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AMERICAN ASSOCIATION FOR THORACIC SURGERY
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The Impact of the Cox-Maze Procedure for Atrial Fibrillation Concomitant to Mitral and Tricuspid Valve Surgery

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Disclosures

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- Atricure
- Medtronic
- Estech

Background

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- **Multiple studies demonstrated that AF is associated with a less favorable outcome in patients undergoing mitral and tricuspid valve surgery**
  - Early
  - Late
- **Surgeons' Approach is highly variable**
  - Performance of surgical ablation
  - Lesion set and ablative energy

Study Aims

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- To assess the impact of the Cox-Maze procedure on early and late outcomes in patients with mitral and tricuspid valve disease undergoing cardiac surgery

- To identify the variables associated with the approach to leave AF untreated

Methods

- A Cohort study with prospective data collection (n=817) – mitral/tricuspid surgery +/- AF
  - No history of AF (n=506); CM procedure (n=236); untreated AF (n=75)
  - Cox-Maze III/IV (65% cryo only;35% Bipolar RF and Cryo)
  - Propensity matching with 208 matched pairs
  - Rhythm follow-up (3,6,12,24 months) using HRS guidelines
  - KM and Cox Hazard curves for long-term outcome

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Patient Characteristics

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- ***Patients presenting with AF vs NSR***
  - Older (64.4 ± 13.3 years vs 57.4 ± 12.8 years, $p<0.001$)
  - Lower ejection fraction (54.5% ± 11.6 vs 59.9% ± 8.0, $p<0.001$)
  - Higher additive EuroSCORE (7.0 ± 3.5 vs 4.8 ± 3.1, $p<0.001$)
  - Greater proportion of females (54% vs 41%, $p<0.001$)

- ***Patients with Cox-Maze procedure vs Untreated AF***
  - Younger (63.6 ± 13.2 years vs 67.1 ± 13.4 years, $p=0.049$)
  - Higher ejection fraction (55.8% ± 10.5 vs 50.5% ± 14.1, $p=0.003$)
  - Lower additive EuroSCORE (6.1 ± 2.9 vs 9.8 ± 3.7, $p<0.001$)

Patient Characteristics

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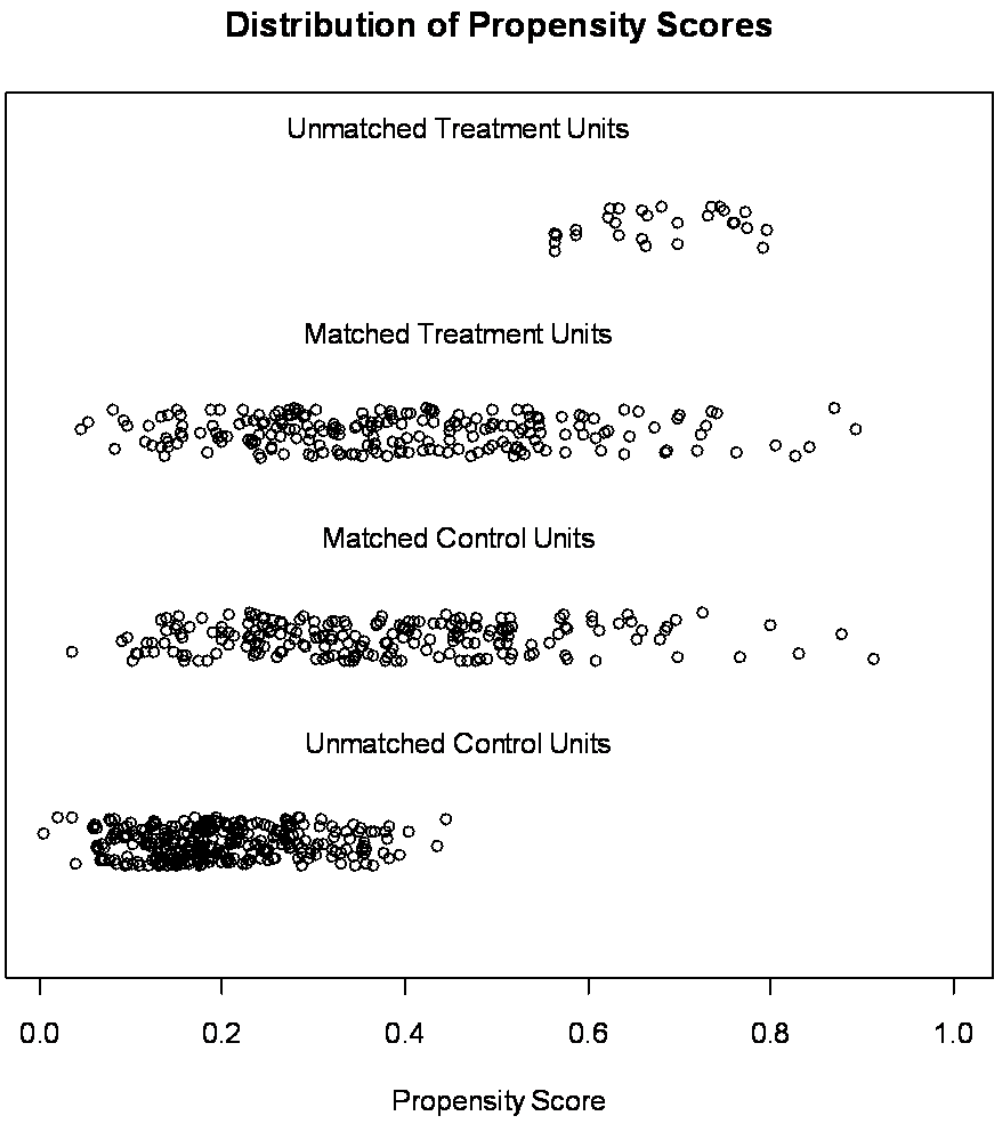
	Non-Matched MV/TV		PSM MV/TV	
	NSR n=506	Cox-Maze n=236	NSR n=208	Cox-Maze n=208
Age *	57.4 ± 12.8	63.6 ± 13.2	62.0 ± 12.2	62.6 ± 13.4
Female *	207 (41)	132 (56)	115 (55)	112 (54)
Diabetes	43 (8)	19 (8)	17 (8)	17 (8)
Hypertension *	248 (49)	143 (61)	123 (59)	121 (58)
CHF *	144 (28)	121 (51)	91 (44)	93 (45)
Ejection Fraction (%) *	59.9 ± 8.0	55.8 ± 10.5	57.4 ± 8.8	56.7 ± 10.0
Elective Status	444 (88)	201 (85)	179 (86)	180 (87)
Previous CVA	31 (6)	17 (7)	14 (7)	14 (7)
CPD	65 (13)	35 (15)	28 (14)	28 (14)
Preop Creatinine Level	1.1 ± 0.9	1.0 ± 0.7	1.1 ± 0.5	1.0 ±0.7
PVD	19 (4)	13 (6)	13 (6)	9 (4)
Previous Cardiac Surgery *	44 (9)	35 (15)	35 (17)	28 (14)
MV Repair *	390 (77)	151 (64)	142 (68)	135 (65)
MV Replacement *	116 (23)	85 (36)	66 (32)	73 (35)
Additive EuroSCORE I *	4.8 ± 3.1	6.1 ± 2.9	6.0 ± 3.3	5.8 ± 2.6
EuroSCORE II *	2.5% ± 5.4	5.0% ± 6.4	3.8 %± 7.3	4.1% ± 4.1

