



Update of MAZE Operation



Hyung Gon Je. MD

Dept. of Thoracic and Cardiovascular surgery

Pusan National University Yangsan Hospital

Yangsan, Korea

Korean Heart Rhythm Society

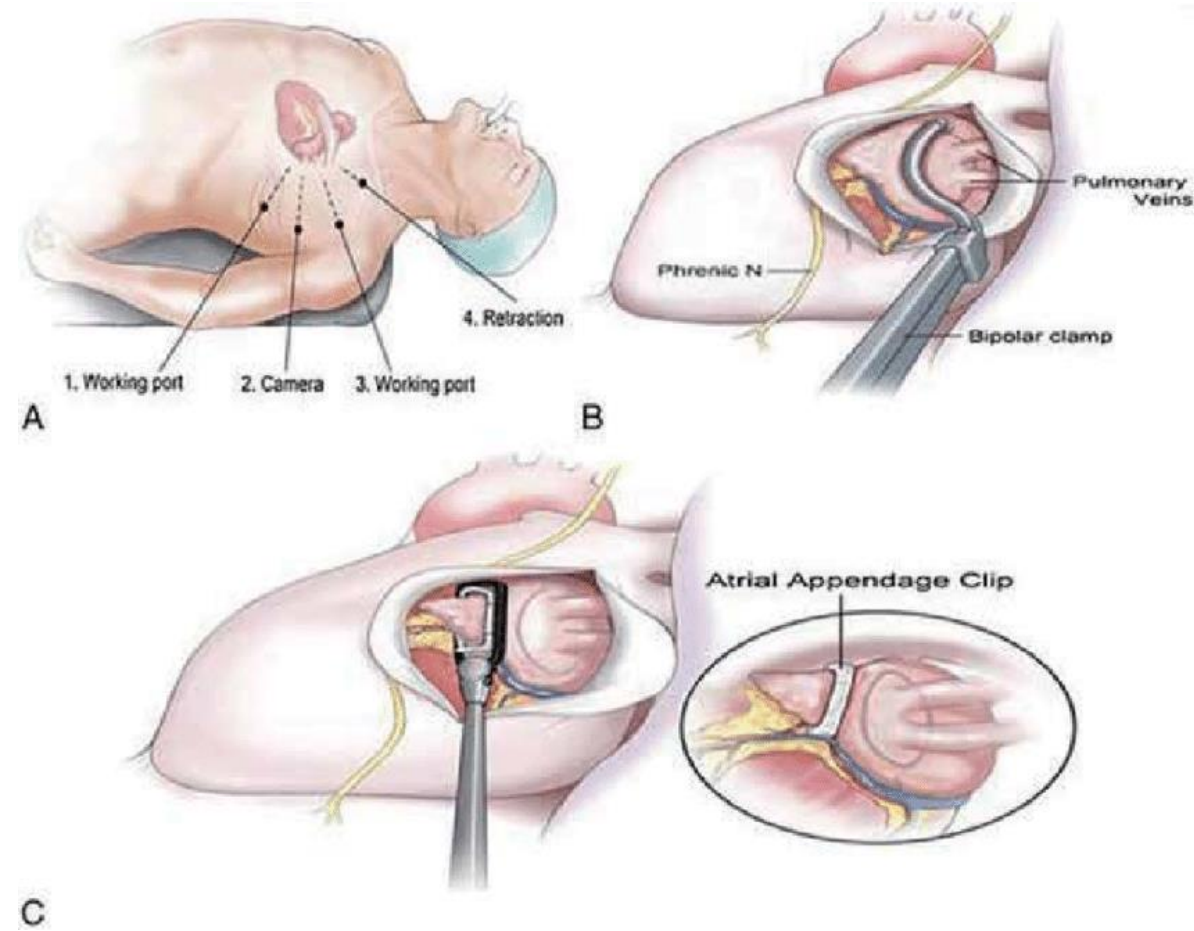
COI Disclosure

Hyung Gon Je :

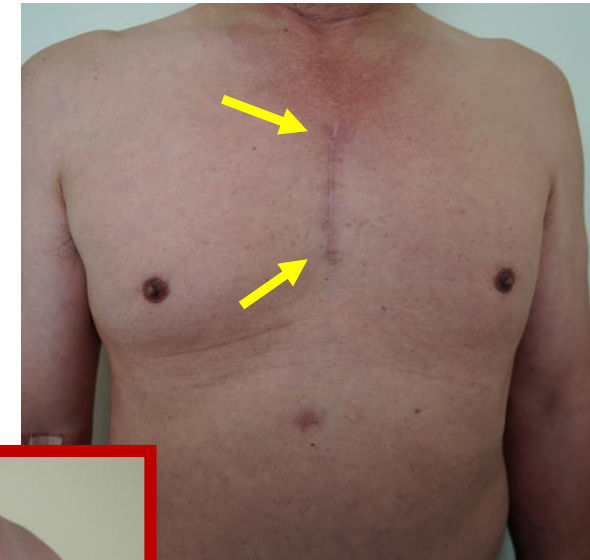
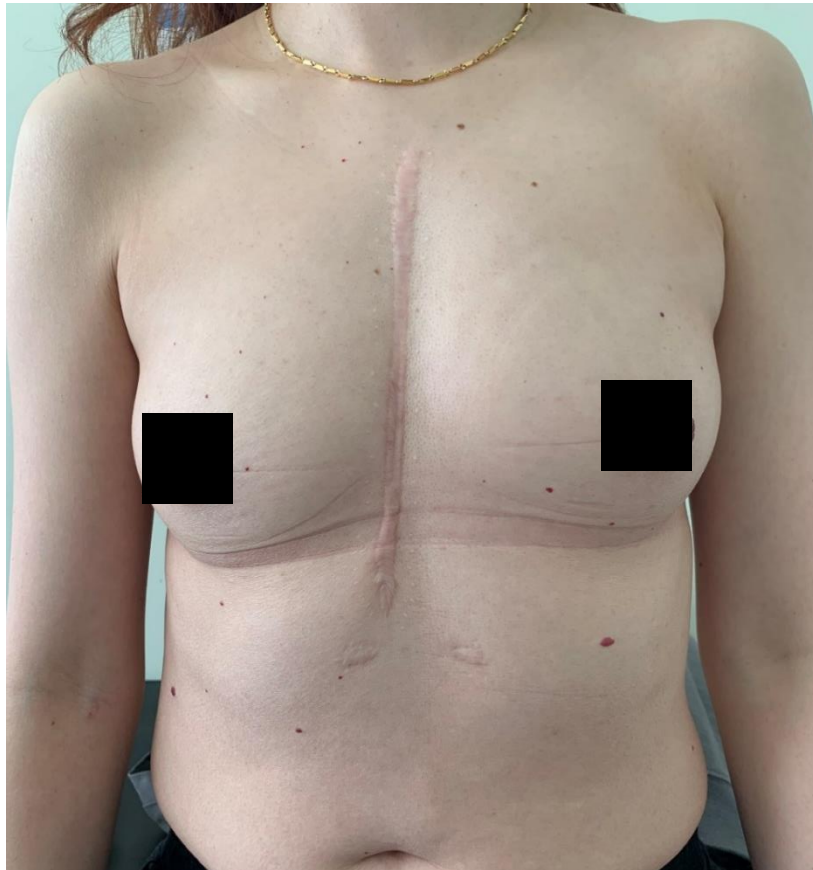
The authors have no financial conflicts of interest
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Technical Update of MAZE Operation

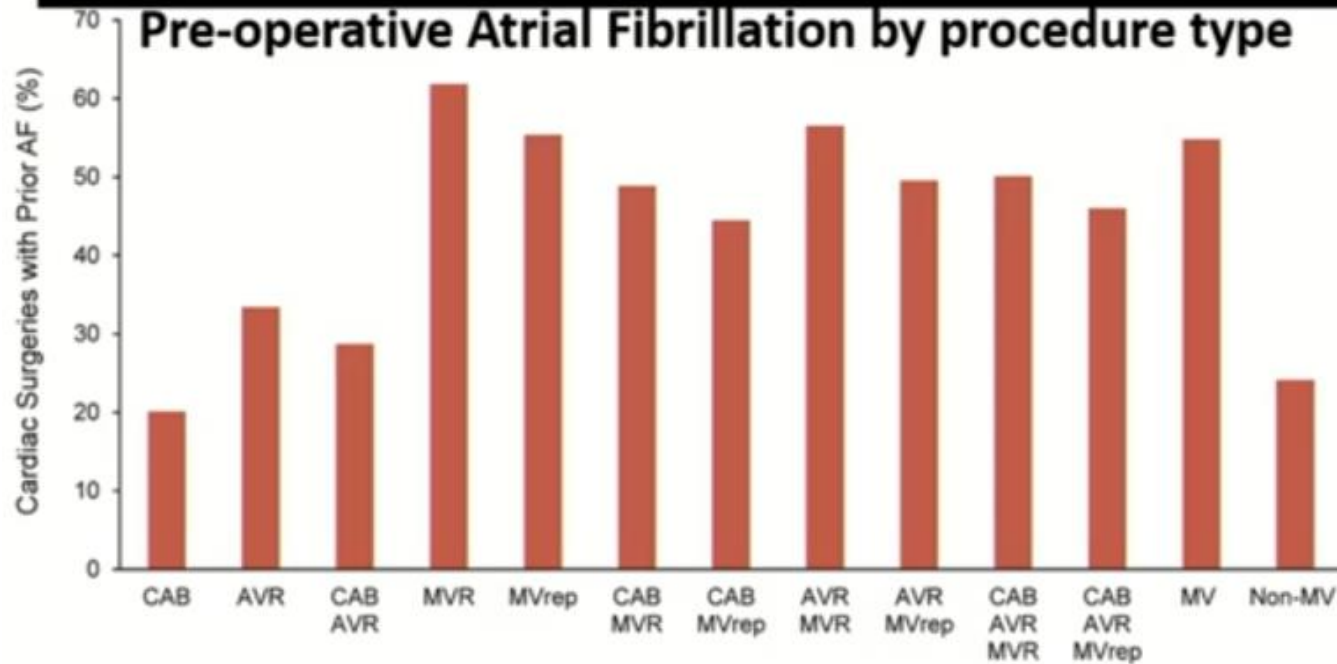


Minimally Invasive Maze Procedure



Surgical Ablation for AF during Cardiac Surgery

79, 134 Medicare Beneficiaries
28% had Atrial Fibrillation (AF)



Mitral Valve Surgery
38% had Surgical Ablation

Non-Mitral Valve Surgery
16% had Surgical Ablation



Only 22% had surgical ablation



2017 AATS

Expert Consensus

Guidelines for AF

Concomitant AF Surgery

- Recommended with **Mitral Valve Surgery**
 - *Class I, Level A*
- Recommended with **CABG, AVR, CABG+AVR**
 - *Class I, Level B*
- Improves operative mortality
 - *Class I, Level A*
- Does not affect operative morbidity
 - *Class IIa, Levels A, B-R, B-NR*
- Decreases perioperative stroke
 - *Class IIa, Level A*
- Improves quality of life
 - *Class IIa, Levels B-R, C-LD*
- Decreases long-term stroke/TIA
 - *Class IIa, Levels A, B-NR*



Introduction

- **Strong recommendation to perform Maze for AF during cardiac surgery**
- **Variable rate of surgical ablation, despite strong recommendation**
- **Factors influencing decision to perform Maze**
 - ✓ **Surgeon experience and training**
 - ✓ **Type of concomitant surgery**
 - ✓ **Perceived risk of Maze**
 - ✓ **Knowledge transfer and education**



2023 AATS Presentation: JK Kang

RESOURCE TYPE: PRESENTATION

94. STATEWIDE DATA ON SURGICAL ABLATION FOR ATRIAL FIBRILLATION: THE DATA PROVIDE A PATH FORWARD

May 7, 2023

Presented by:

Richard Lee, Invited Discussant, Augusta University Medical Center

Jin Kook Kang, Abstract Presenter

Source:

