Atrial Fibrillation Update 2018 : Obesity and Atrial Fibrillation An Epidemic of Destructive Codependency

Matthew W Ebinger DO
Genesys Regional Medical Center

Disclosures

- None

Questions 

- Atrial fibrillation epidemic/ Obesity epidemic
- Current Atrial Fibrillation Therapy
- Establish the relationship between RFM and AF
- Determine causality
- Can we do something about it
- What happens then

What We Know

Atrial Fibrillation Epidemic

- Most common sustained cardiac arrhythmia
- Incidence continues to rise
- Why

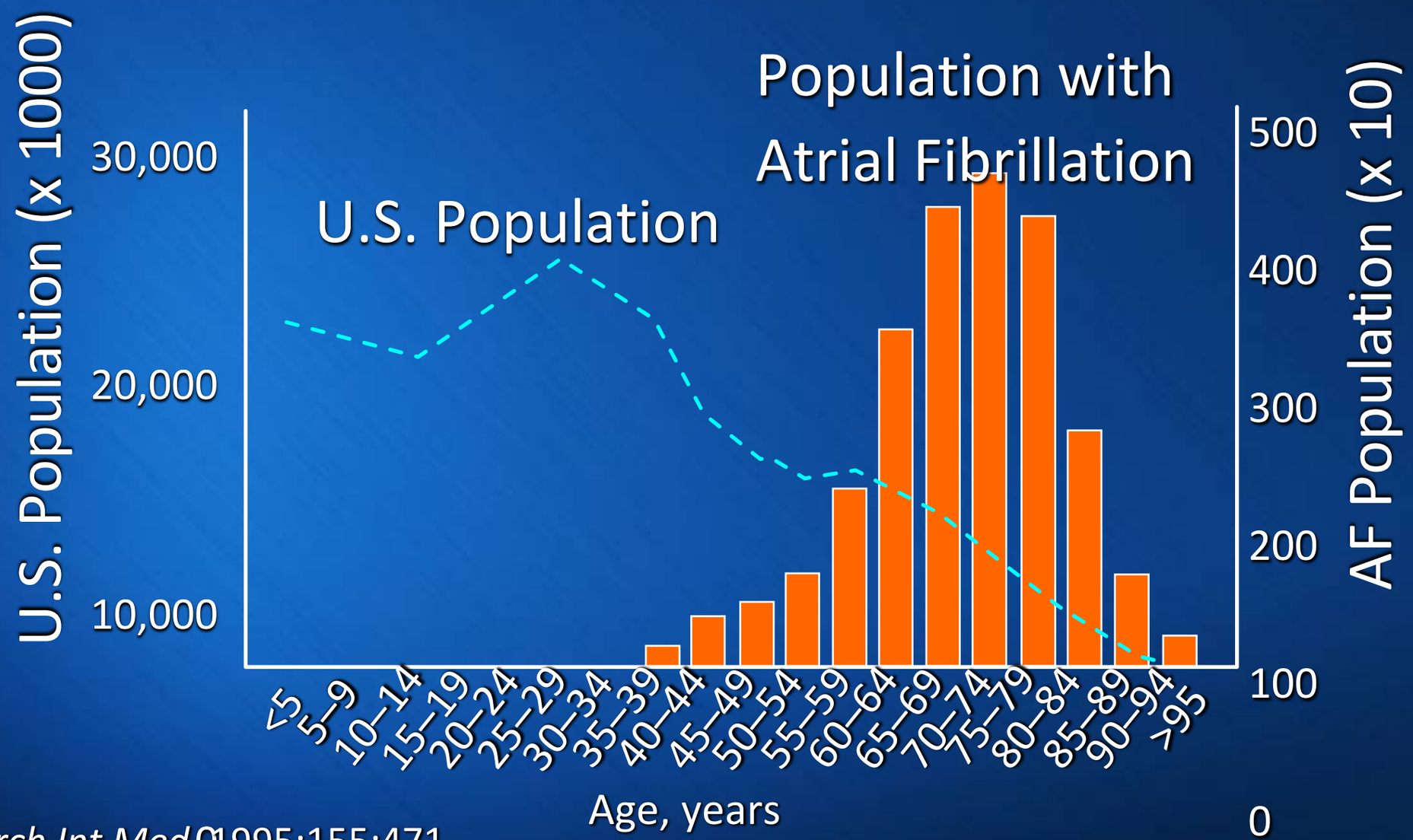
Obesity Epidemic

- 🍔🍰🍻🍟=😕
- Everyone knows its out of contro and its bad
- 78 (34.9%) million adults
- 13 million children

