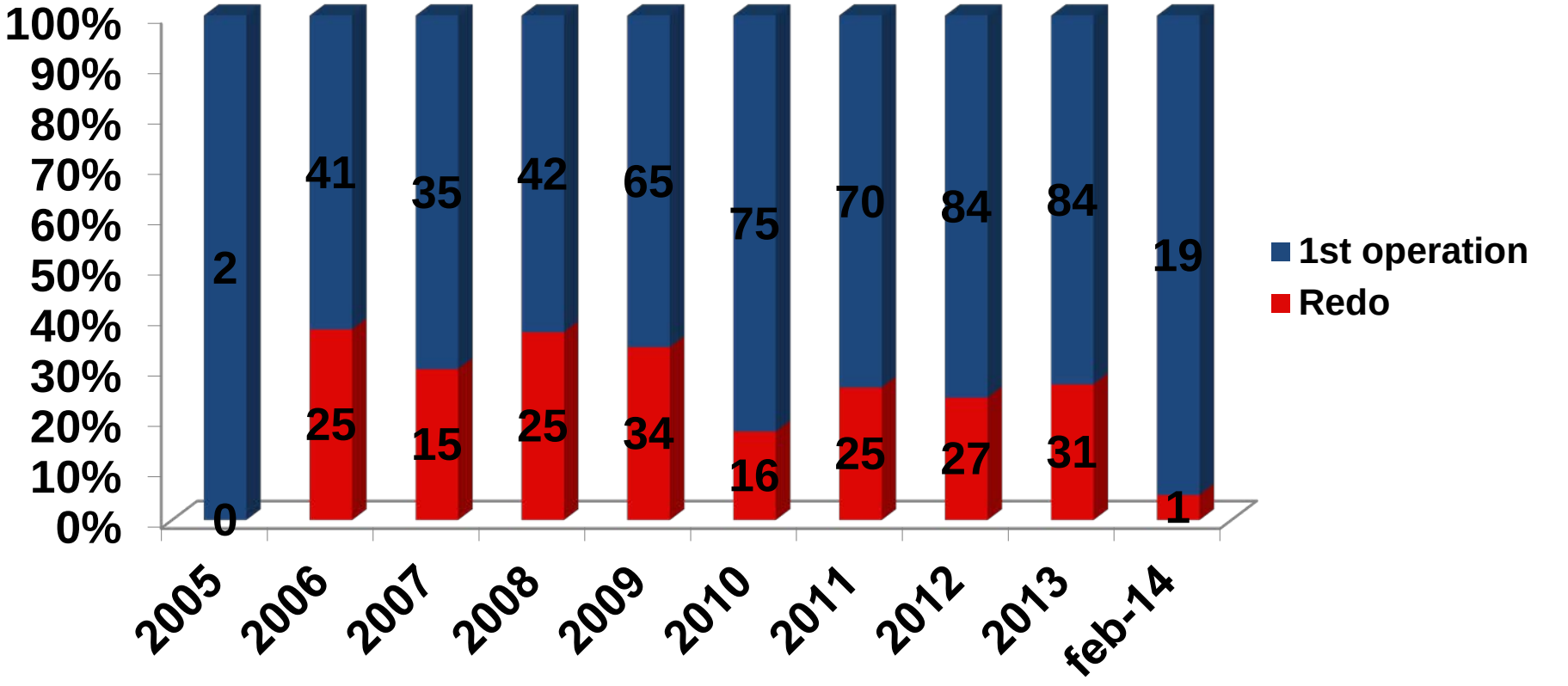


Minimally invasive mitral valve surgery

Redo surgery: 199/719 (27.7%)

- 1st redo 125 (63%)
- 2nd redo 43 (22%)
- 3rd redo 26 (13%)
- 4th redo 5 (2%)

74 (37.2%)

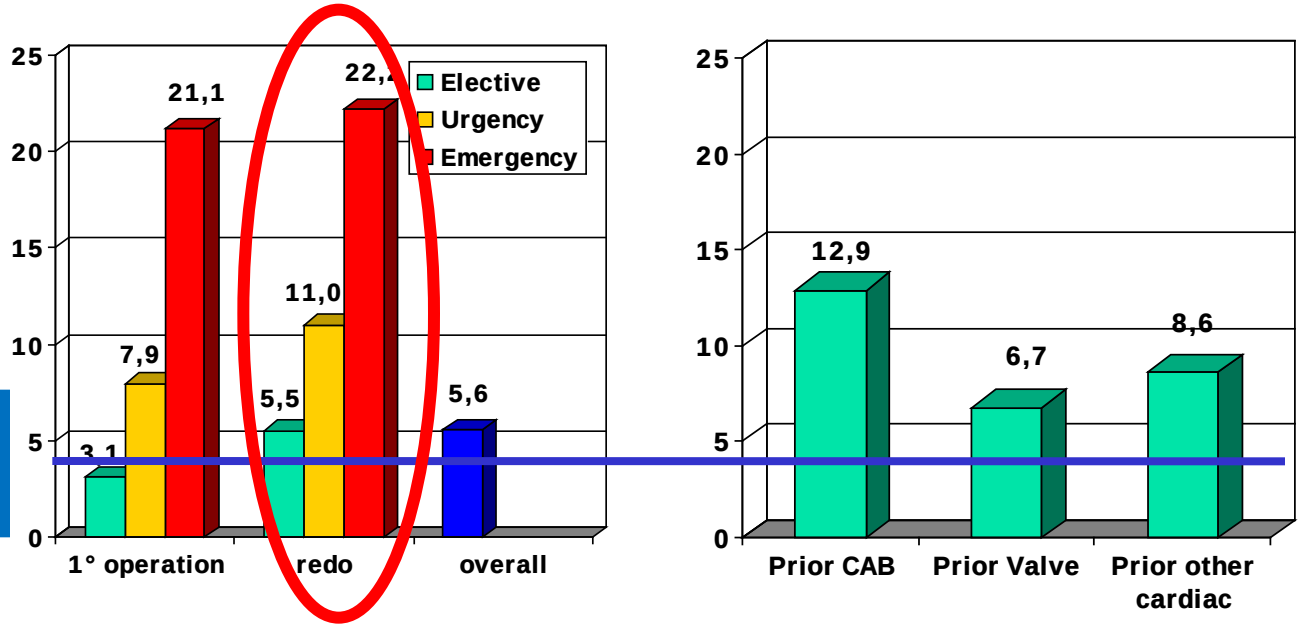


Minimally invasive mitral valve surgery

Port-access surgery as elective approach for mitral valve operation in re-do procedures

Davide Ricci [b,*], Carlo Pellegrini [a], Marco Aiello [a], Alessia Alloni [a], Barbara Cattadori [a], Andrea M. D'Armini [a], Mauro Rinaldi [b], Mario Viganò [a]

[a] Division of Cardiac Surgery, Foundation I.R.C.C.S. Policlinico San Matteo, University of Pavia, 27100 Pavia, Italy
[b] Division of Cardiac Surgery, San Giovanni Battista Hospital "Molinette", University of Torino, 10126 Turin, Italy