103rd Annual Meeting, the Los Angeles Convention Center, Los Angeles, CA, USA

Los Angeles Convention Center, 515A



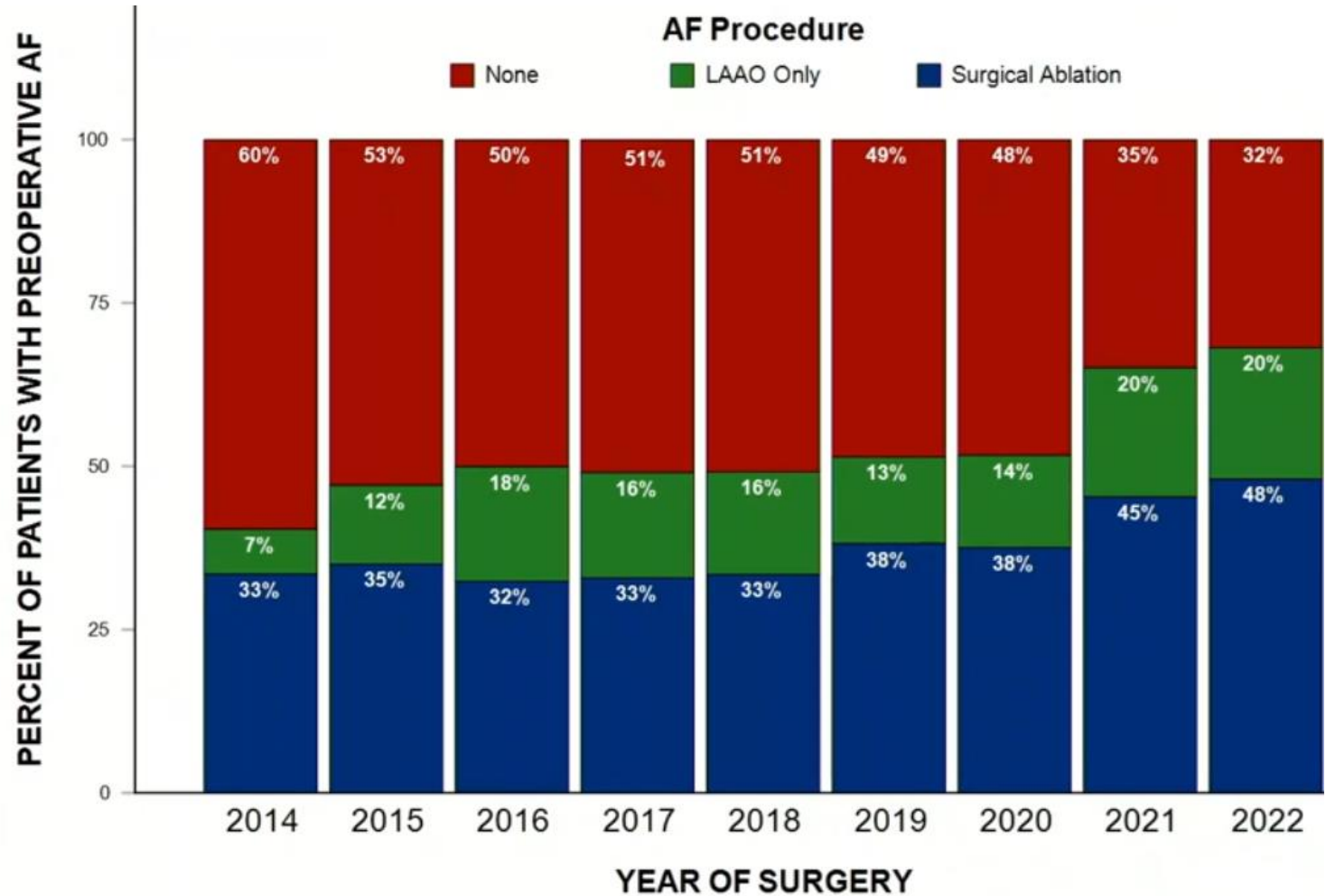
Maryland Statewide Registry

- **Surgical ablation**

- 2014: 33%
- 2022: 48%

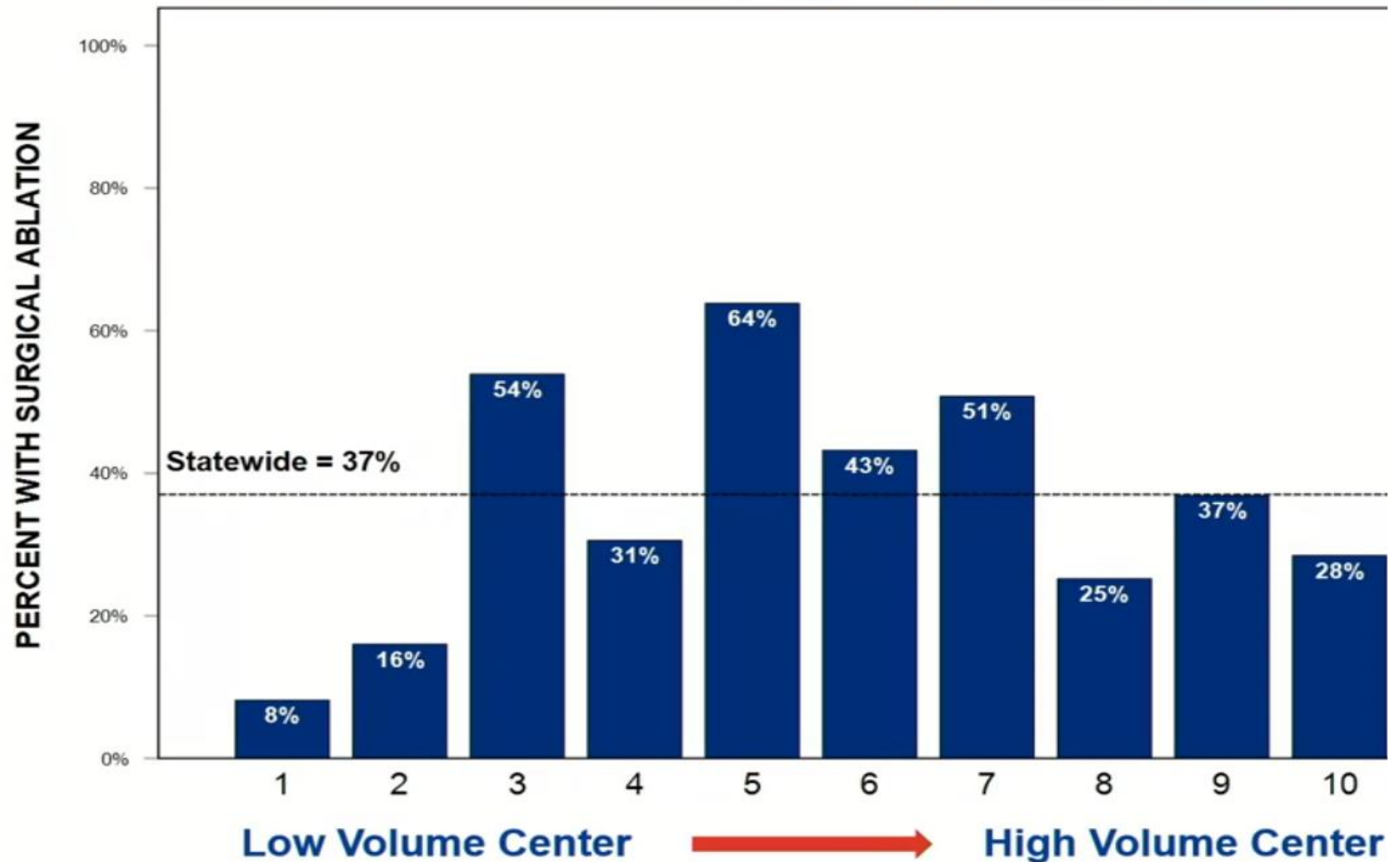
- **LAAO only**

- 2014: 7%
- 2022: 20%

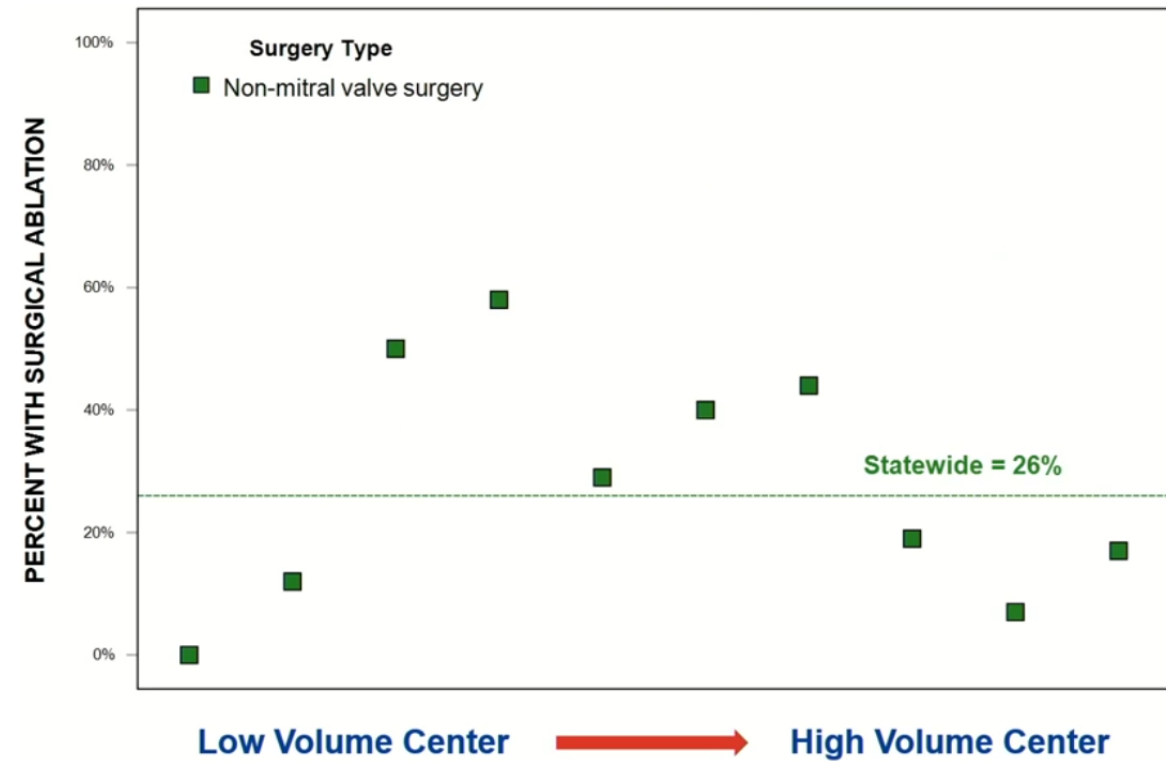
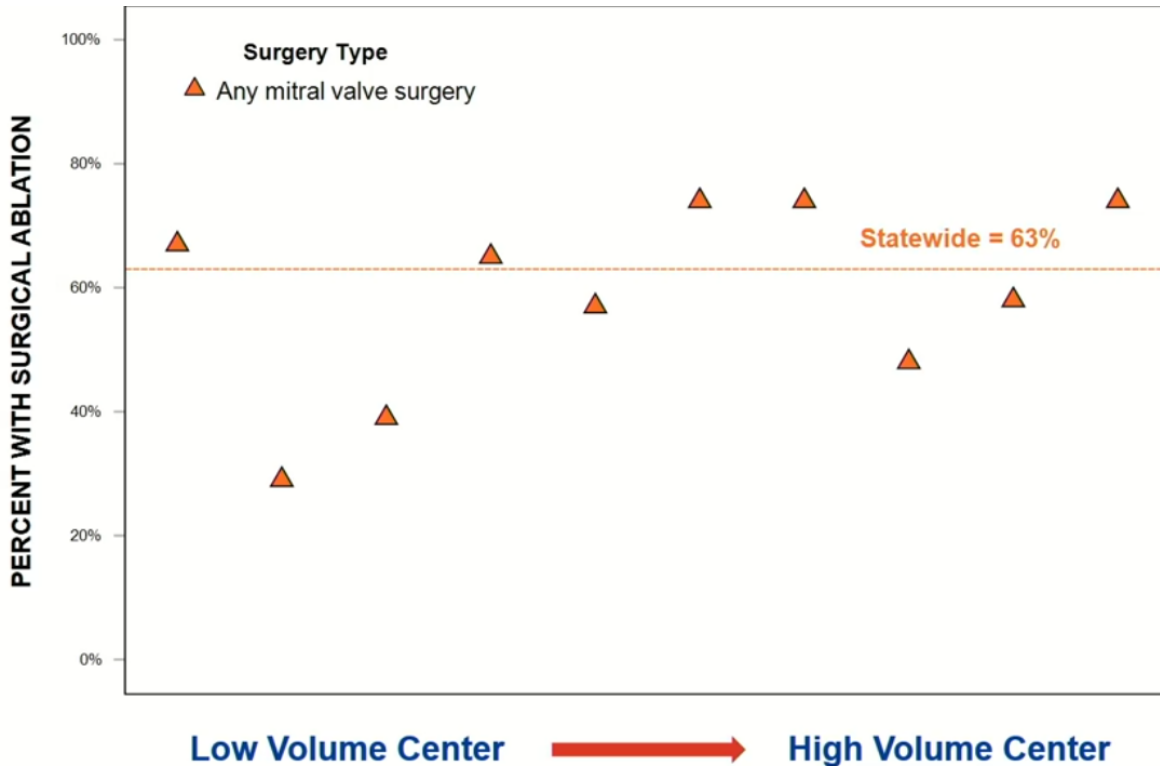


Maryland Statewide Registry

- **No volume correlation was found**
- **Academic & training centers performed below statewide rate**



Maryland Statewide Registry: MV vs. Non-MV



KHRS 2021 Guidelines



수술 후 심방세동의 재발과 관련된 수술전 위험 요인은 일반적으로 카테터를 이용한 도자절제술과 크게 다르지 않다. 좌심방 크기, 환자 나이, 심방세동 유병 기간, 심부전, 좌심실 수축기능, 신기능 저하 등이 이에 속한다.^{408, 541, 543-549} 현재 까지 여러 연구에서 **수술적 치료의 울동 조절에 대한 긍정적 효과는 분명해 보이지만, 삶의 질, 뇌졸중 사망률에 대해 미치는 영향에 대해서는 아직 논란이 존재한다.**^{537, 539, 550-554}

증력을 갖춘 연구는 아니었다.⁵³⁷ 대규모 레지스트리 연구에서 승모판 수술이나, 관상동맥 우회술을 할 당시에 절제술을 함께 진행했을 때 좀 더 좋은 생존율이 관찰되었다.⁵⁴⁰ 환자의 치료 방향을 결정할 때는 심장 전문 흉부외과 의사와 부정맥 전문 내과 의사가 서로 협업하여 결정하는 것이 가장 이상적인 방법이다.

