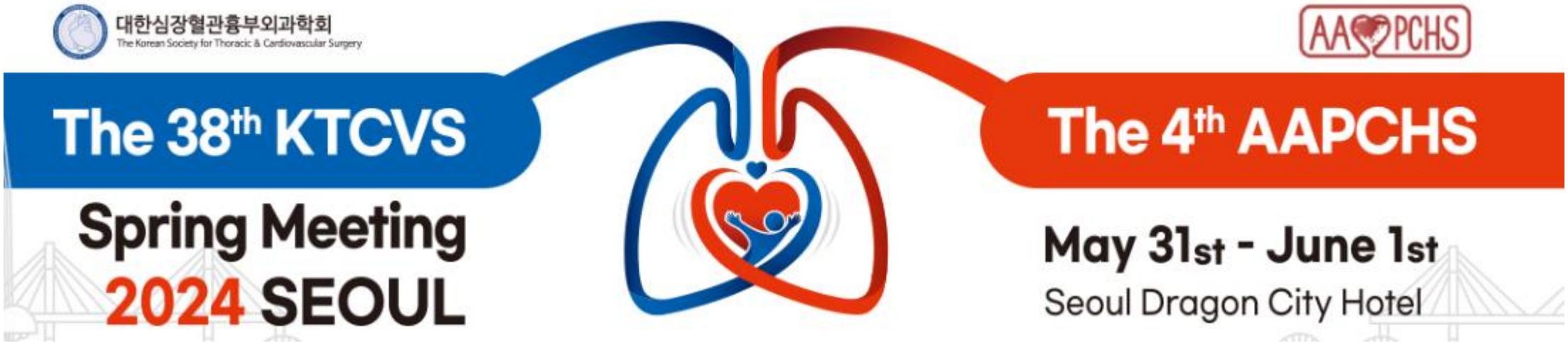
YONSEI UNIVERSITY

AF combined with Giant left atrium in young patients - I DO maze operation and LA reduction -

SEUNG HYUN LEE, M.D, PH.D

Division of Cardiovascular Surgery,
Department of Thoracic and Cardiovascaulr surgery,
Severance Hospital, Yonsei University College of Medicine



COI Disclosure

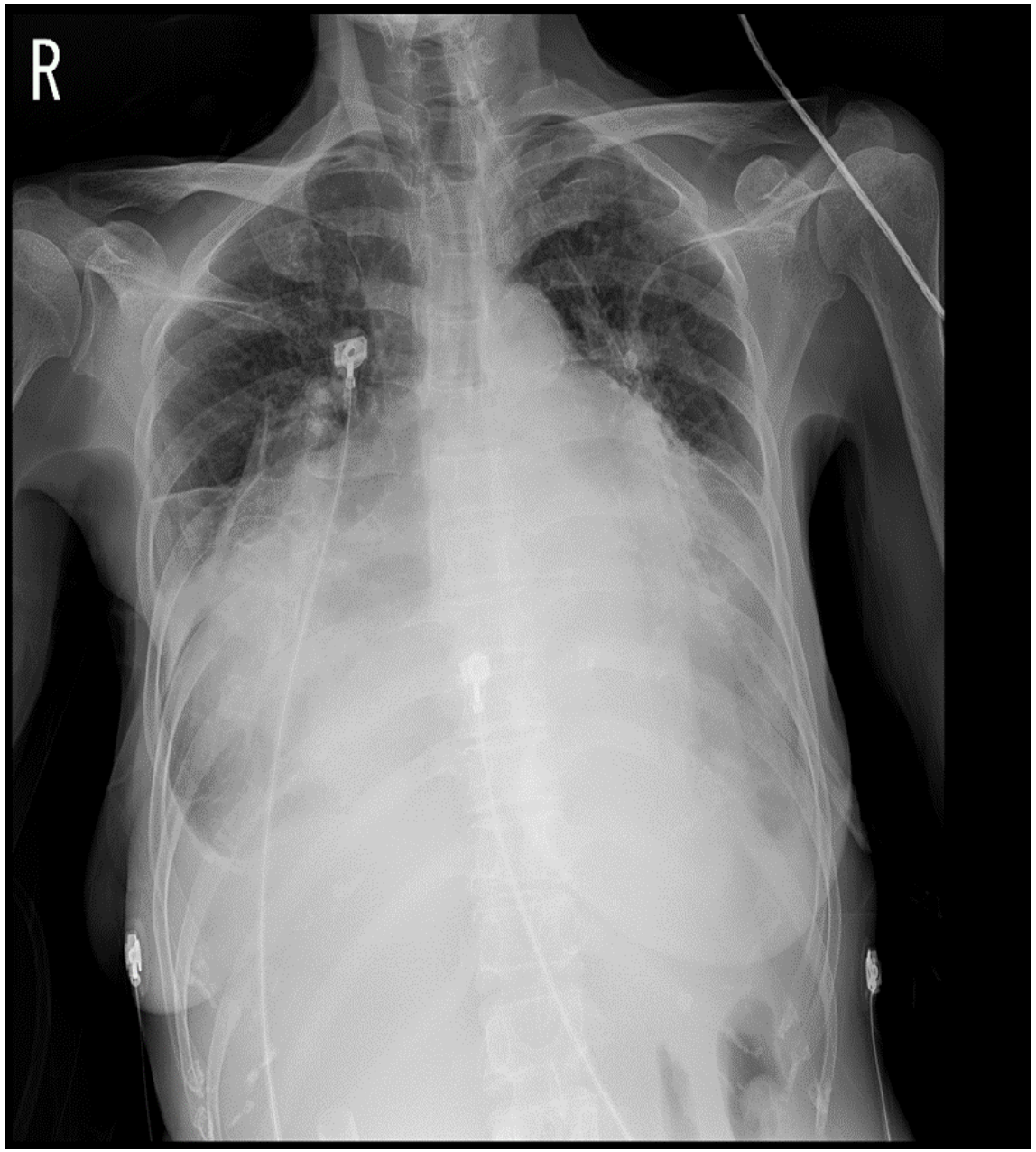
Seung Hyun Lee

- The authors have no financial conflicts of interest to disclose concerning the presentation

F/74

- HFrEF
- Huge LA (LAVI: 790ml/m2) and enlarged LV (LVEDD/ESD: 58/40mmHg), EF: 50 -> 34%
- MS, Severe TR, LAA thrombus
- PeAf
- DOE aggravation

MVR TAP MAZE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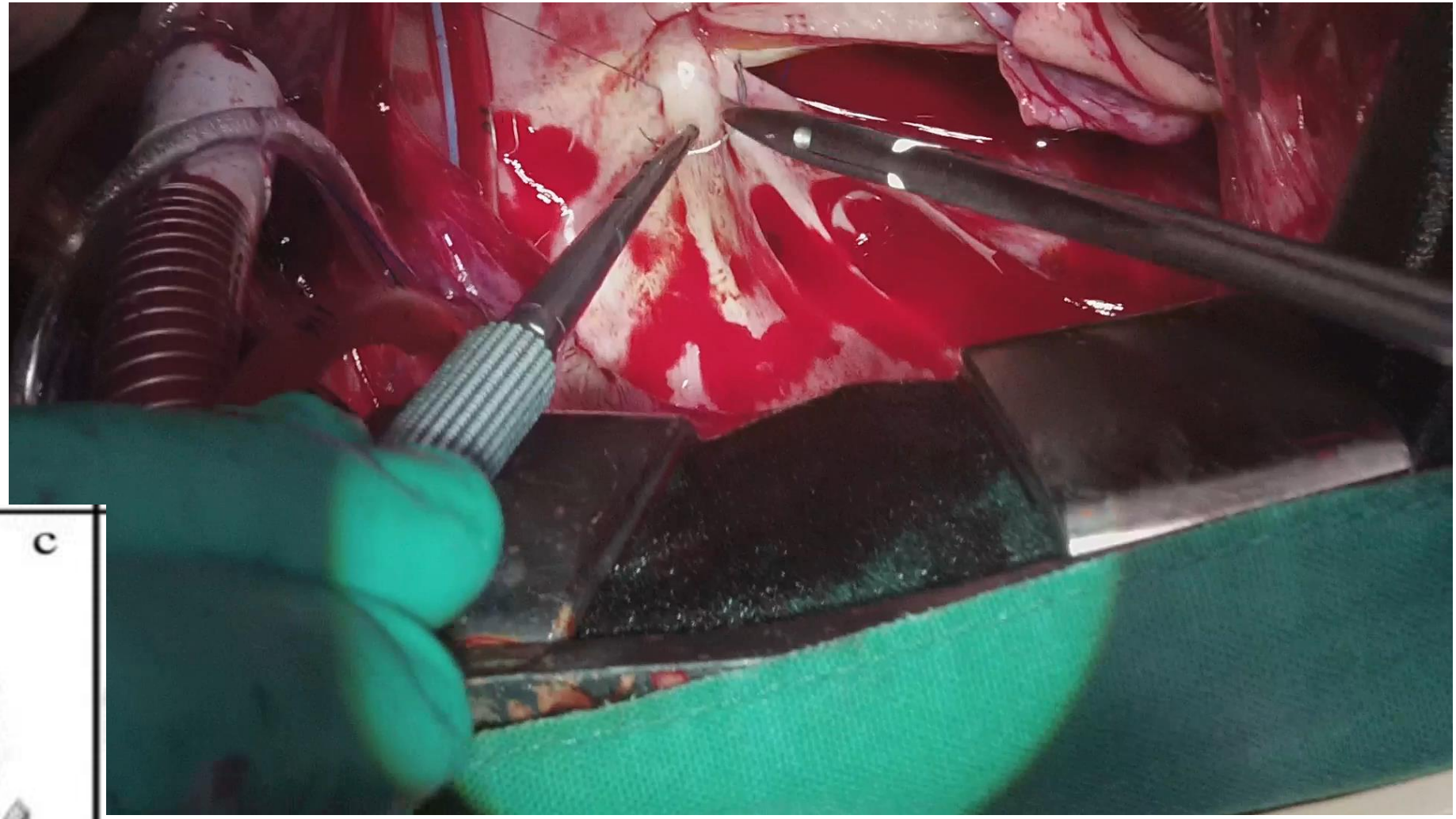

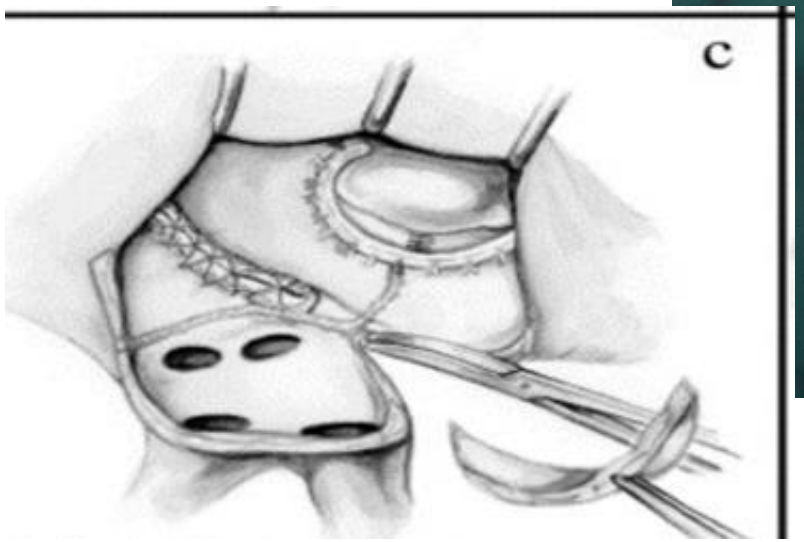
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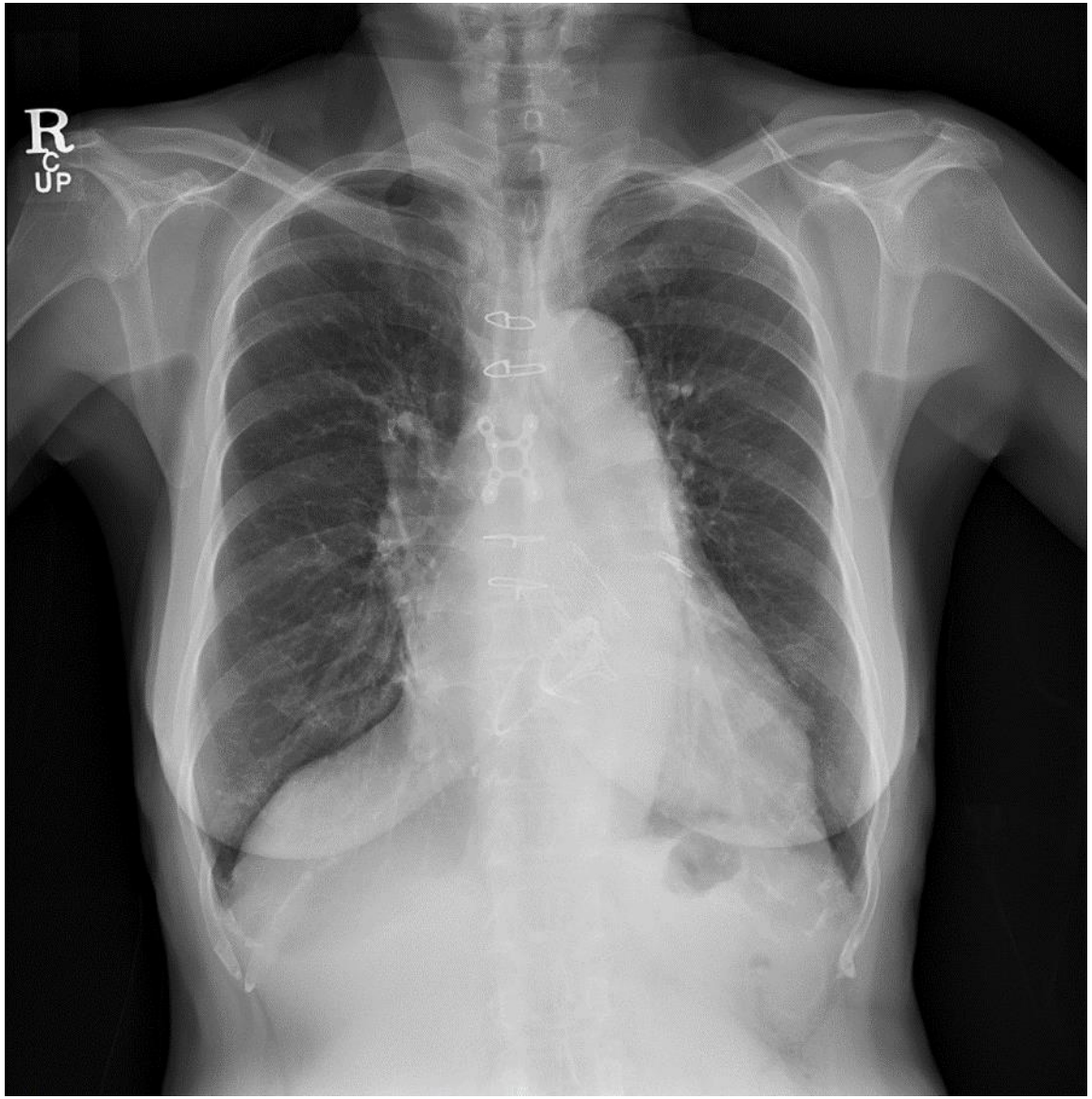
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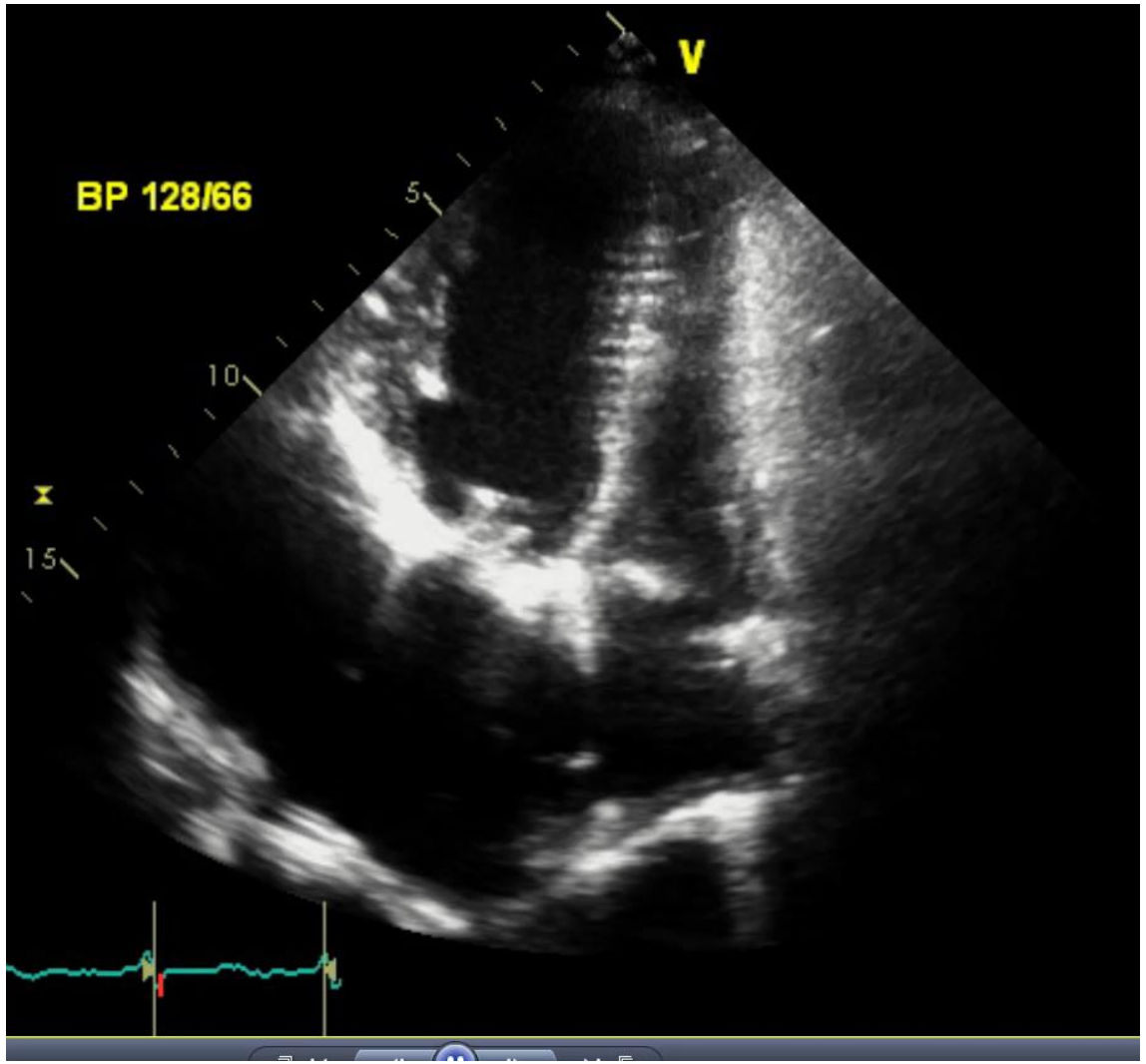
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BP 128/66
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10
15