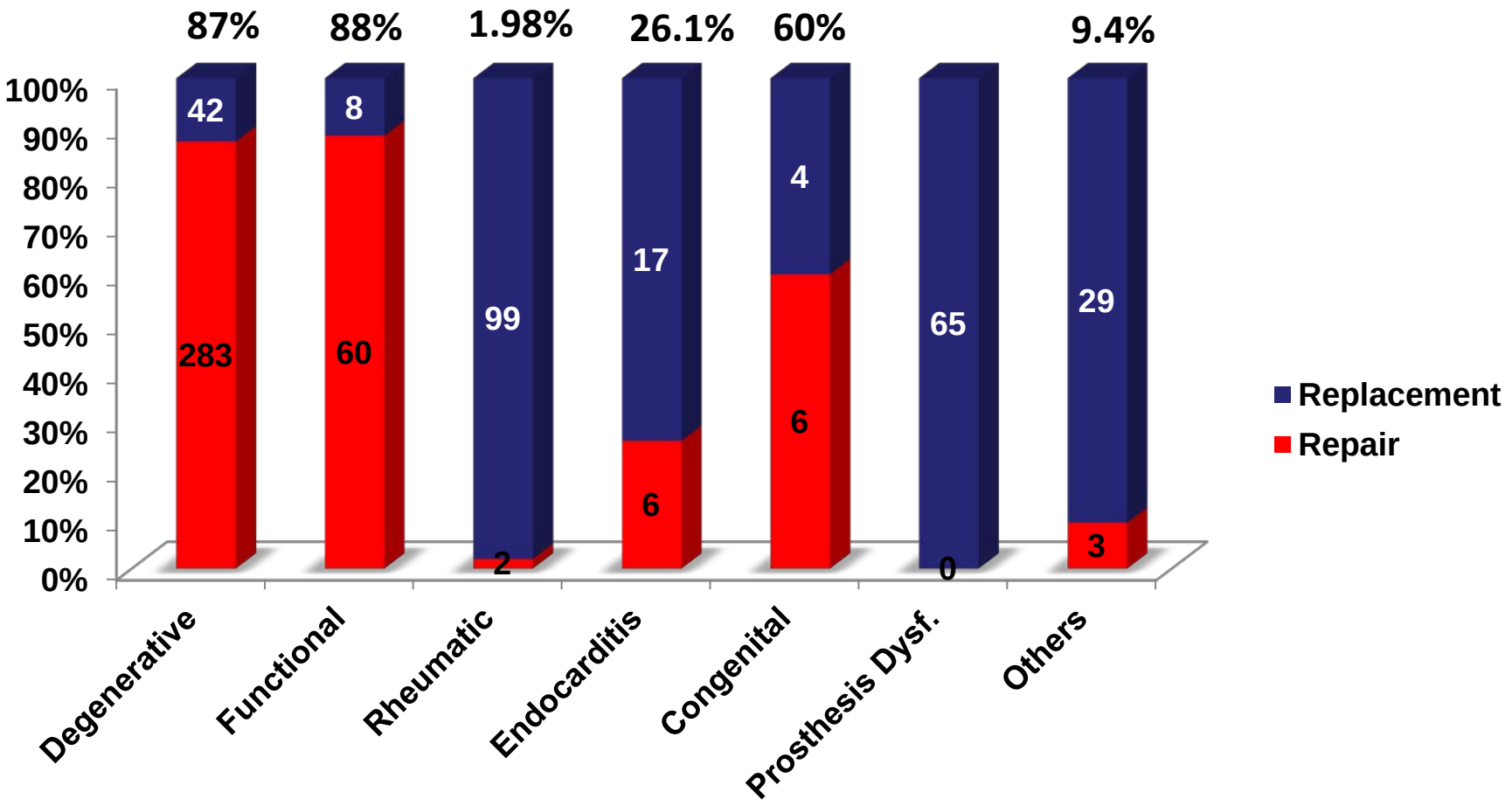


Mortality 4.9%

Ricci et al, EJCTS. 2010;37:920-7

Minimally invasive mitral valve surgery

Overall MV surgeries: 624 procedures
Repair rate (≅90%)



Minimally invasive mitral valve surgery

Overall MV surgeries: 624/707 (88.3%)

	Mean ± SD	Median
ECC (min)	126.5 ± 38.8	**119**
Aortic clamp (min)	87.2 ± 25.3	**84**
ICU stay (gg)	2.8 ± 8.4	**1**
Ventilation (h)	32.2 ± 168.3	**9**
Reop. for bleeding (%) (n)	4.8%	**(30/624)**
Drainage blood loss (cc)	495 ± 528	**340**
Hospital stay (gg)	11.0 ± 13.4	**7**
Hospital mortality (%) (n)	1.6%	**10/624**

Operative mortality 0%

Degenerative mitral regurgitation

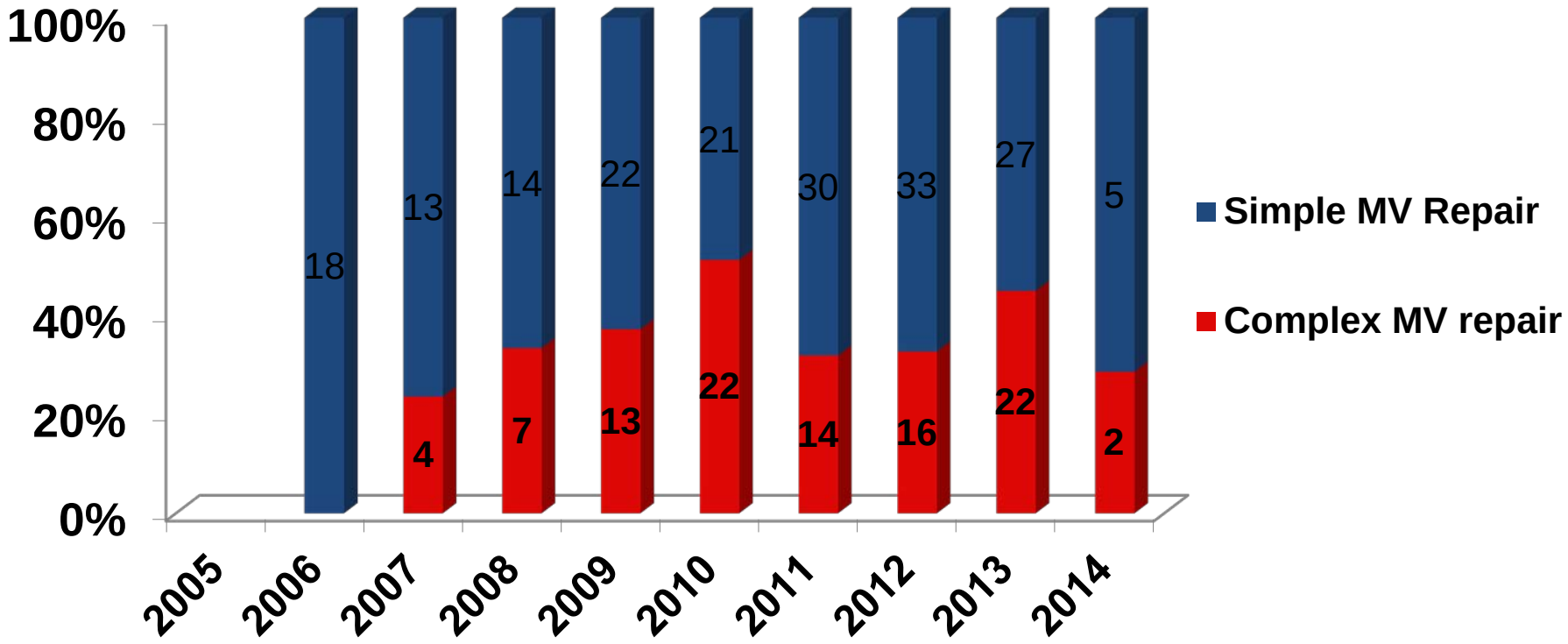
Minimally invasive mitral valve surgery

Overall MV surgeries: 624/707 (88.3%)

Degenerative MV: 325/624 (52.1%)

MV repair rate: 283/311 (91.0%) - MV replacement 42/325 (12.9%)

Previous MV repair 14/325



Minimally invasive mitral valve surgery

Mitral valve repair techniques

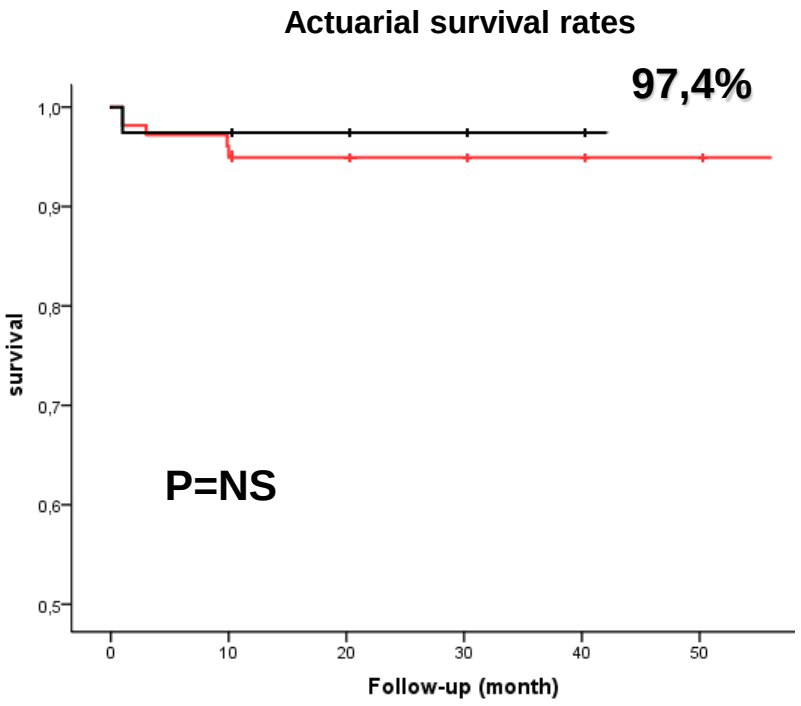
Technique	(n=283)	%
Simple MV repair	**183**	**64.7**
Ring annuloplasty	178	97.3
Quadrang/Triang resection ± folding/sliding	129	70.5
Complex MV repair	**100**	**35.3**
Ring annuloplasty	96	96
Quadrang/Triang resection ± folding/sliding	61	61
Chordal transposition	32	32
Gore-tex neochordae	73	73
Papillary muscle splitting	3	3
Anterior leaflet triangular resection	1	1
Anterior leaflet patch	3	3
Edge-to-edge	1	1