Evidence of Uncertainty

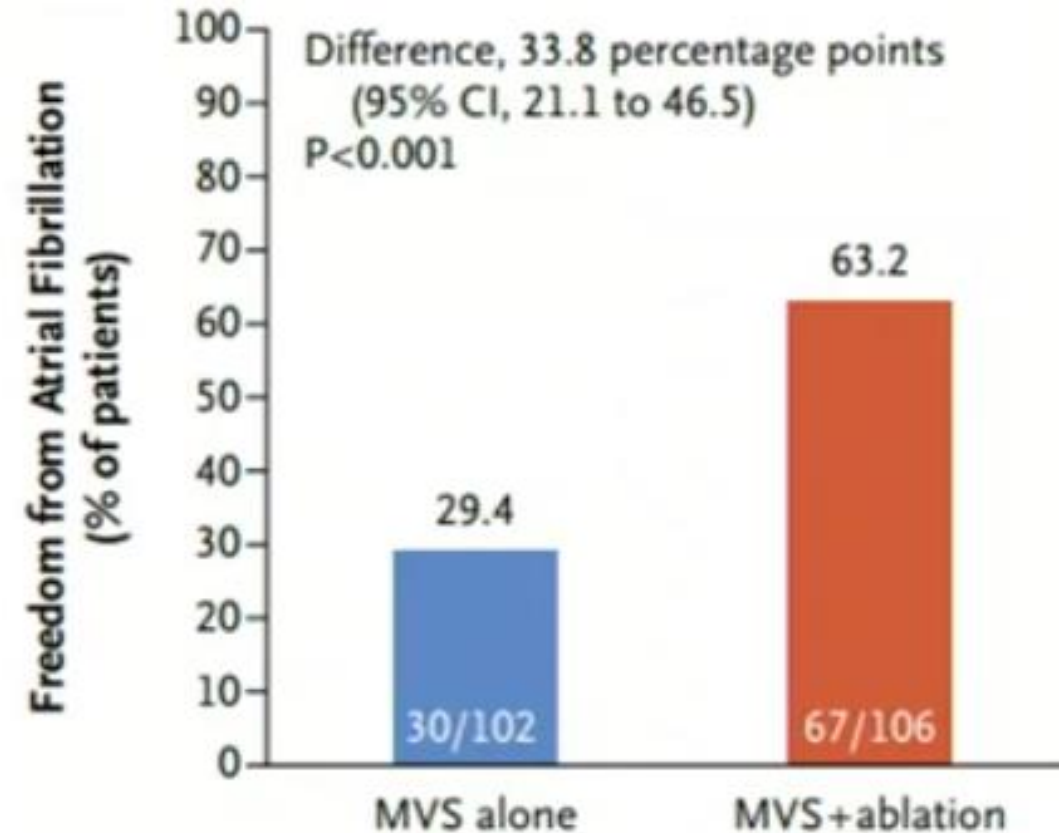
THE NEW ENGLAND JOURNAL OF MEDICINE

ORIGINAL ARTICLE

Surgical Ablation of Atrial Fibrillation during Mitral-Valve Surgery

A. Marc Gillinov, M.D., Annetine C. Gelijns, Ph.D., Michael K. Parides, Ph.D., Joseph J. DeRose, Jr., M.D., Alan J. Moskowitz, M.D., Pierre Voisine, M.D., Gorav Ailawadi, M.D., Denis Bouchard, M.D., Peter K. Smith, M.D., Michael J. Mack, M.D., Michael A. Acker, M.D., John C. Mullen, M.D., Eric A. Rose, M.D., Helena L. Chang, M.S., John D. Puskas, M.D., Jean-Philippe Couderc, Ph.D., Timothy J. Gardner, M.D., Robin Varghese, M.D., Keith A. Horvath, M.D., Steven F. Bolling, M.D., Robert E. Michler, M.D., Nancy L. Geller, Ph.D., Deborah D. Ascheim, M.D., Marissa A. Miller, D.V.M., Emilia Bagiella, Ph.D., Ellen G. Moquete, R.N., Paula Williams, M.S., Wendy C. Taddei-Peters, Ph.D., Patrick T. O'Gara, M.D., Eugene H. Blackstone, M.D., and Michael Argenziano, M.D., for the CTSN Investigators*

All Patients



Evidence of Uncertainty

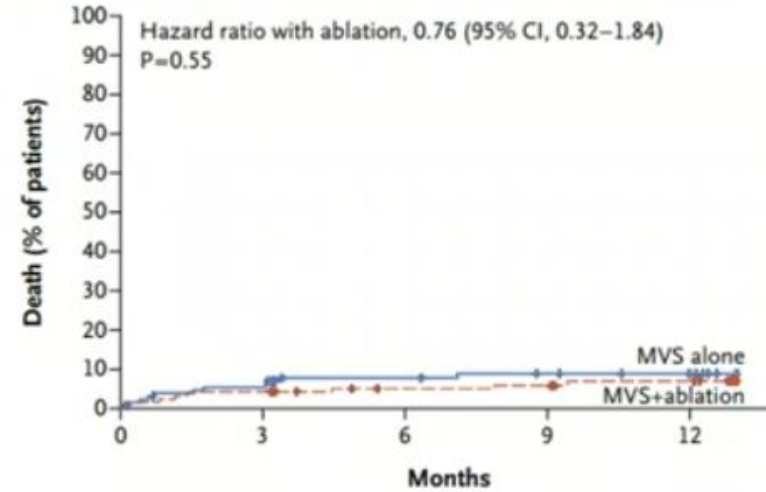
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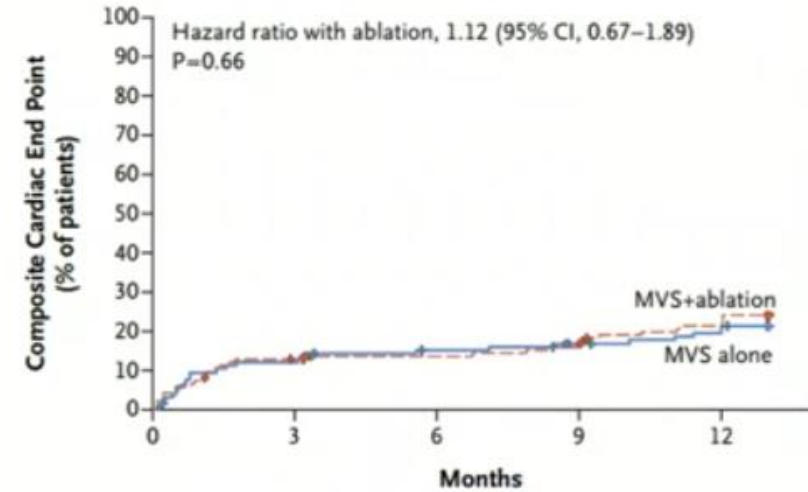
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A



B

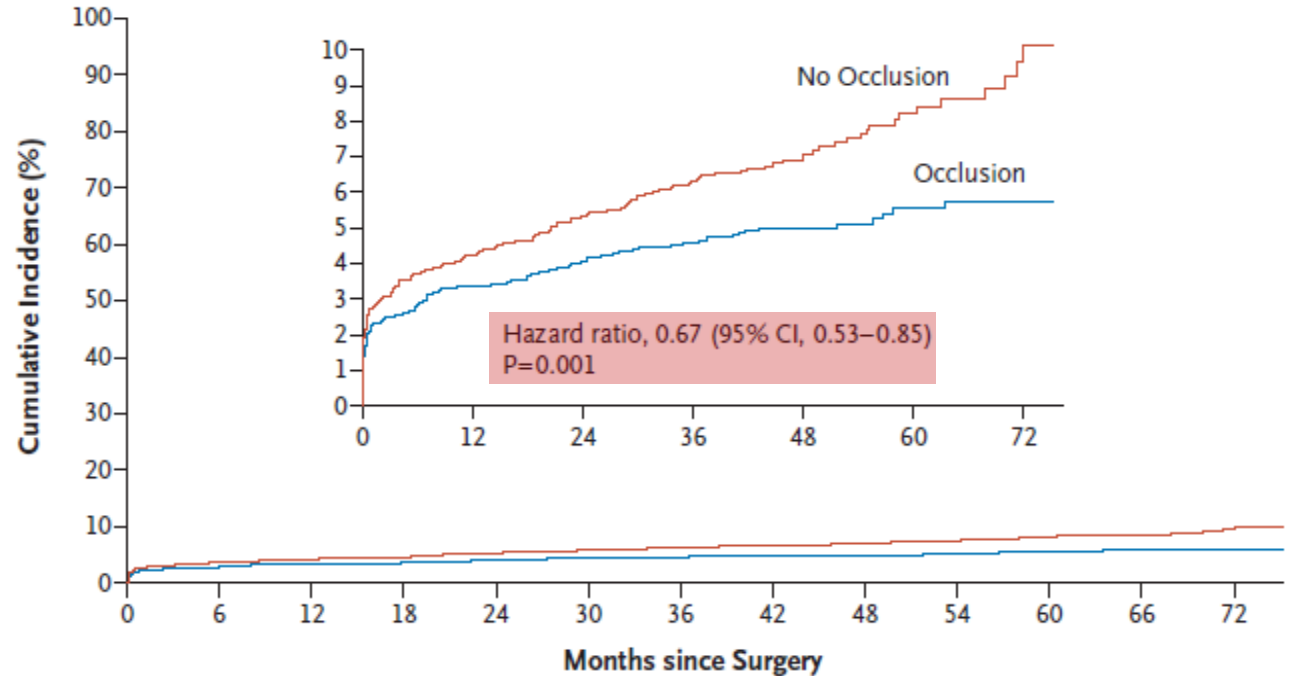


LAA Occlusion: LAAOS III

- 2.2% Reduction in Stroke at 3.8 years
- No Difference in Survival



Left Atrial Appendage Occlusion during Cardiac Surgery to Prevent Stroke



No. at Risk

No Occlusion	2391	2134	2081	2030	1981	1897	1607	1291	1016	751	540	348	205
Occlusion	2379	2163	2105	2059	2020	1948	1642	1322	1046	781	550	349	199

Figure 1. Cumulative Incidence of Stroke or Systemic Arterial Embolism.

number, NCT01561651.)

N ENGL J MED 384:22 2021

2021

The New England Journal of Medicine

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2023 AATS Presentation: Niv Ad, J. Hunter

RESOURCE TYPE: **PRESENTATION**



135. SURGICAL ABLATION OF ATRIAL FIBRILLATION IS SUPERIOR TO APPENDAGE OBLITERATION ALONE: ANALYSIS OF 100,000 MEDICARE BENEFICIARIES

May 7, 2023

Presented by:

[Niv Ad](#) , [Invited Discussant](#) , [Adventist White Oak Medical Center](#)

[J. Hunter Mehaffey](#) , [Abstract Presenter](#) , [West Virginia University](#)

Source:

103rd Annual Meeting, the Los Angeles Convention Center, Los Angeles, CA, USA

Los Angeles Convention Center, 515A

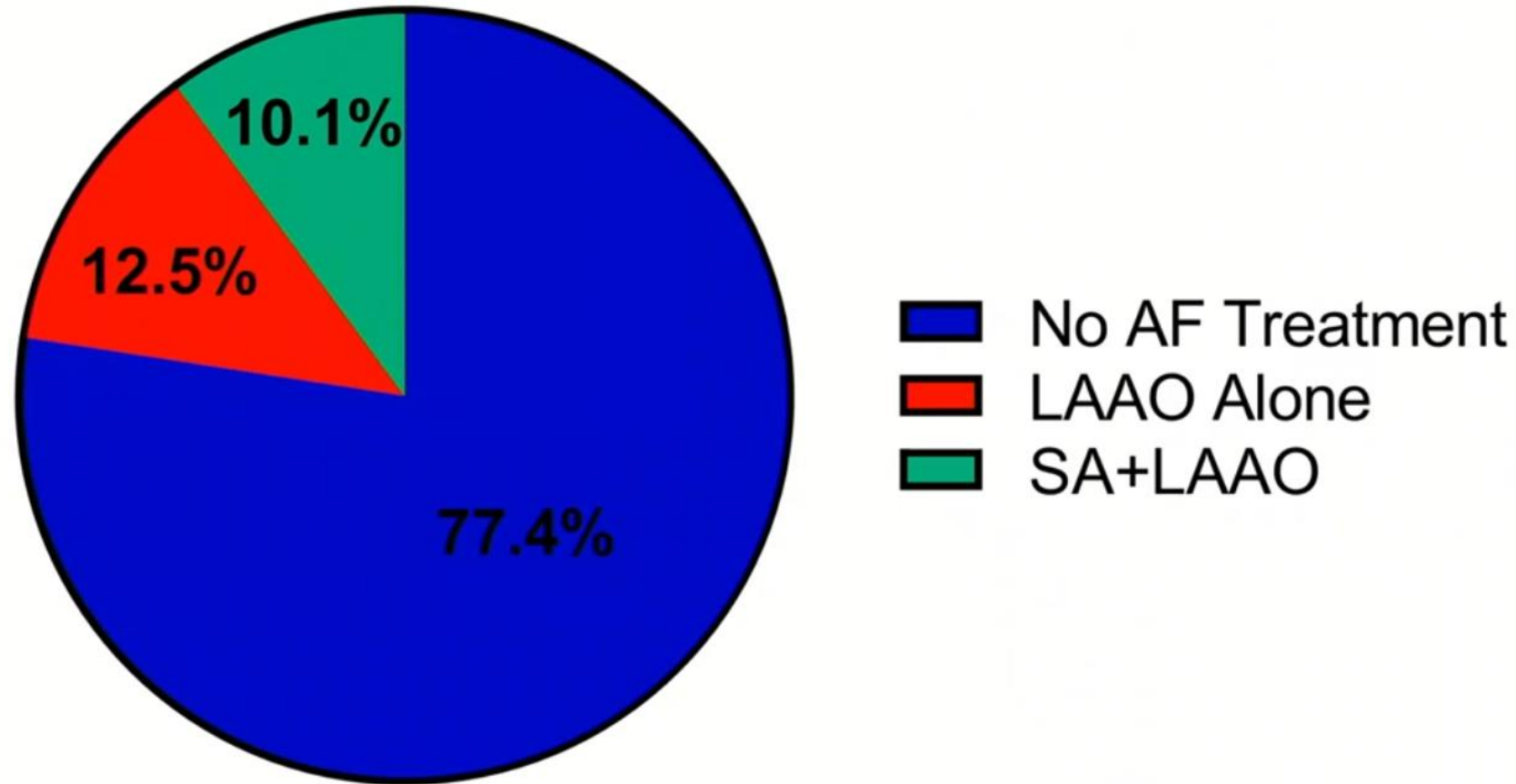


Patients

- **103,382 Patients**
- Centers for Medicare and Medicaid Services
 - Atrial Fibrillation
 - Elective, First time
 - CABG and/or Valve Operations
 - 2018-2020