* Significant difference in factor between non-matched NSR and Cox-Maze groups ($p<0.05$)

The Balance of the Matched Groups



Patient Outcomes (Unmatched)

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	NSR n=506	Cox-Maze n=236	Untreated AF n=75
Stroke/TIA	3 (0.6)	1 (0.4)	2 (3)
Perioperative MI	0	0	0
Prolonged Ventilation (>24h) ^	33 (7)	17 (7)	21 (28)
Pneumonia ^	7 (1.4)	7 (3)	11 (15)
Deep Sternal Wound Infection	0	0	0
Postoperative Renal Failure	6 (1.2)	7 (3)	4 (5)
Renal Failure Requiring Dialysis	3 (0.6)	4 (1.7)	2 (2.7)
Reoperation for Bleeding	10 (2)	7 (3)	3 (4)
Length of ICU Stay (Hrs) *	17.9 [9.1-34.6]	48 [25-94.8]	62.3 [25-163.5]
Length of Stay (Days) *^	3 [2-6]	6 [5-10]	9 [6-15]
Readmissions Within 30 Days ^	50 (10)	28 (12)	3 (4)
Operative Death	5 (1)	5 (2)	5 (7)

^ Significant difference in factor between non-matched Cox-Maze and Untreated AF groups ($p<0.05$)
* Significant difference in factor between non-matched Cox-Maze and NSR groups ($p<0.05$)

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Patient Outcomes (Matched)