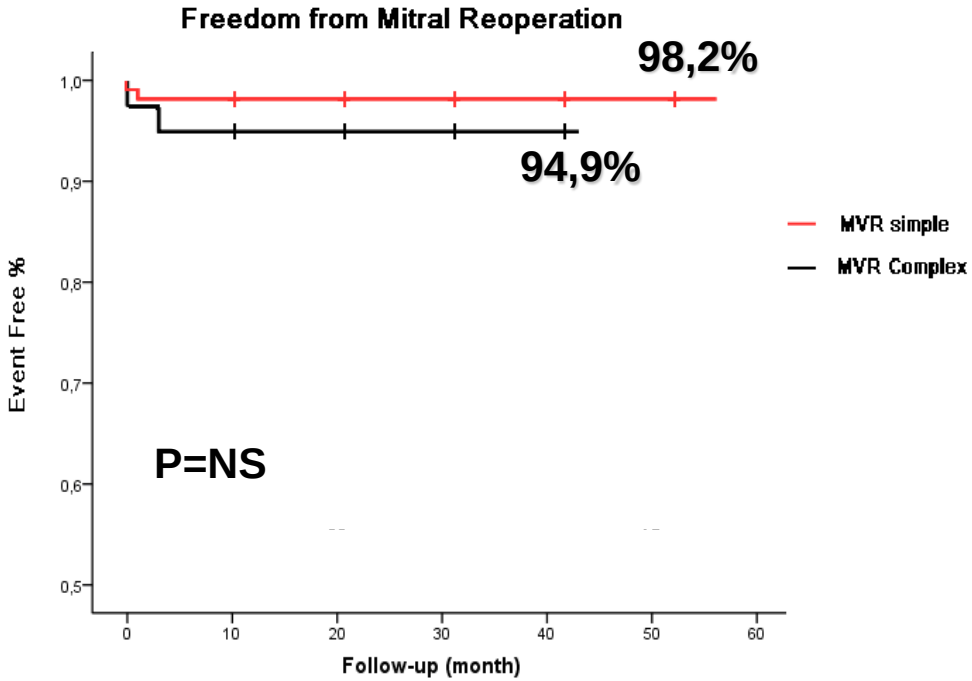
Minimally invasive mitral valve surgery

MV repair - Perioperative and postoperative complication

Type of complication	(n=283)	
Renal insufficiency (n,%)	4	(1.4)
Neurologic event (n,%)	4	(1.4)
Reoperation for bleeding (n,%)	2	(0.7)
MOF (n,%)	1	(0.3)
Postoperative drainage of Rigthpleural effusion (n,%)	3	(1.0)
30-day mortality (n,%)	3	(1.0)

Minimally invasive mitral valve surgery



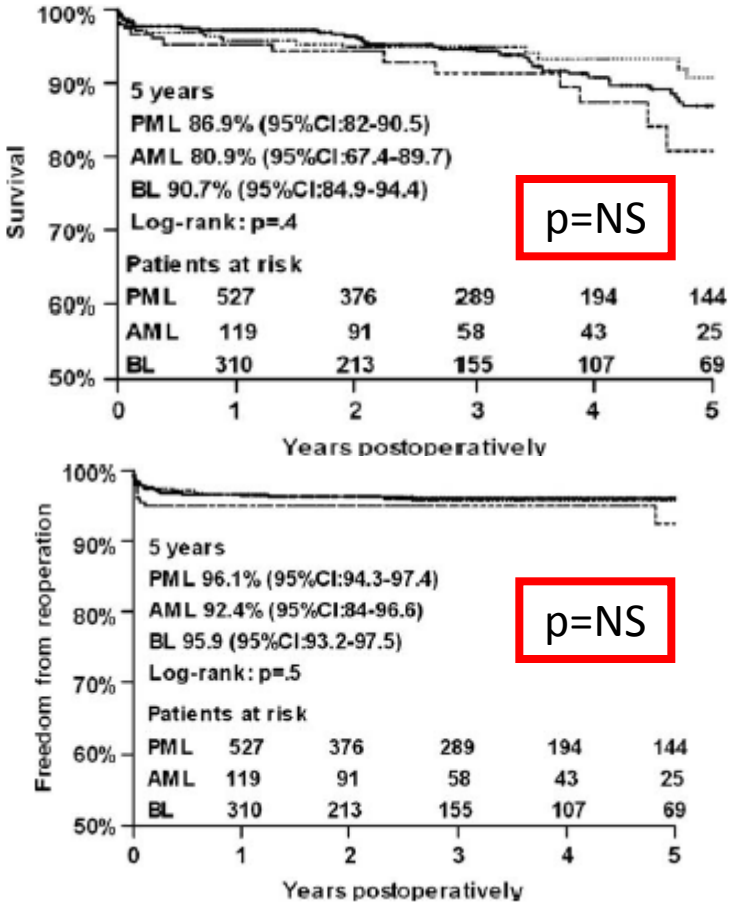


Minimally invasive mitral valve surgery

Comparison of outcomes of minimally invasive mitral valve surgery for posterior, anterior and bileaflet prolapse☆

Joerg Seeburger *, Michael A. Borger, Nicolas Doll, Thomas Walther, Jurgen Passage, Volkmar Falk, Friedrich W. Mohr

- Min Invasive = 1230
- AML or BL = 558
- PML = 672
- No difference in survival or reoperation at 5 years



Seeburger et al, EJCTS. 2009;36:532-38

Functional mitral regurgitation

Mitral valve repair in heart failure

Iva A. Smolens, Francis D. Pagani, Steven F. Bolling*

The University of Michigan, Section of Cardiac Surgery, Taubman Health Care Center, 2120D, Box 0348, 1500 E Medical Center Drive, Ann Arbor, MI 48109-0348, USA

Received 6 September 1999; received in revised form 7 October 1999; accepted 12 September 2000

Mitral valve repair via an **'undersized' annuloplasty** repair is **safe and effectively corrects MR in heart-failure patients**. All of the observed changes **contribute to reverse remodeling and restoration of the normal left-ventricular geometric relationship**. Mitral valve repair offers a new strategy for patients with MR and end-stage heart failure

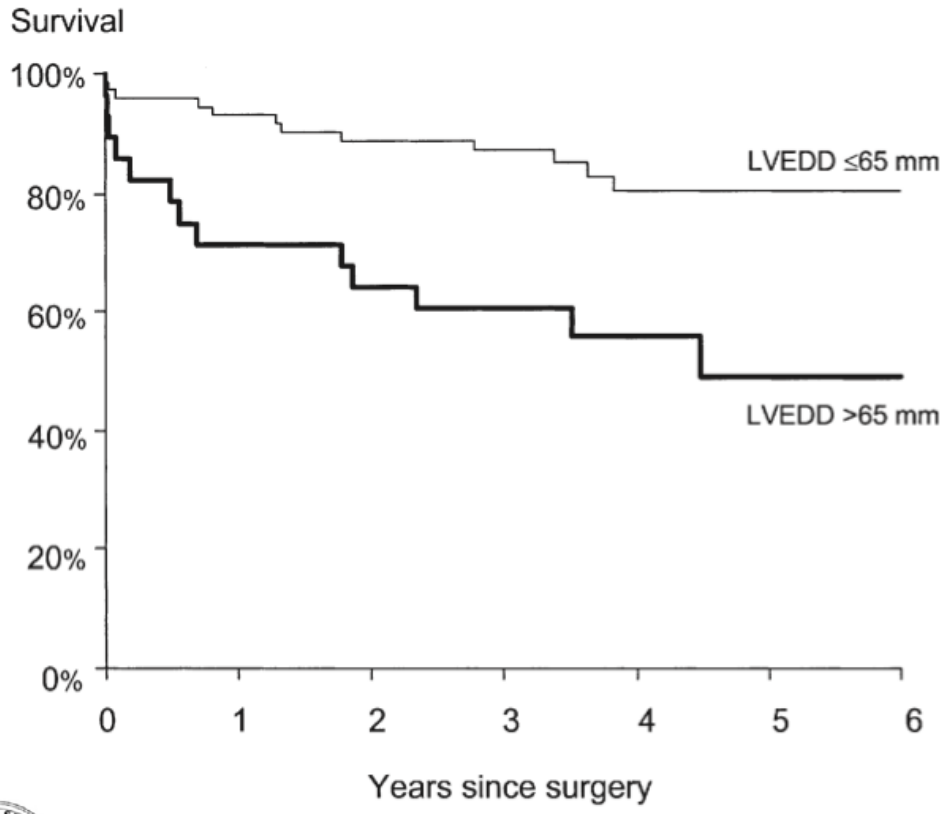
	EDV (ml)	*D/L*	*EF (%)*	*CO (L/min)*	*RF (%)*
Preop.	281 ± 86	0.82 ± 0.10	17 ± 3	3.3 ± 0.9	68 ± 14
Postop.	206 ± 88	0.74 ± 0.07	26 ± 8	5.2 ± 1.1	15 ± 14
Change	−75 ± 33	−0.08 ± 0.07	+9 ± 5	1.9 ± 0.9	−53 ± 18
p Value	<0.001	0.005	0.008	0.001	<0.001

European Journal of Heart Failure 2 (2000) 365–371

Restrictive Mitral Annuloplasty Cures Ischemic Mitral Regurgitation and Heart Failure

Jerry Braun, MD, Nico R. van de Veire, MD, Robert J. M. Klautz, MD, PhD, Michel I. M. Versteegh, MD, Eduard R. Holman, MD, PhD, Jos J. M. Westenberg, PhD, Eric Boersma, PhD, Ernst E. van der Wall, MD, PhD, Jeroen J. Bax, MD, PhD, and Robert A. E. Dion, MD, PhD

Departments of Cardiothoracic Surgery, Cardiology, and Radiology, Leids Universitair Medisch Centrum, Leiden, and Department of Cardiology, Erasmus Medisch Centrum, Rotterdam, the Netherlands



Conclusions. At 4.3 years' follow-up, intermediate-term cutoff values for left ventricular reverse remodeling proved to be predictors for late mortality. **For patients with preoperative LVEDD of 65 mm or less, restrictive mitral annuloplasty** with revascularization **provides a cure** for ischemic mitral regurgitation and heart failure; however, **when LVEDD exceeds 65 mm, outcome is poor** and a ventricular approach should be considered.