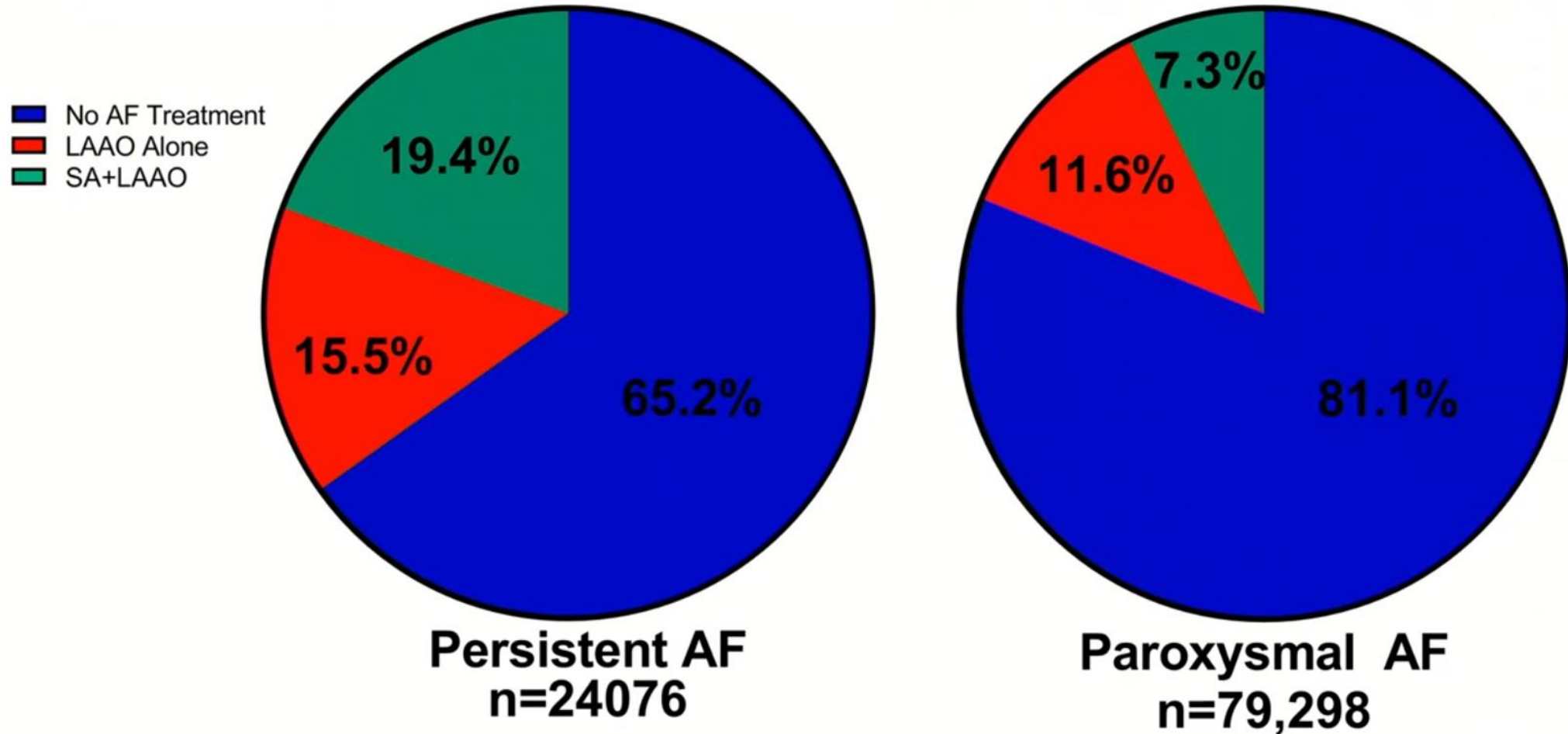
Treatment options



Total=103,382

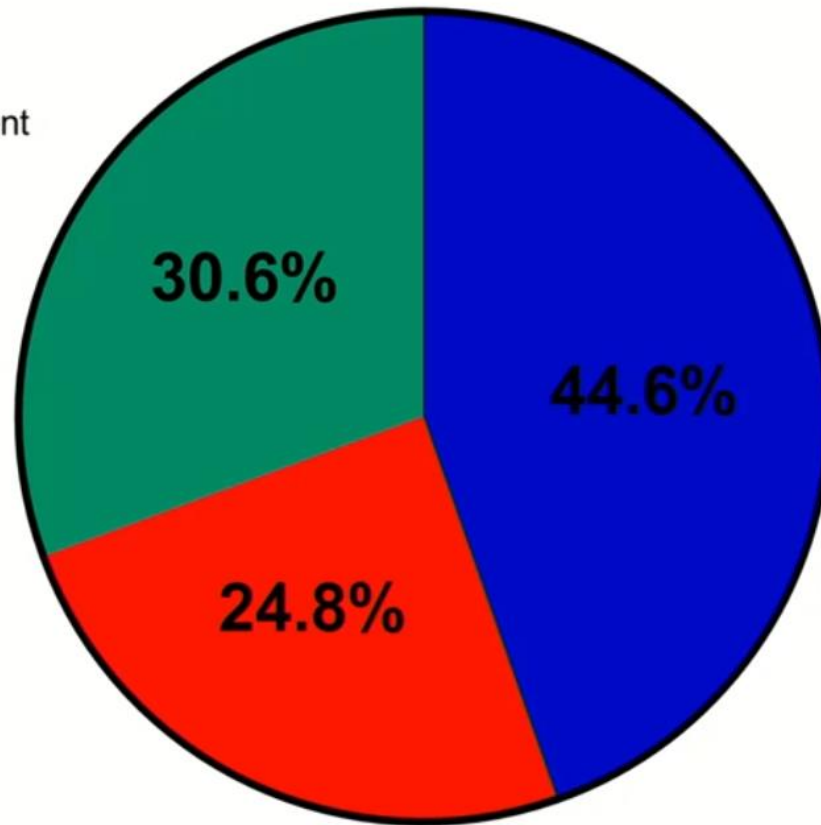
J. Hunter presented at AATS 2023

Treatment: Persistent vs. Paroxysmal

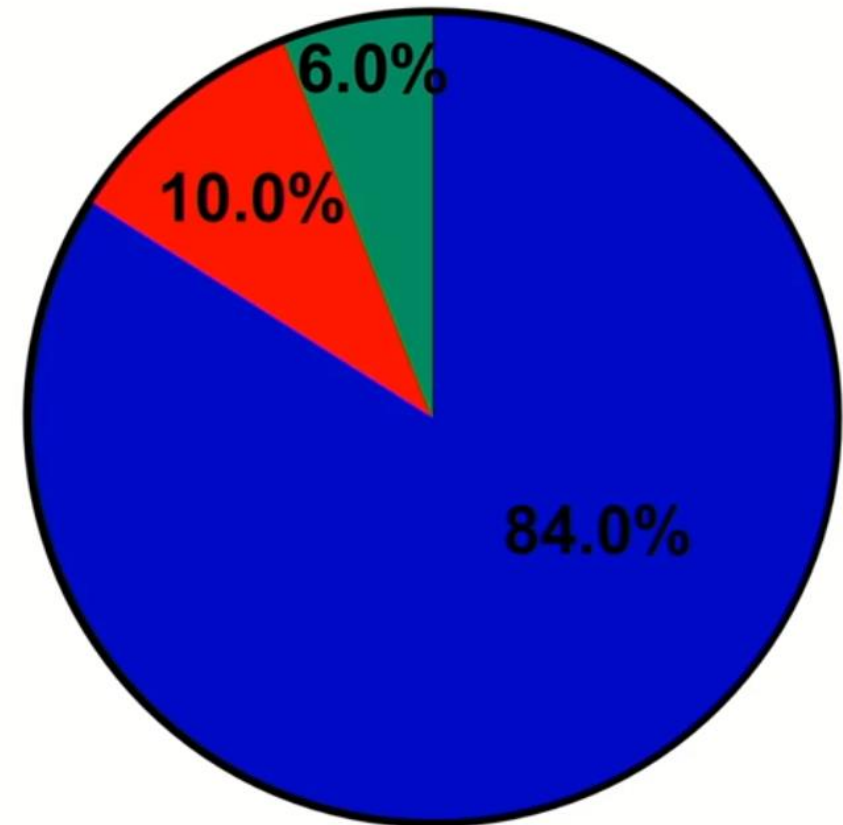


Treatment: Open vs. Closed

- No AF Treatment
- LAO Alone
- SA+LAO



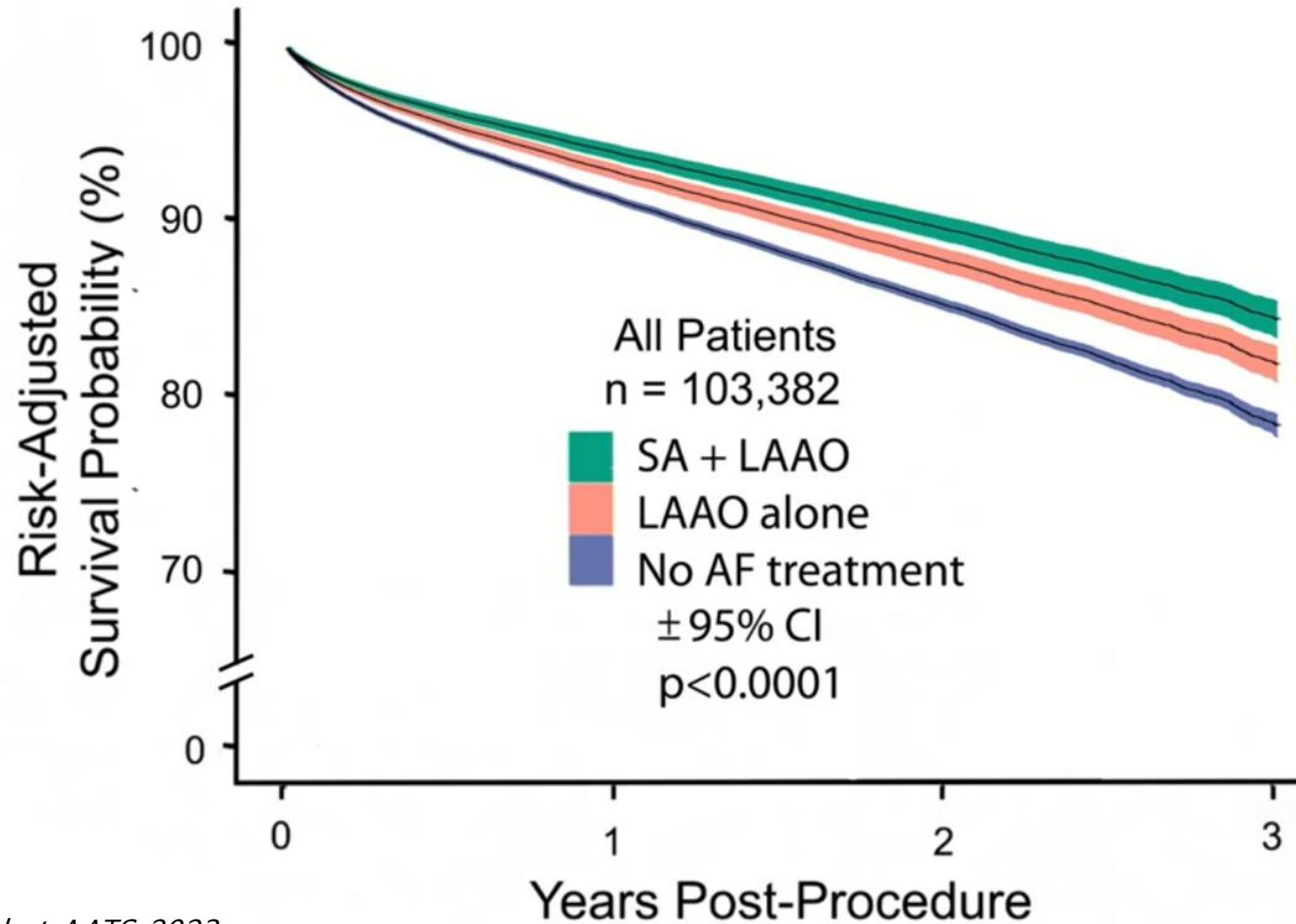
Open Atrial
n=17,206



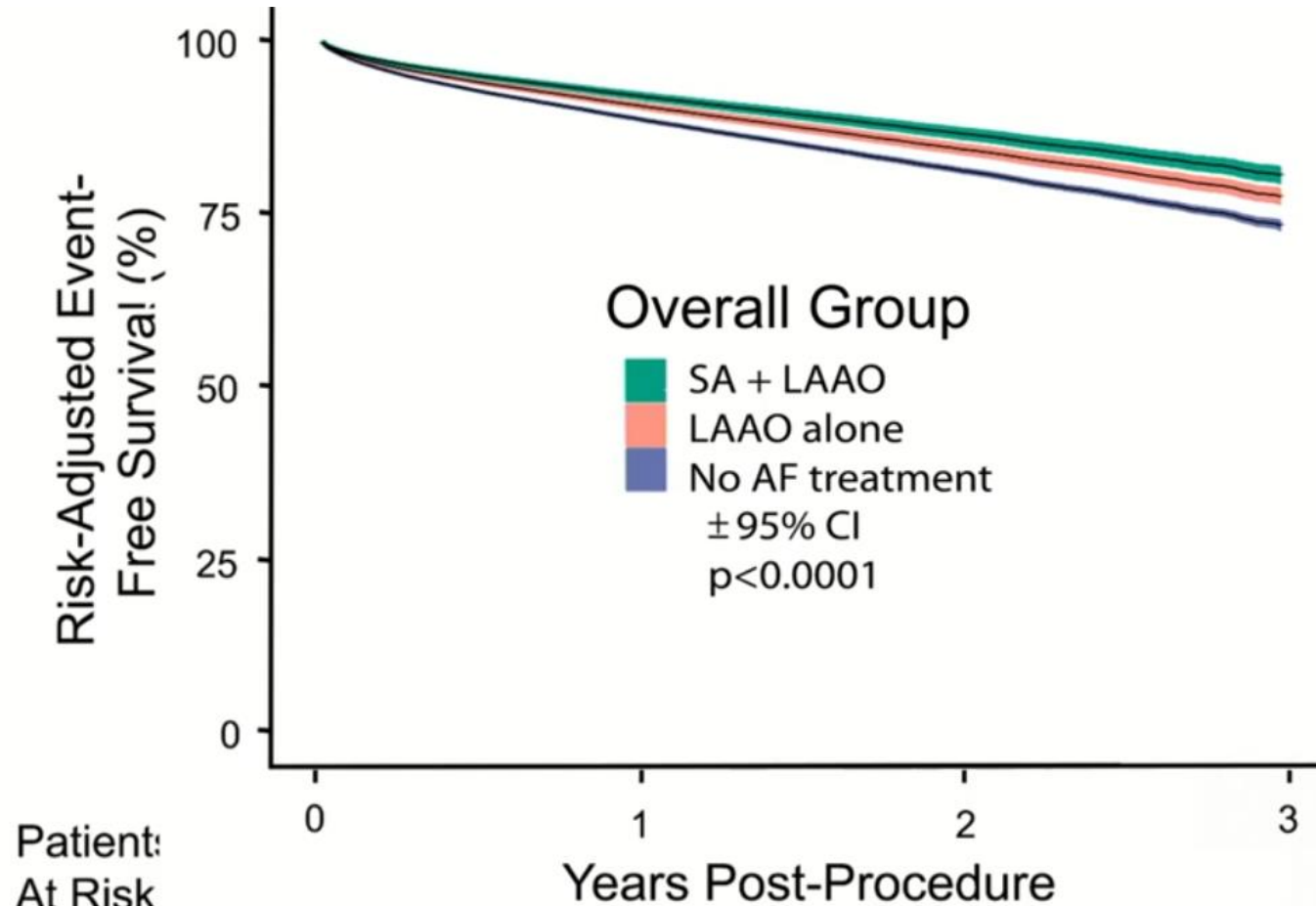
Closed Atrial
n=86,176



Survival: SA better than LAAO alone



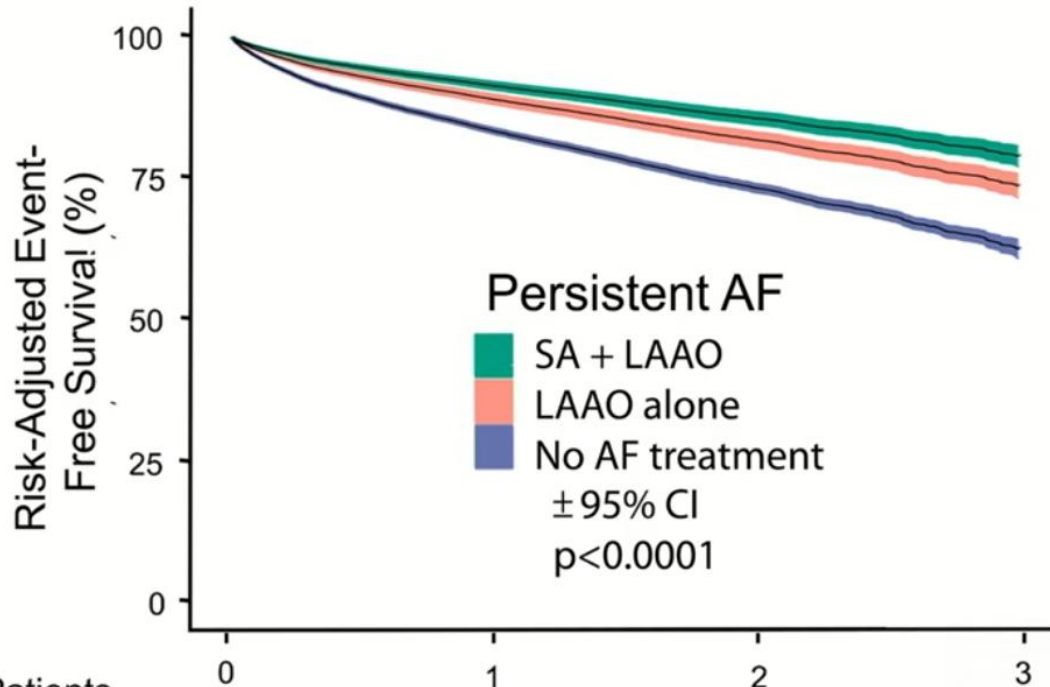
Stroke free survival: SA better than LAAO alone



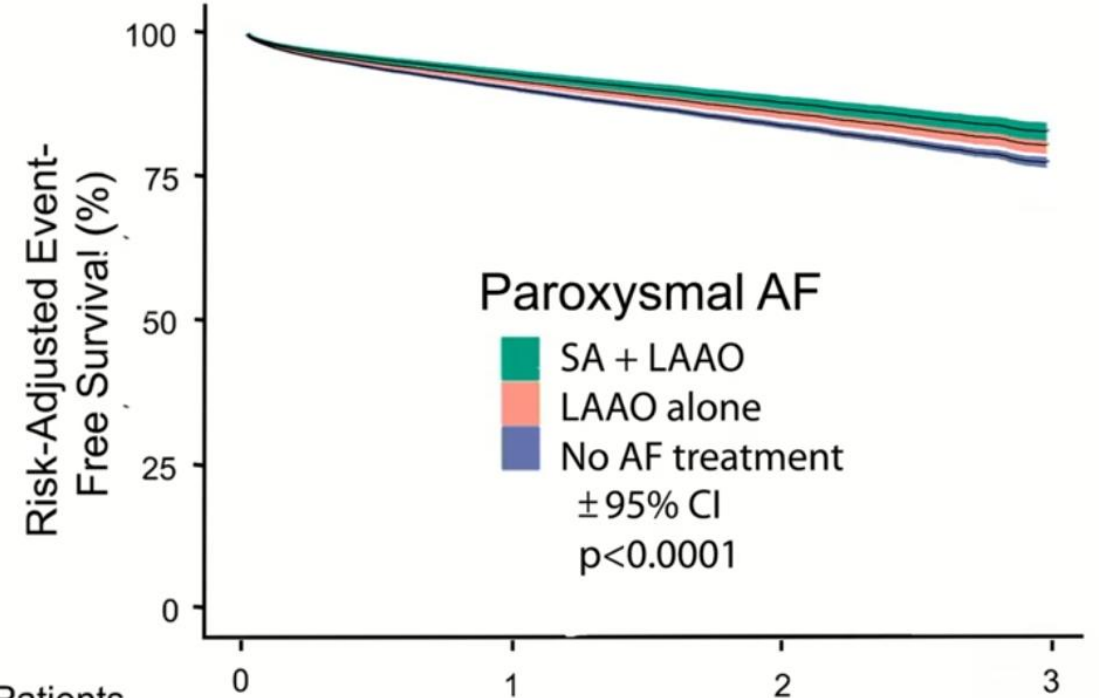
Patient:	0	1	2	3
At Risk	Years Post-Procedure			
No LAAL/Abl	88,044	52,090	24,994	848
LAAL	12,901	8,391	4,008	155