M/61, TR, AF

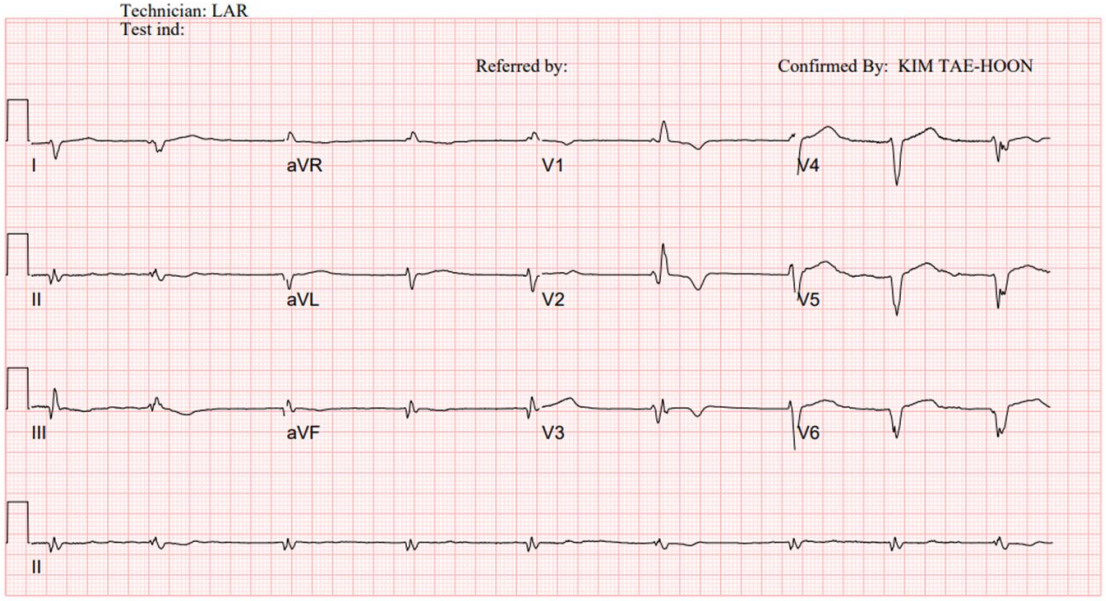
KIM, JUNG HOON ID:7376142 13-MAR-2023 10:25:43 YONSEI CARDIOVASCULAR CENTER

13-MAY-1961 (61 yr)	Vent. rate	52	BPM
Male Oriental	PR interval	*	ms
0in 0lb	QRS duration	132	ms
Room:	QT/QTc	534/496	ms
Loc:11	P-R-T axes	* 180	-24

Atrial fibrillation with slow ventricular response
Right bundle branch block
Lateral infarct , age undetermined
Inferior infarct , age undetermined
Abnormal ECG

Technician: LAR
Test ind:

Referred by: Confirmed By: KIM TAE-HOON



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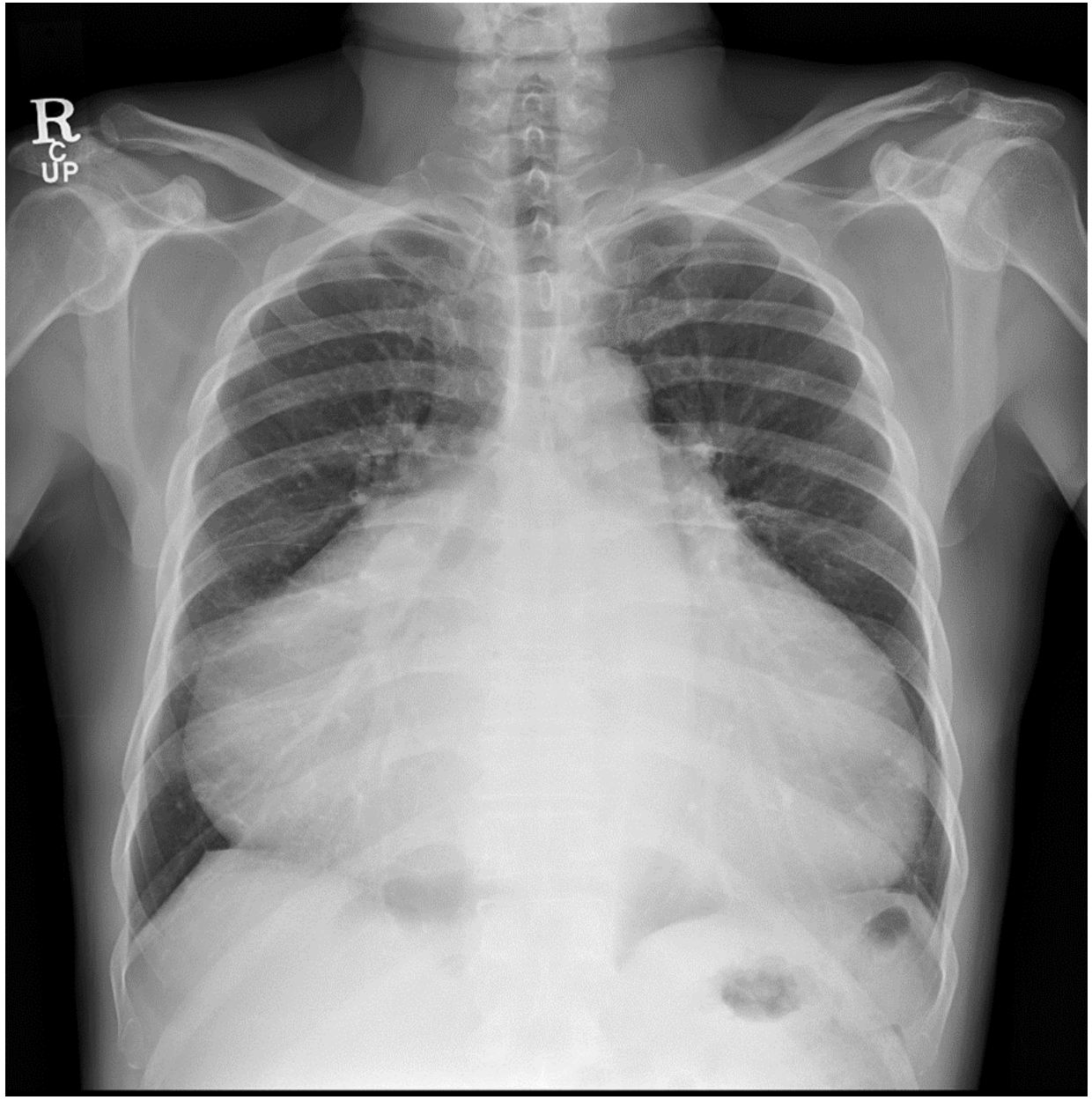
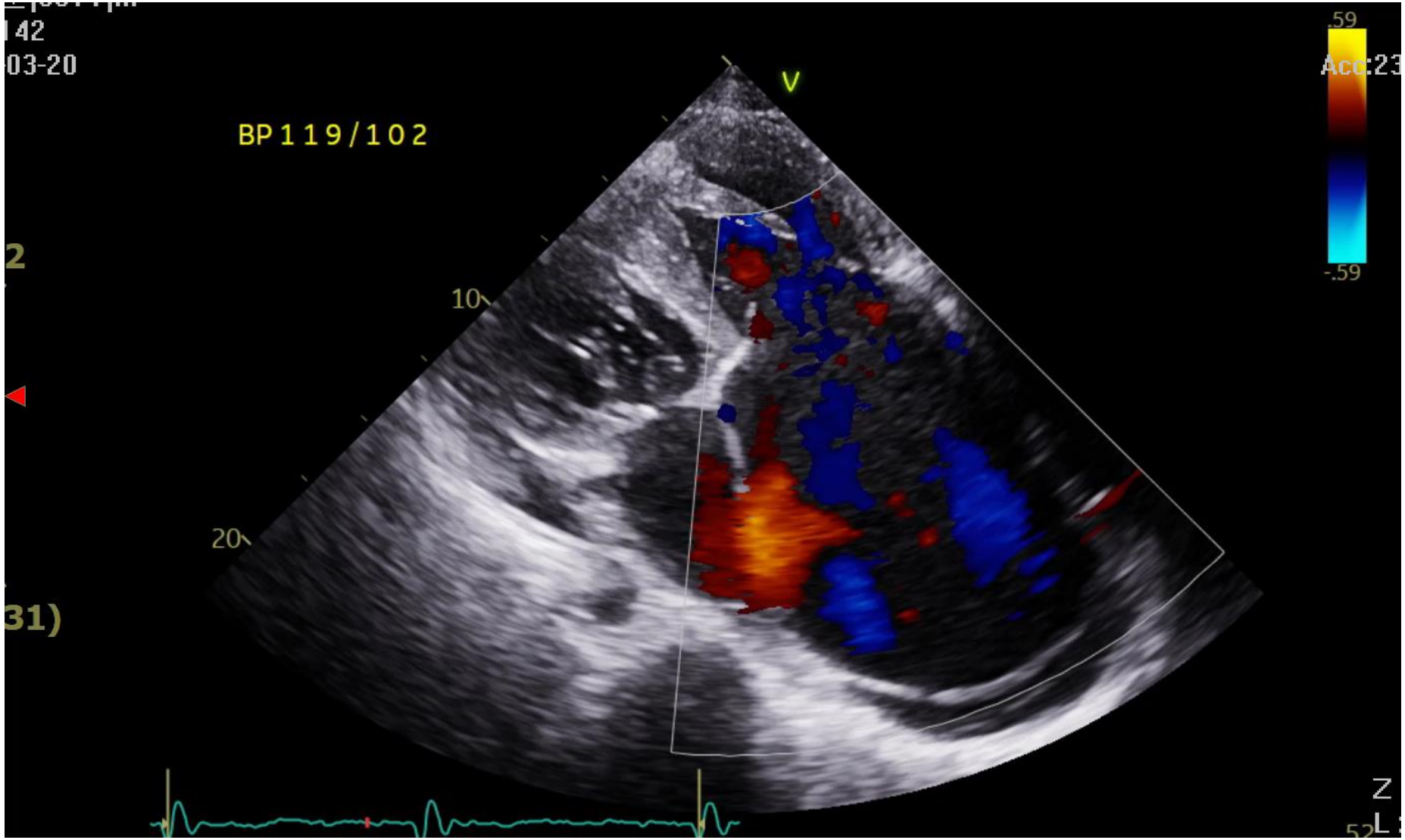
Page 1 of 1