Ann Thorac Surg 2008;85:430–7

Mitral valve surgery in heart failure: Insights from the Acorn Clinical Trial

Michael A. Acker, MD,[a] Steven Bolling, MD,[b] Richard Shemin, MD,[c] James Kirklin, MD,[d] Jae K. Oh, MD,[e] Douglas L. Mann, MD,[f] Mariell Jessup, MD,[g] Hani N. Sabbah, PhD,[h] Randall C. Starling, MD,[i] and Spencer H. Kubo, MD,[j] for the Acorn Trial Principal Investigators and Study Coordinators

Recurrent MR after MV surgery

	Baseline (189 patients)		6 mo (154 patients)		12 mo (145 patients)		18 mo (95 patients)	
MR severity	No.	%	No.	%	No.	%	No.	%
0	14	7.4	94	61.0	81	55.9	56	58.9
1+	20	10.6	34	22.1	40	27.6	28	29.5
2+	44	23.3	13	8.4	16	11.0	7	7.4
3+	49	25.9	10	6.5	6	4.1	2	2.1
4+	62	32.8	3	1.9	2	1.4	2	2.1
Mean score	2.66		0.67		0.67		0.59	
P vs baseline	—		<.0001		<.0001		<.0001	

MR, Mitral regurgitation.

Acker et al. J Thorac Cardiovasc Surg 2006;132:568-77

The NEW ENGLAND JOURNAL of MEDICINE
2014;370(1):23-32

ORIGINAL ARTICLE

Mitral-Valve Repair versus Replacement for Severe Ischemic Mitral Regurgitation

Multicenter (Cardiothoracic Surgical Trials Network – CTSN**) randomized trial** to evaluate the relative risks of repair vs replacement with or without CABg in patients with severe FMR

Primary end point
- Degree of LV reverse remodelling by means of LVESVI (at 12 months after surgery)

Secondary end points
- Mortality, composite of major adverse events (death,stroke,hospit for heart failure), recurrency of MR, QoL, and rehospitalization

Mitral valve pathology in severely impaired left ventricles can be successfully managed using a right-sided minimally invasive surgical approach†

Jens Garbade*, Joerg Seeburger, Denis R. Merk, Bettina Pfannmüller, Marcel Vollroth, Markus J. Barten, Michael A. Borger and Friedrich-Wilhelm Mohr

Department of Cardiac Surgery, Heart Center, University of Leipzig, Leipzig, Germany

Garbade et al EJTCV 2013;1:1-7

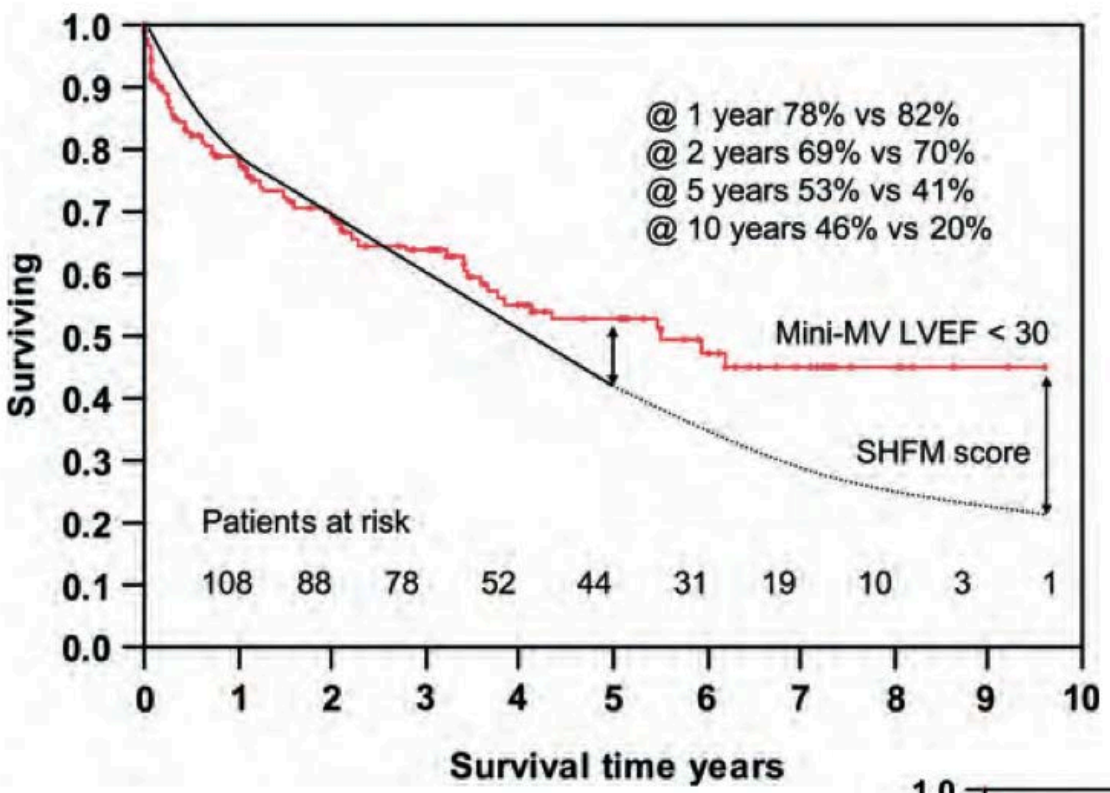
Table 1: Baseline clinical characteristics in patients undergoing Mini-MV with an LVEF < 30%

Variable	Mini-MV *n* = 177 patients
Study period	1999–2010
Demographics	
Age (years)	67 ± 11
Sex (male)	110 (63%)
Weight (kg)	75.3 ± 13.3
BMI	25.8 ± 3.6
LVEF (%)	23.9 ± 5.8
LVEDD (mm)	69 ± 11
NYHA class	3.1 ± 0.8
Comorbidities	
Previous cardiac surgery	32 (18.3%)
Primary ICM	22 (12.4%)
Primary DCM	155 (87.6%)
COPD	9 (5.4%)
Renal insufficiency	45 (25%)
Stroke	2 (1.1%)
Hypertention	35 (19.8%)
Diabetes	51 (28.8%)
EuroSCORE (%)	14.7 ± 13.6
Indication for surgery	
MV insufficiency	172 (97.2%)
MV stenosis/insufficiency	5 (2.8%)
Concomitant indications	
TV insufficiency	27 (15.4%)
Atrial fibrillation	61 (34.5%)
ASD/PFO	10 (5.6%)

Mini-MV surgery in patients with significantly **impaired left ventricular function** can be performed with a ***reasonable operative mortality and acceptable long-term survival for this high-risk patient cohort***

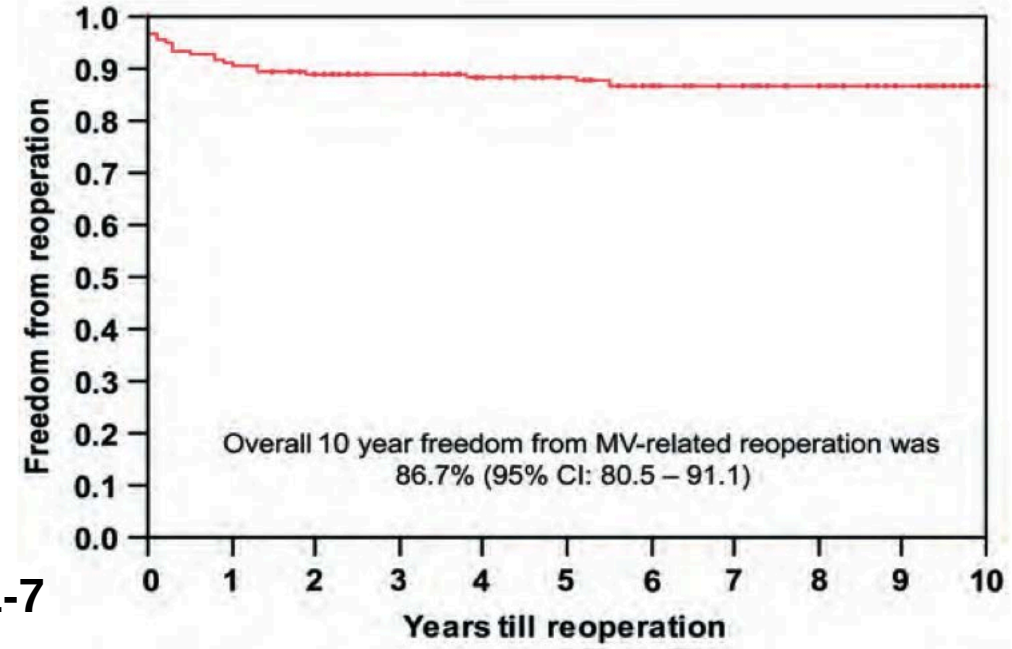
Table 3: MV-related operative data of 177 patients undergoing Mini-MV with an LVEF < 30%