LAAL+ Abl	10,437	7,098	3,580	135



Stroke free Survival in Persistent vs. Paroxymal AF



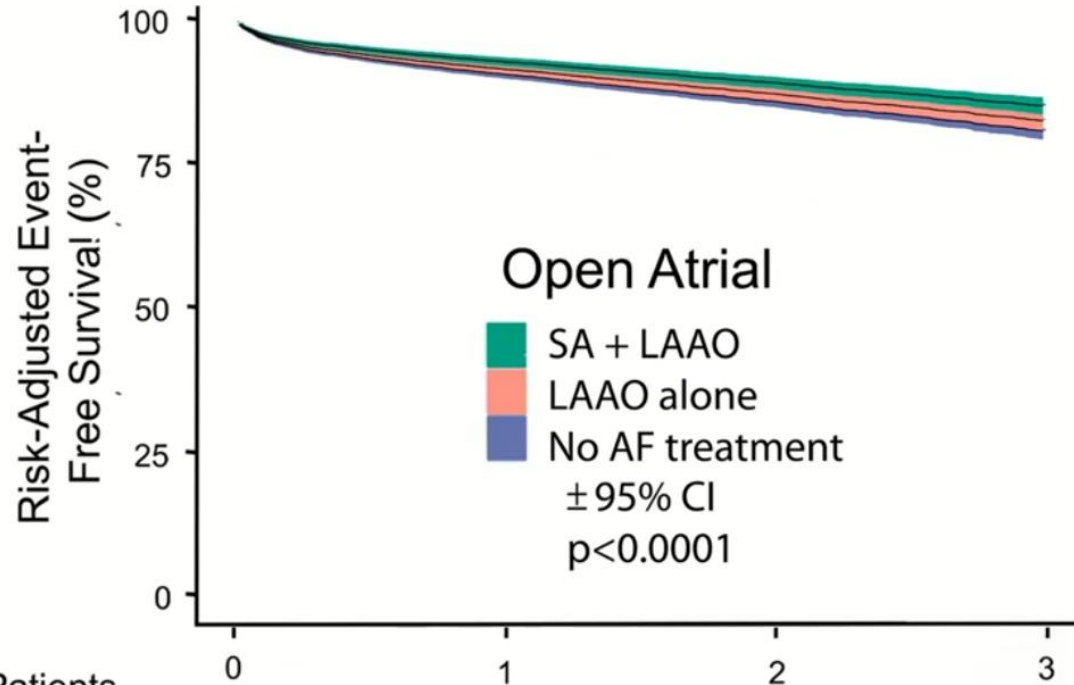
Patients At Risk	0	1	2	3
No LAAL/Abl	15,691	9,224	4,086	117
LAAL	3,724	2,385	1,185	46
LAAL+ Abl	4,661	3,175	1,643	61



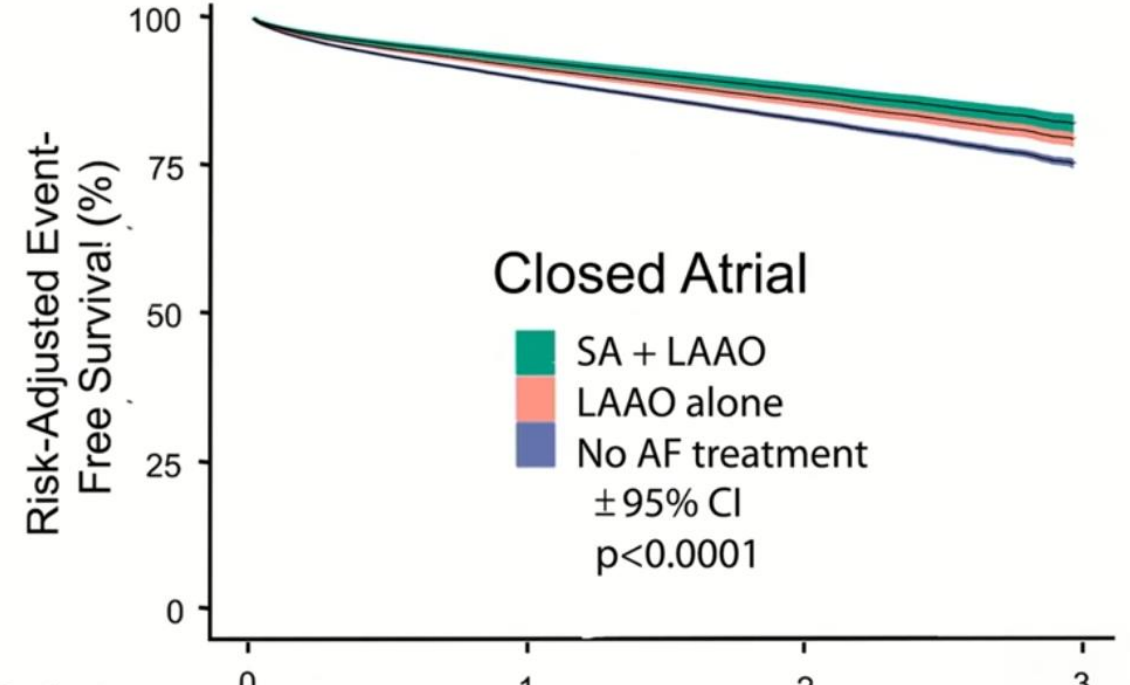
Patients At Risk	0	1	2	3
No LAAL/Abl	64,358	48,079	22,528	604
LAAL	9,177	6,244	2,992	176
LAAL+ Abl	5,776	3,868	1,926	73



Stroke free Survival in Open LA vs. Closed LA



Patients At Risk	0	1	2	3
No LAAL/Abl	7,679	5,287	2,910	743
LAAL	4,259	2,945	1,493	387
LAAL+ Abl	5,268	3,601	2,007	534



Patients At Risk	0	1	2	3
No LAAL/Abl	72,365	49,832	26,374	4,232
LAAL	8,642	5,756	2,934	874
LAAL+ Abl	5,169	3,523	2,003	475