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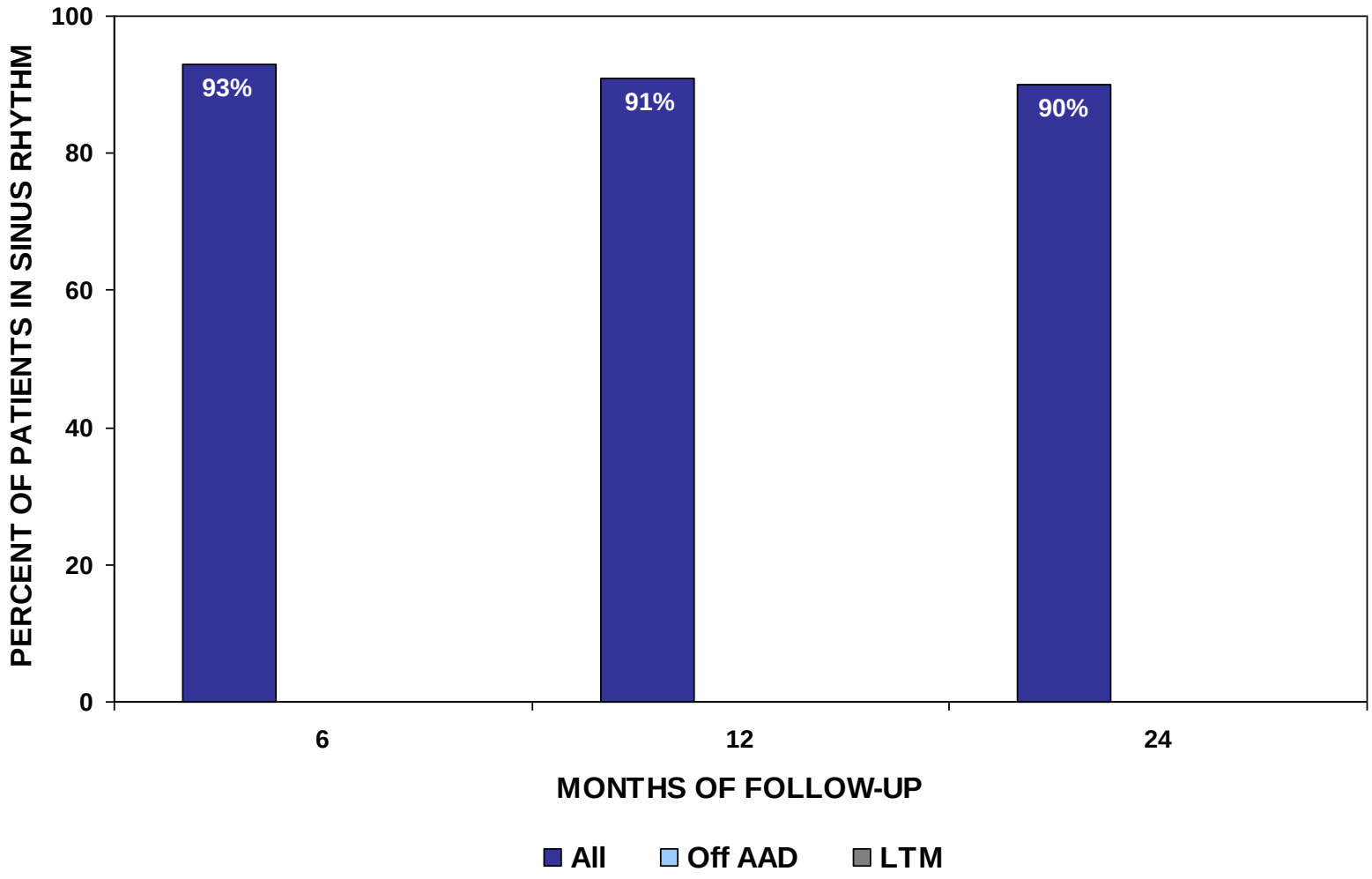
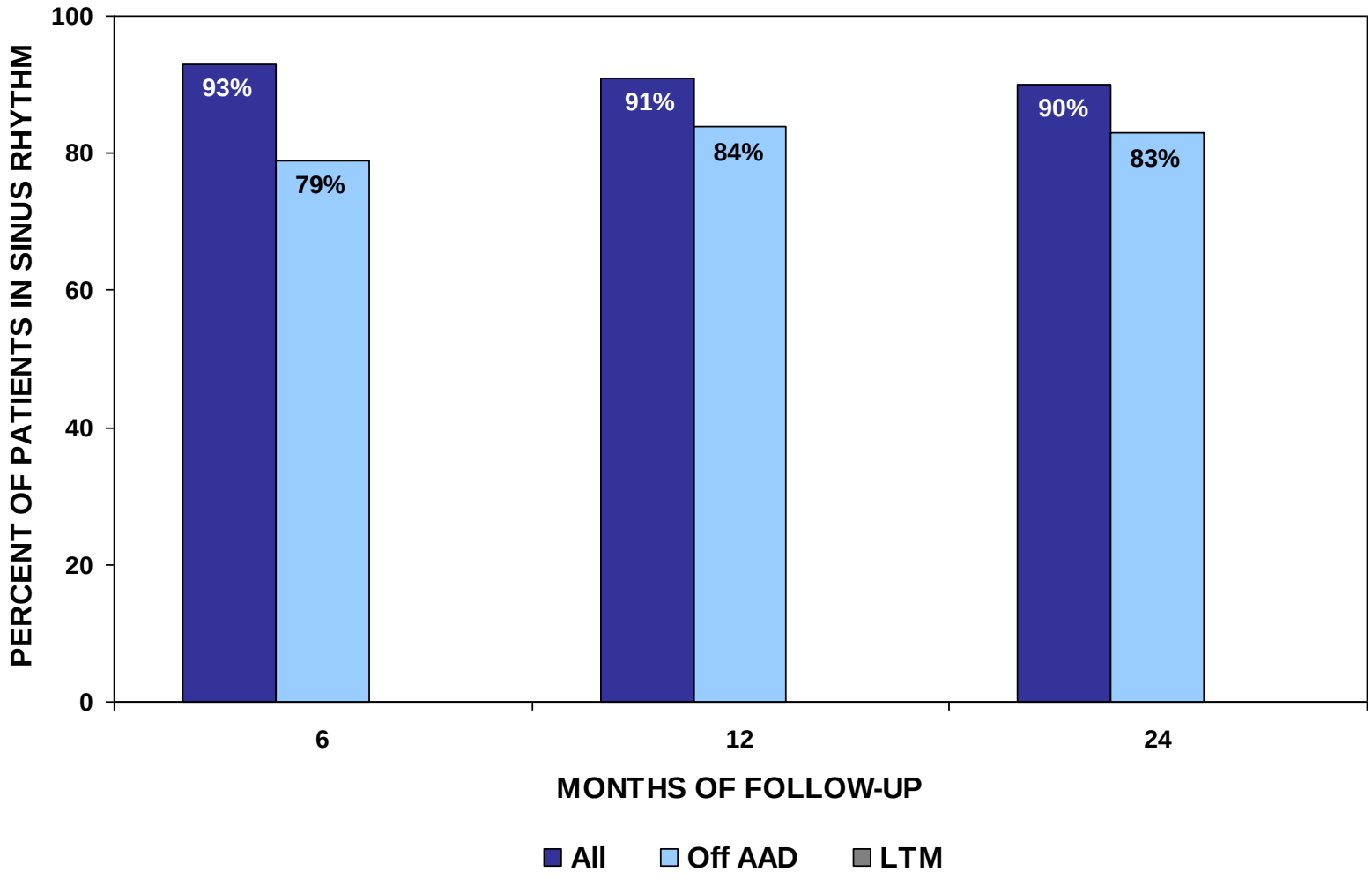
	NSR n=208	Cox-Maze n=208	*p* value
Stroke/TIA	1 (0.5)	1 (0.5)	1.00
Perioperative MI	0	0	—
Prolonged Ventilation (>24h)	15 (7)	16 (8)	1.00
Pneumonia	3 (1.4)	7 (3)	0.34
Deep Sternal Wound Infection	0	0	—
Postoperative Renal Failure	3 (1.4)	6 (2.9)	0.50
Renal Failure Requiring Dialysis	2 (1)	4 (2)	0.69
Reoperation for Bleeding	4 (2)	6 (3)	0.75
Length of ICU Stay (Hrs) *	21.2 [8.5-43.1]	47.1 [23.8-85.6]	<0.001
Length of Stay (Days) *	4 [3-6]	6 [5-10]	<0.001
Readmissions Within 30 Days	22 (11)	26 (13)	0.65
Operative Death	3 (1.4)	3 (1.4)	1.00