Variable	Mini-MV *n* = 177 patients
MV procedure	
MV repair	153 (86.4%)
MV replacement	24 (13.6%); mean size 28.9 ± 1.4
Conversion repair–replacement	6 (3.4%)
Annuloplasty ring	146; mean size 29.5 ± 2.3
Physio[a]	107; mean size 29.2 ± 2.0
IMR ETLogix[a]	26; mean size 30.4 ± 2.2
Other	Cosgrove[a] *n* = 7; Micardia[b] *n* = 1; Classic[a] *n* = 1; Saddle[c] *n* = 4
Chordae replacement	AML 5 patients; PML 3 patients
Leaflet resection	AML 2 patients (sliding plasty 1); PML 5 patients
Edge-to-edge/Alfieri	2



Replacement if:

LVEDD > 65 mm
Tethering > 11 mm



Garbade et al EJTCV 2013;1:1-7

Minimally invasive mitral valve surgery

Functional Mitral Regurgitation

(2006 - Feb 2014)

- **624 pts → 68/624 (10.1%) FMR**

22 (F) - 38 (M), Mean Age 68 ± 13 years

Redos: 31/68 (45.6%)

- 1st redo 27 (87.1%)
- 2nd redo 3 (9.6%)
- 3rd redo 1 (3.3%)

24/27 (88.9%) previous CABG

Minimally invasive mitral valve surgery

MV Replacement: 8/68 cases (12%)

MV Repair: 60/68 cases (88%)

Subgroup division according to:

- **EF** ≤ 40% (33 pts) *vs* > 40% (27 pts)
- **LVEDD** < 65 mm (40 pts) *vs* ≥ 65 mm (20 pts)
- **Etiology** ICM (42 pts) *vs* DCM (18 pts)

Minimally invasive mitral valve surgery

Periop. variables & complications

Variables	FMR (60pts)
Ventilation (hs) (median)	27.6 ± 45.2 (**10**)
ICU stay (ds) (median)	2.8 ± 3.9 (**1**)
Hospital stay (ds) (median)	16.0 ± 27.0 (**8**)
Blood loss (cc)	450.2 ± 277.3
Re-operation for bleeding	3 (5.0%)
Acute renal failure (CVVH)	5 (8.3%)
Low cardiac output syndrome - IABP	4 (6.7%)
Neurological complication	2 (3.3%)
Intraoperative repair failure	0
Postoperative repair failure	0
30-day mortality	2 (3.3%)

Since the last 2 years 0% neurologic events

No differences between the subgroups

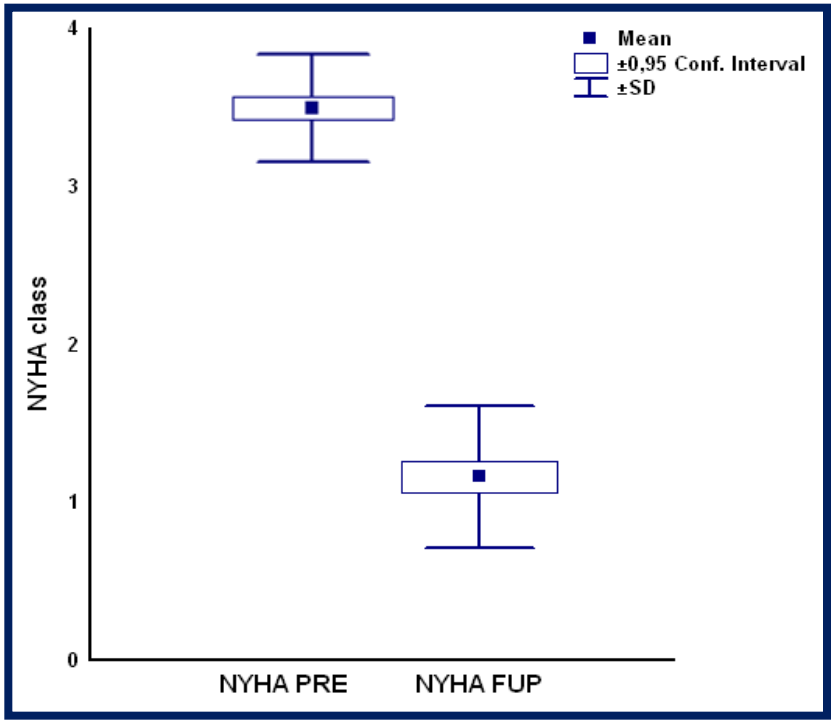
30 day mortality: 3.3%

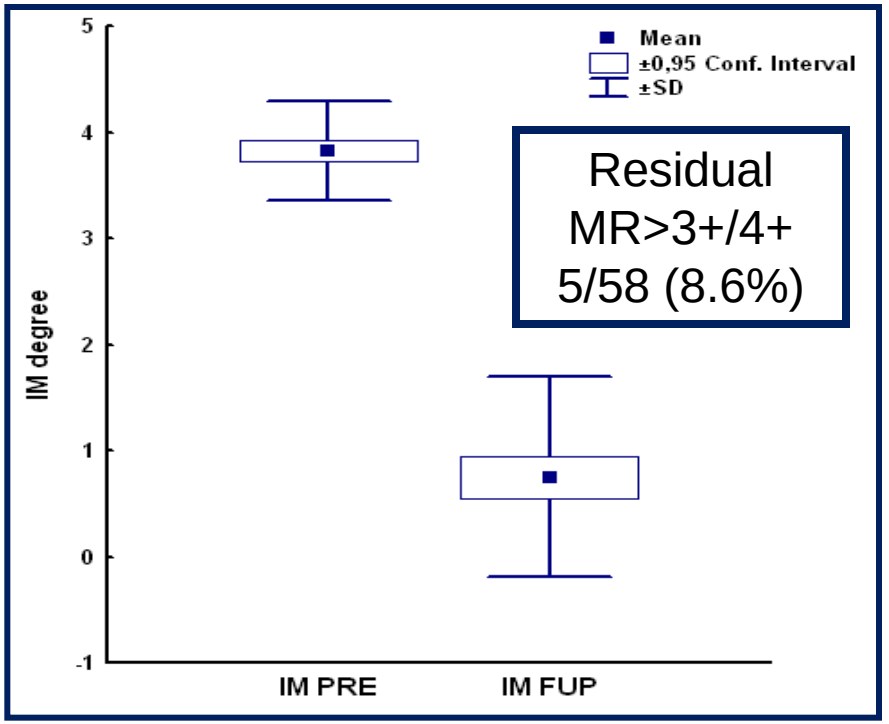
Minimally invasive mitral valve surgery

Follow-up (100% completed)

58/60 pts (2 pts died within 30 days)

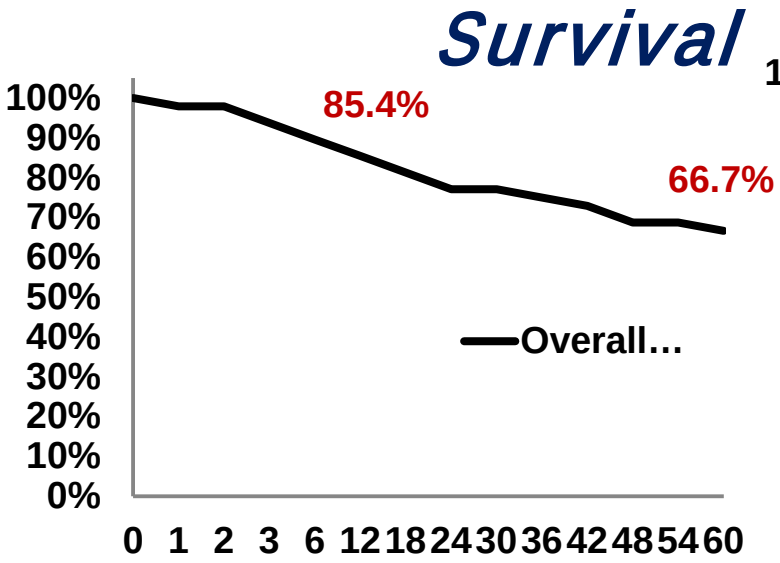
Mean follow-up time: 28 ± 24 months (range 1 – 87)