KHRS 2021 Guidelines

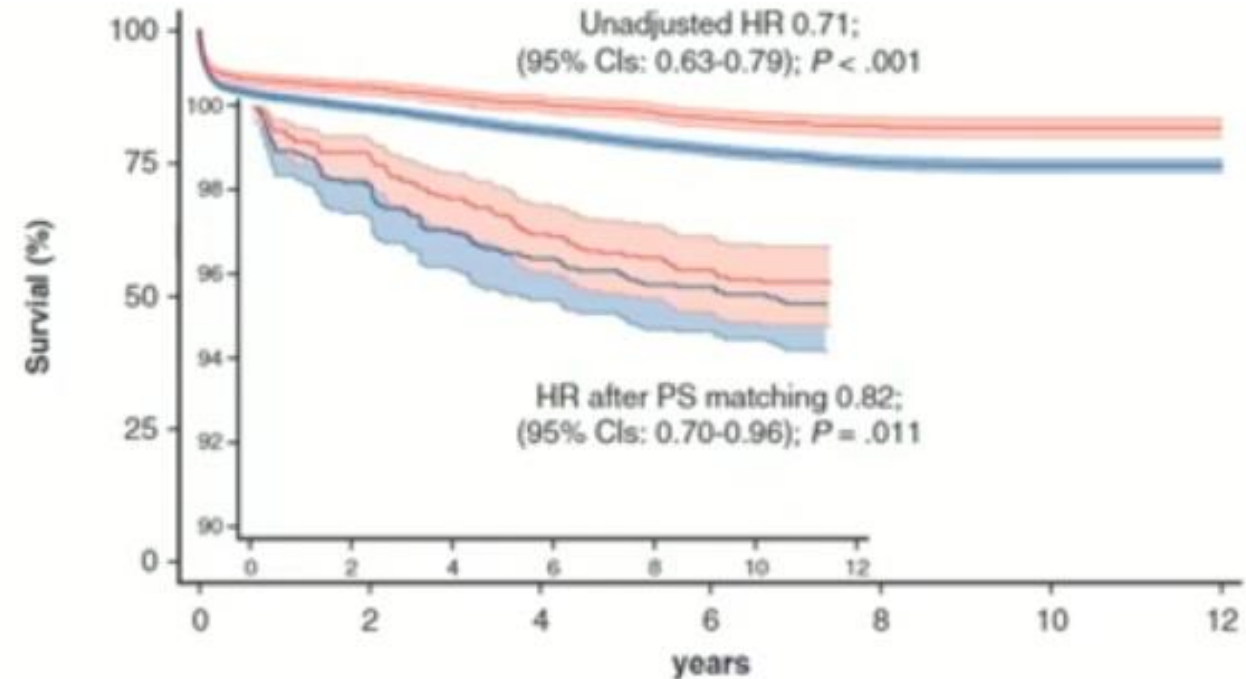


심방세동 수술적 치료의 권고 사항

권고 사항	권고 등급	근거 수준
다른 심장 수술을 진행할 때, 함께 심방세동 수술적 치료를 하는 것을 고려해야 한다. 다만 리듬 조절의 이익과 심방 부정맥 재발의 위험성을 따져보아야 한다.	IIa	A
하이브리드 시술을 포함하여 흉강경을 이용한 심방세동 시술은 이전 경피적 심방세동 시술이 실패하였거나 혹은 실패할 확률이 높고, 항부정맥 약제에 불응하는 유증상 발작성, 지속성 심방세동 환자에게 장기간의 리듬조절을 목적으로 고려되어야 한다. 그리고 시술은 부정맥 전문의와 외과 의사로 구성된 경험있는 협의체를 통해 결정되어야 한다.	IIa	B
하이브리드 시술을 포함하여 흉강경을 이용한 심방세동 수술적 치료는 항부정맥제 약물치료에 불응하는 재발의 위험성의 높은 유증상 지속성 심방세동 환자에서 리듬조절을 선호하는 경우 고려될 수 있다.	IIb	C

Maze in MV Surgery: Polish Heart Surgery Registry (KROK)

- Concomitant SA:
 - Significant survival benefit
 - Sustained survival benefit in PSM

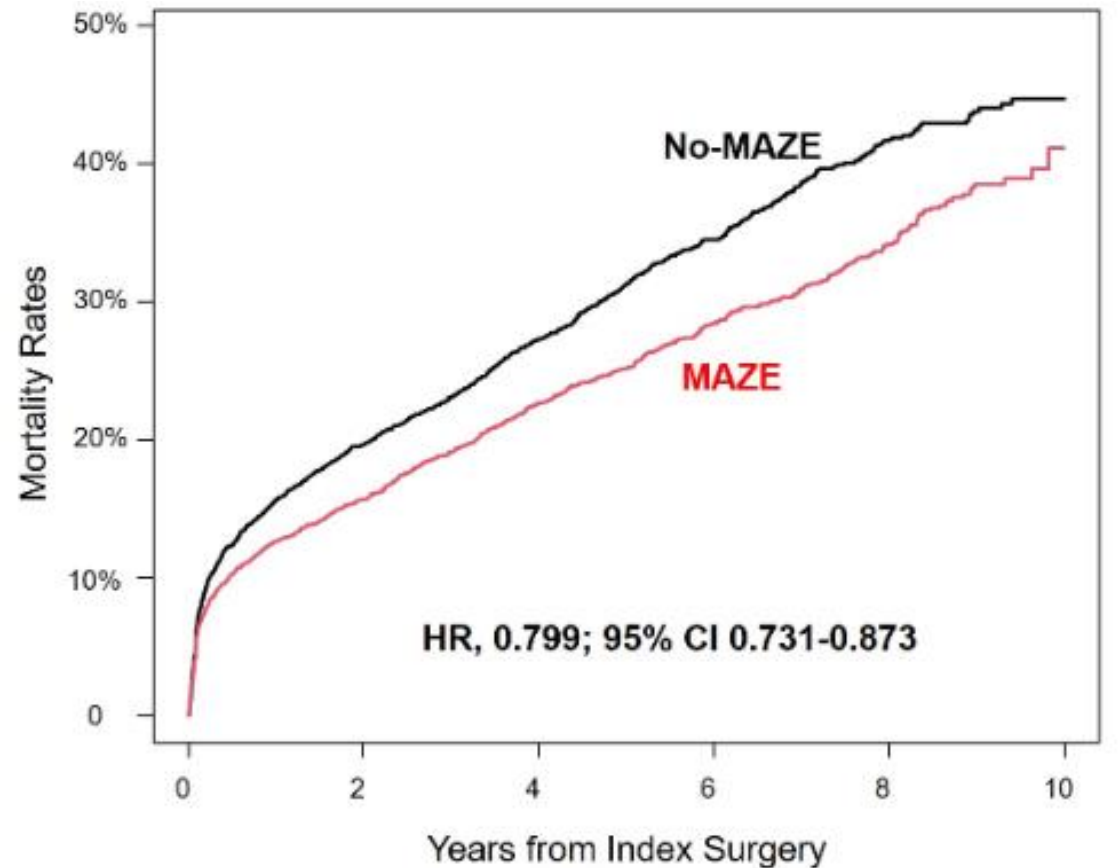


Number at risk		0	2	4	6	8	10	12
MV alone	8819	6344	4766	3389	2047	913	78	
MV+ablation	2432	1824	1403	1038	702	353	26	



Maze in MV Surgery: Korea National Data

- From 2010 to 2017 were reviewed
- Maze performed in 58.0% (5508/9501)
- In PSM: 3,376 pairs compared
- In this real-world Korean population data, Maze lowering mortality, stroke & bleeding



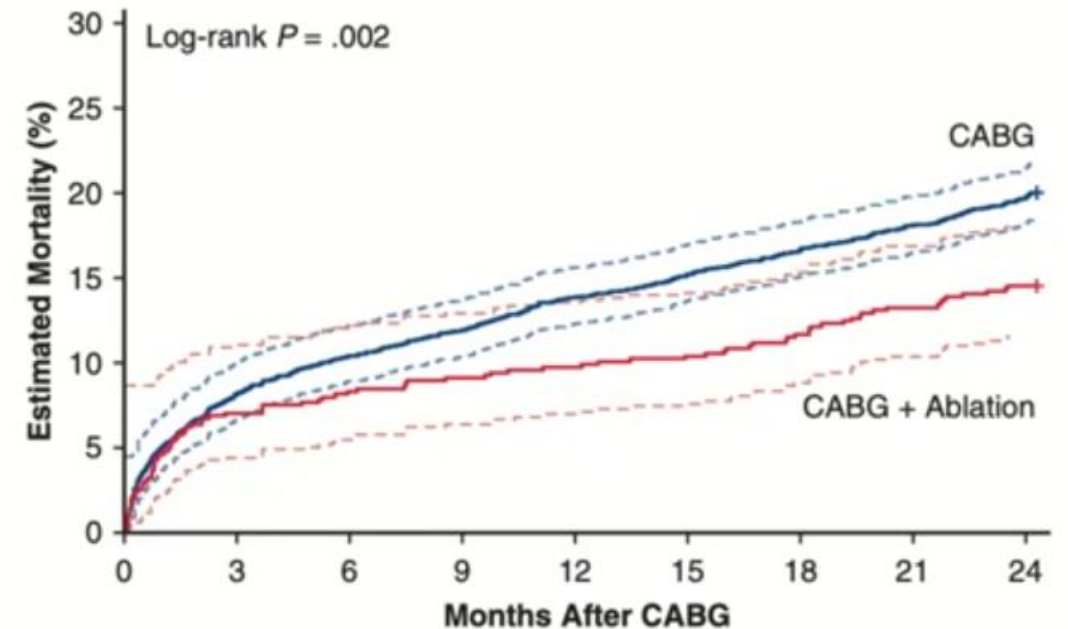
Years from Index Surgery	No-MAZE	MAZE
0	3376	3376
2	2357	2500
4	1576	1606
6	959	981
8	455	492
10	1	0



Maze in CABG

Conclusions:

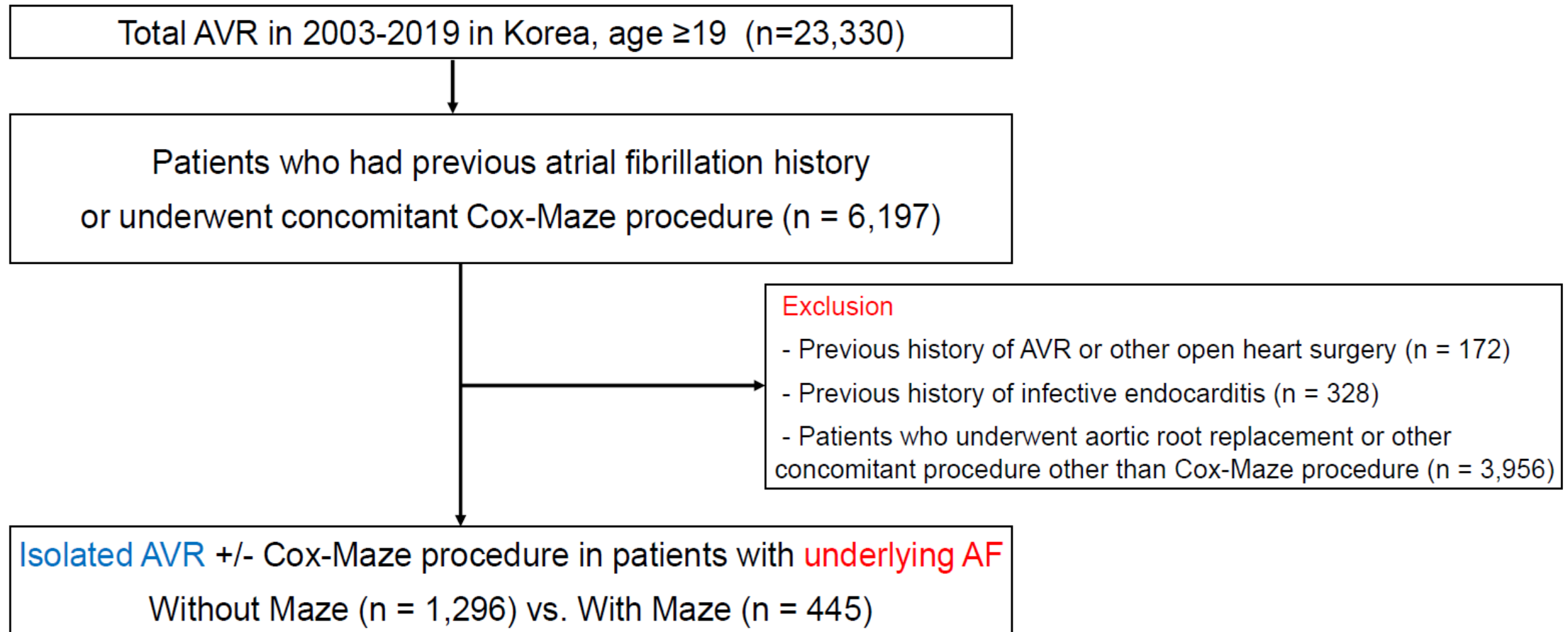
- CABG + SA: 29% lower risk-adjusted hazard for late mortality
- Total inpatient costs similar after 2 years
- SA: cost-effective & enhance late 2-year survival



No. at Risk	
CABG	3119 2794 2685 2598 2495
CABG + Ablation	626 574 565 553 535



Maze in Isolated AVR: Korea National Data



Propensity score-matching : Extracted 445 pairs



Maze in Isolated AVR: Korea National Data

Variables	Group	Total cohort population					Matched population						
		N	No. of event (%)	F/U duration, months, (median)	Incidence, per 100pyr (95%CI)	Adjusted HR	P	N	No. of event (%)	F/U duration, months, (median)	Incidence, per 100pyr (95%CI)	Crude HR(95% CI)	P
All cause death, n (%)	no Maze	1296	529 (40.8)	57.3 (26, 97)	7.3 (6.7-8.0)	reference							
	with Maze	445	147 (33.0)	50.7 (26, 84)	6.6 (5.6-7.8)	0.94 (0.78-1.13)	0.53	445	147 (33.0)	50.7 (26, 84)	6.60 (5.61-7.75)	1.10 (0.88-1.38)	0.42
Stroke ^a , n (%)	no Maze	918	205 (22.3)	50.4 (22, 75)	4.3 (3.8-5.0)	reference							
	with Maze	342	45 (13.2)	49.7 (25, 79)	2.9 (2.2-3.9)	0.70 (0.51-0.97)	0.03	324	45 (13.9)	49.7 (25, 79)	2.89 (2.16-3.87)	0.66 (0.45-0.95)	0.03
Ischemic, n (%)	no Maze	918	164 (17.9)	50.4 (22, 75)	3.5 (3.0-4.0)	reference							
	with Maze	342	28 (8.2)	49.7 (25, 79)	1.8 (1.2-2.6)	0.55 (0.37-0.83)	0.00	324	28 (8.6)	49.7 (25, 79)	1.80 (1.24-2.60)	0.55 (0.35-0.86)	0.01
Hemorrhagic, n (%)	no Maze	918	75 (8.2)	50.4 (22, 75)	1.6 (1.3-2.0)	reference							
	with Maze	342	23 (6.7)	49.7 (25, 79)	1.5 (1.0-2.2)	0.91 (0.61-1.56)	0.91	324	23 (7.1)	49.7 (25, 79)	1.48 (0.98-2.22)	0.81 (0.47-1.39)	0.44
Reoperation, n (%)	no Maze	1293	34 (2.6)	56.7 (25, 96)	0.5 (0.3-0.7)	reference							
	with Maze	445	6 (1.4)	50.5 (26, 84)	0.3 (0.1-0.6)	0.53 (0.22-1.27)	0.16	445	6 (1.4)	50.5 (26, 84)	0.27 (0.12-0.60)	0.57 (0.22-1.48)	0.25