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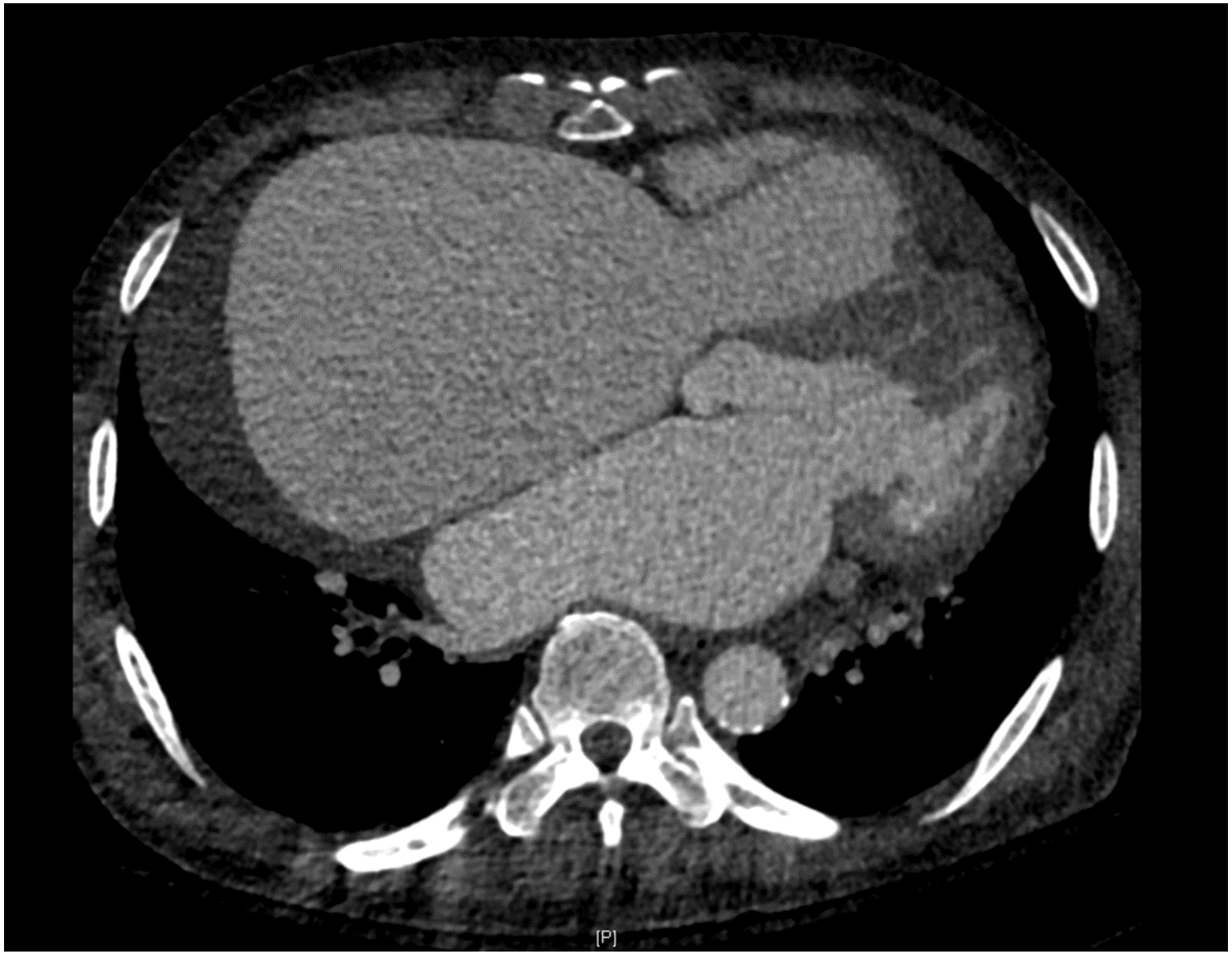
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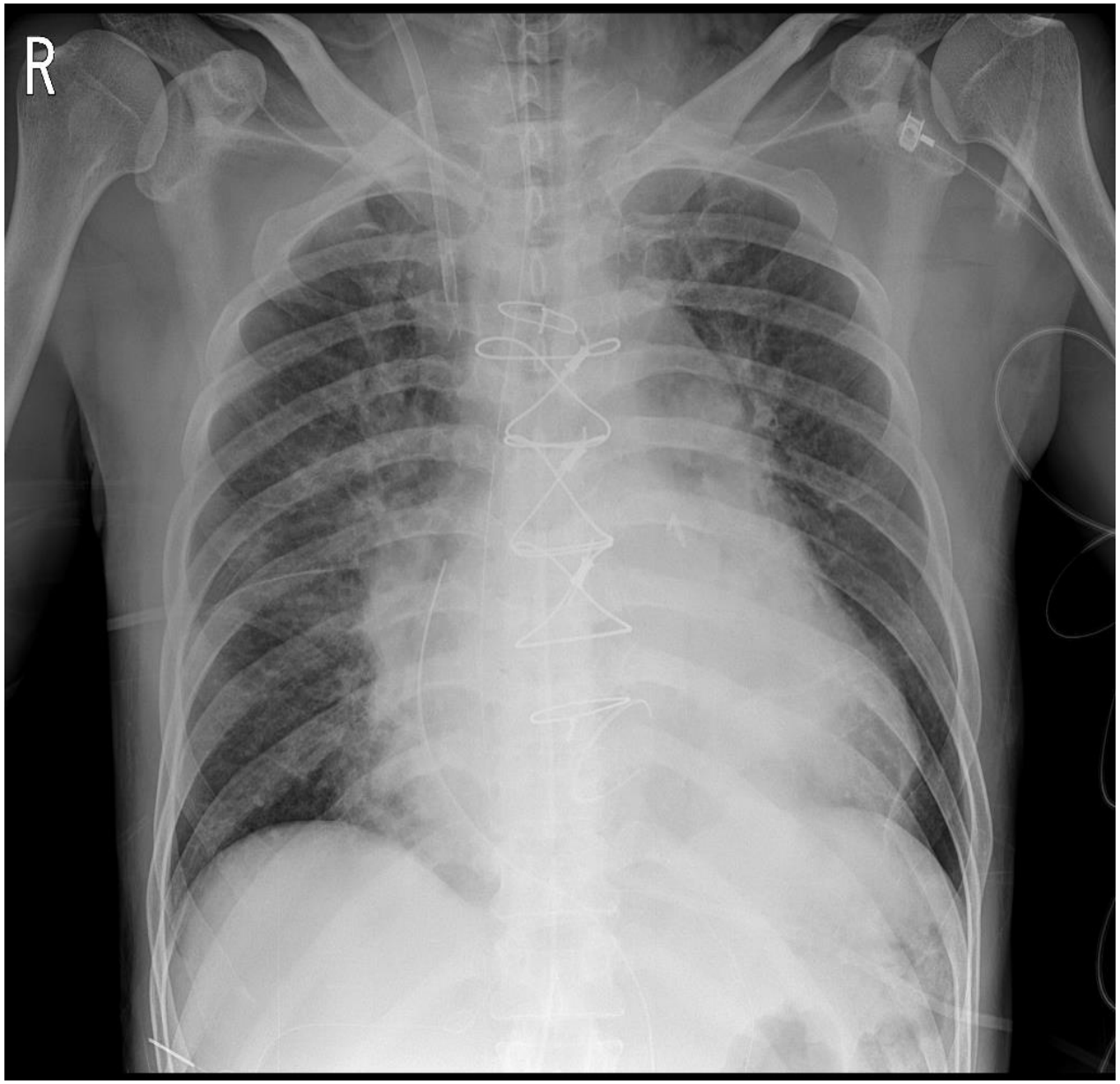
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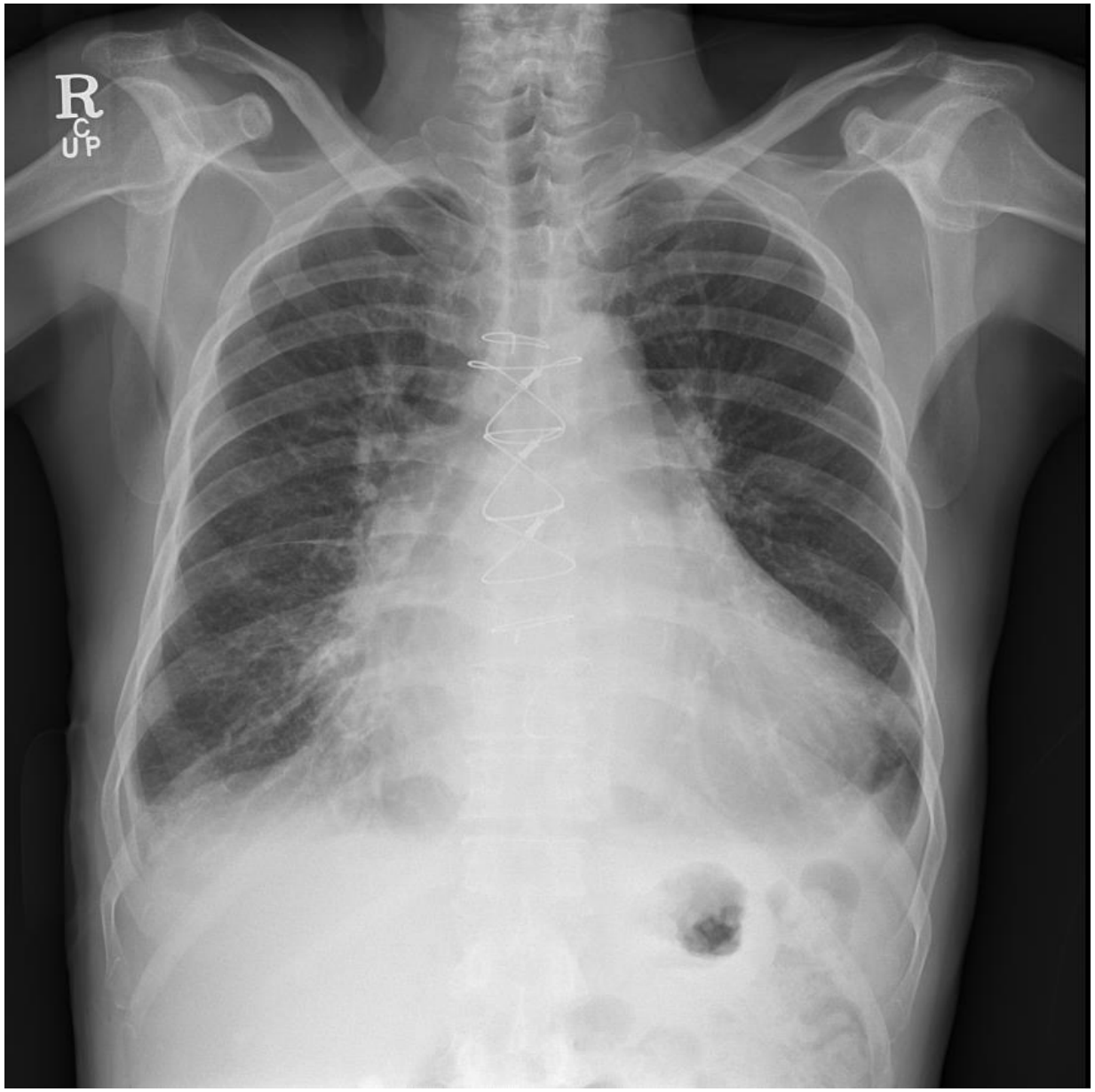
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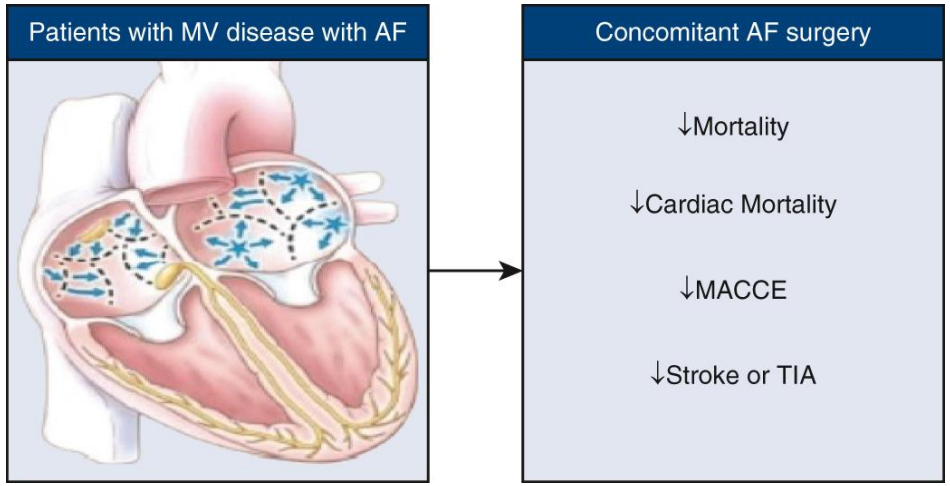
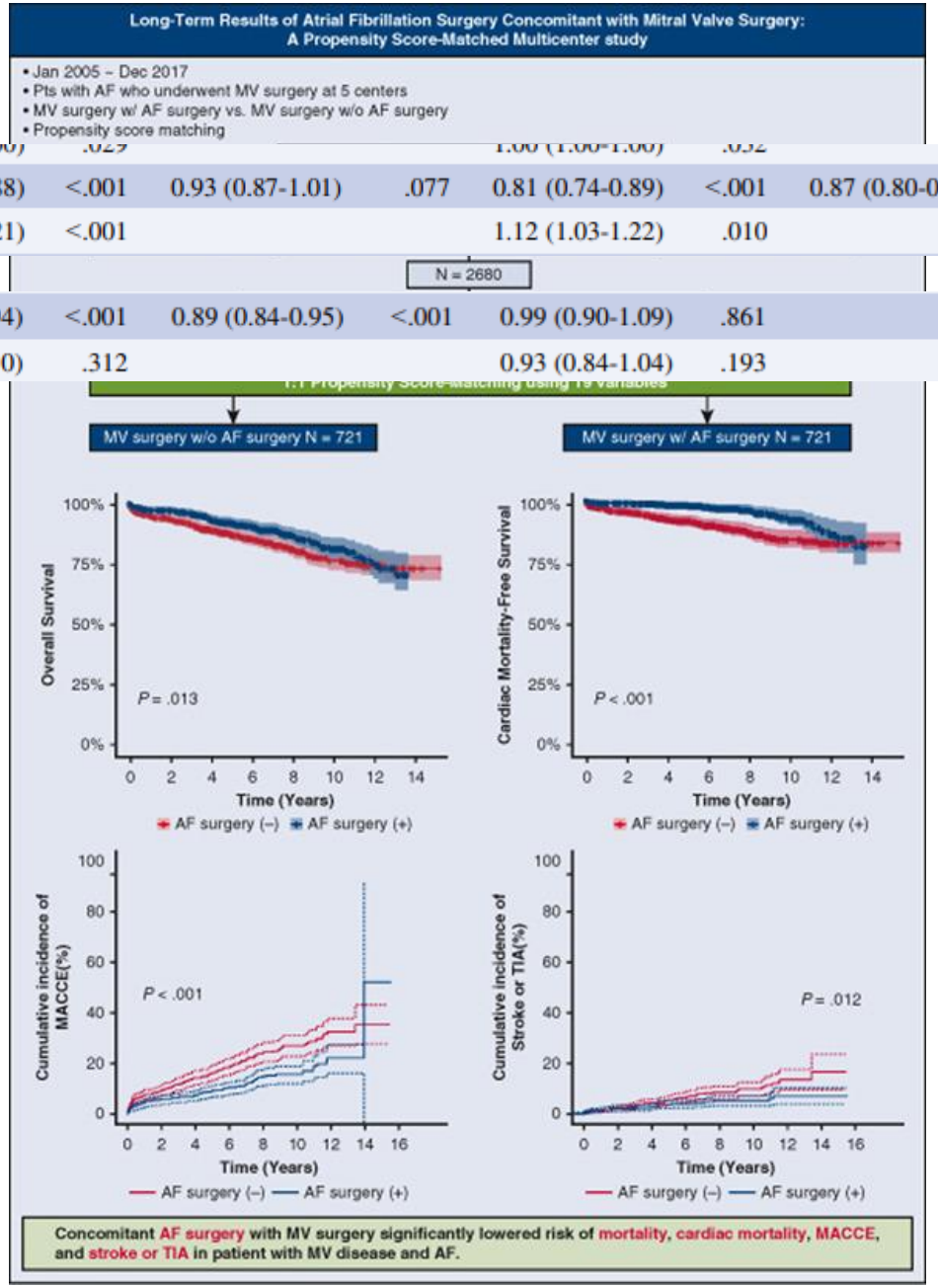
Adult

Long-term results of atrial fibrillation surgery concomitant with mitral valve surgery: A propensity score–matched multicenter study

Min-Seok Kim MD, PhD [a], Hee Jung Kim MD, PhD [b], Hyung Gon Je MD, PhD [c], Yang Hyun Cho MD, PhD [d], Joon Bum Kim MD, PhD [e], Sak Lee MD, PhD [f], Seung Hyun Lee MD, PhD [f]





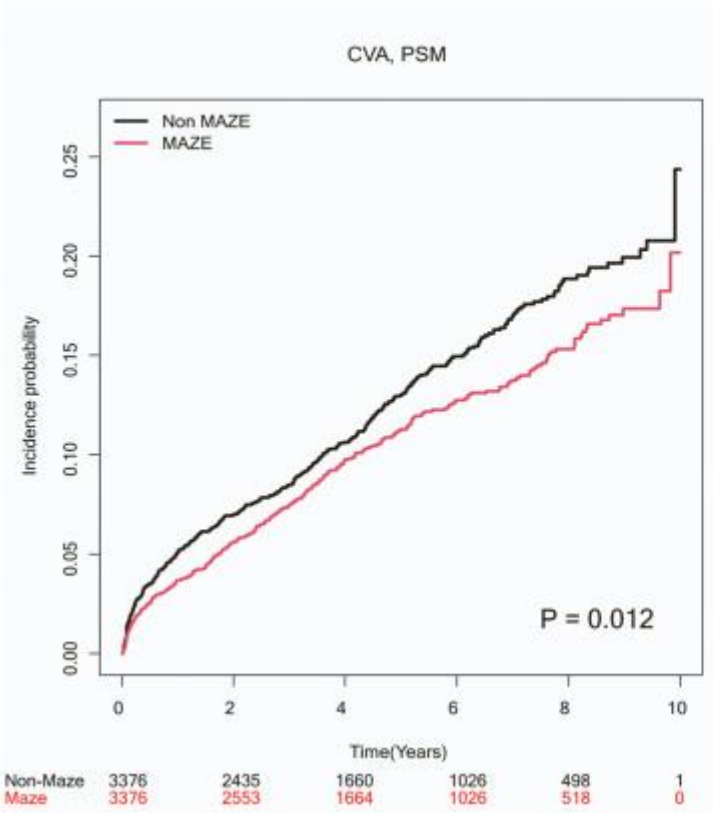
AF duration	1.00 (1.00-1.00)	.029			1.00 (1.00-1.00)	.032		
Severity of MS	0.83 (0.77-0.88)	<.001	0.93 (0.87-1.01)	.077	0.81 (0.74-0.89)	<.001	0.87 (0.80-0.96)	.005
Severity of MR	1.13 (1.06-1.21)	<.001			1.12 (1.03-1.22)	.010		
Severity of MS	0.88 (0.83-0.94)	<.001	0.89 (0.84-0.95)	<.001	0.99 (0.90-1.09)	.861		
Severity of MR	1.03 (0.97-1.10)	.312			0.93 (0.84-1.04)	.193		