Atrial Fibrillation Epidemic

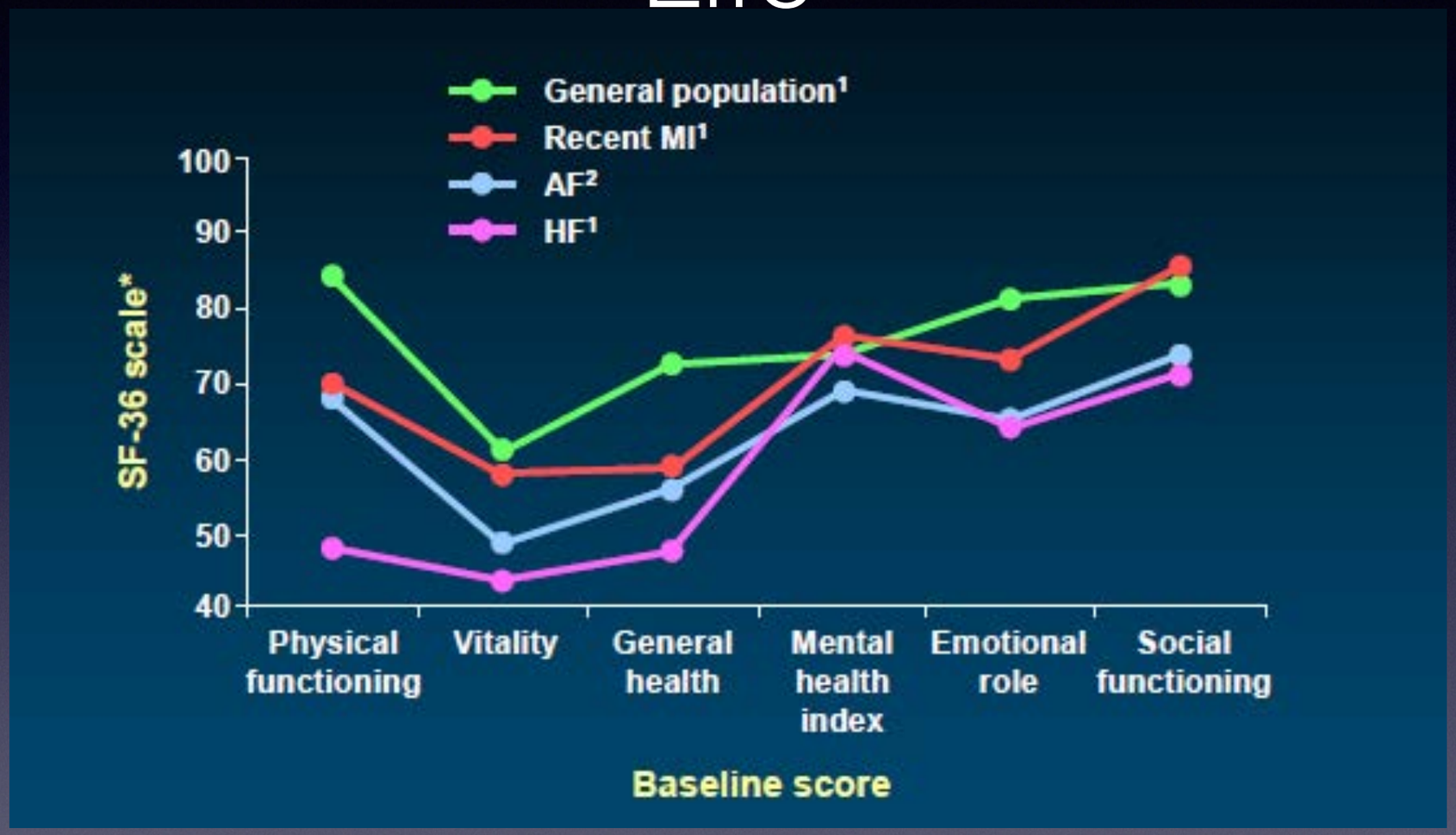
Age Distribution of People With AF

Compared With U.S. General Population



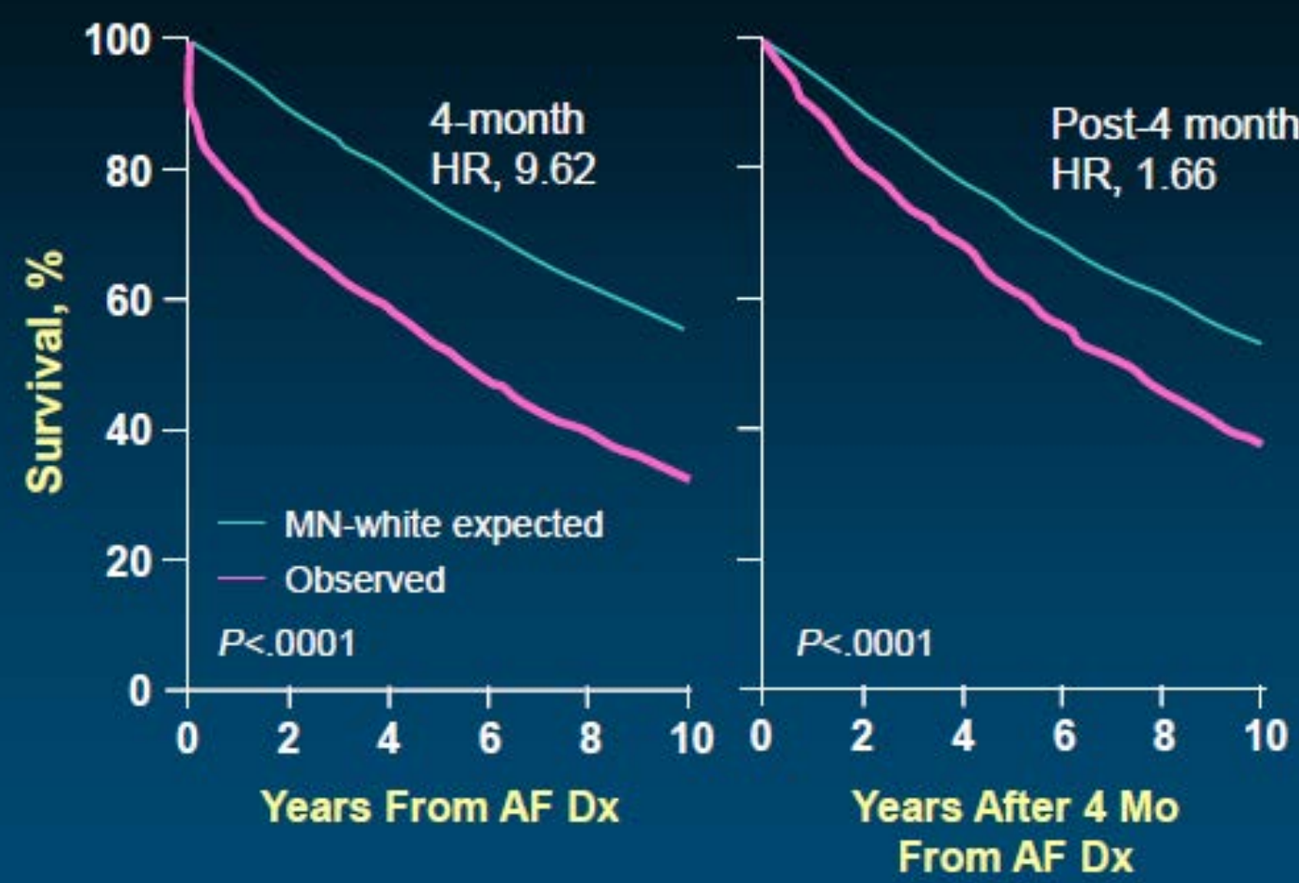
Arch Int Med. 1995;155:471.

AF Reduction In Quality of Life



1. Ware JE, et al. New England Medical Center Health Survey; 1993.
2. Dorian P, et al. *J Am Coll Cardiol*. 2000;36(3):1303-1309.

AF Increases Mortality



Reproduced with permission from Miyasaka Y, et al. *J Am Coll Cardiol*. 2007;49(9):986-992.