^a patients with history of stroke before surgery were excluded

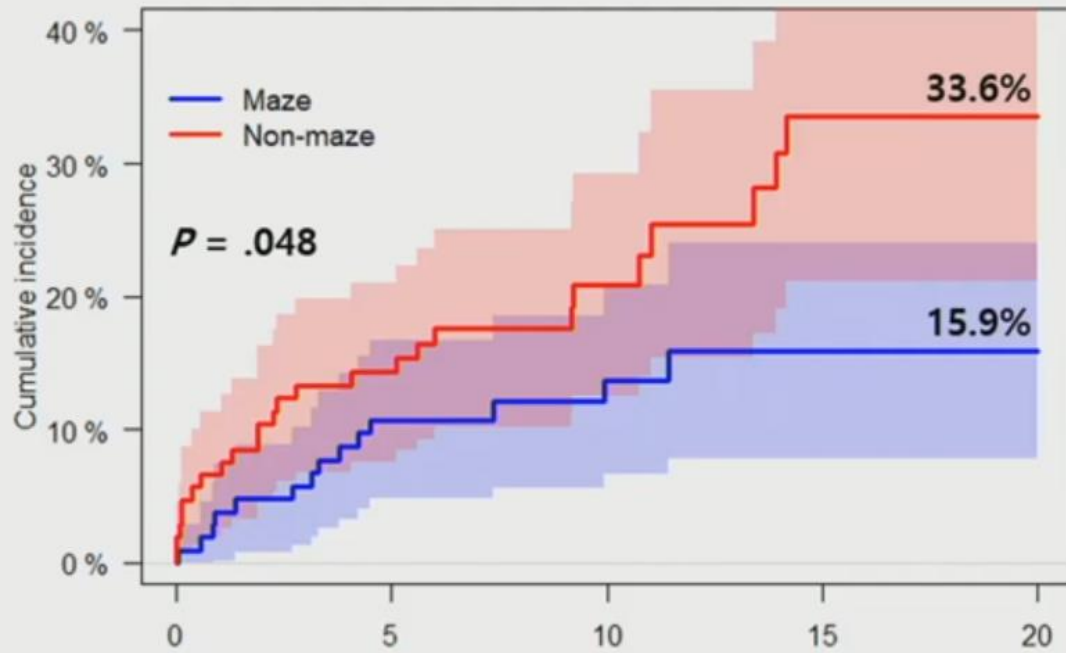
Conclusion

- In patients with AV disease with underlying AF, occurrence of **new late ischemic stroke were significantly lower** when the concomitant Cox-Maze procedure were performed during AVR
- Therefore, concomitant Cox-Maze procedure must be considered in patients with AF planning to undergo isolated AVR



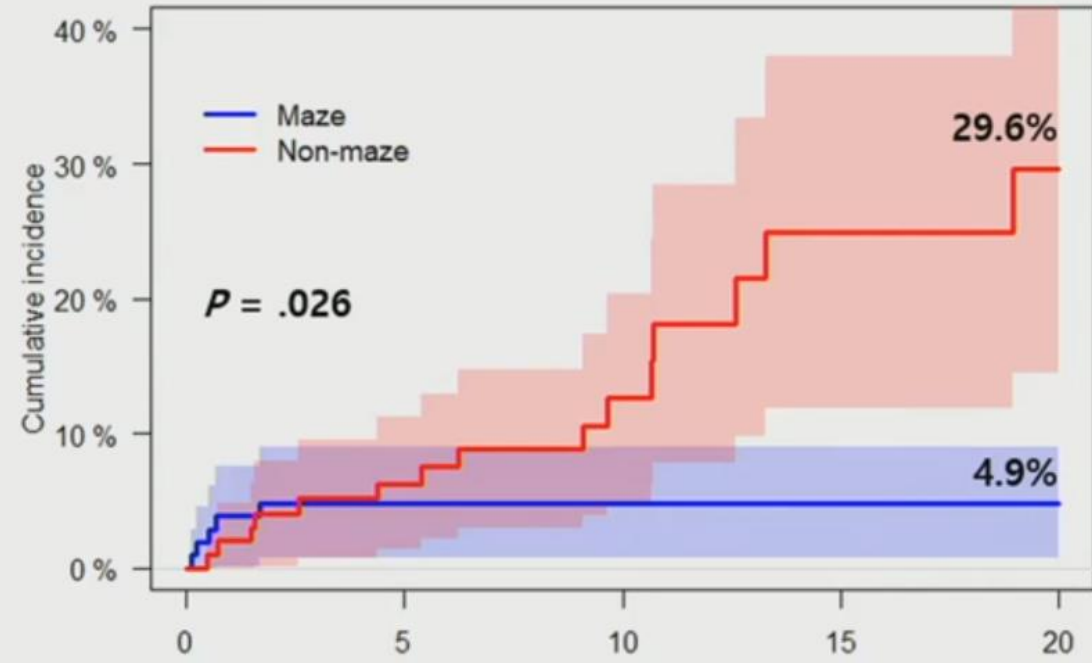
Maze in TVP for Severe TR: data from SMC

Cardiac Death



Number at risk	Time after the Operation (years)				
	0	5	10	15	20
Maze:	106	84	51	19	2
Non-maze:	106	82	40	24	11

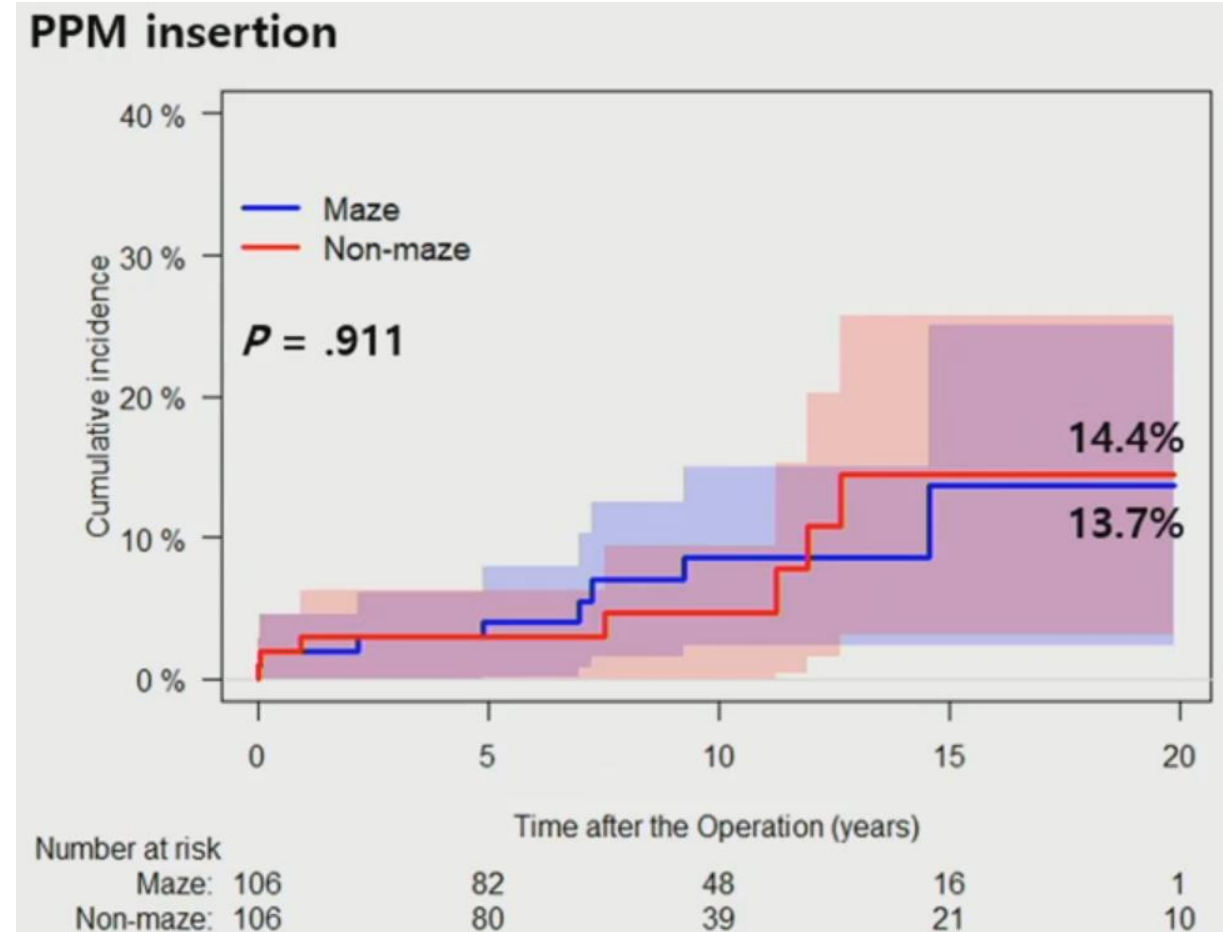
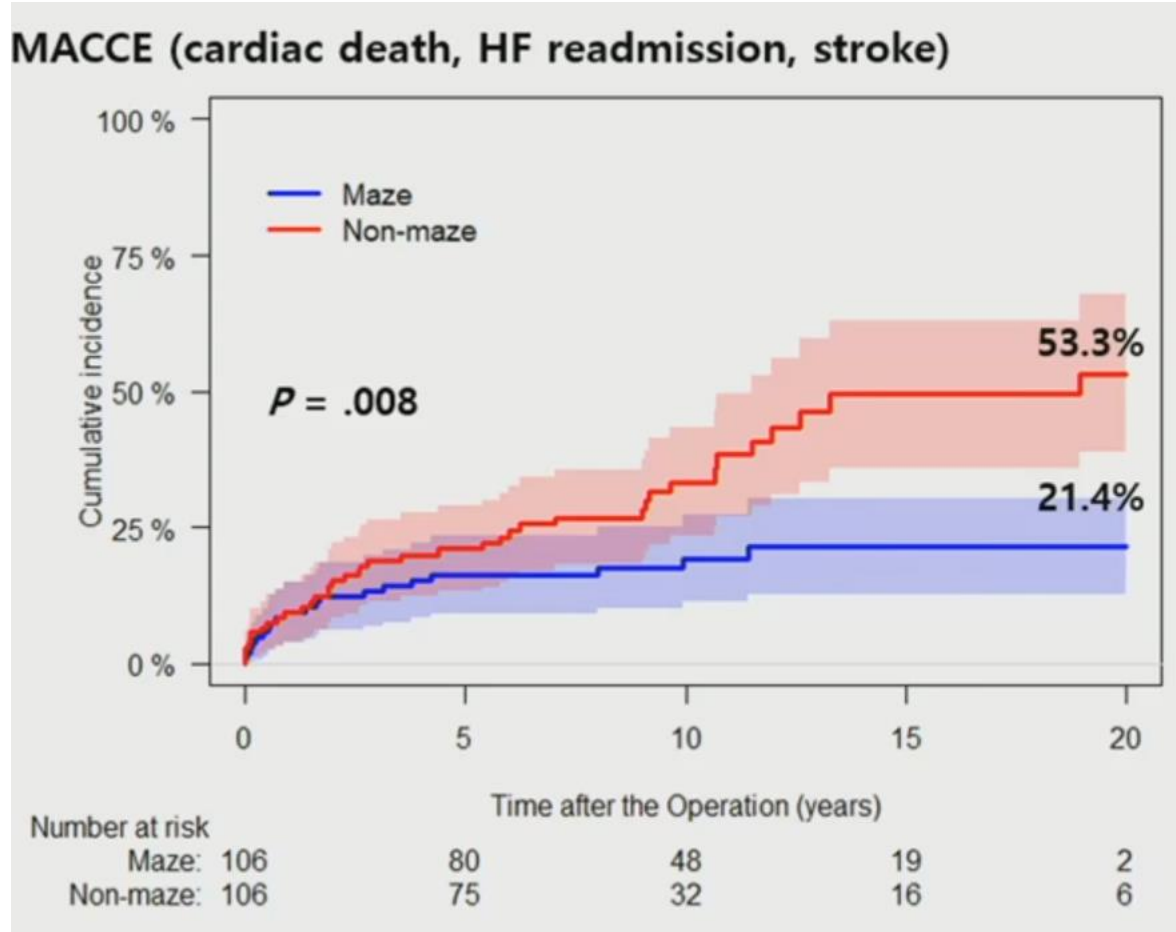
Rehospitalization for HF



Number at risk	Time after the Operation (years)				
	0	5	10	15	20
Maze:	106	83	51	19	2
Non-maze:	106	79	37	20	9