* Significant difference in factor between NSR and Cox-Maze groups ($p<0.05$)

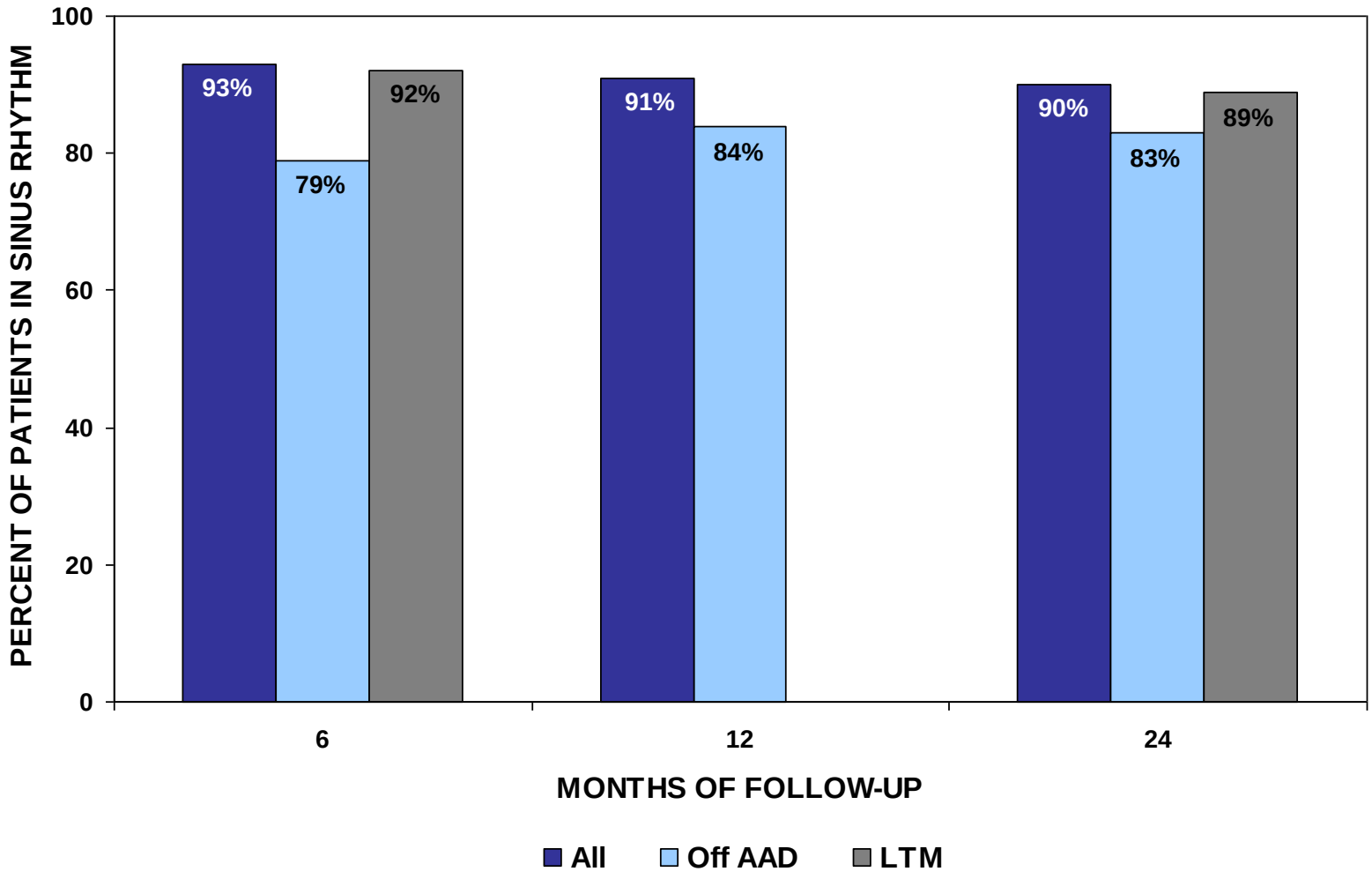
Return to Sinus Rhythm



Return to Sinus Rhythm



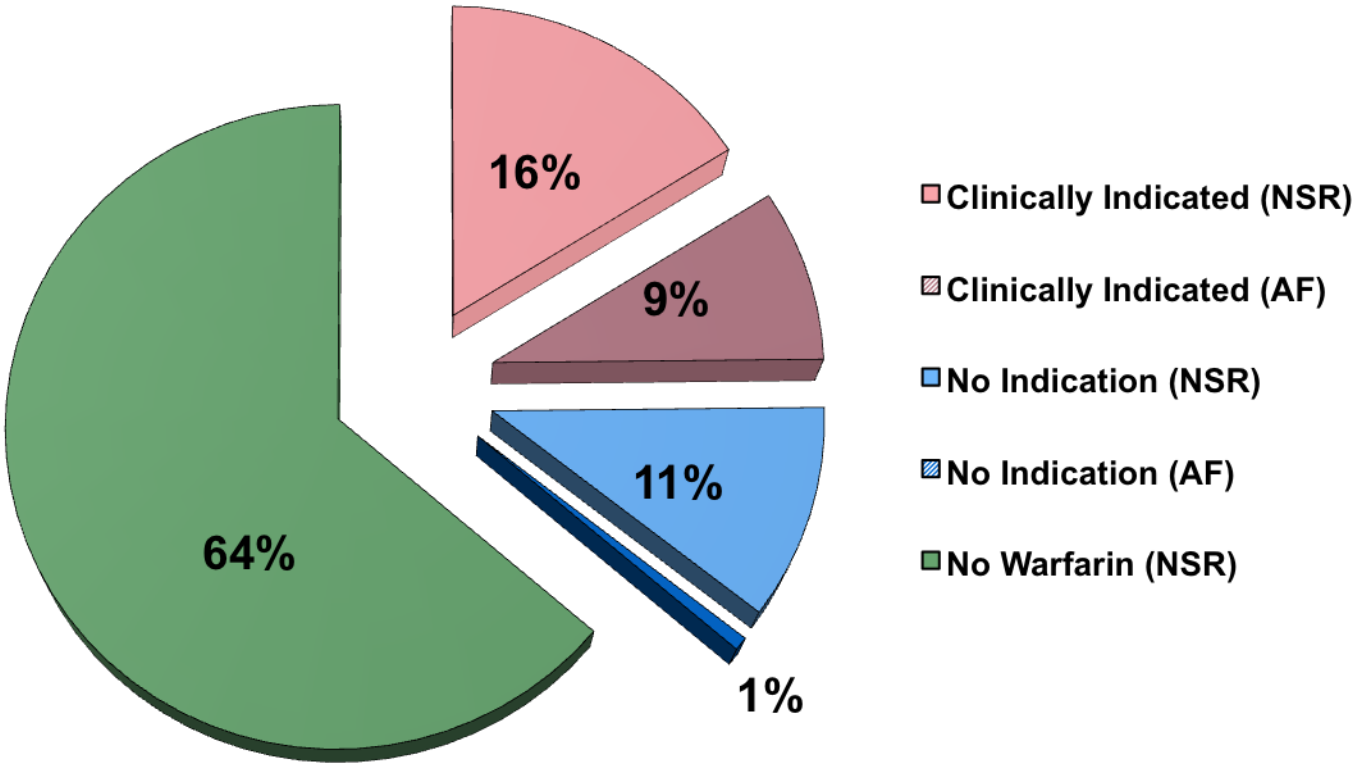
Return to Sinus Rhythm