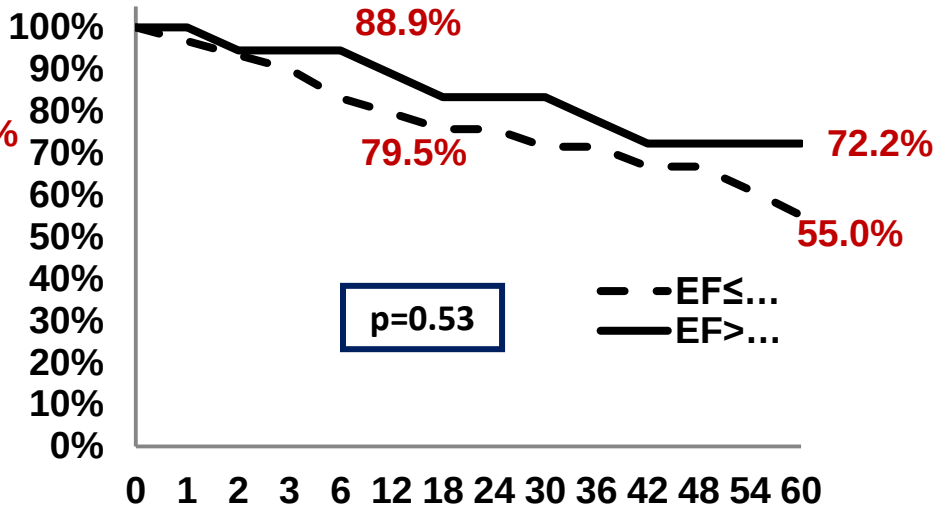


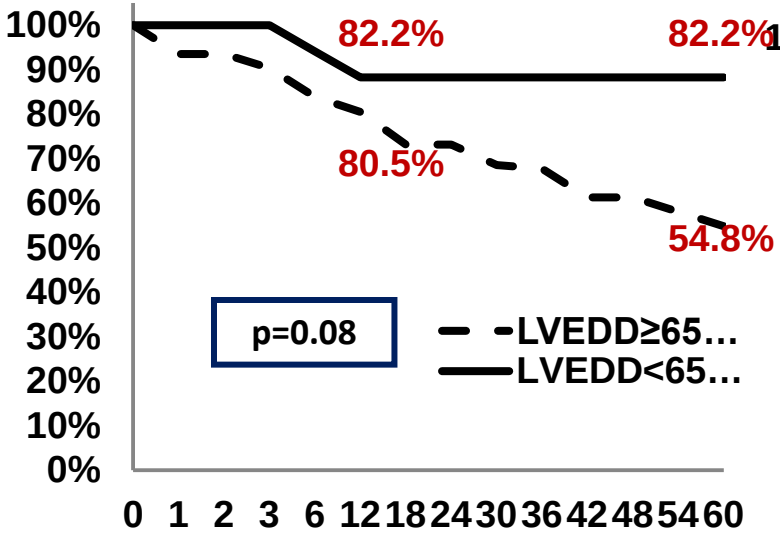


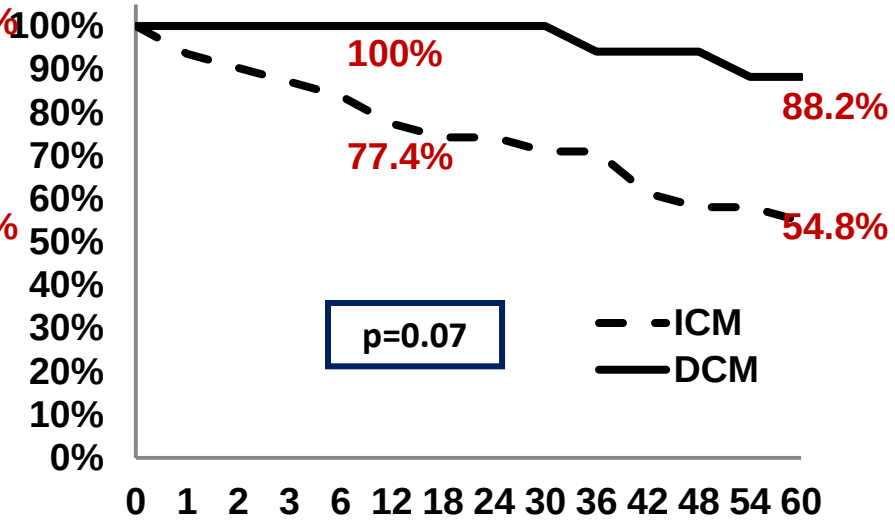
0% freedom from reoperation (at 1 and 5 years)