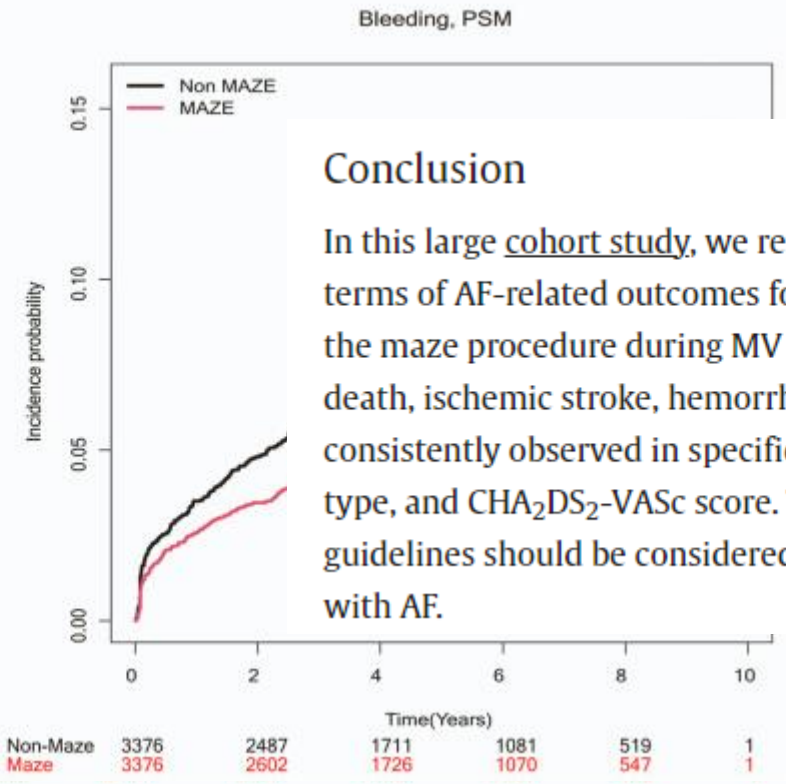
Clinical

Atrial Fibrillation

Clinical benefits of concomitant surgical ablation for atrial fibrillation in patients undergoing mitral valve surgery

Hee Jung Kim MD, PhD [*, 1], Kyung-Do Han PhD [†, 1], Wan Kee Kim MD [‡], Yang Hyun Cho MD, PhD [§], Seung-Hyun Lee MD, PhD [¶], Hyung Gon Je MD, PhD [‖]





Conclusion

In this large cohort study, we reported the efficacy of concomitant maze procedure in terms of AF-related outcomes for subjects who had undergone MV surgery. Addition of the maze procedure during MV surgery reduced the incidence of the composite outcome, death, ischemic stroke, hemorrhagic stroke, and major bleeding. This benefit was consistently observed in specific subgroups stratified by age, MV pathology, MV surgery type, and CHA_2DS_2-VASc score. These findings and the supporting data from recent guidelines should be considered by surgeons when performing MV surgery on subjects with AF.

GUIDELINES | Open Access

2023 APHRS expert consensus statements on surgery for AF

Takashi Nitta, James Wong Woon Wai, Seung Hyun Lee, Michael Yii, Suchart Chaiyaroj, Chawannuch Ruaengsri, Tharumenthiran Ramanathan, Yosuke Ishii ... See all authors

First published: 25 October 2023 | https://doi.org/10.1002/joa3.12939

- Recommendation with Level of Evidence

a. Surgical AF ablation is recommended in patients with AF undergoing a surgical procedure requiring an opening of the left atrium, such as mitral valve surgery. (Class I, Level of Evidence: B)
b. Education, training, and proctoring are recommended to enhance uptake and improve outcomes. (Class I, Level of Evidence: C)

a. patients' comorbidities and safety factors
b. types of AF; paroxysmal, persistent, or long-standing persistent
c. durations of AF
d. hemodynamics and LA performance, such as viability and compliance
e. extent of RA enlargement, remodeling or cardiomyopathy
f. association of tricuspid regurgitation

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.23.127
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2024;57(1):1-24

Guideline

2023 KASNet Guidelines on Atrial Fibrillation Surgery

Hyung Gon Je[1,*], Jae Woong Choi[2,*], Ho Young Hwang[2], Ho Jin Kim[3], Joon Bum Kim[3], Hee-Jung Kim[4], Jae-Sung Choi[5], Dong Seop Jeong[6], Jae Gun Kwak[2], Han Ki Park[7], Seung Hyun Lee[7], Cheong Lim[8], Jae Won Lee[9], for the KASNet Guideline Writing Committee

Atrial fibrillation surgery in rheumatic mitral valve disease

Summary

- Concomitant AF surgery can be performed without increasing the risk of early mortality and is recommended at the time of rheumatic mitral valve (MV) surgery (class of recommendation I; level of evidence B).
- Concomitant AF surgery can effectively restore the sinus rhythm and is recommended for rheumatic MV surgery (class of recommendation I; level of evidence A).
- It is reasonable to perform concomitant AF surgery to decrease the long-term risks of thromboembolic events and mortality during rheumatic MV surgery (class IIa; level of evidence B).

Atrial fibrillation surgery in degenerative mitral valve disease

Summary

- Concomitant AF surgery for degenerative MV disease is recommended to restore sinus rhythm because it does not increase the risk of operative mortality or major complications (class of recommendation I; level of evidence A).
- Concomitant AF surgery for degenerative MV disease is a reasonable method to improve early mortality and long-term survival (class of recommendation IIa; level of evidence B).
- Concomitant AF surgery for degenerative MV disease is a reasonable method of preventing late stroke (class of recommendation IIa; level of evidence B).

The influence of age on atrial fibrillation recurrence after the maze procedure in patients with giant left atrium

Seung Hyun Lee, MD, Joon Bum Kim, MD, Won Chul Cho, MD, Cheol Hyun Chung, MD, Sung Ho Jung, MD, Suk Jung Choo, MD, and Jae Won Lee, MD

Objective: The presence of a giant left atrium (LA) is strongly associated with the recurrence of atrial fibrillation (AF) after the maze procedure. Therefore, we investigated the factors affecting the rhythm outcomes after the maze procedure in patients with a giant LA and AF-associated mitral valve disease to determine the best candidates for the maze procedure in this population.

Methods: From January 1999 to December 2006, 224 patients with a giant LA (> 60 mm) underwent bi-atrial maze procedures combined with mitral valve surgery. Multivariate Cox regression analysis was performed to determine the risk factors for maze failure.

Results: Follow-up was complete in all patients at a mean of 48.3 ± 28.0 months, during which 4 early and 9 late deaths occurred. Of the 218 early survivors, 24 had late AF recurrence. The 5-year AF-free rate was 87.1% ± 4.3% in patients 50 years or younger and 77.3% ± 4.1% in patients older than 50 years ($P = .001$). Univariate analysis showed that advanced patient age (> 50 years), a longer duration of AF, a fine AF pattern (wave length < 1 mm), and increased cardiothoracic ratio (> 60%) were associated with late AF recurrence. On multivariate analysis, advanced patient age was the only significant, independent risk factor for AF recurrence.

Conclusions: Although giant LA is known to be a predictor of poor outcomes after the maze procedure, younger patients had more favorable rhythm outcomes than older patients, as shown by the superior freedom from AF recurrence. A more aggressive surgical approach in younger patients might eliminate AF, even in the presence of a giant LA. (J Thorac Cardiovasc Surg 2011;141:1015-9)

Because of its efficacy, the Cox maze procedure, first introduced in 1987, has become the standard method used to treat atrial fibrillation (AF).[1] This procedure has been modified for easier and more effective interruption of micro-reentry circuits, resulting in normal sinus conversion rates as great as 90%.[2] The risk factors for early or late recurrence after the modified maze procedure include AF duration (> 5 years), low amplitude (< 1 mm) AF, advanced age, a greater cardiothoracic ratio (> 60%), and a giant (> 60 mm) left atrium (LA). The LA size is a particularly important risk factor for failure of the maze procedure.[3,4] A giant LA can be understood as a marker of arrhythmogenecity, in that pathologic changes such as atrial interstitial fibrosis, which is not involved in contraction, can easily induce AF.[5]

Differences in the rates of sinus conversion, however, have been observed between younger and older patient groups in the presence of a giant LA, suggesting that younger patients with a giant LA might be better candidates for successful maze procedures, with an age cutoff for success. We, therefore, investigated the factors affecting rhythm outcomes after the maze procedure in patients with a giant LA and AF-associated mitral valve disease to determine the best candidates for the maze procedure in this population.

MATERIALS AND METHODS

From January 1999 to December 2006, 224 patients with a preoperative LA size larger than 60 mm underwent the bi-atrial maze procedure combined with mitral valve surgery. The data were collected prospectively. The preoperative factors included patient age, sex, preoperative ejection fraction, AF duration, AF pattern (coarse or fine), AF type (paroxysmal, persistent, or long-standing persistent), and cardiothoracic ratio. The intraoperative factors included abrasion energy source (microwave or cryocatheter), concomitant surgery, and mitral valve operation type. Postoperatively, the in-patient rhythms were monitored daily using standard 12-channel surface electrocardiography. The patients were routinely evaluated with 24-hour Holter monitoring before hospital discharge. Follow-up electrocardiograms were performed at 3- to 6-month intervals during first 2 years and every year thereafter. Any symptoms suspicious of arrhythmia were assessed using 24-hour Holter monitoring during follow-up.

Our institution's ethical committee/institutional review board approved the present study.

Definitions

Recurrences or events of AF during the initial postablation blanking period of 3 months were defined as "early events." A failure of the maze procedure was defined as any recurrent AF, atrial tachycardia, or atrial flutter at

From the Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea.

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Address for reprints: Jae Won Lee, MD, Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, University of Ulsan College of Medicine, 388-1 Pungnap-dong Songpa-gu, Seoul 138-736 South Korea (E-mail: jwlee@amc.seoul.kr).

0022-5223/$36.00

doi: 10.1016/j.jtcvs.2010.08.036

PM

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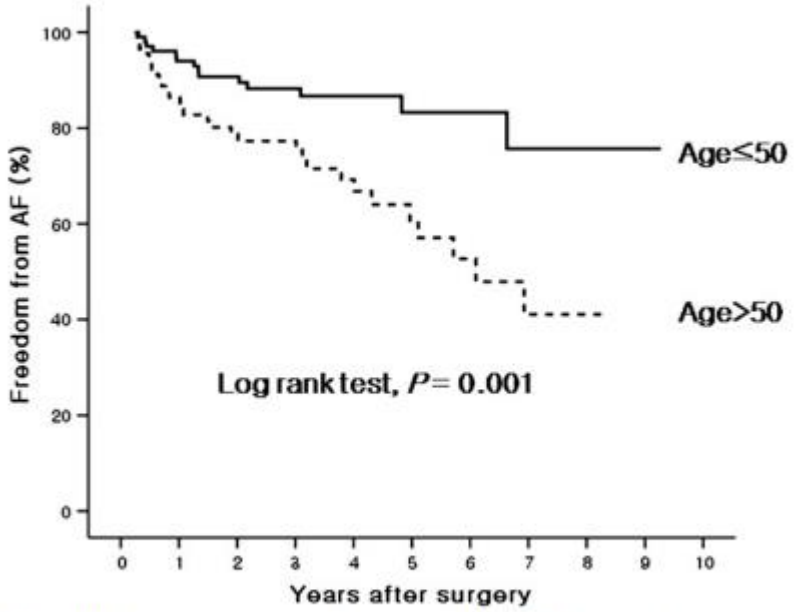

FIGURE 1. Kaplan-Meier analysis of atrial fibrillation *(AF)* recurrence over time in patients with giant left atrium 50 years old or younger and older than 50 years.

ORIGINAL ARTICLE

Surgical ablation of atrial fibrillation in patients with a giant left atrium undergoing mitral valve surgery

Ho Jin Kim, Joon Bum Kim, Sung-Ho Jung, Suk Jung Choo, Cheol Hyun Chung, Jae Won Lee

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/heartjnl-2015-308482).

Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Correspondence to
Dr Jae Won Lee, Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, University of Ulsan College of Medicine, 88, Olympic-Ro 43-Gil, Songpa-Gu, Seoul 138-736, Republic of Korea; jwlee@amc.seoul.kr

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ABSTRACT

Objective As the efficacy of surgical ablation for atrial fibrillation (AF) is reported to be suboptimal for patients with a giant left atrium (LA), its routine use on this population has remained controversial. We sought to evaluate the clinical outcomes of patients with a giant LA undergoing mitral valve (MV) surgery with/without the maze procedure.

Methods We identified 759 patients with a giant LA (>60 mm) and AF undergoing MV surgery from 1999 through 2012. Of these, 400 underwent MV surgery with the maze procedure (maze group), and the remainder (n=359) underwent MV surgery only (no-maze group). To reduce the impact of selection bias, propensity score analyses were performed based on 25 baseline covariates.

Results Early death occurred in five (1.3%) and nine (2.5%) patients in the maze and the no-maze group, respectively (p=0.28). Freedom from AF at 5 years was 68.9% in the maze group and 9.6% in the no-maze group (p<0.001). After adjustment, the maze group showed a significantly lower risk of death (HR, 0.65; 95% CI 0.44 to 0.98; p=0.038), thromboembolic events (HR, 0.23; 95% CI 0.09 to 0.58; p=0.002) and composite adverse outcomes (death, congestive heart failure and valve-related complications; HR, 0.55; 95% CI 0.42 to 0.71; p<0.001) than the no-maze group. In subgroup analyses, MV surgery with the maze procedure resulted in higher survival and event-free survival in most risk subgroups than without the maze procedure.

Conclusions The concomitant maze procedure improved postoperative rhythm status, clinical outcomes and cardiac functions in patients with a giant LA undergoing MV surgery. This study indicates that the patients with a giant LA undergoing MV surgery may benefit from an addition of the maze procedure.

INTRODUCTION

Since the maze procedure was proven to effectively restore sinus rhythm after chronic atrial fibrillation (AF), it has been widely used as a concomitant surgical procedure for patients with AF undergoing major cardiac surgery. Observational studies have shown improved haemodynamic profiles and reduced adverse cardiac events when the maze procedure is performed concomitantly with heart valve surgery in patients with AF.[1–4]

Despite the recent encouraging results with using the maze procedure, it still remains controversial whether the superior rhythm outcomes of this procedure translate into long-term clinical advantage in patients with AF. In particular, performing the maze procedure in patients with giant left atrium (LA) has not reached general consensus, and the risk–benefit profile of the procedure in this population has remained questionable.[1 2] This is because the restoration of sinus rhythm using this procedure in patients with enlarged atria has been reported to be suboptimal, and associated with a high failure rate and frequent late recurrence of AF. To date, however, there have been only few studies comparing the long-term clinical outcomes, such as safety and clinical efficacy, in this cohort.[2 5]

Therefore, we sought to evaluate the long-term outcomes in patients with AF and a giant LA undergoing mitral valve (MV) surgery with or without the maze procedure to evaluate the clinical impact of the maze procedure in a reasonably sized cohort.

METHODS

Patients

Of a total of 3681 patients undergoing MV surgery between January 1999 and December 2012 registered in our institutional prospective cardiac surgical database, we identified 759 patients with preoperative AF and a giant LA (>60 mm) on echocardiographic evaluation. Of these, 400 underwent MV surgery with the maze procedure (maze group), whereas 359 underwent MV surgery only (no-maze group).