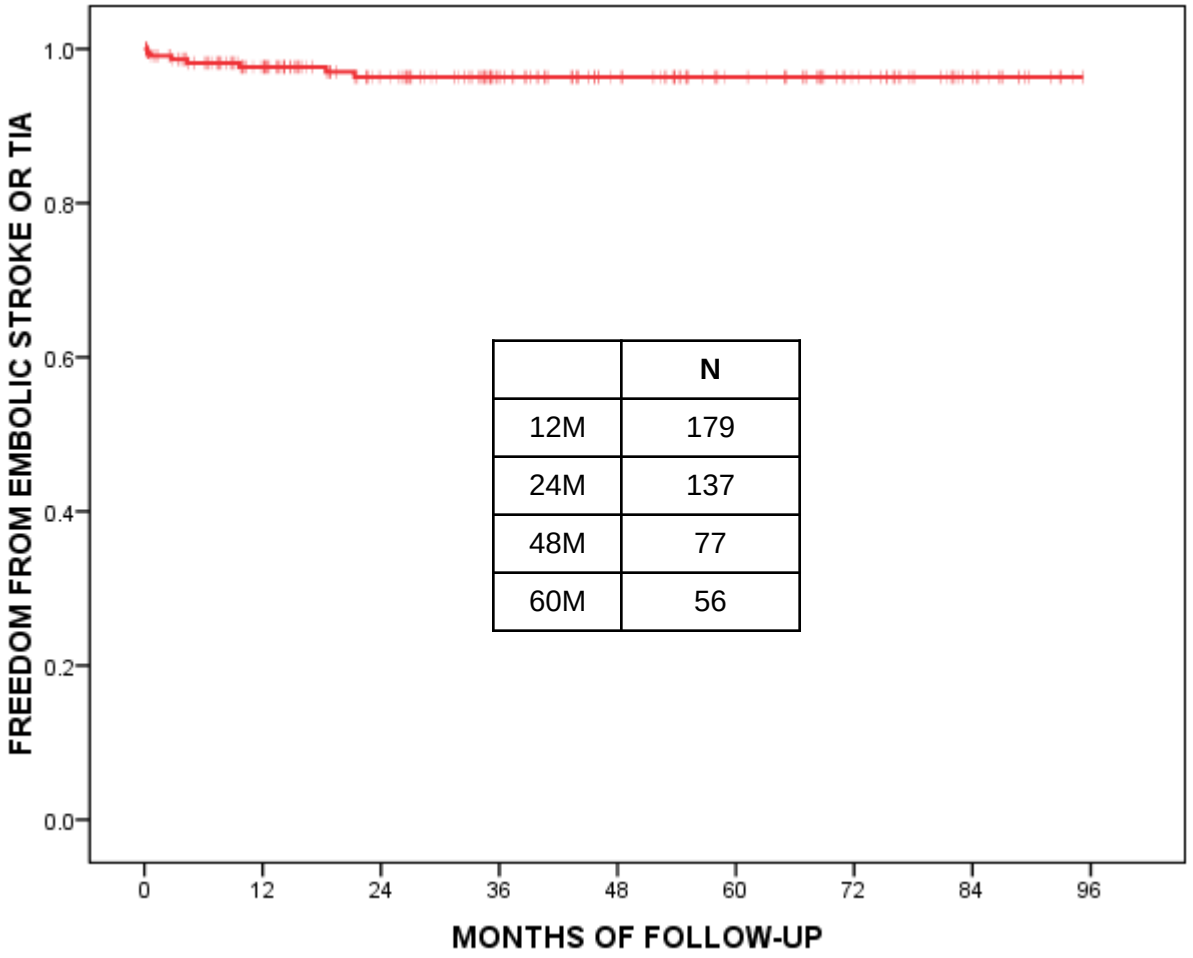
Mode of Failures During Follow-up

	Failure at 6M (13/185)	Failure at 12M (14/155)	Failure at 24M (10/96)
Percent Failure	7%	9%	10%
Mode of Failure			
>30sec - <=5min	0	2	0
>5min - <=1hr	0	1	1
>1hr	6	1	3
Continuous	7	10	6