Minimally invasive mitral valve surgery



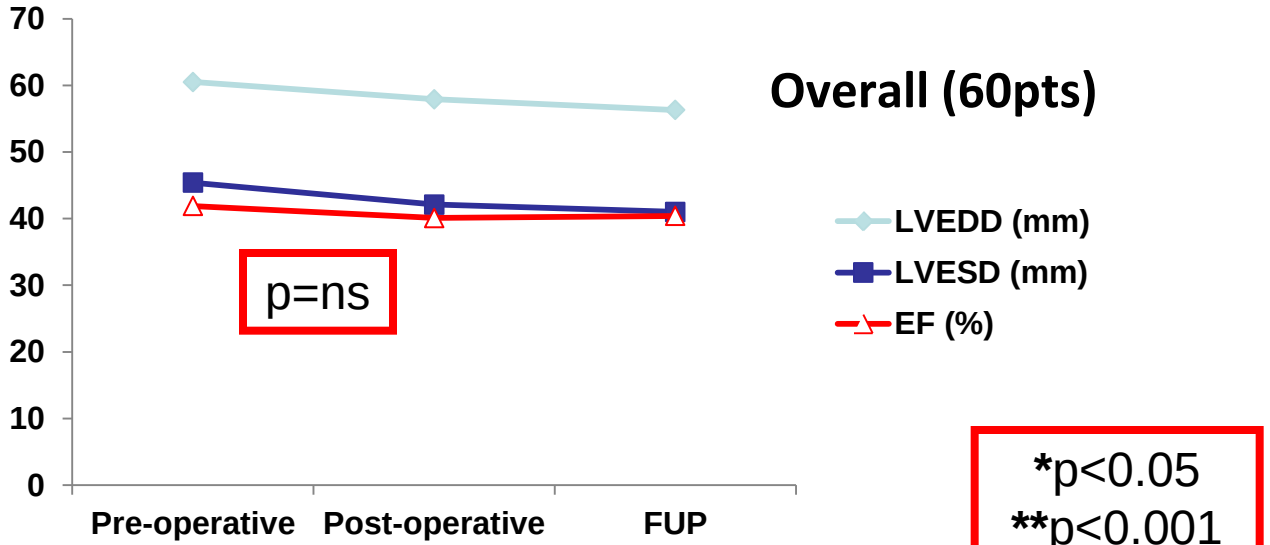




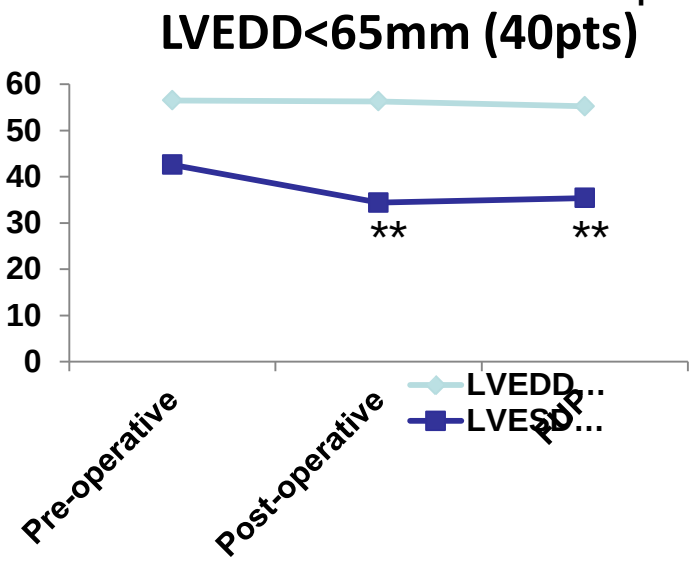


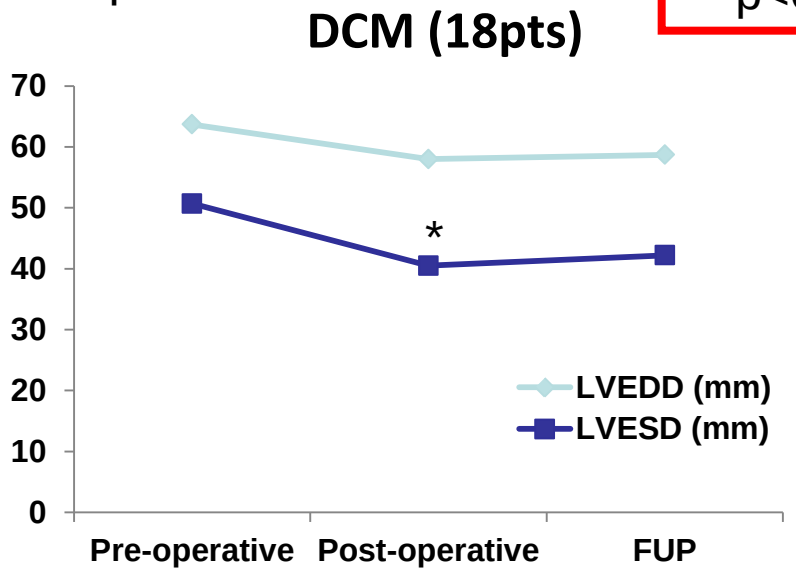
Minimally invasive mitral valve surgery

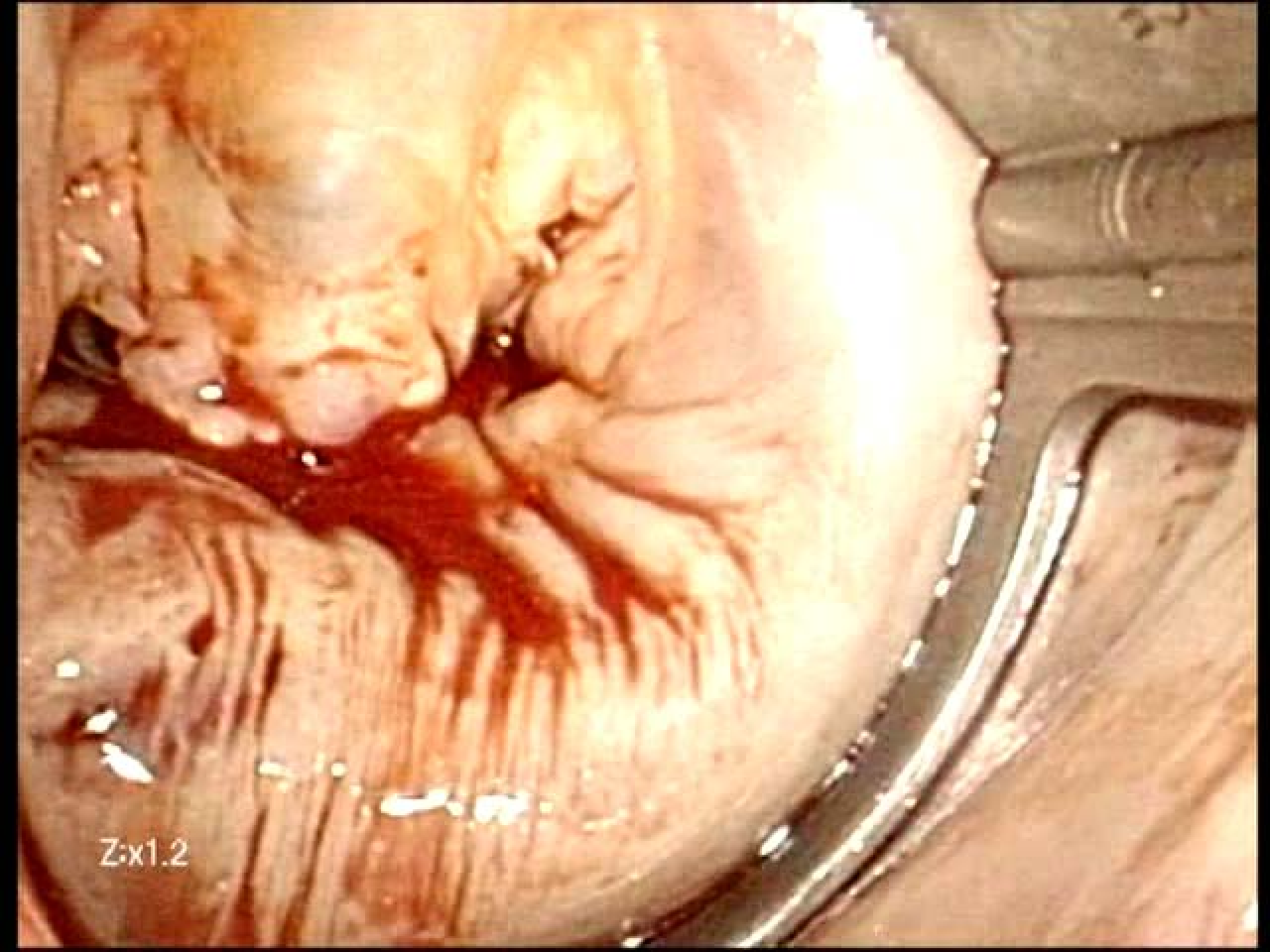
LV modifications (echo)



*p<0.05
**p<0.001



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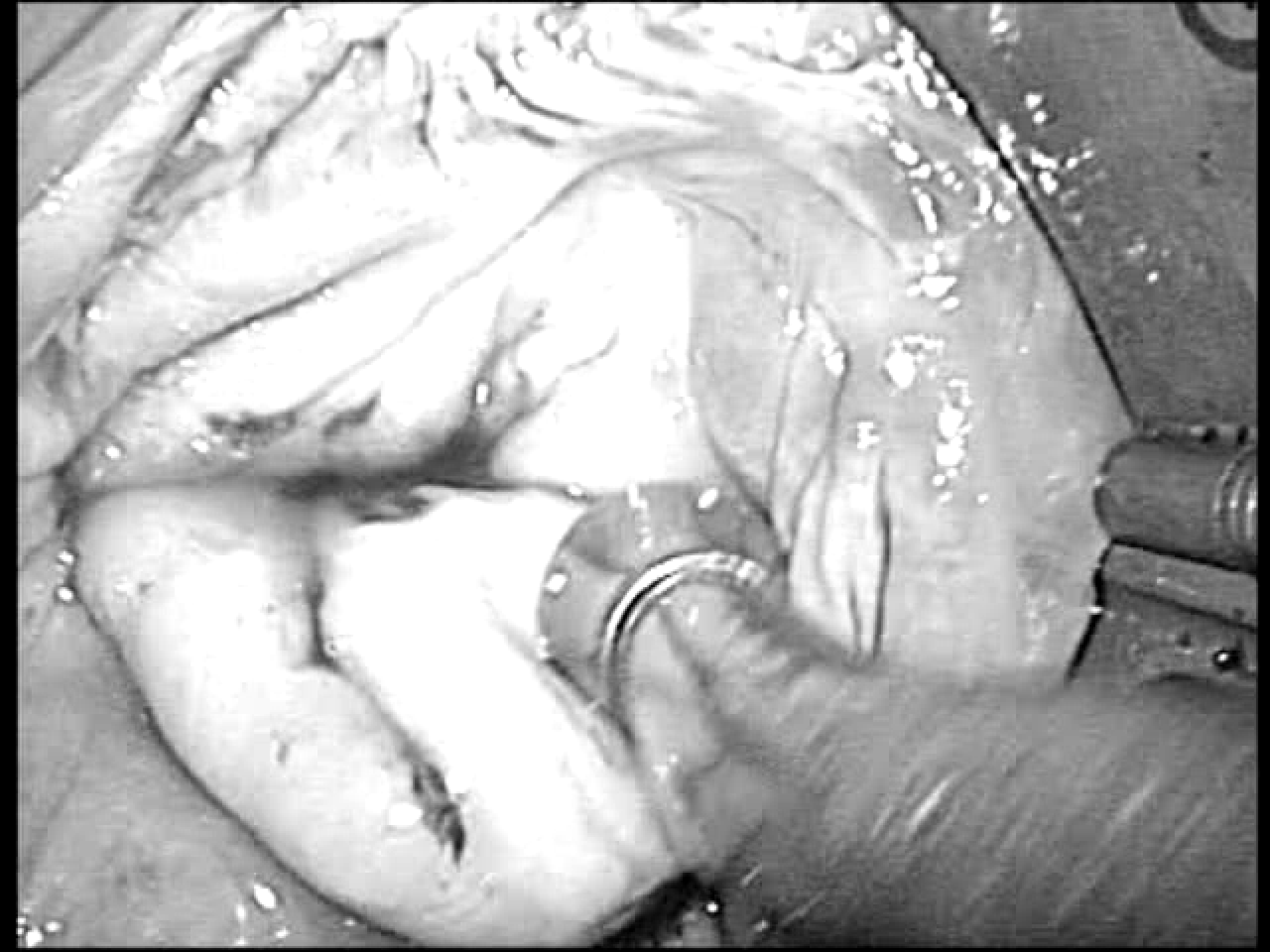
Barlow