Mechanisms That Contribute to Atrial Fibrillation

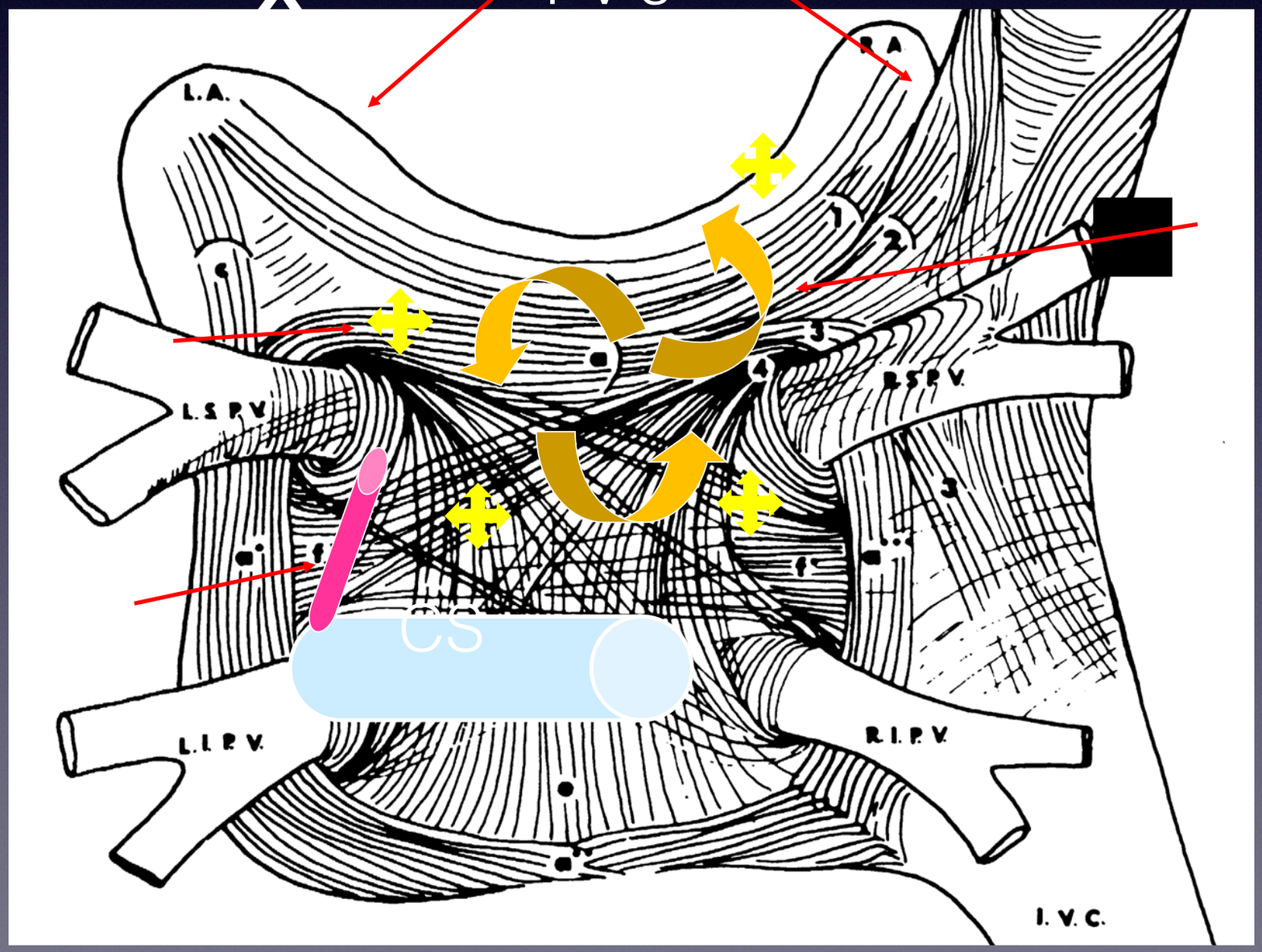
SVC

PV's

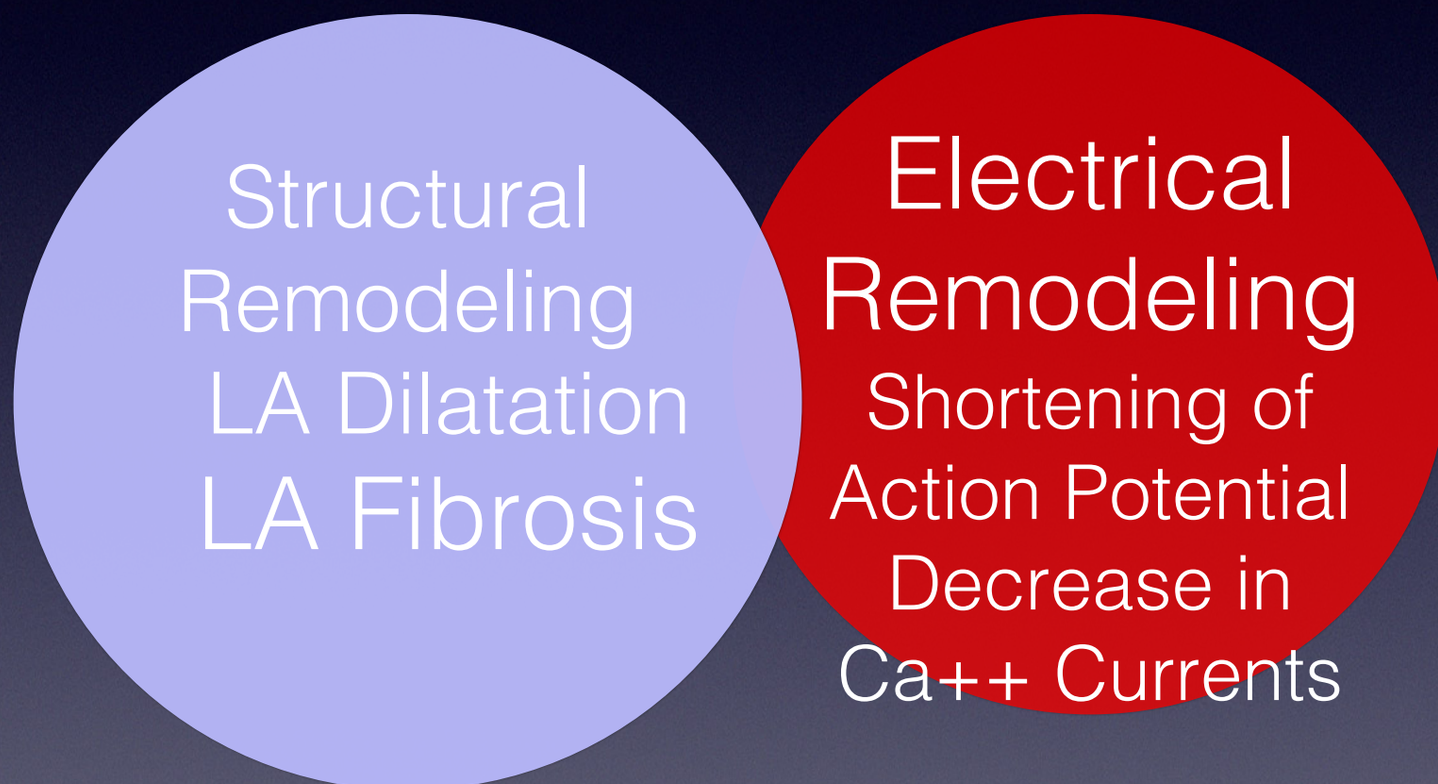
Autonomic Innervation

VOM

Rotors/ Wavelets



Atrial Remodeling



Fibrotic Atrial Cardiomyopathy

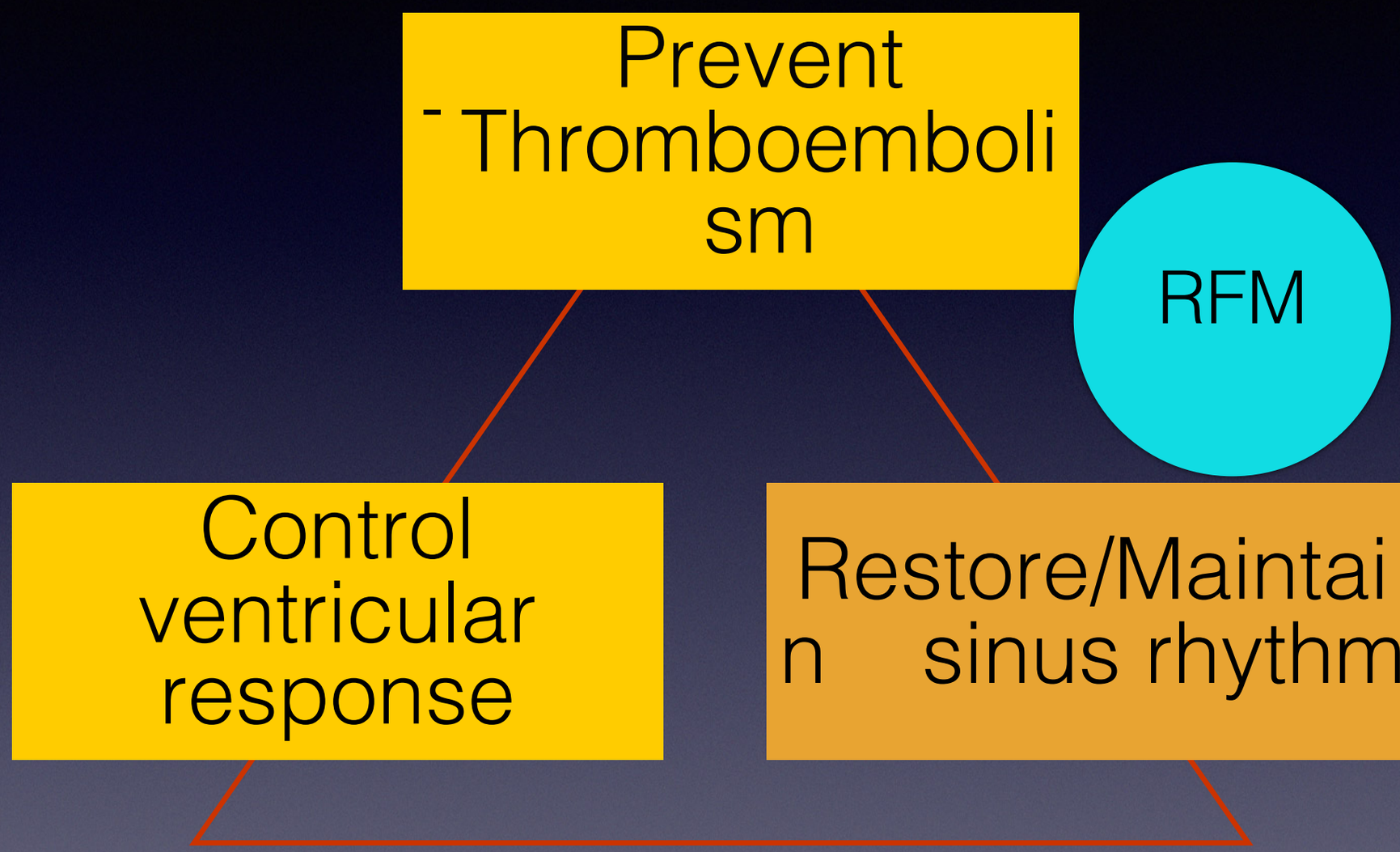
Fibrotic Atrial Cardiomyopathy: A Specific Disease/Syndrome Supplying Substrates for Atrial Fibrillation, Atrial Tachycardia, Sinus Node Disease, AV Node Disease, and Thromboembolic Complications

HANS KOTTKAMP, M.D., F.E.S.C.

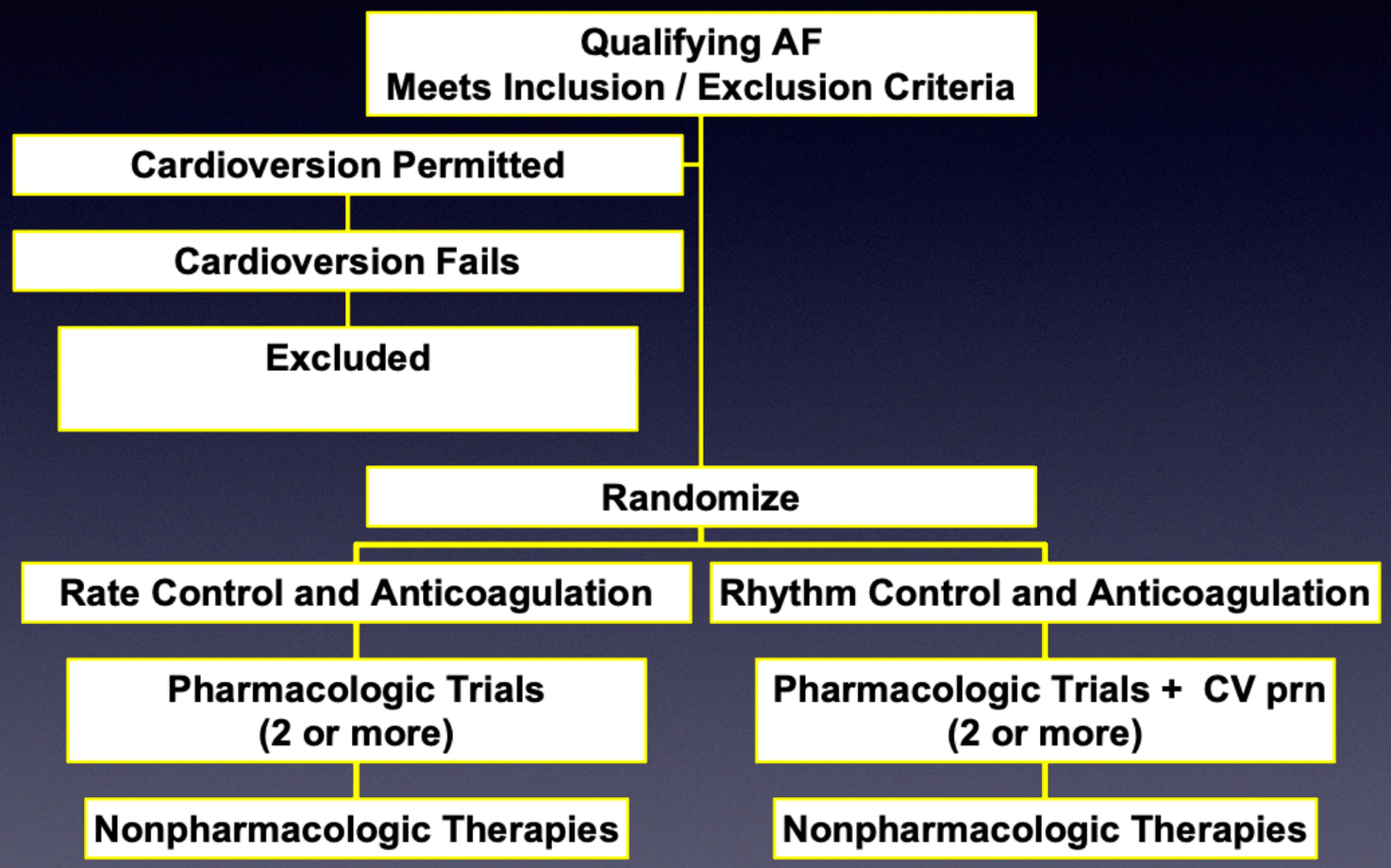
- FACM is a specific disease/syndrome supplying substrates for AF and other manifestations.
- The long help concept that "atrial begets atrial fibrillation" does not explain the variable pattern of atrial fibrosis in patients with atrial fibrillation.
- Some patients with new onset of AF have severely scarred atria.
- Other patients with longstanding AF have little fibrosis.
- Tachy-brady syndrome is likely a manifestation of FACM.
- Outcomes of ablation are impacted significantly by the extent of FACM.
- Stroke risk is related to the extent of FACM.