Warfarin Use at 12 Months

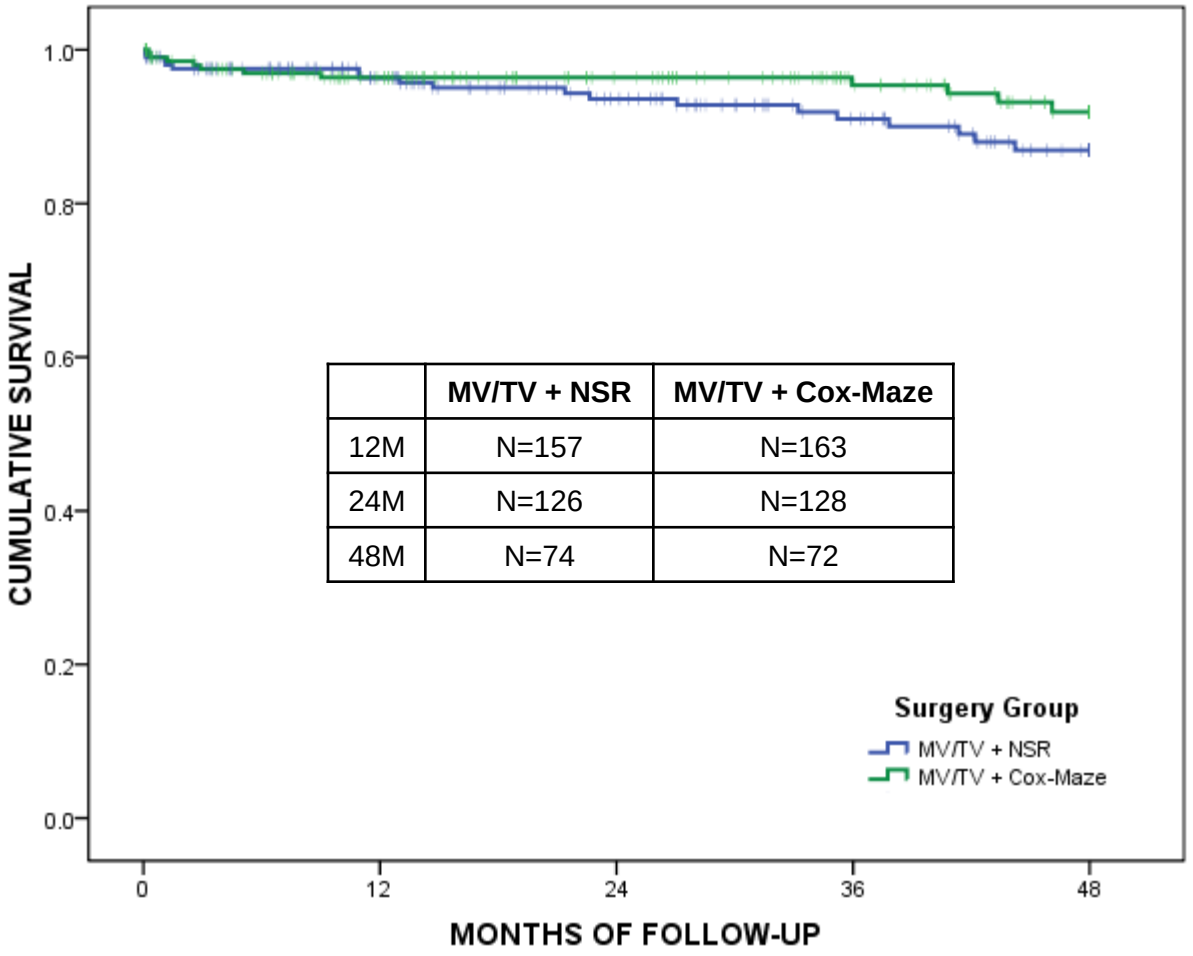


Freedom Stroke or TIA



	N
12M	179
24M	137
48M	77
60M	56

Survival – Matched Groups



	MV/TV + NSR	MV/TV + Cox-Maze
12M	N=157	N=163
24M	N=126	N=128
48M	N=74	N=72

Adjusted Survival (Cox Hazard) Untreated AF & CM

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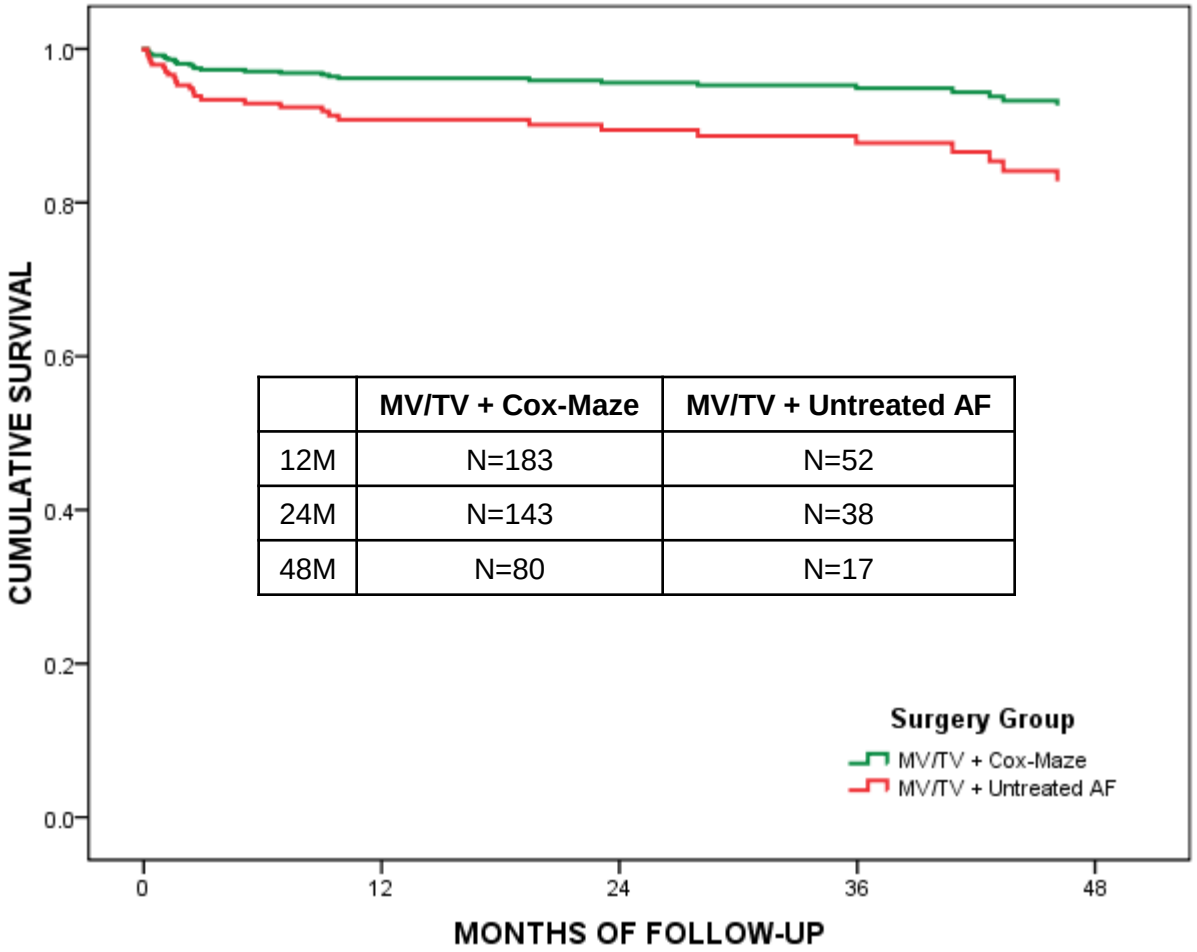
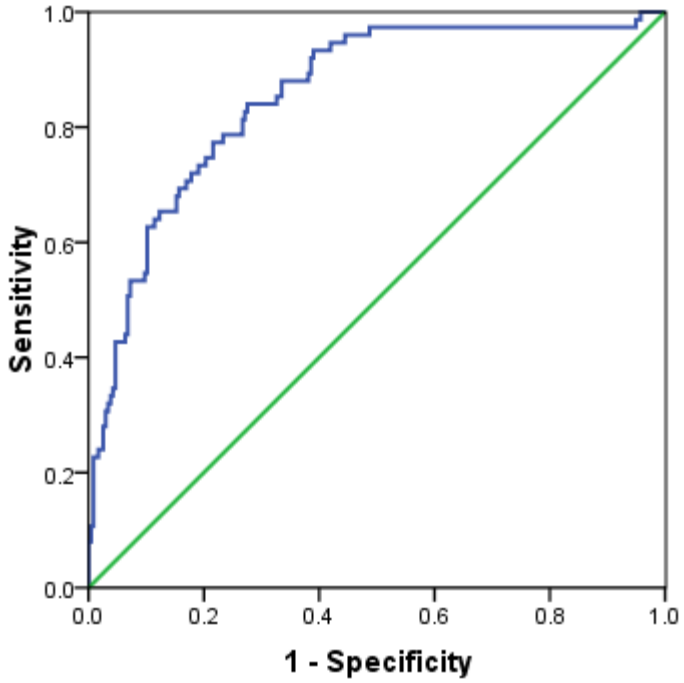


	MV/TV + Cox-Maze	MV/TV + Untreated AF
12M	N=183	N=52
24M	N=143	N=38
48M	N=80	N=17

Predictors for not performing the Cox-Maze procedure

- Significant predictors:
  - EuroSCORE (OR=1.40, *p*<0.001)
  - Surgeon experience with AF ablation <50 cases (OR=3.60, *p*<0.001)
- Area Under the Curve (AUC) = 0.86



Summary

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- **The CM procedure was performed in 76% of the patients with AF**
- No major perioperative complications were observed
- The study demonstrated comparable 4 years survival for patients having CM procedure and patients presented in NSR
- Low embolic rate was documented
- Risk and experience in surgical ablation were associated with performing the CM procedure

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Conclusions

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- The Cox-Maze procedure performed together with mitral and tricuspid valve surgery is safe and effective
- The impact of AF on patient outcomes should be discussed and results should be measured beyond 30 days postoperatively
- Anticoagulation can be stopped safely in the majority of patients
- Training and education are fundamental to improve the surgical approach offered to AF patients undergoing cardiac surgery

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Thank You