The decision to perform the concomitant maze procedure was influenced by the demographic and clinical profile of each patient, including age, LA size, left ventricular ejection fraction (LVEF), type of valve surgery and prosthesis, and estimated surgical risks. But the ultimate decision was left at the discretion of the operating surgeon who reviewed such factors holistically. The study was approved by the institutional ethics committee/review board, which waived the requirement for informed consent due to the retrospective nature of the study.

Surgical procedure

The lesion sets for the maze procedure were created as described previously.[3 6] In brief, right-sided ablation was performed on the beating heart after an atriotomy under cardiopulmonary bypass (CPB) support and composed of (1) cavo-tricuspid isthmus isolation and (2) creation of a linear lesion from the isthmus to the superior vena cava (SVC). The left-sided ablation was performed after cross-clamping the aorta and included (1) a box lesion isolating the pulmonary vein (PV), (2) a linear lesion connecting the PV-box lesion to the LA

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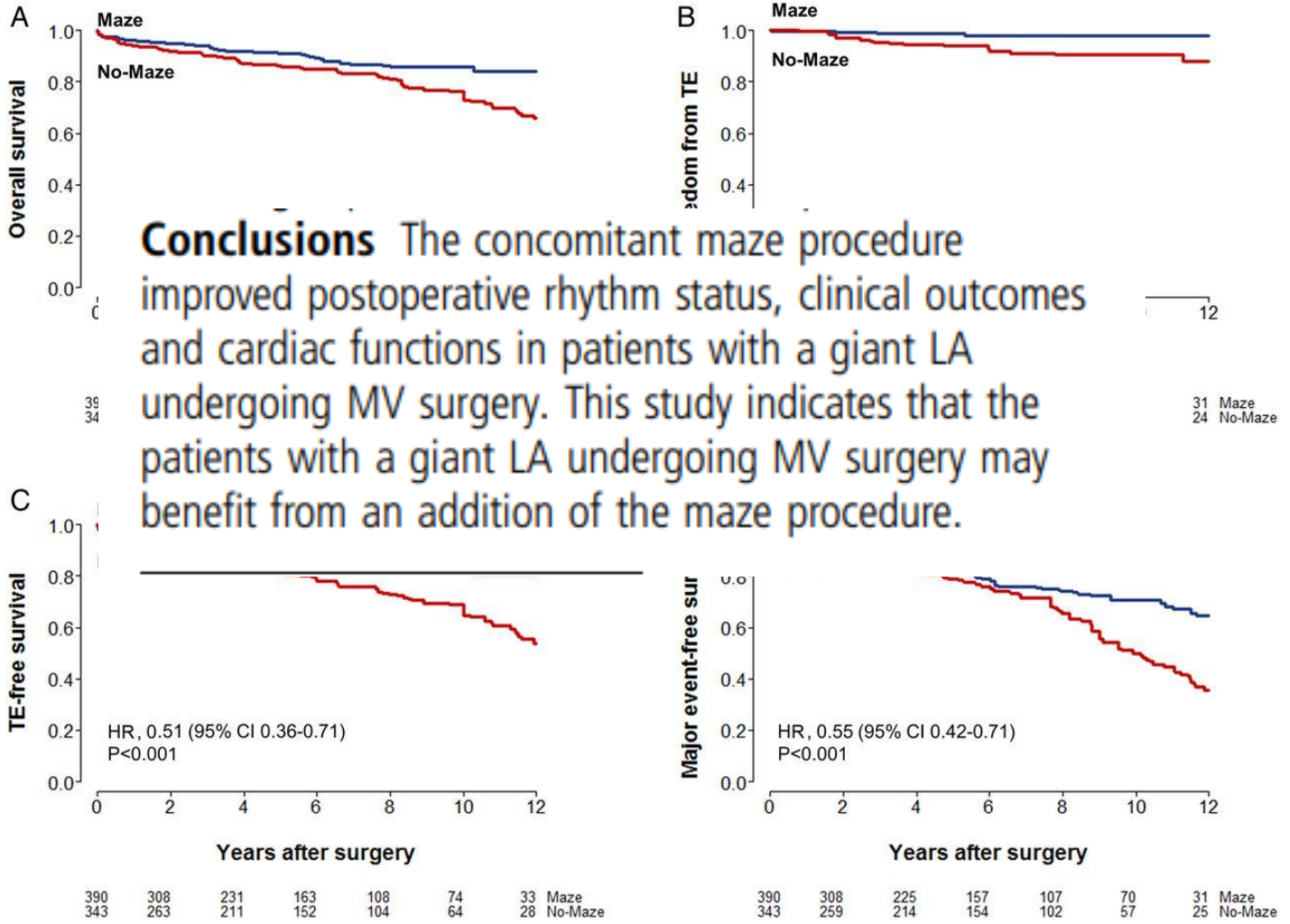
To cite: Kim HJ, Kim JB, Jung S-H, *et al*. *Heart* 2016;**102**:1206–1214.



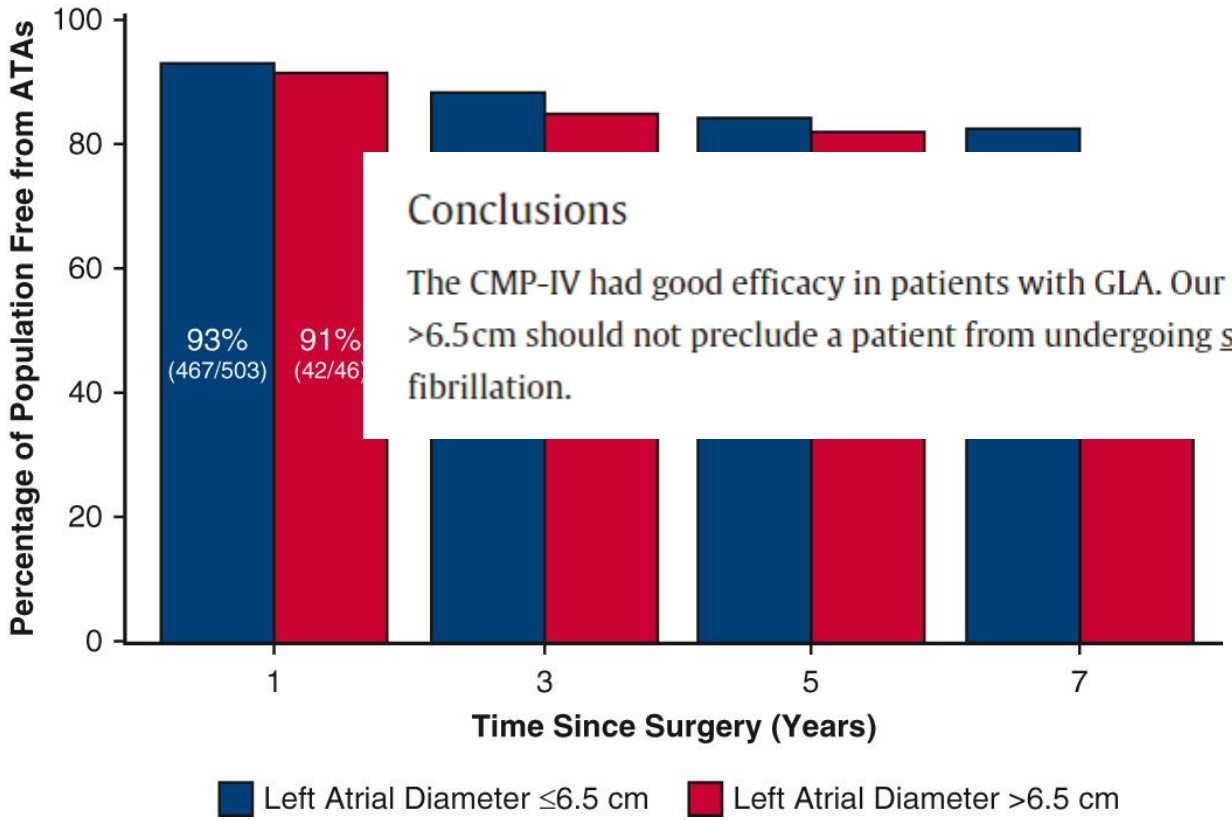
Conclusions The concomitant maze procedure improved postoperative rhythm status, clinical outcomes and cardiac functions in patients with a giant LA undergoing MV surgery. This study indicates that the patients with a giant LA undergoing MV surgery may benefit from an addition of the maze procedure.

Adult: Arrhythmias

Surgical ablation for atrial fibrillation is efficacious in patients with giant left atria

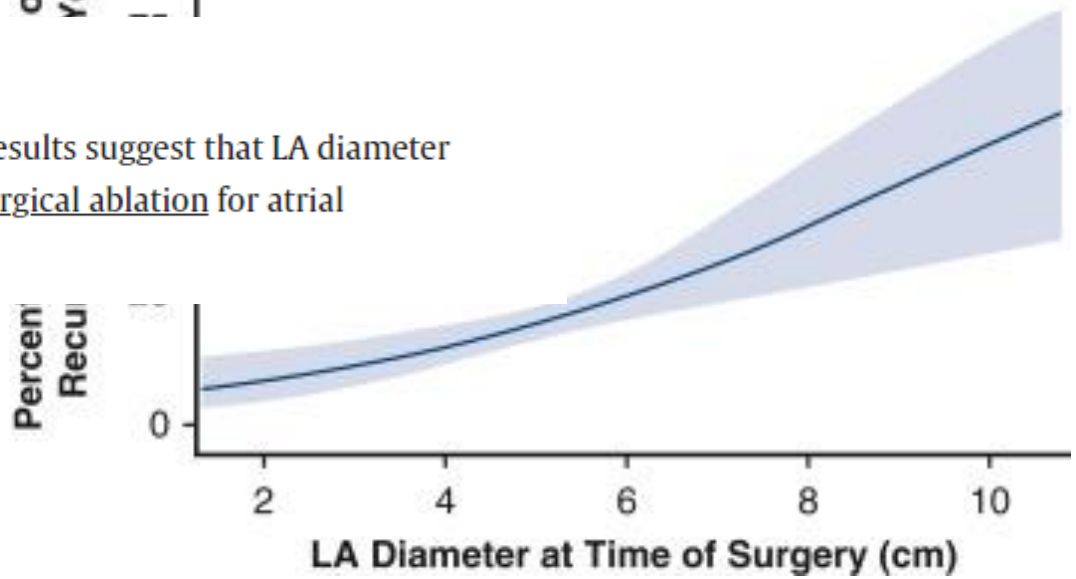
Read at the 101st Annual Meeting of The American Association for Thoracic Surgery: A Virtual Learning Experience, April 30-May 2, 2021.

Martha M.O. McGilvray MSt, MD, MPHS, Nadia H. Bakir MD, Tari-Ann E. Yates MD, Meghan O. Kelly MD, Laurie A. Sinn RN, Christian W. Zemlin PhD, Spencer J. Melby MD, Ralph J. Damiano Jr. MD



Conclusions

The CMP-IV had good efficacy in patients with GLA. Our results suggest that LA diameter >6.5cm should not preclude a patient from undergoing surgical ablation for atrial fibrillation.

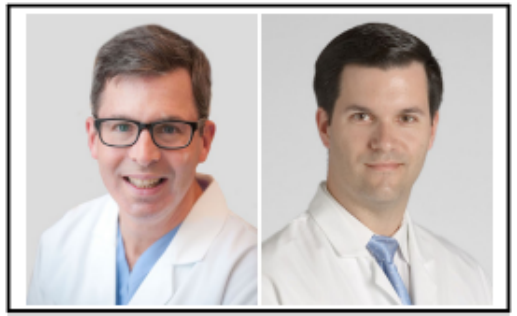


See Article page 680.

Commentary: Maze deniers and the giant left atrium

Marc Gillinov, MD, and
Edward G. Soltesz, MD, MPH

Surgical ablation with the cut-and-sew Cox-maze III procedure or the energy-assisted Cox-maze IV procedure (CMP-IV) is the most effective means of restoring sinus rhythm in those with atrial fibrillation (AF). Because a large body of evidence supports both the effectiveness and safety of surgical ablation, guidelines consistently endorse its application in cardiac surgical patients with preexisting AF.[1] Yet, the procedure is underused.[1,2] Although 28% of patients on Medicare presenting for cardiac surgery have a history of AF, only 22% of those with AF undergo ablation.[1] In the Society of Thoracic Surgeons database, approx-



Marc Gillinov, MD, and Edward G. Soltesz, MD, MPH

CENTRAL MESSAGE

Cardiac surgical patients with an enlarged left atrium and atrial fibrillation should undergo concomitant surgical ablation.

Commentary Gillinov and Soltesz

See Article page 680.

Commentary: Maze deniers and the giant left atrium

Marc Gillinov, MD, and
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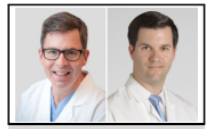
Surgical ablation with the cut-and-sew Cox-maze III procedure or the energy-assisted Cox-maze IV procedure (CMP-IV) is the most effective means of restoring sinus rhythm in those with atrial fibrillation (AF). Because a large body of evidence supports both the effectiveness and safety of surgical ablation, guidelines consistently endorse its application in cardiac surgical patients with preexisting AF.[1] Yet, the procedure is underused.[1,2] Although 28% of patients on Medicare presenting for cardiac surgery have a history of AF, only 22% of those with AF undergo ablation.[1] In the Society of Thoracic Surgeons database, approximately 48% of cardiac surgical patients with AF receive concomitant surgical ablation.[2] How can we explain this widespread failure to treat a condition—AF—that increases patients' long-term morbidity and mortality? The CMP-IV procedure is technically straightforward, extends operative time by no more than 30 minutes, and adds no increased operative risk. Therefore, the barrier to its adoption should be low. In truth, there are few reasons to omit a concomitant CMP-IV in cardiac surgical patients with preexisting AF. We must carefully and methodically address surgeons' reluctance to employ this therapy.

Certain patient factors do impact the success of the CMP-IV, and consideration of these patient characteristics may influence surgical decision-making. Increased left atrial size has consistently been associated with reduced effectiveness of surgical ablation.[3] In the setting of an enlarged left atrium, surgeons may therefore elect not to perform a CMP-IV. This is the wrong decision. With their investigation of the CMP-IV in patients with a giant left atrium (GLA), defined as left atrial diameter >6.5 cm, McGilvray and colleagues[4] inform us that we should absolutely perform a CMP-IV in patients with enlarged left atria.

In their analysis of 786 patients who underwent a CMP-IV, the authors identified 72 who had a GLA; in that group, the median left atrial diameter was 7 cm. When compared with patients with a more normal-sized left atrium, those with a GLA had substantially greater comorbidity, more persistent/long-standing persistent AF, and more complex operations; however, the results of ablation were similar between the 2 groups. At 5 years' follow-up with long-term monitoring, freedom from atrial tachyarrhythmias was greater than 80% in both groups. Although patients with a GLA experienced a trend toward increased operative mortality and had decreased late survival, this is attributable to their more advanced cardiac disease rather than to the ablation. In fact, one might surmise that they might have had worse long-term outcomes if they been left in AF.

AF in cardiac surgical patients is dramatically undertreated. In 2022, there are few reasons not to perform a CMP-IV in cardiac surgical patients with AF. An enlarged or "giant" left atrium is not a valid reason to withhold surgical ablation.



Marc Gillinov, MD, and Edward G. Soltesz, MD, MPH

CENTRAL MESSAGE

Cardiac surgical patients with an enlarged left atrium and atrial fibrillation should undergo concomitant surgical ablation.

ADULT

From the Department of Thoracic and Cardiovascular Surgery, Cleveland Clinic, Cleveland, Ohio.

Disclosures: Dr Gillinov serves as a consultant to Edwards Lifesciences, Medtronic, Abbott, AtriCure, ClearFlow, and Artivion; he has the right to equity in ClearFlow. Dr Soltesz serves as a consultant to AtriCure. Cleveland Clinic receives royalties from AtriCure.

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Address for reprints: Marc Gillinov, MD, Department of Thoracic and Cardiovascular Surgery, Cleveland Clinic, 9500 Euclid Ave, Desk J4-1, Cleveland, OH 44195 (E-mail: gillinom@ccf.org).

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worse long-term outcomes if they been left in AF.