What We Know

Therapy for Atrial Fibrillation

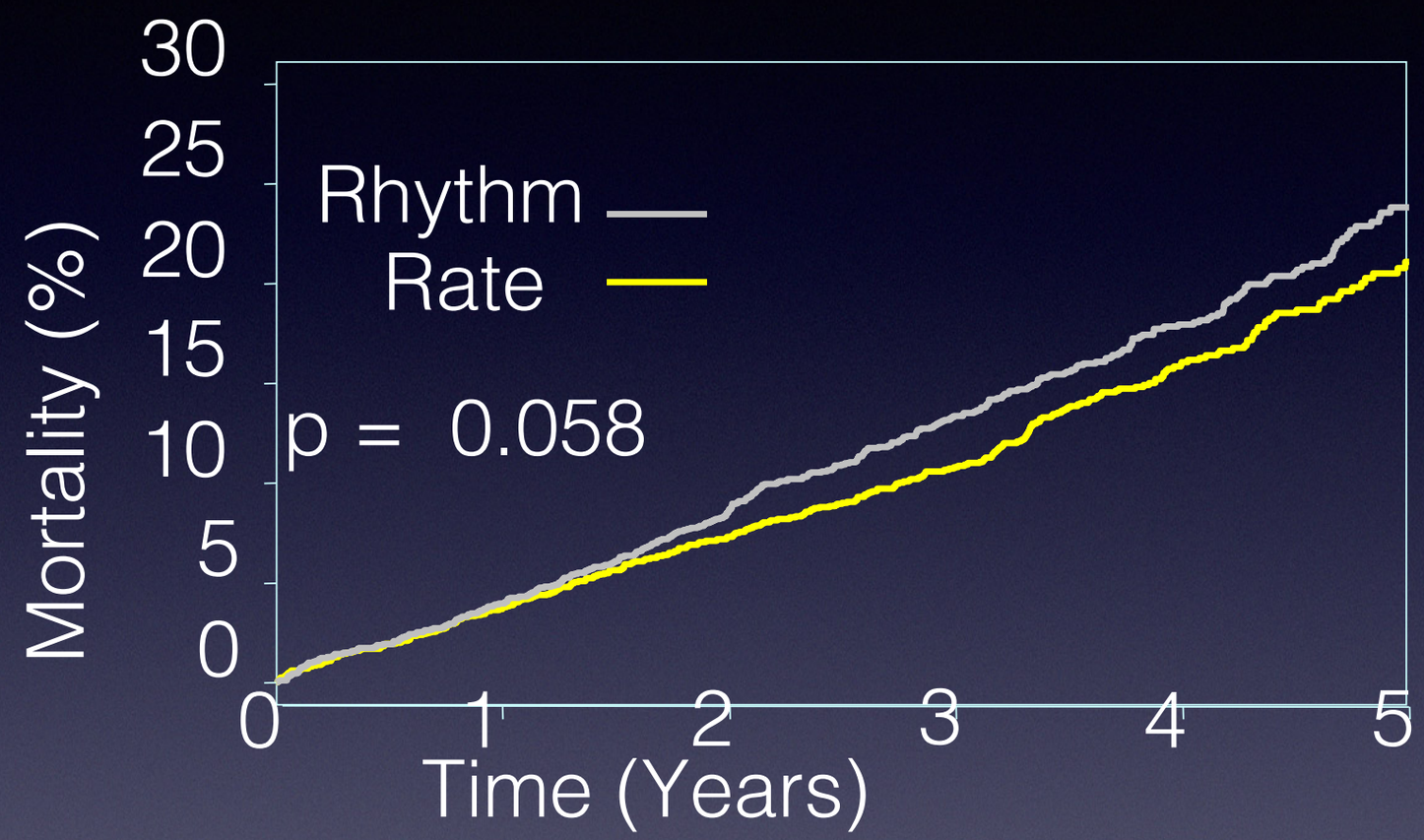


AFFIRM Study Design



American Journal of Cardiology 1997;79:1198-1202

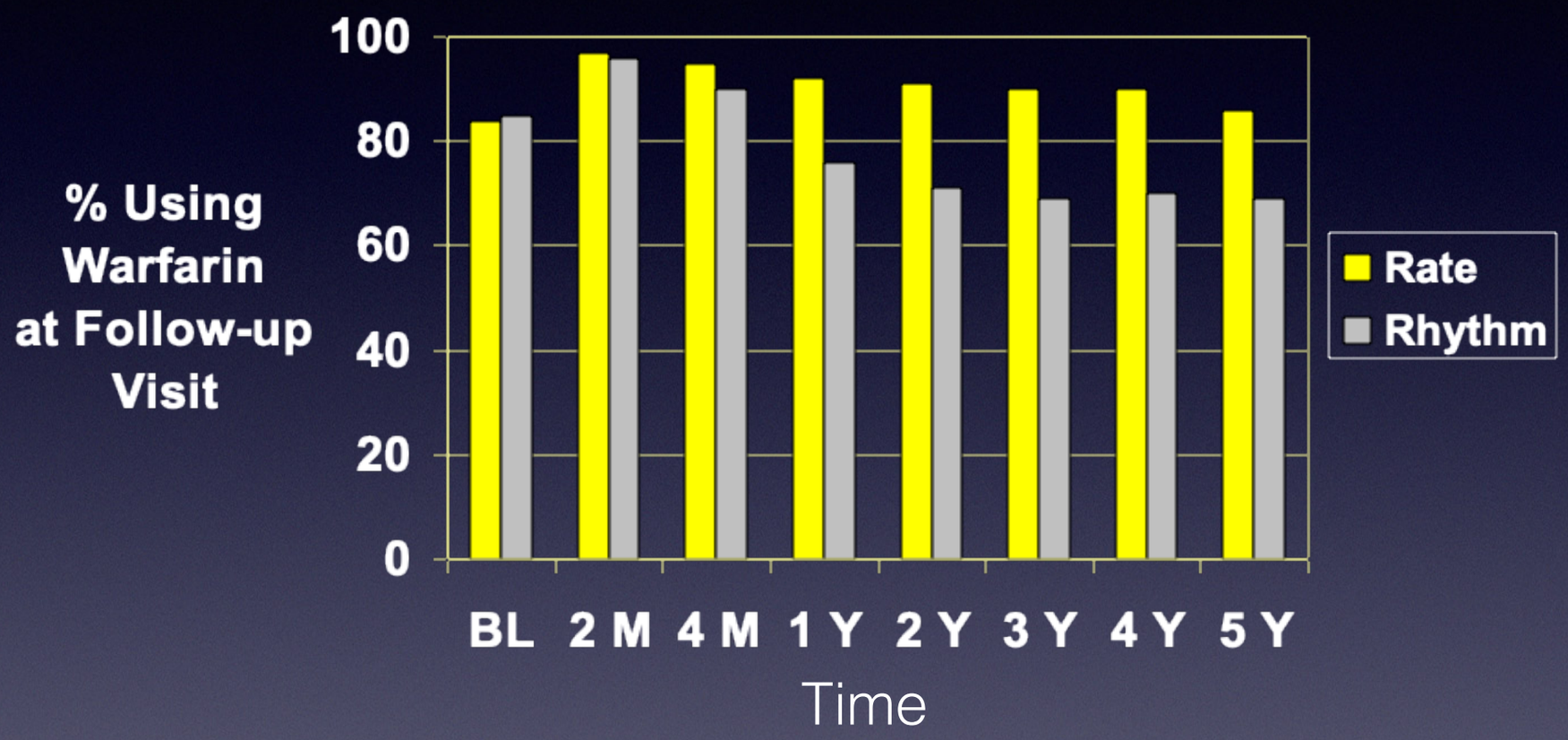
Primary Endpoint: All-Cause Mortality



Rhythm N:	2033	1932	1807	1316	780	255
Rate N:	2027	1925	1825	1328	774	236

Wyse G, et al NEJM 2002