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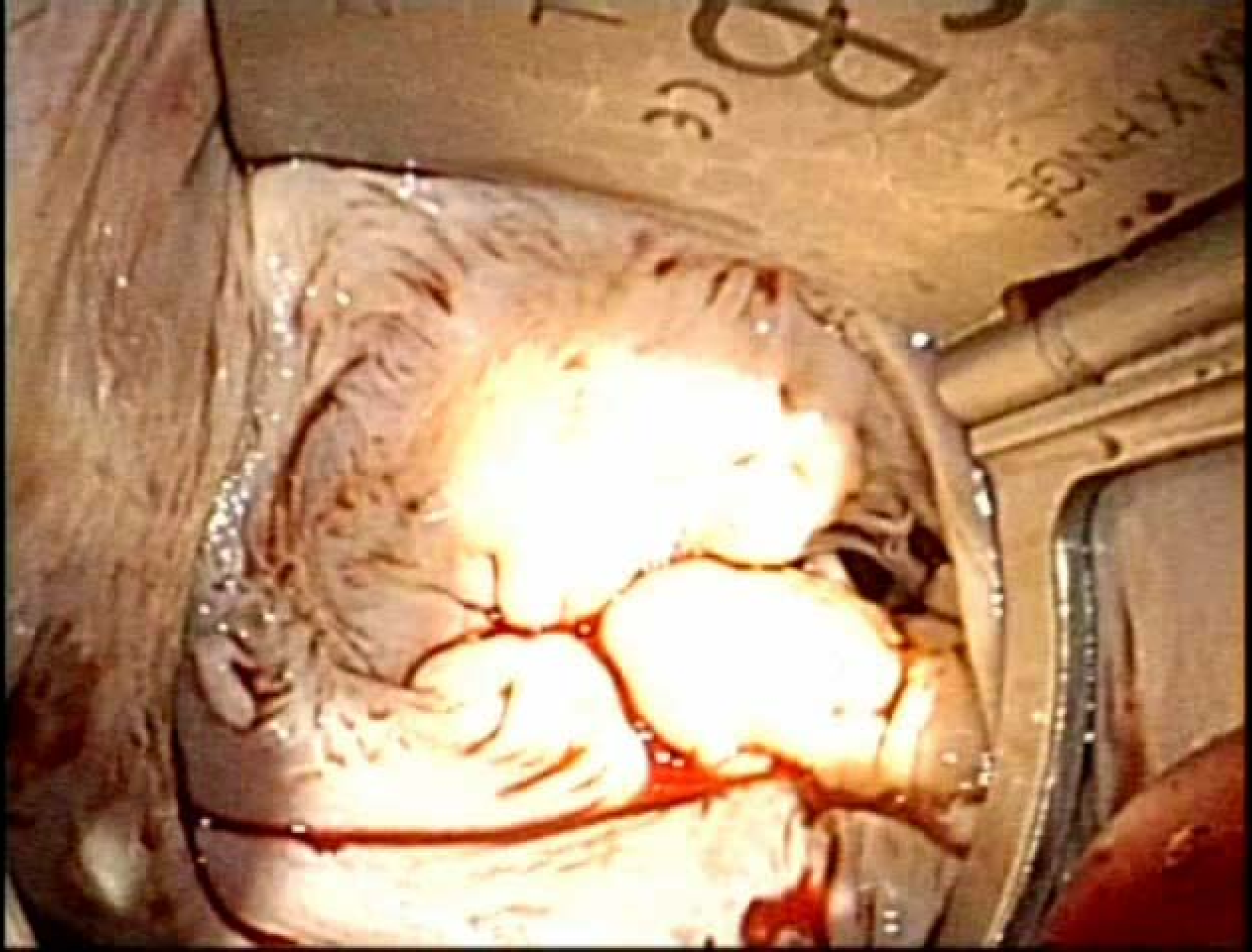
CF
59%
4.4MHz
WF Alto
Med.
138
M4 M4
+61.6
-61.6
cm/s
JPEG
bpm
Temp. PAZ.: 37.0C
Temp. TEE: 38.7C

Chordal transposition

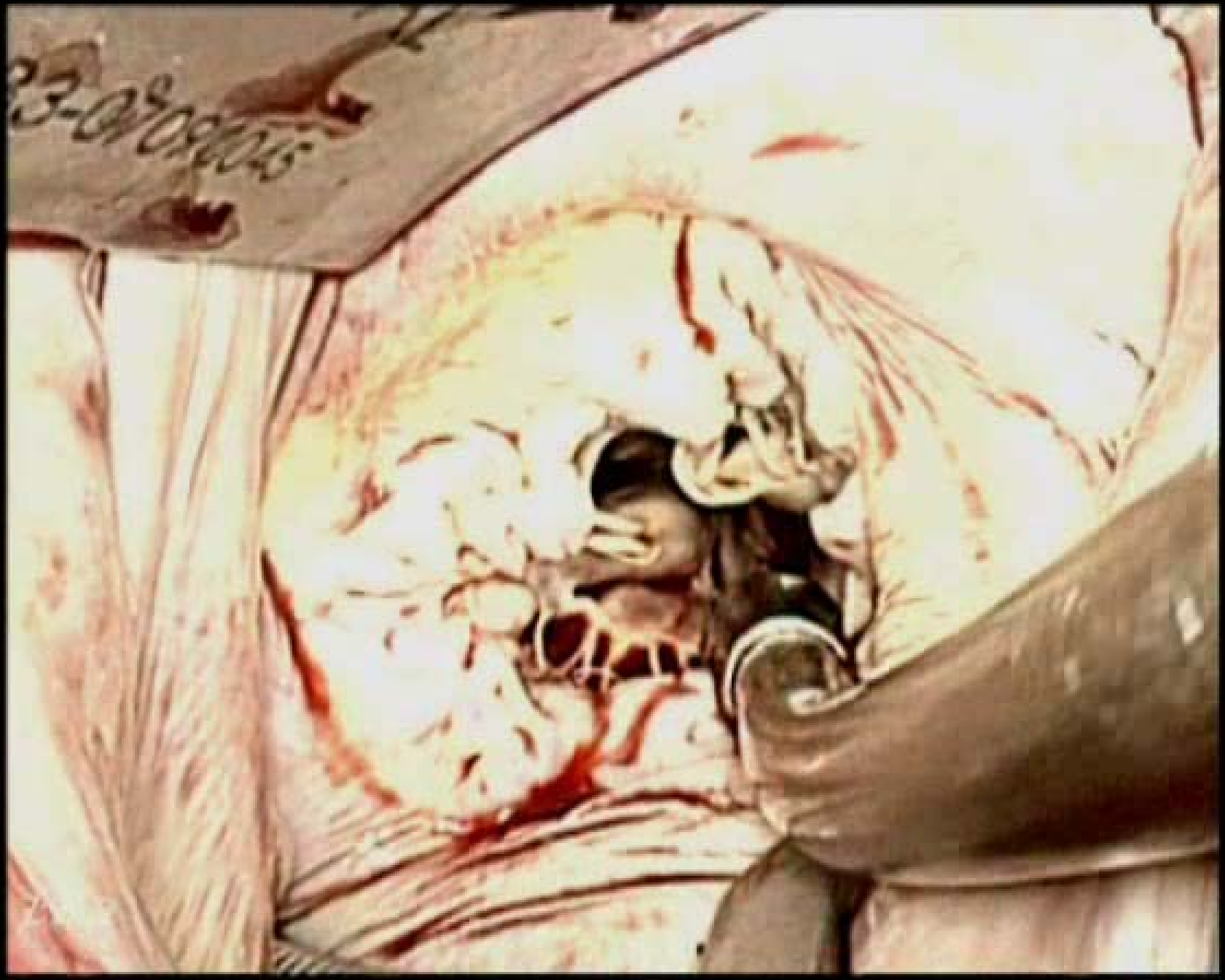

PHILIPS
16/09/2010 16:23:59 TIS0.1 MI 0.5
CX7-2t/Adulti
FR 52Hz
7.0cm
M4
2D
61%
C 50
P Off
Gen
JPEG
285 bpm
Temp. PAZ.: 37.0C
Temp. TEE: 38.5C




PHILIPS
16/09/2010 19:33:59 TIS0.4 MI 0.8
CX7-2t/Adulti
FR 13Hz
10cm
2D
74%
C 50
P Off
Gen
CF
59%
4.4MHz
WF Alto
Med.
128
M4 M4
+61.6
-61.6
cm/s
JPEG
231 bpm
Temp. PAZ.: 37.0C
Temp. TEE: 38.3C

SAM


PHILIPS
25/05/2010 10:30:49 TIS1.1 MI 0.7
T6H/Adulti
FR 17Hz
8.1cm
2D
65%
C 50
P Off
Gen
CF
70%
4.9MHz
WF Alto
Med.
M3 M4
+61.6
-61.6
cm/s
JPEG
*** bpm




PHILIPS
25/05/2010 14:02:01 TIS1.4 MI 0.7
T6H/Adulti
FR 22Hz
14cm
2D
54%
C 50
P Off
Gen
CF
70%
4.9MHz
WF Alto
Med.
156 mm
M3 M4
+61.6
-61.6
cm/s
JPEG
300 bpm

Minimally invasive valve surgery

CONCLUSIONS

✓ Same or even better safety and efficacy respect to standard technique

- ✓ Reduction of surgical dissection → low blood loss
- ✓ Reduction of postoperative pain
- ✓ Improvement of postoperative respiratory function
- ✓ Early mobilization & shorter hospital stay
- ✓ Faster recovery to functional activity
- ✓ Less rehabilitation resources
- ✓ Cosmetically superior incision
- ✓ Facilitation for reoperation at a later date
- ✓ Reduction of costs

Minimally invasive valve surgery

CONCLUSIONS

✓Need for learning curve with consulting and proctoring;
✓ Need for Heart team with daily collaboration between Cardiac Surgeons – Cardiologists – Anesthesiologists – Perfusionists and Nurses;
✓ Need for appropriate patient/technique selection;
✓The further development of surgical and percutaneous treatment of the mitral valve must be done by means of close collaboration between cardiologists and cardiac surgeons in high volume surgery centers experienced in MIMVS

“We must tailor the operation to the patient and not the patient to the operation”

Denton A. Cooley