AF in cardiac surgical patients is dramatically undertreated. In 2022, there are few reasons not to perform a CMP-IV in cardiac surgical patients with AF. An enlarged or "giant" left atrium is not a valid reason to withhold surgical ablation.

The Maze Procedure and Left Atrial Enlargement: *Just Do It*

Marc Gillinov, MD, and Edward G. Soltesz, MD, MPH

Surgeons know that untreated atrial fibrillation (AF) leaves their patients at increased risks for stroke, anticoagulant-related hemorrhage and death.[1] There is also compelling evidence confirming that surgical ablation of AF (ie, the Cox maze procedure) increases the likelihood of return to sinus rhythm (AF) and is associated with improved short- and long-term outcomes.[1,2] Nevertheless, surgeons frequently find reasons to omit surgical ablation and, instead, satisfy themselves (and undertreat their patients) by addressing only the primary indication for heart surgery. Most of the excuses for omitting ablation have been refuted by data demonstrating that the Cox maze procedure is both safe and effective.[1–4] In this issue of *Seminars in Thoracic and Cardiovascular Surgery*, Wang et al address one of the few remaining reasons for withholding ablation: the notion that ablation will not work in patients with left atrial enlargement.[5]

Edward G. Soltesz, MD, MPH and Marc Gillinov, MD.

Central Message

Surgical ablation is effective in most patients with left atrial enlargement and should be included if the left atrial dimension is less than 75 mm. The biatrial Cox maze IV is the preferred lesion set.

Multiple studies demonstrate that increased left atrial size constitutes a risk factor for failure of surgical ablation.[2–4,6,7] While some centers advocate atrial reduction at the time of ablation in those with substantial left atrial enlargement,[8] others simply omit ablation if the left atrial dimension exceeds some arbitrary dimension. Wang et al provide data suggesting that ablation should be performed regardless of left atrial size.

In their study, Wang et al report 82% freedom from AF off antiarrhythmic medications in patients with a left atrial dimension ≥65 mm at 2 years' follow-up; however, results were not as good in the small number of patients with LA dimension ≥75 mm. After ablation, the majority of patients had evidence of left and right atrial contraction. These results did not differ substantially from those observed in patients with smaller left atria. Complications in both groups (those with and without left atrial enlargement) were few. Thus, the authors conclude that ablation should be applied in those with large left atria as the results are good.

But, there is a catch—the surgical procedure that the authors performed will not be appealing to most surgeons. The authors performed a cut-and-sew ablation procedure that included a somewhat unconventional lesion set. First, the cut-and-sew piece. After its introduction, the cut-and-sew maze was adopted by very few surgeons; the complexity and time requirements were responsible for this low adoption rate. In fact, in Wang's series, the average cardiopulmonary bypass time approached 3 hours in patients undergoing mitral valve surgery. Although surgical results were good, this is a relatively long period on cardiopulmonary bypass, and it is likely that some patients would not fare well with such a long pump run. Today, surgeons employ alternate energy sources—cryothermy and bipolar radiofrequency—to complete their lesion sets. These tools reduce the risk of bleeding and speed up the procedure. In addition, when these ablation devices are properly employed, surgical results are excellent.[3,4] The cut-and-sew approach to surgical ablation is obsolete.

Standardization of lesion sets has long been a challenge in our field. It seems that every surgeon has his or her own version of the maze procedure.[9] The authors performed an ablation procedure that is similar—but not identical—to the Cox maze III/IV. Most notably, they added a right atrial isthmus lesion in many patients in order to reduce the occurrence of right atrial flutter. The standard right atrial lesions of the Cox maze III/IV reach the tricuspid annulus, rendering the addition of a right atrial isthmus lesion both unnecessary and inadvisable. At this point in our understanding of the surgical ablation of AF, surgeons should stick to the biatrial lesion set of the Cox maze III/IV. Until and unless we have additional data that provide a firm rationale for varying the lesion set, we should employ this standard operation that generates good results.

Department of Thoracic and Cardiovascular Surgery, Cleveland Clinic, Cleveland, Ohio

Address reprint requests to Marc Gillinov, MD, Department of Thoracic and Cardiovascular Surgery, Cleveland Clinic, Desk J4-1, 9500 Euclid Avenue, Cleveland, OH 44195. E-mail: gillinom@ccf.org

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Central Message

Surgical ablation is effective in most patients with left atrial enlargement and should be included if the left atrial dimension is less than 75 mm. The biatrial Cox maze IV is the preferred lesion set.

The central message of this paper—surgical ablation is safe and effective in those with left atrial enlargement—should encourage surgeons to perform the Cox maze IV procedure in such patients. With alternate energy sources, the procedure will add no more than 30 minutes to the cardiopulmonary bypass time, and its application should free a substantial number of patients from the risks that accompany AF.

CARDIOVASCULAR

Left Atrial Reduction Enhances Outcomes of Modified Maze Procedure for Permanent Atrial Fibrillation During Concomitant Mitral Surgery

Vinay Badhwar, MD, Joshua D. Rovin, MD, Gail Davenport, ARNP-BC, J. Crayton Pruitt, MD, Robert R. Lazzara, MD, George Ebra, EdD, Gary H. Dworkin, MD

Cardiac Surgical Associates MAZE Investigators, Tampa-St. Petersburg, Florida

Background. Success of the maze procedure after mitral operations with large left atria and permanent atrial fibrillation remains suboptimal. Current technique variations tend to obscure the decision-making algorithm in these patients. A single energy-source approach for the surgical management of patients with large left atria and permanent atrial fibrillation is presented.

Methods. From January 2003 to July 2005, 71 consecutive drug-resistant patients with permanent atrial fibrillation and left atrial enlargement who required mitral valve surgery underwent aggressive left atrial reduction combined with left-sided only irrigated radiofrequency unipolar maze. Left atrial dimensions were measured by transesophageal echo anterior-to-posterior leading edge-to-edge standardized protocol. There were 39 men (54.9%) and 32 women (45.1%), and their mean age was 71.9 ± 9.5 years. Mean duration of atrial fibrillation was 49.3 ± 58.0 months.

Results. All patients underwent left atrial reduction with identical Cox-maze III pulmonary vein and appendage isolation including mitral annular connection, followed by appendage suture closure. Left atrial size was reduced from 6.7 ± 1.2 cm to 4.3 ± 0.6 cm ($p = 0.001$). Mitral valve repair was performed in 55 patients (76.1%) and replacement in 17 (23.9%). The 30-day mortality was 4.2% (3/71). Postoperative length of stay was 8.8 ± 5.7 days, with 56 (82.4%) of 68 patients discharged in normal sinus rhythm. P-wave sinus rhythm was 93.8% between 7 and 12 months and 92.0% for patients with 1 year or more of follow-up.

Conclusions. Left atrial reduction combined with a left atrial only single energy-source radiofrequency maze procedure is an effective treatment for patients with permanent atrial fibrillation undergoing concomitant mitral operations.

(Ann Thorac Surg 2006;82:1758–64)

The surgical management of permanent atrial fibrillation (AF) in patients with concomitant mitral valve disease continues to be a clinical challenge. AF that is not addressed during mitral valve surgery has been identified as an independent predictor of late stroke and cardiovascular mortality [1, 2]. A successful maze operation with corrective mitral valve surgery improves long-term outcomes.

The traditional cut-and-sew Cox-maze III operation serves as the benchmark in treatment, providing 90% to 97% freedom from AF [3, 4]. However, concerns about procedural complexity have limited the acceptance of this surgical technique [3–6]. Recent modifications in the operation that include the use of ablative therapies and limiting the approach to the left atrium have increased the application of the maze procedure with concomitant mitral valve surgery. Despite some groups achieving acceptable early results, few have been able to replicate those obtained with the traditional Cox-maze III operation. Most reports describe the use of single or even combined energy sources applied to a heterogeneous AF population, resulting in rates of freedom from AF of 60% to 80% [7–10].

Unlike paroxysmal or persistent AF, patients with permanent AF tend to have larger left atria and are more resistant to spontaneous size reduction or rhythm conversion after isolated mitral valve surgery [2]. The foci of AF in this cohort of patients may be from the remodeled left atrium in addition to the pulmonary veins. Because permanent AF and large left atria have both been implicated in modified maze operation failures, it has been postulated that a reduction of left atrium size may improve patient outcomes [10–17].

The purpose of this report is to discern the efficacy of combined left atrial reduction (LAR) with a left atrium only, modified Cox-maze III lesion set performed with a single radiofrequency energy source applied in patients with permanent AF and large left atria during concomitant mitral valve surgery. The objective was also to assess the early outcomes of this simplified technique.

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Address correspondence to Dr Badhwar, Cardiac Surgical Associates, Tampa Bay Heart Institute, 6006 49th St N, Suite 310, St. Petersburg, FL 33701; e-mail: vbadhwar@heartsurgery-csa.com.

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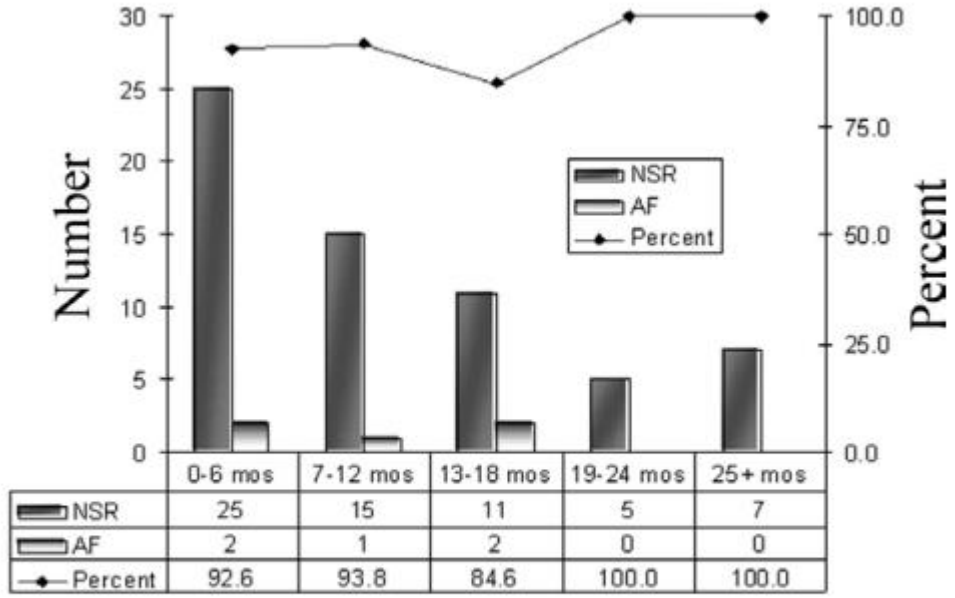

	0-6 mos	7-12 mos	13-18 mos	19-24 mos	25+ mos
NSR	25	15	11	5	7
AF	2	1	2	0	0
Percent	92.6	93.8	84.6	100.0	100.0

Fig 2. Rhythm after operation at designated time intervals. (NSR (dark boxes) = normal sinus rhythm; AF (light boxes) = atrial fibrillation; mos = months). Line with diamond, percentage.

Left atrial reduction can be safely and effectively combined with isolated left atrium–only radiofrequency ablation to treat permanent AF during concomitant mitral valve operations. Results of 1-year 92.0% freedom from AF by this modified technique may be comparable with those obtained from the traditional Cox-maze III operation. Continued clinical evaluation and further follow-up remains essential to confirm long-term outcomes.

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ORIGINAL ARTICLE

Left Atrium Volume Reduction Procedure Concomitant With Cox-Maze Ablation in Patients Undergoing Mitral Valve Surgery: A Meta-Analysis of Clinical and Rhythm Outcomes

Massimo Baudo, MD*, Fabrizio Rosati, MD, Lorenzo Di Bacco, MD, Michele D'Alonzo, MD, Stefano Benussi MD, PhD, Claudio Muneretto, MD

Division of Cardiac Surgery, Spedali Civili di Brescia, University of Brescia, Brescia, Italy

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Background The management of an enlarged left atrium (LA) in mitral valve (MV) disease with atrial fibrillation (AF) is still being debated. It has been postulated that a reduction in LA size may improve patient outcomes. This meta-analysis aimed to assess rhythm and clinical outcomes of combined surgical AF treatment with or without LA volume reduction (LAVR) in patients undergoing MV surgery.

Methods A systematic review was performed and all available literature to May 2022 was included. The primary endpoint was analysis of early and late mortality and rhythm outcomes. Secondary outcomes included early and late cerebrovascular accident (CVA) and permanent pacemaker implantation.

Results The search strategy yielded 2,808 potentially relevant articles, and 19 papers were eventually included. The pooled estimated rate of 30-day mortality was 3.76% (95% CI 2.52–5.56). The incidence rate of late mortality and late cardiac-related mortality was 1.75%/year (95% CI 0.63–4.84) and 1.04%/year (95% CI 0.31–3.53), respectively. At subgroup analysis when comparing the surgical procedure with and without AF ablation, the ablation subgroup showed a significantly lower rate of postoperative CVA ($p<0.0001$) and higher restoration to sinus rhythm at discharge ($p=0.0124$), with only a trend of lower AF recurrence at 1 year ($p=0.0608$). At univariable meta-regression, reintervention was significantly associated with higher late mortality ($p=0.0033$).

Conclusion In enlarged LA undergoing MV surgery, LAVR combined with AF ablation showed a trend of improved rhythm outcomes when compared with AF ablation without LAVR. Each LAVR technique has its advantages and disadvantages, which must be managed accordingly.

Keywords Cardiac surgery • Mitral valve surgery • Atrial fibrillation ablation • Left atrium volume reduction surgery • Meta-analysis

Table 4 Meta-analysis of the outcomes in randomised controlled studies only.

Outcome	Studies, n	Estimate (95% CI)	Heterogeneity (I^2, P-Value)
Early outcomes			
LAA exclusion	4	97.54% (94.79–98.86)	0%, p=0.7600
CPB time	3	133.79 min (110.39–162.15)	93.5%, p<0.0001
CXC time	3	96.64 min (86.01–112.51)	88.7%, p=0.0001
Postop atrial diameter	2	54.57 mm (47.86–62.21)	98.1%, p<0.0001
Postop CVA	2	1.03% (0.15–6.96)	0%, p=0.7002
Postop bleeding	1	4.29% (1.39–12.46)	NA
Postop PPM	1	5.71% (2.16–14.26)	NA
Discharged with SR	3	82.32% (52.62–95.12)	84.8%, p=0.0014
30-day mortality	4	3.11% (0.94–9.81)	56.5%, p=0.0754
Late outcomes			
Follow-up	4	1.49 years (1.16–1.92)	95.1%, p<0.0001
Late death	3	0.35%/year (0.03–4.95)	81.4%, p=0.0046
Late cardiac death	3	0.33%/year (0.02–5.49)	83.0%, p=0.0028
AF at 1 year	4	17.87% (6.74–39.59)	88.0%, p<0.0001
Late CVA	2	2.81%/year (0.57–12.82)	0%, p=0.5856
Late atrial diameter	4	47.45 mm (41.31–54.51)	98.2%, p<0.0001

Abbreviations: AF, atrial fibrillation; CPB, cardiopulmonary bypass; CVA, cerebrovascular accident; CXC, cross-clamp; LAA, left atrial appendage; NA, not applicable; PPM, permanent pacemaker; SR, sinus rhythm.

Conclusions

Clinical and rhythm outcomes of LAVR surgery concomitant with MV surgery and AF ablation in patients with severely dilated LA are encouraging. The combination of LAVR techniques with AF ablation strategies may improve rhythm outcomes in patients with unfavourable LA anatomy otherwise at high risk of arrhythmia recurrences. Further studies are warranted to investigate the outcomes of this meta-analysis.