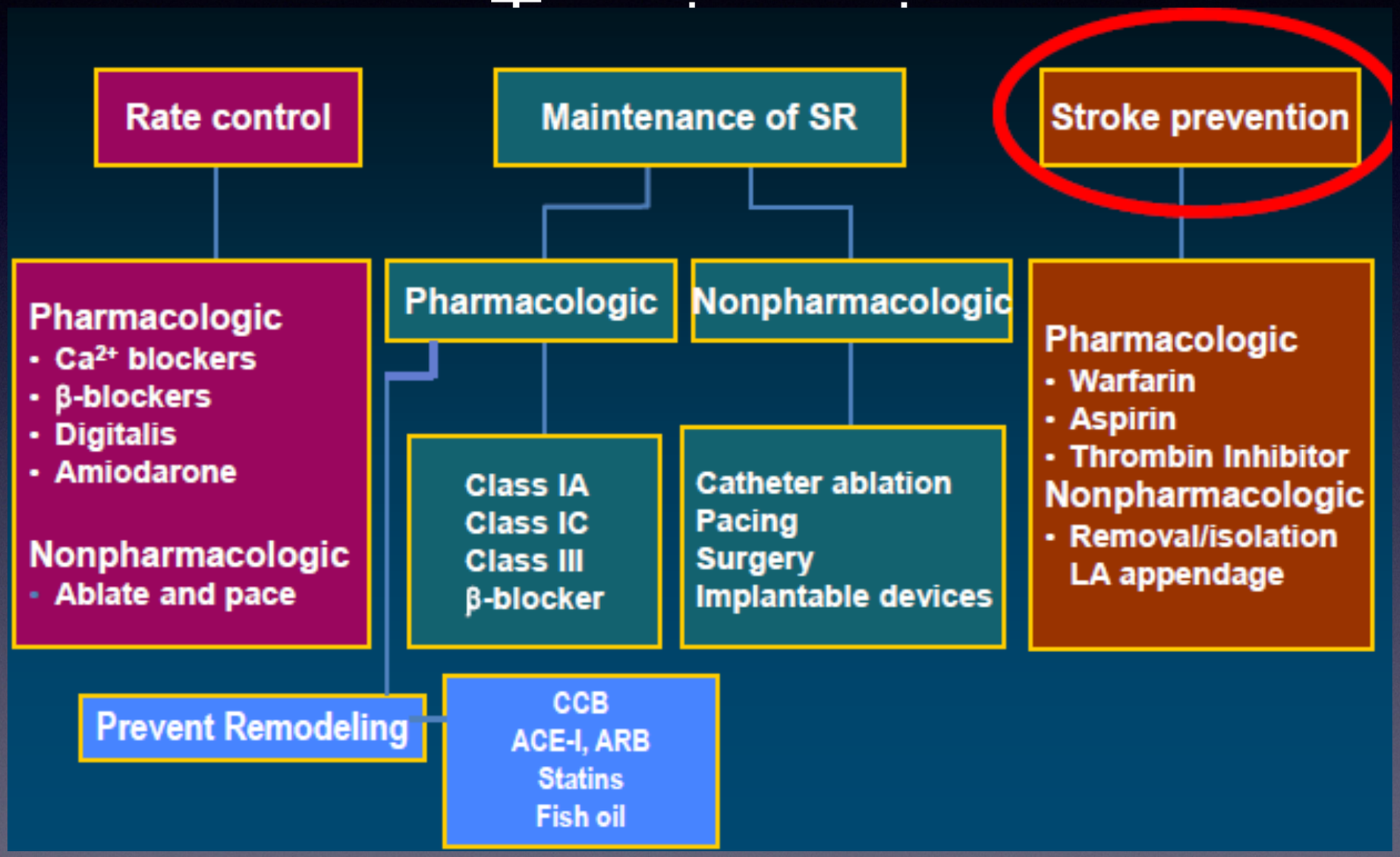
Warfarin Use



Wyse G, et al NEJM 2002
Wyse G, et al NEJM 2003

Treatment Options

Triad of Atrial Fibrillation



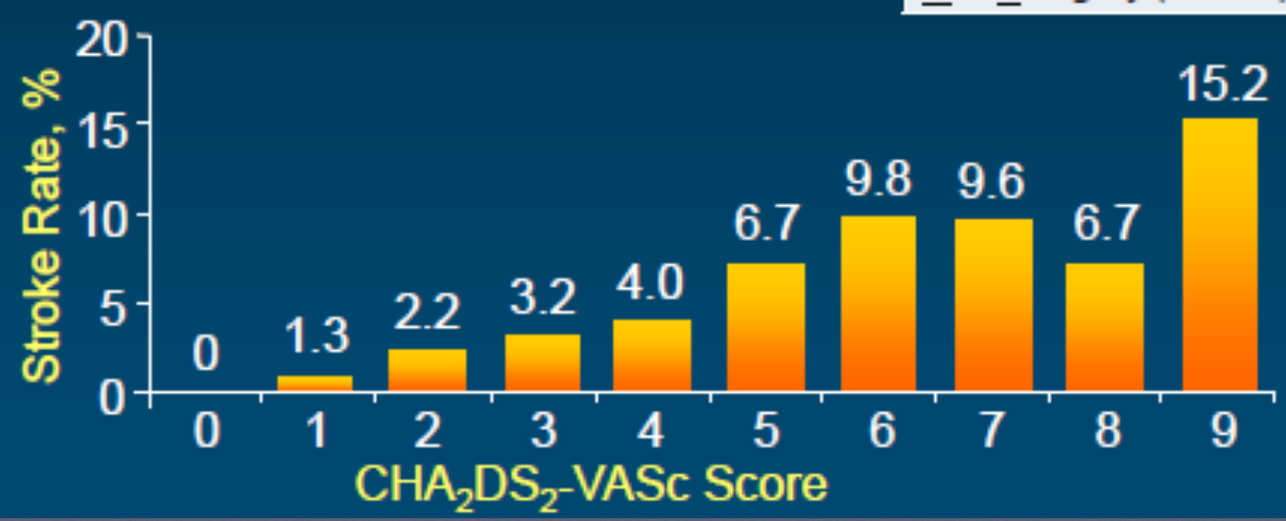
Stroke Risk Stratification

$CHADS_2$

Risk Factor	Score
Cardiac failure	1
HTN	1
Age ≥75 y	1
Diabetes	1
Stroke	2

CHA_2DS_2-VASc

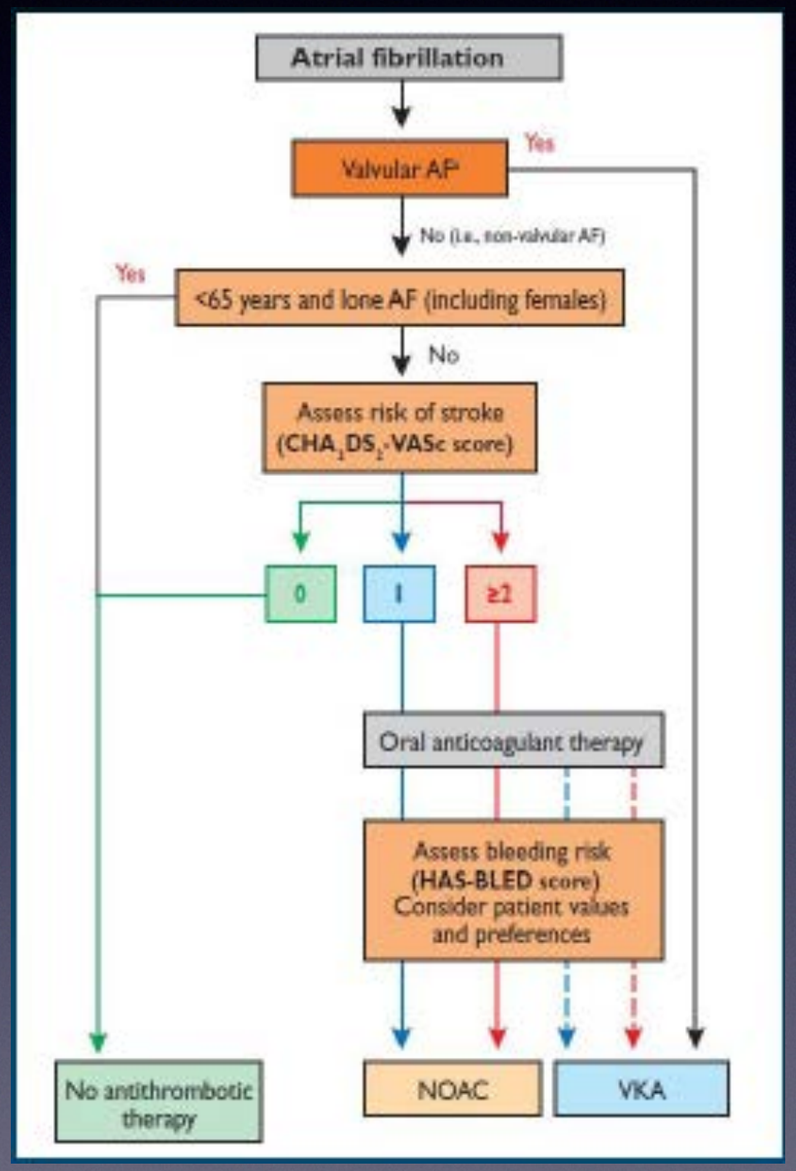
Risk Factor	Score