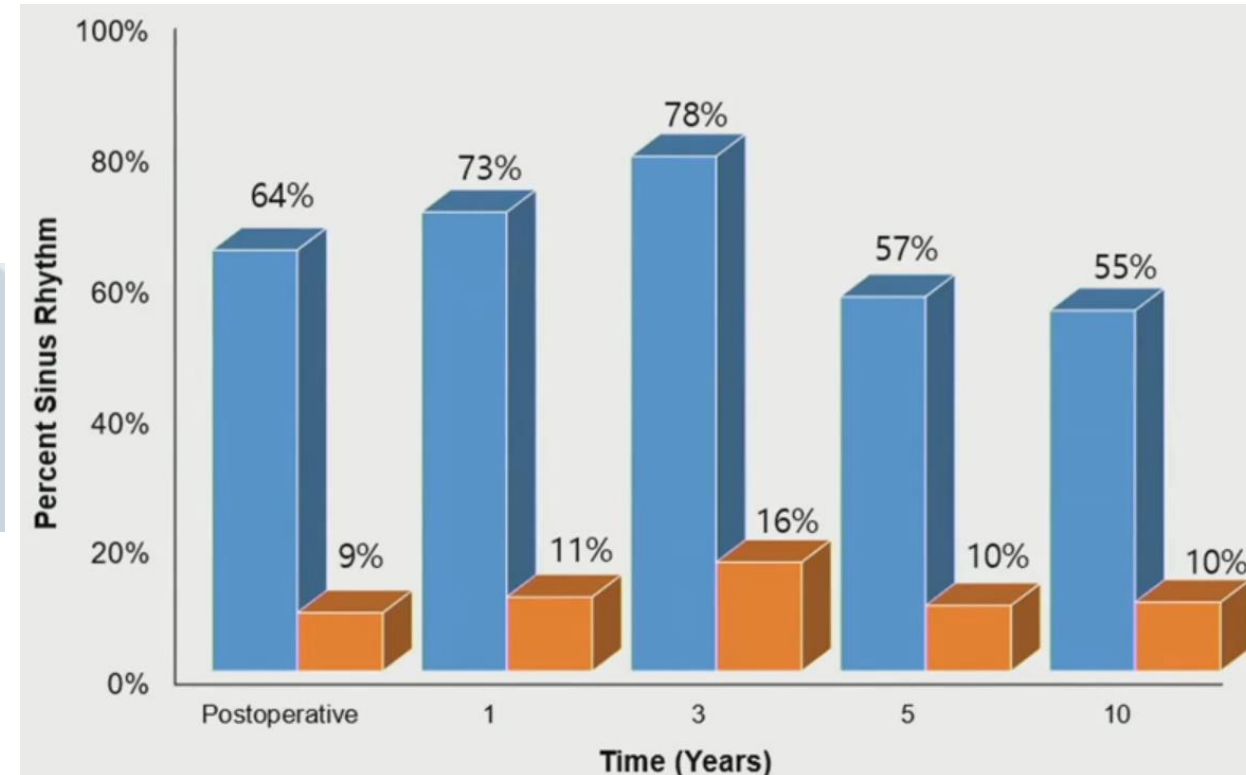


Maze in TVP for Severe TR: data from SMC



Maze in TVP for Severe TR: data from SMC

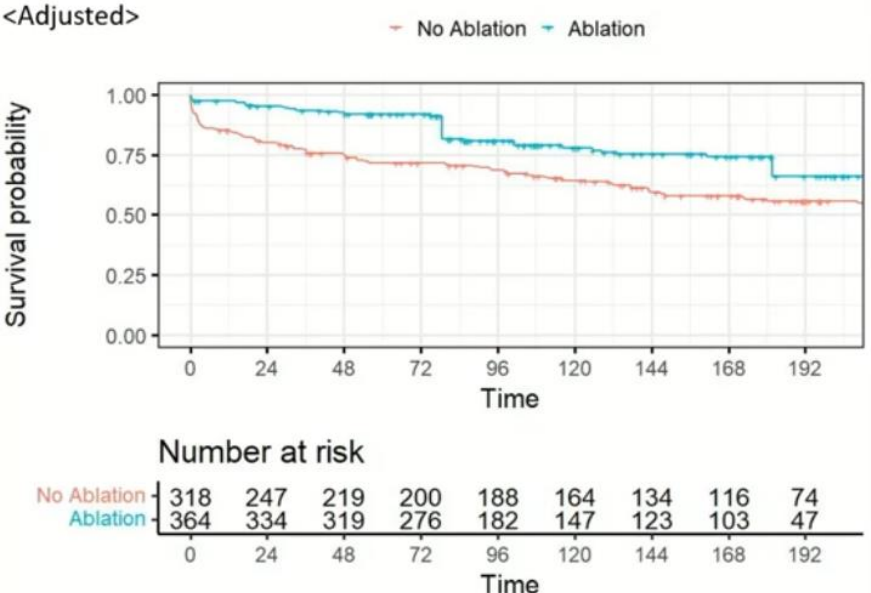
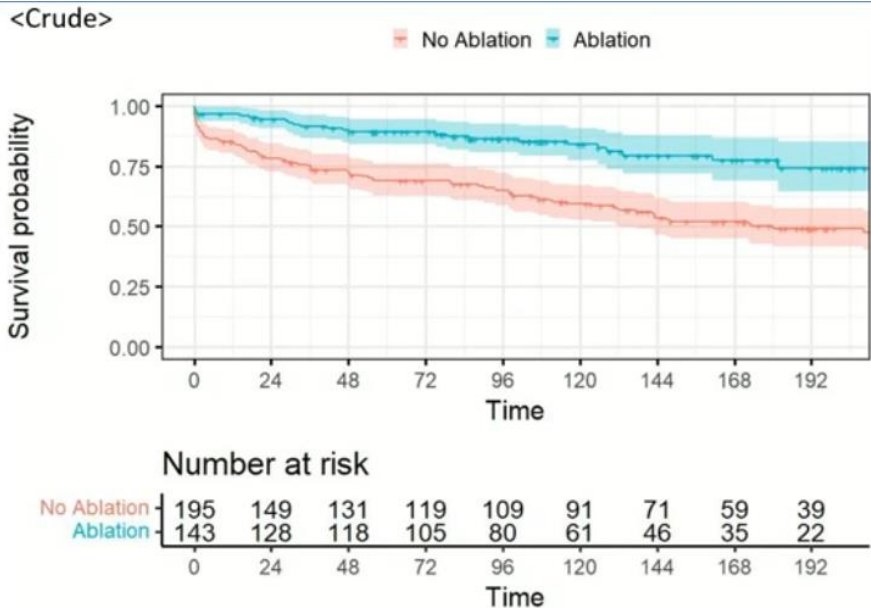
- Acceptable sinus rhythm restoration rate
- Low incidence of MACCE, cardiac death, HF rehospitalization
- Possible LA reverse remodeling



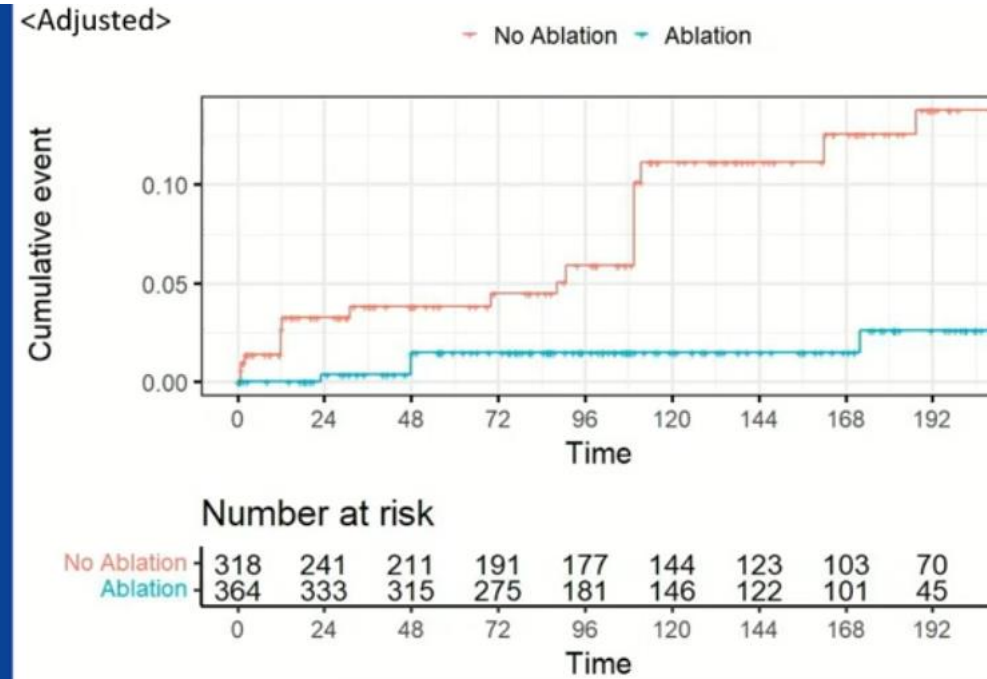
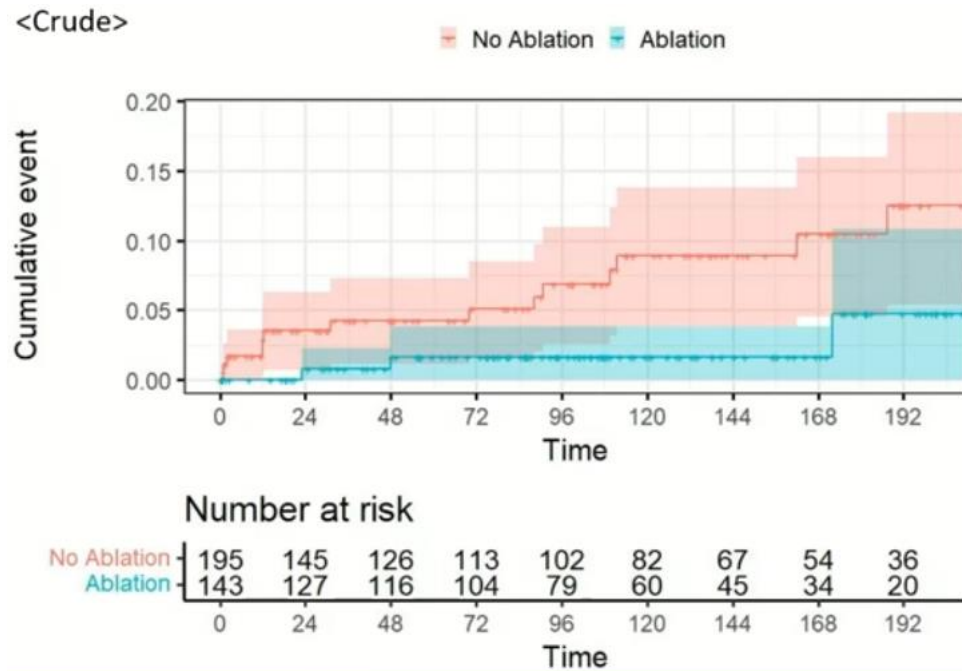
Maze in Redo Cardiac Surgery

- SNUH & AMC, 2000~2015, n=338
- Maze(143) vs. no Maze (195)
- IPTW analysis
- Survival benefit in ablation group

	Crude			IPTW-adjusted		
	HR	95% CI	P value	HR	95% CI	P value
	0.336	0.218-0.519	<0.001	0.455	0.277-0.747	0.002



Maze in Redo Cardiac Surgery: TE event



Crude			IPTW-adjusted		
HR	95% CI	P value	HR	95% CI	P value
0.234	0.068-0.808	0.022	0.193	0.053- 0.697	0.012

Cumulative incidence of AF recurrence at 5 years

1.5% ± 0.0% (Ablation)
4.2 ± 0.0% (No Ablation)

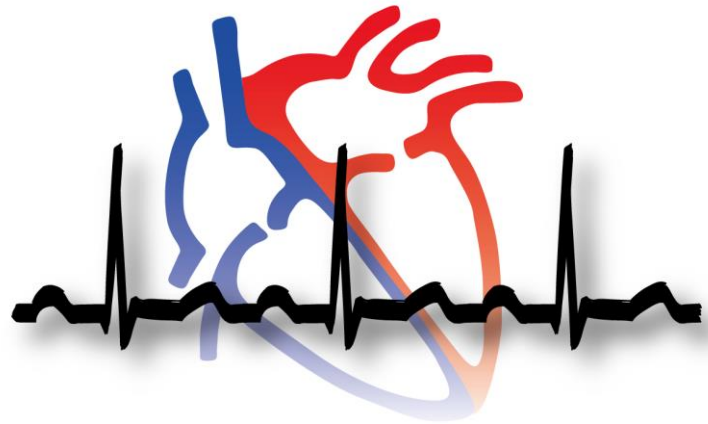


Summary

- **Maze is still underutilized in 2023, especially in closed cardiac surgery**
- **Maze is mostly performed with mitral valve surgery**
- **Surgical volume was not associated with adoption rate of Maze**
- **Despite new evidences, big gaps between guidelines and real practice**
- **KHRS 2023 meeting shed light on education and training**
- **KASNet is actively working on this issue**



KASNet 2023 AF Guideline



The Korean Arrhythmia Surgery Network

Atrial fibrillation surgery in rheumatic mitral valve disease

- Concomitant AF surgery can be performed without increasing the risk of early mortality, and is recommended at the time of rheumatic MV surgery. (Class I, Level of Evidence B)
- Concomitant AF surgery can efficaciously restore sinus rhythm, and is recommended at the time of rheumatic MV surgery. (Class I, Level of Evidence A)
- It is reasonable to perform concomitant AF surgery to decrease the long-term risk of thromboembolic events and mortality at the time of rheumatic MV surgery (Class IIa, Level of Evidence B)

COR	LOE
I	B
I	A
IIa	B

Atrial fibrillation surgery in degenerative mitral valve disease

- Concomitant AF surgery in degenerative MV disease is recommended to restore sinus rhythm, because this procedure has not increased risk of operative mortality or major complications (Class I, Level of Evidence A)
- Concomitant AF surgery in degenerative MV disease is reasonable to improve early mortality and long-term survival (Class IIa, Level of Evidence B)
- Concomitant AF surgery in degenerative MV disease is reasonable to prevent late stroke (Class IIa, Level of Evidence B)

COR	LOE
I	A
IIa	B
IIa	B