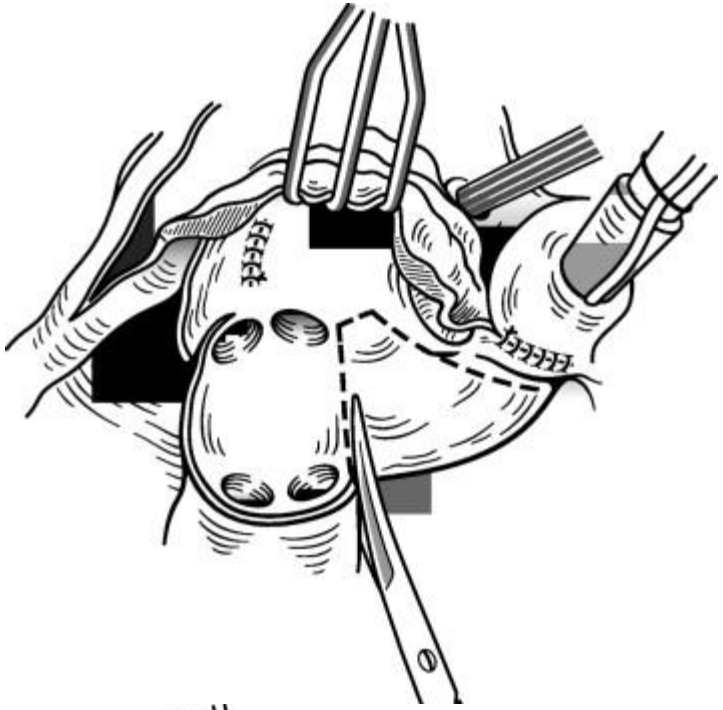
Atrial reduction plasty Cox maze procedure: extended indications for atrial fibrillation surgery

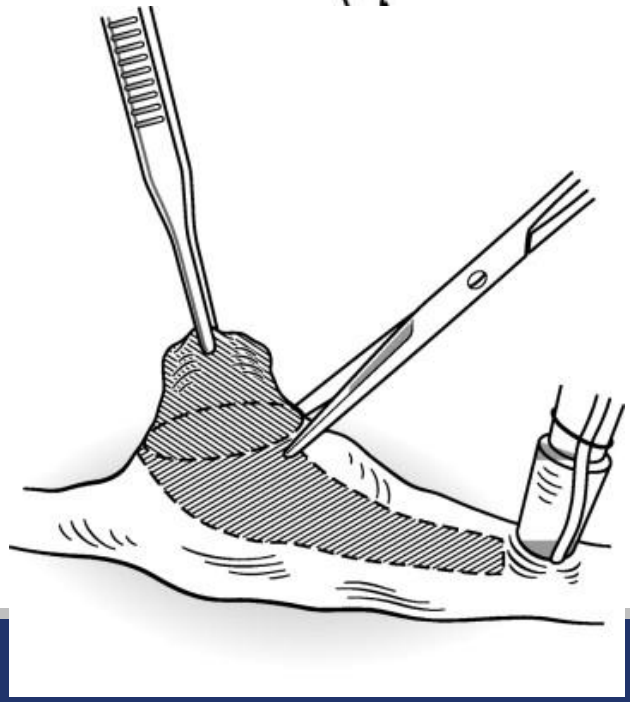
Presented at the Thirty-ninth Annual Meeting of The Society of Thoracic Surgeons, San Diego, CA, Jan 31–Feb 2, 2003.

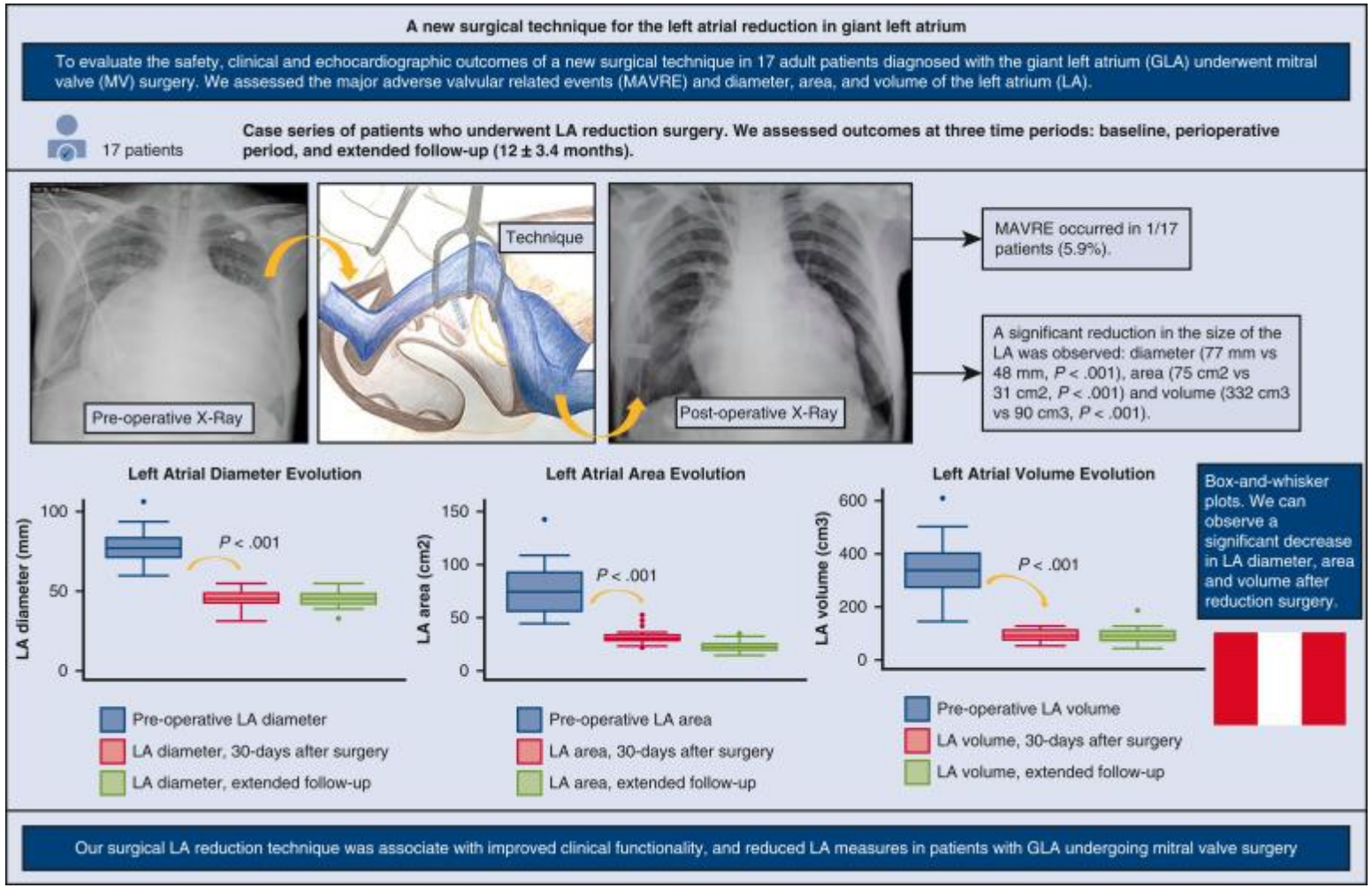
Matthew A Romano MD [a], David S Bach MD [b], Francis D Pagani MD, PhD [a], Richard L Prager MD [a], G.Michael Deeb MD [a], Steven F Bolling MD [a]

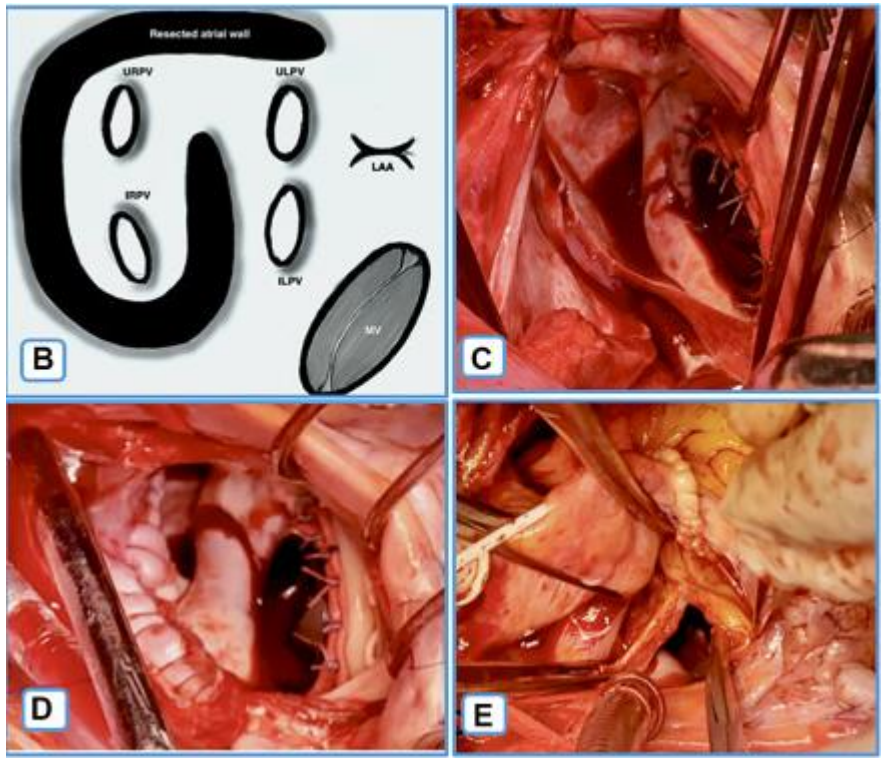
Conclusions

Aggressive biatrial reduction plasty Cox maze procedure was effective in 89% of these "low success" AF patients. This simple procedure can extend utilization of the Cox maze procedure to more patients with chronic AF.






A new surgical technique for the left atrial reduction in giant left atrium
To evaluate the safety, clinical and echocardiographic outcomes of a new surgical technique in 17 adult patients diagnosed with the giant left atrium (GLA) underwent mitral valve (MV) surgery. We assessed the major adverse valvular related events (MAVRE) and diameter, area, and volume of the left atrium (LA).
17 patients
Case series of patients who underwent LA reduction surgery. We assessed outcomes at three time periods: baseline, perioperative period, and extended follow-up (12 ± 3.4 months).
Pre-operative X-Ray
Technique
Post-operative X-Ray
MAVRE occurred in 1/17 patients (5.9%).
A significant reduction in the size of the LA was observed: diameter (77 mm vs 48 mm, P < .001), area (75 cm2 vs 31 cm2, P < .001) and volume (332 cm3 vs 90 cm3, P < .001).
Left Atrial Diameter Evolution
LA diameter (mm)
100
50
0
P < .001
Pre-operative LA diameter
LA diameter, 30-days after surgery
LA diameter, extended follow-up
Left Atrial Area Evolution
LA area (cm2)
150
100
50
0
P < .001
Pre-operative LA area
LA area, 30-days after surgery
LA area, extended follow-up
Left Atrial Volume Evolution
LA volume (cm3)
600
400
200
0
P < .001
Pre-operative LA volume
LA volume, 30-days after surgery
LA volume, extended follow-up
Box-and-whisker plots. We can observe a significant decrease in LA diameter, area and volume after reduction surgery.
Our surgical LA reduction technique was associate with improved clinical functionality, and reduced LA measures in patients with GLA undergoing mitral valve surgery


Resected atrial wall
URPV
ULPV
LAA
IRPV
ILPV
MV
B
C
D
E

Echocardiographic Evaluation of Morphological and Hemodynamic Significance of Giant Left Atrium

An Important Lesson

Jae K. Oh, MD

In this issue of *Circulation,* Minagoe et al[1] describe an interesting Doppler echocardiographic observation that blood flow velocity in the inferior vena cava (IVC) entrance into the right atrium is increased especially during inspiration in patients with a giant left atrium (GLA) and mitral stenosis. The increase in velocity was caused by the narrowed IVC orifice at its junction with the right atrium resulting from bulging of the atrial septum in these patients with GLA. Compared with the patients with lone atrial fibrillation or mitral stenosis without GLA, they had a smaller IVC orifice and higher flow velocity in the absence of severe tricuspid regurgitation. Two-dimensional and Doppler echocardiographic measurements were made from a right parasternal longitudinal plane, and pulsed-wave Doppler velocities in the IVC were recorded simultaneously with a respiratory tracing. In these patients with GLA, hepatomegaly by palpation was more frequent, and the authors concluded that a localized obstruction at the IVC orifice by GLA resulted in systemic venous congestion.

See p 214

Definition of Giant Left Atrium

A case of "extreme dilatation of the left auricle" in a 40-year-old woman was described by Owen and Fenton[2] in 1901. The patient had suffered from rheumatic fever and presented with urgent dyspnea. On examination, the entire right side of the chest at the back was dull, which was thought to reflect the presence of pleural effusion. Urgent paracentesis, however, produced pure blood. Postmortem examination showed that the pericardial sac occupied the entire thoracic cavity with extreme dilatation of the left atrium, which had been tapped. Since this case report, various diagnostic criteria of GLA were proposed with advances in imaging modalities to debate its clinical significance.[3–7] To describe the clinical features of the patients with "extreme left atrial enlargement," DeSanctis et al[3] reviewed 10 patients whose left atrium either "touched the right chest wall or extended within one centimeter of it on posteroanterior chest x-ray." All of their patients had some degree of heart failure and hepatomegaly. Compression of adjacent structures (lung, trachea, bronchi, aorta, and esophagus) was common. The cardiothoracic ratio (CTR) was greater than 88% in each patient. Others used a CTR of ≥0.7 to define giant left atrium.[5,6] However, the left atrial size is difficult to be measured accurately from a chest x-ray. Since the initial clinical application of echocardiography in the 1960s, it became the imaging technique of choice to determine the cardiac chamber size, including the left atrium, in everyday cardiology practice.[8,9] When Piccoli et al[5] measured the left atrial dimension by echocardiography from the parasternal long-axis view in 40 patients with a CTR >0.7, it ranged from 7 to 12 cm.

Therefore, echocardiographic evidence of massive left atrial enlargement (i.e., anteroposterior diameter >8 cm) has been combined with CTR ≥0.7 to define GLA in another study. More recently, computed tomography was used to determine the left atrial dimension and volume in a patient with GLA. There are no established diagnostic criteria for GLA, however, and an empirical definition of left atrial dimension of ≥65 mm on two-dimensional echocardiography parasternal long-axis view was used in this study. Compared with the previous criteria of GLA, the present study includes patients with smaller left atrial size.

Echocardiographic Evaluation of the GLA

Morbidity of GLA comes from compression of intracardiac and adjacent extracardiac structures. In 28–40% of patients with GLA who underwent mitral valve replacement, the atrial septum was found to be anteriorly displaced narrowing the IVC–atrial junction along with small and compressed right atrium[5,6] as described in Minagoe's present study. A two-dimensional echocardiographic study demonstrated that the posterobasal wall of the left ventricle may be bent inward (toward the ventricular septum) by inferior extension of the left atrial dilatation.[11] When the bending is significant, the motion of the bending segment of the posterobasal wall may become akinetic. Hemodynamic effects of the intracardiac compression by GLA, however, has not been evaluated until the present study using Doppler echocardiography.

From the Division of Cardiovascular Diseases and Internal Medicine, Mayo Clinic, Mayo Foundation, Rochester, Minn.

Address for correspondence: Jae K. Oh, MD, Division of Cardiovascular Diseases and Internal Medicine, Mayo Clinic, Mayo Foundation, Rochester, MN 55905.

In this issue of *Circulation,* Minagoe et al[1] describe an interesting Doppler echocardiographic observation that blood flow velocity in the inferior vena cava (IVC) entrance into the right atrium is increased especially during inspiration in patients with a giant left atrium (GLA) and mitral stenosis. The increase in velocity was caused by the narrowed IVC orifice at its junction with the right atrium resulting from bulging of the atrial septum in these patients with GLA. Compared with the patients with lone atrial fibrillation or mitral stenosis without GLA, they had a smaller IVC orifice and higher flow velocity in the absence of severe tricuspid regurgitation. Two-dimensional and Doppler echocardiographic measurements were made from a right parasternal longitudinal plane, and pulsed-wave Doppler velocities in the IVC were recorded simultaneously with a respiratory tracing. In these patients with GLA, hepatomegaly by palpation was more frequent, and the authors concluded that a localized obstruction at the IVC orifice by GLA resulted in systemic venous congestion.