Cardiac failure	1
HTN	1
Age ≥75 y	2
Diabetes	1
Stroke	2
Vasc dz (MI, PAD, aortic ath)	1
Age 65-74 y	1
Sex category (female)	1



Relationship between CHA_2DS_2-VASc score and annual risk of stroke

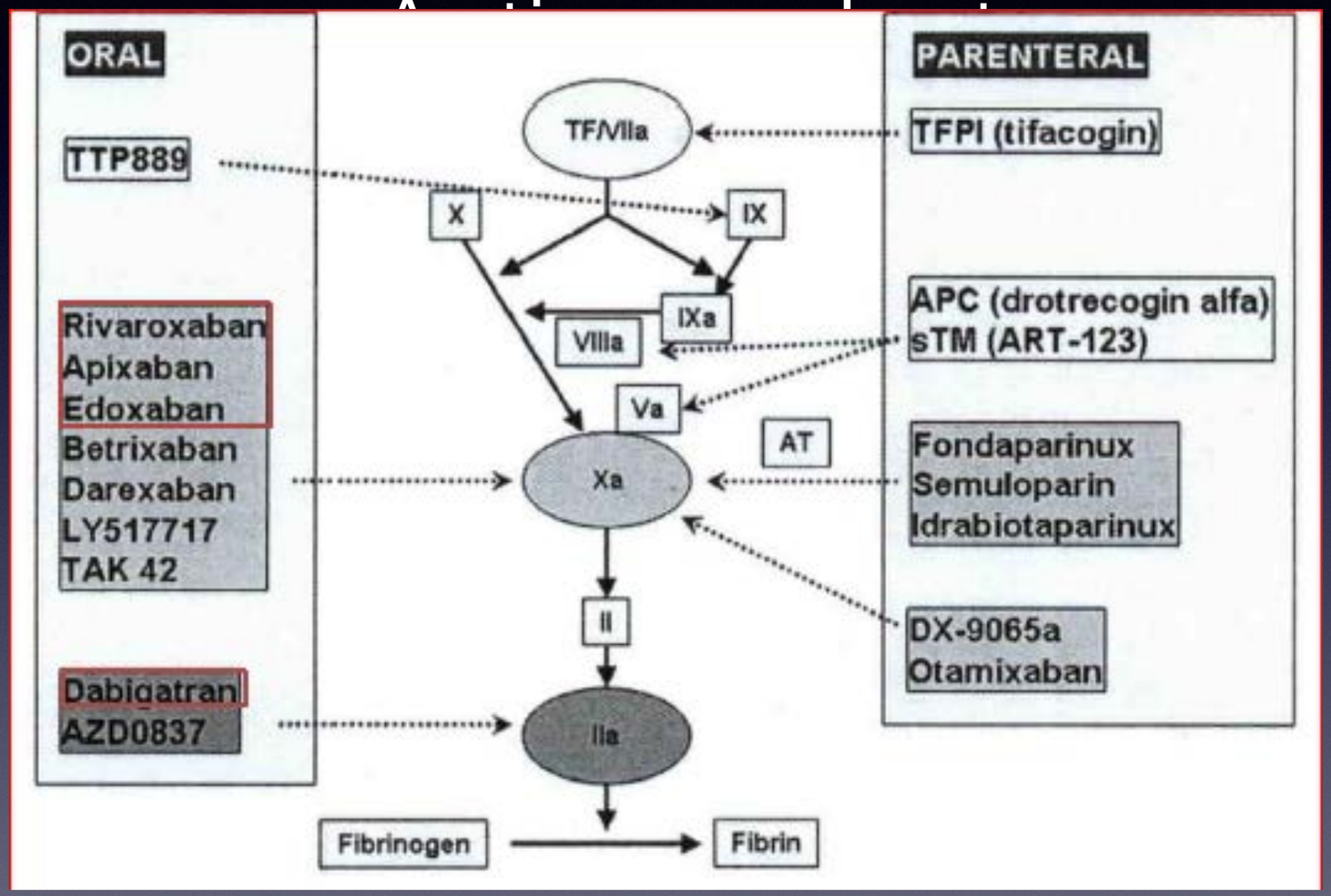
1. Lip GY, Halperin JL. *Am J Med*. 2010;123(6):484-488.
2. Camm AJ, et al. *Eur Heart J*. 2010;31(19):2369-2429.