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Case Report

A rare appearance of a large mural thrombus in left atrium detected two years after the Maze procedure

Shunta Taminishi (MD)[a,*], Tetsuya Nomura (MD,PhD)[a], Hiroshi Kubota (MD)[a], Daisuke Miyawaki (MD)[a], Ryota Urata (MD)[a], Takeshi Sugimoto (MD)[a], Yusuke Higuchi (MD)[a], Taku Kato (MD)[a], Natsuya Keira (MD, PhD)[a], Kiyoshi Doi (MD, PhD)[b], Hitoshi Yaku (MD, PhD, FJCC)[b], Tetsuya Tatsumi (MD, PhD)[a]

[a] Department of Cardiovascular Medicine, Nantan General Hospital, Kyoto, Japan
[b] Department of Cardiovascular Surgery, Kyoto Prefectural University of Medicine, Japan

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ABSTRACT

A 77-year-old Japanese woman underwent bioprosthetic aortic valve replacement (AVR) and the Maze procedure for severe aortic valve disease and paroxysmal atrial fibrillation (AF), and one year after the AVR, she also underwent a permanent pacemaker implantation for sick sinus syndrome. At two postoperative years, a large mural mass happened to be detected in her left atrium on routine trans-thoracic echocardiography. The cardiac rhythm records produced by the implanted pacemaker demonstrated the recurrence of AF. As anticoagulant therapy was not effective at reducing the size of the mass, surgery was performed and organized thrombus was detected on the ablation line made at the Maze procedure.
<**Learning objective:** The formation of large mural thrombi in the left atrium after the Maze procedure is rare in patients without mitral valve disease. The thrombus was considered to have been caused by several complex factors, including atrial wall damage brought by the Maze procedure and the recurrence of atrial fibrillation (AF). It is important to be aware that the recurrence of AF after the Maze procedure can carry a risk of unexpected mural thrombus formation in the left atrium.>

Introduction

Atrial fibrillation (AF) is a major cause of thrombus formation in the left atrium, especially in the left atrial appendage (LAA). The Maze procedure is effective at maintaining sinus rhythm for those patients with AF, and consequently, preventing thrombus formation [1]. Although arrhythmia, e.g. sinus bradycardia, is a well-known postoperative complication of the Maze procedure [2], only a few reports have described thrombus formation in the left atrium (LA) after this procedure [3,4]. We experienced a case in which a rare appearance of a large mural thrombus was detected in the LA as late as two years after the Maze procedure. The thrombus was considered to have been caused by several complex factors, including atrial wall damage brought by the Maze procedure and recurrent AF.

Case report

A 77-year-old Japanese woman with paroxysmal AF and severe aortic valve stenosis and regurgitation underwent bioprosthetic aortic valve replacement (AVR) and the Maze procedure. On left side Maze procedure, the LA was opened via right lateral approach. Bipolar radio-frequency ablation was applied for isolation of bilateral pulmonary veins, and also between LAA and the origin of the left upper pulmonary vein. Because she continued to exhibit a sinus rhythm postoperatively, she was administered only warfarin for three months after the operation. One year after the AVR, a permanent dual chamber (DDD) pacemaker implantation for sick sinus syndrome was performed. Recurrence of AF had not yet been confirmed at that time. Transmitral Doppler demonstrated abnormal relaxation pattern (E = 0.76 m/s, A = 0.87 m/s, E/A = 0.87). LA volume was calculated with 92 ml (volume index: 70.6 ml/m^2). Another year has passed after the implantation of the DDD pacemaker, and routine trans-thoracic echocardiography (TTE) was performed. We accidentally discovered a large high echoic mass adhering to the posterior wall of the LA (Fig. 1A).

* Corresponding author at: Department of Cardiovascular Medicine, Nantan General Hospital, 25, Yagi-Ueno, Yagi-cho, Nantan City, Kyoto 629-0197, Japan. Tel.: +81 0771 42 2510; fax: +81 0771 42 2096.
E-mail address: s.taminishi.1223@gmail.com (S. Taminishi).

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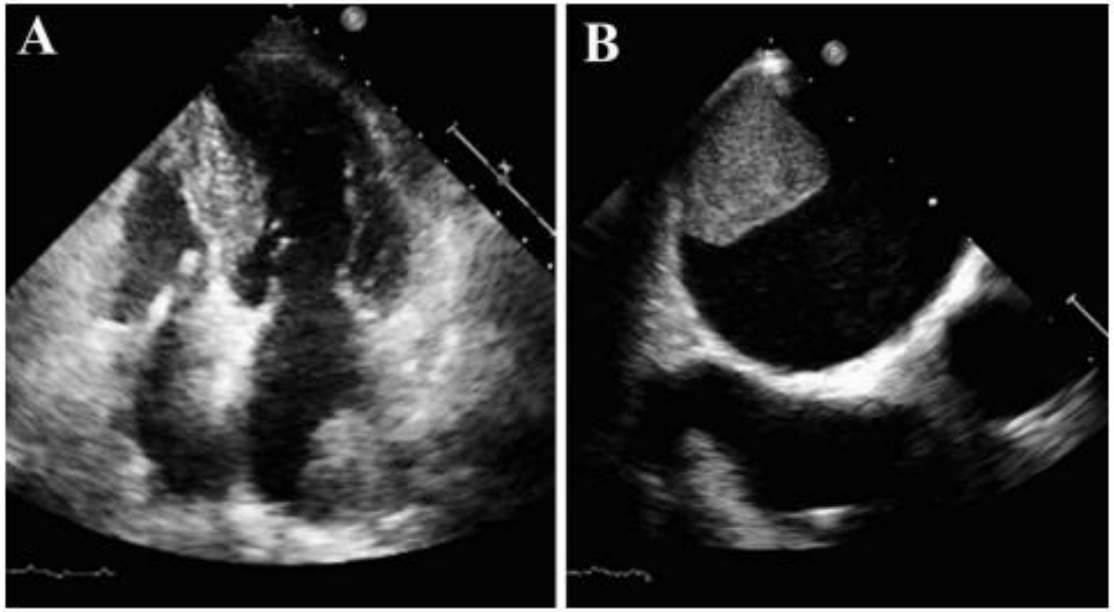

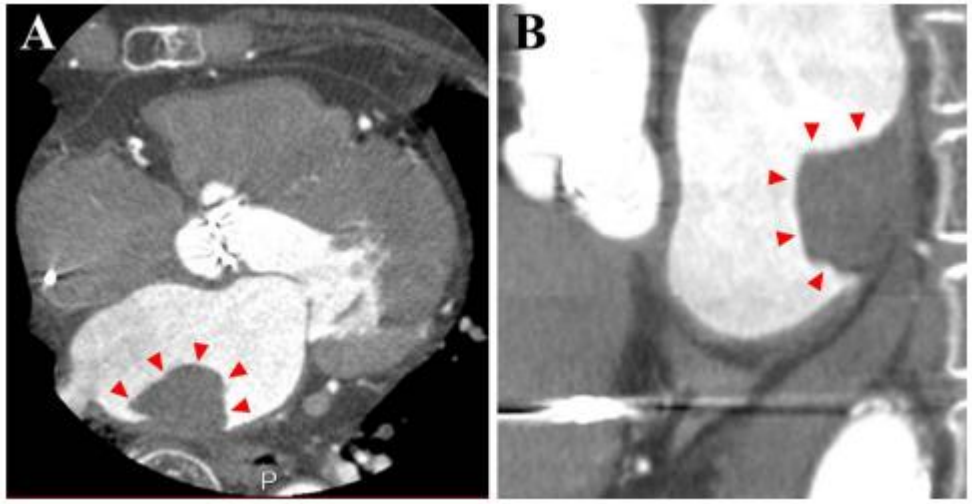

Enhanced cardiac computed tomography demonstrated a homogenous mass that did not exhibit a stalk-like morphology. (A) Hori-

Article

Human Tissue Analysis of Left Atrial Adipose Tissue and Atrial Fibrillation after Cox Maze Procedure

Jung-Hwan Kim [1,†], Joon-Young Song [1,†], Hyo-Sup Shim [2], Sak Lee [1], Young-Nam Youn [1], Hyun-Chel Joo [1], Kyung-Jong Yoo [1] and Seung-Hyun Lee [1,*]

[1] Division of Cardiovascular Surgery, Department of Thoracic and Cardiovascular Surgery, Severance Cardiovascular Hospital, Yonsei University College of Medicine, Yonsei University Health System, Seoul 03722, Korea; jhkim0907@yuhs.ac (J.-H.K.); songjy2k@yuhs.ac (J.-Y.S.); sak911@yuhs.ac (S.L.); ynyoun@yuhs.ac (Y.-N.Y.); vietcomm@yuhs.ac (H.-C.J.); kjy@yuhs.ac (K.-J.Y.)
[2] Department of Pathology, Severance Hospital, Yonsei University College of Medicine, Seoul 03722, Korea; shimhs@yuhs.ac
* Correspondence: henry75@yuhs.ac; Tel.: +82-02-2228-8491
† These authors contributed equally to this work.

Abstract: Cardiac adipose tissue is a well-known risk factor for the recurrence of atrial fibrillation (AF) after radiofrequency catheter ablation, but its correlation with maze surgery remains unknown. The aim of this study was to investigate the correlation between the recurrence of AF and the adipose component of the left atrium (LA) in patients who underwent a modified Cox maze (CM) III procedure. We reviewed the pathology data of resected LA tissues from 115 patients, including the adipose tissue from CM-III procedures. The mean follow-up duration was 30.05 ± 23.96 months. The mean adipose tissue component in the AF recurrence group was 16.17% ± 14.32%, while in the non-recurrence group, it was 9.48% ± 10.79% ($p = 0.021$), and the cut-off value for the adipose component for AF recurrence was 10% ($p = 0.010$). The rates of freedom from AF recurrence at 1, 3, and 5 years were 84.8%, 68.8%, and 38.6%, respectively, in the high-adipose group (≥10%), and 96.3%, 89.7%, and 80.3%, respectively, in the low-adipose group (<10%; $p = 0.002$). A high adipose component (≥10%) in the LA is a significant risk factor for AF recurrence after CM-III procedures. Thus, it may be necessary to attempt to reduce the perioperative adipose portion of the cardiac tissue using a statin in a randomized study.

Keywords: atrial fibrillation; Cox maze procedure; atrial adipose tissue

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1. Introduction

Atrial fibrillation (AF) is the most frequent heart rhythm disorder and is known to be associated with obesity, metabolic syndrome, and inflammation [1,2]. Patients with heart valve disease often have AF, of which mitral valve (MV) disease is the most common type, occurring in about 40–60% of heart valve disease cases [3,4]. MV surgery with concomitant AF ablation is superior to MV surgery alone with an intensive rhythm control strategy, and the potential benefits and safety of a surgical ablation procedure for AF during MV surgeries have been well documented [4]. The benefits of one surgical ablation procedure called the Cox maze procedure include the restoration of synchronous atrioventricular contractions, leading to an improvement in cardiac output, the relief of palpitation symptoms, the prevention of thromboembolic events, and the discontinuation of anticoagulation therapy, which may improve the quality of life [3].

However, about 30–35% of patients who undergo maze procedures experience AF recurrence during follow-up [5]; therefore, many studies have attempted to reveal factors that can predict risk or failure, such as AF duration, left atrial size, and the degree of left atrial tissue fibrosis. Epicardial adipose tissue was recently shown to be associated

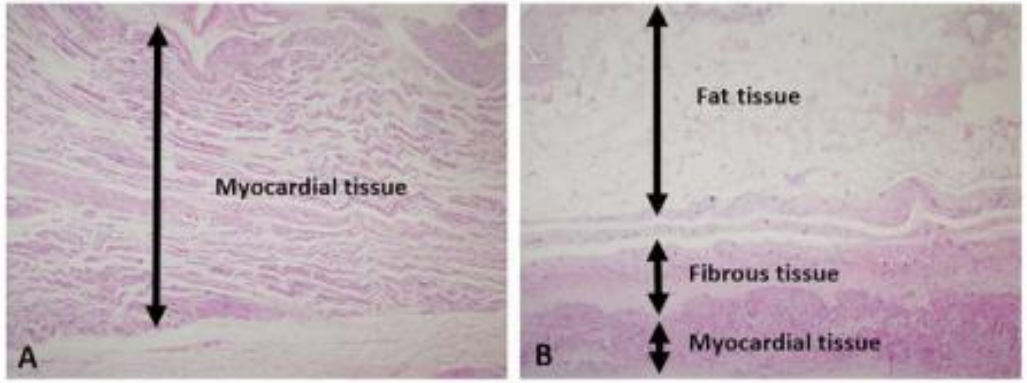

Figure 1. Hematoxylin and eosin staining of the left atrial tissue ((**A**) adipose tissue component <10%; (**B**) adipose tissue component ≥10%).

Variables	No Recurrence ($n = 83$)	Recurrence ($n = 32$)	p Value
Smoking	80 (96.4%)	29 (90.6%)	0.346
Hypertension	57 (68.7%)	21 (65.6%)	0.754
Diabetes mellitus	16 (19.3%)	6 (18.8%)	0.949
Chronic kidney disease	2 (2.4%)	2 (6.3%)	0.309
CVA history	17 (20.5%)	8 (25.0%)	0.599
Coronary artery disease	9 (10.8%)	2 (6.3%)	0.725
Total cholesterol, mg/dL	172.80 ± 35.918	159.91 ± 36.102	0.088
LDL cholesterol, mg/dL	99.70 ± 30.851	82.10 ± 33.211	0.263
HDL cholesterol, mg/dL	43.41 ± 11.275	43.42 ± 9.387	0.995
Triglyceride, mg/dL	124.19 ± 72.452	107.00 ± 37.236	0.113
Adipose tissue, %	9.48 ± 10.79	16.17 ± 14.32	0.021
Fibrosis, %	5.08 ± 9.19	5.656 ± 9.81	0.770
Type of maze			0.671
LA only	6 (7.2%)	1 (3.1%)	
Both atriums	77 (92.8%)	31 (96.9%)	
Ejection fraction, %	59.06 ± 11.28	60.84 ± 13.59	0.849
LAVI, mL/m^2	93.45 ± 33.42	96.80 ± 33.67	0.641

AF, atrial fibrillation; CVA, cerebrovascular accident; LDL, low-density lipoprotein; HDL, high-density lipoprotein; LA, left atrium; LAVI, left atrial volume index.

Just Do It !


VISUALDIVE
헬스장에 안 가는 이유
1. 더운데 가지 말까
2. 추운데 가지 말까
3. 피곤한데 가지 말까
4. 어제 운동했는데 가지 말까
5. 어차피 몸짱 안 될 것 같은데 가지 말까
6. 몸짱 돼도 얼굴이 그대론데 가지 말까
7. 비 오는데 가지 말까
8. 눈 오는데 가지 말까
9. 그냥 가지 말까
기획 강영기

환자중심 의료기술 최적화 연구 사업단장

<연구사업 개요>

○ 사업 목적

공익적 가치 중심의 임상연구 지원을 통해 다양한 의료기술 간 비교효과성 등의 근거를 생성하고 이를 임상현장 및 정책과 연계함으로써 국민건강 향상과 보건의료체계 지속가능한 운영을 지원함

○ 사업 범위

허가 후 통용되고 있는 의료기술에 대한 임상연구, 중개연구 분류에서 T3 및 T4 구간에 해당

○ 사업 구조

세부사업	① 의료기술 비교평가 연구	② 의료기술 근거생성 연구
사업내용	안전성과 유효성이 검증된 의료기술 간 상대적 효과성 및 비용효과성에 관한 비교평가연구	임상현장에서 활용되고 있지만 안전성·유효성의 의학적 근거가 불충분한 의료기술에 대한 근거산출연구
세부과제 유형	▷ **전향연구**(다기관·다학제 구성) - 무작위배정비교임상시험(RCT)을 원칙으로 하되, 연구 특성에 따라 실용임상시험(PCT), 또는 전향적 코호트 연구 가능	
	▷ **후향연구** - 다양한 후향적 자료 및 2차 자료원을 활용한 성과연구	
	▷ **DB 활용 후속연구** - 기구축된 양질의 임상연구 데이터베이스(DB)를 활용·연계·결합하는 성과연구	
	▷ **가이드라인 연구**(학회의 위임·참여, 다학제 구성) - 한국형 임상진료지침의 정립이 필요한 분야의 개발(제·개정) 지원	

18 month: 1억 5천만원
KASNET registry 구축비 기증