ESC Guideline for Anticoagulation



	Clinical Characteristic	Score
H	Hypertension	1
A	Abnormal renal or liver function (1 each)	1 or 2
S	Stroke	1
B	Bleeding	1
L	Labile INR	1
E	Elderly age	1
D	Drugs or alcohol (1 each)	1 or 2
	Maximum Score	9

Targets for Novel



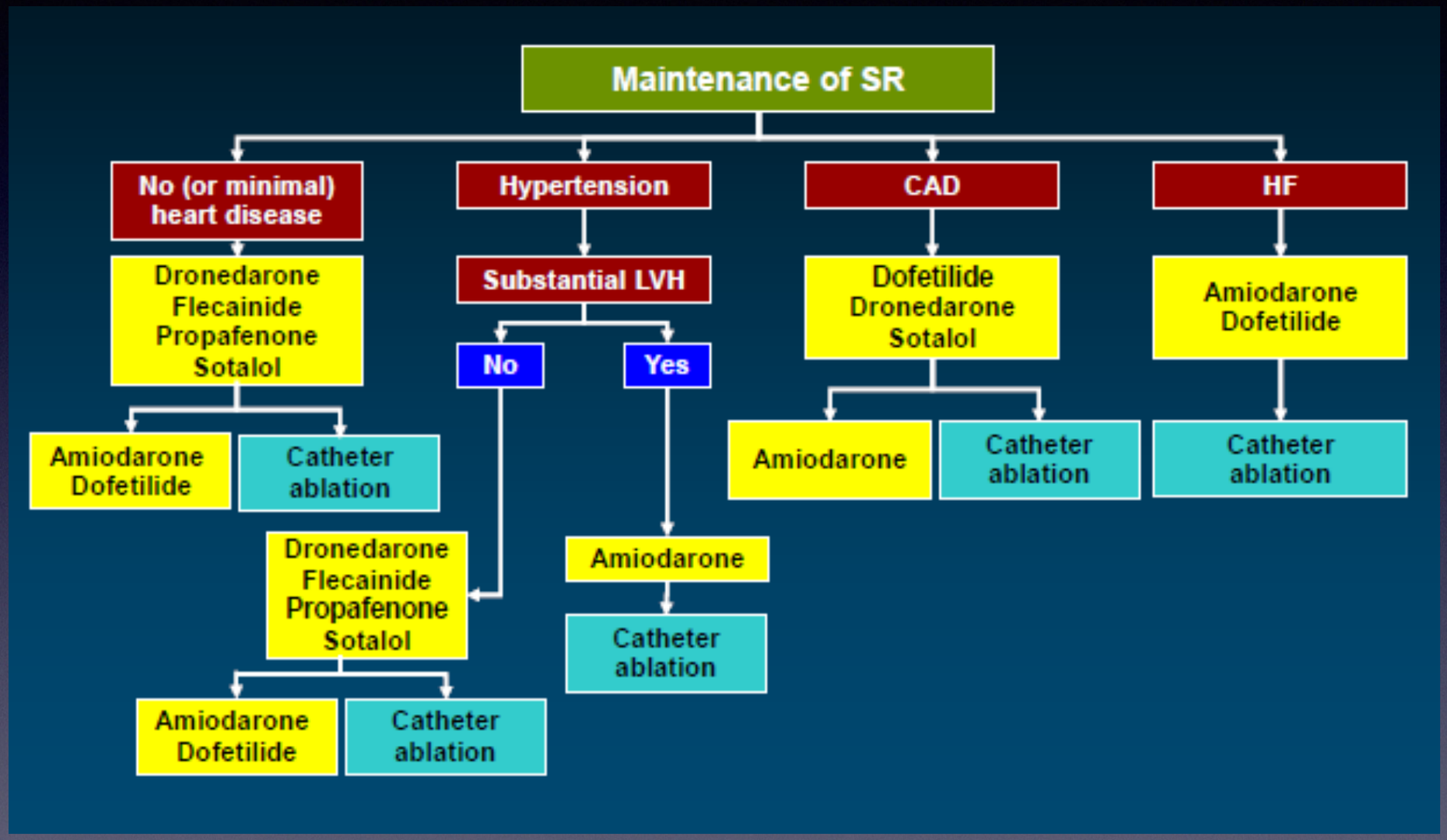
Becattini Throm Res 2012

Rate Control

Pharmacologic
- Beta blockers: Metoprolol, Esmolol
- Calcium channel blockers: Verapamil, Diltiazem
- Digoxin
- Adenosine

Non-pharmacologic
- Atrioventricular nodal ablation/ Pacemaker

Rhythm Control Therapies



Which is better
for my patients?

Post AFFIRM Approach

- No increase in mortality
  - Anticoagulated
  - Rate Controlled (documented)

- Symptomatic Patients
  - Maintenance of Sinus Rhythm
    - Pharmacologic
    - Ablation

Relationships Between Sinus Rhythm, Treatment, and Survival in the Atrial Fibrillation Follow-Up Investigation of Rhythm Management (AFFIRM) Study

The AFFIRM Investigators*

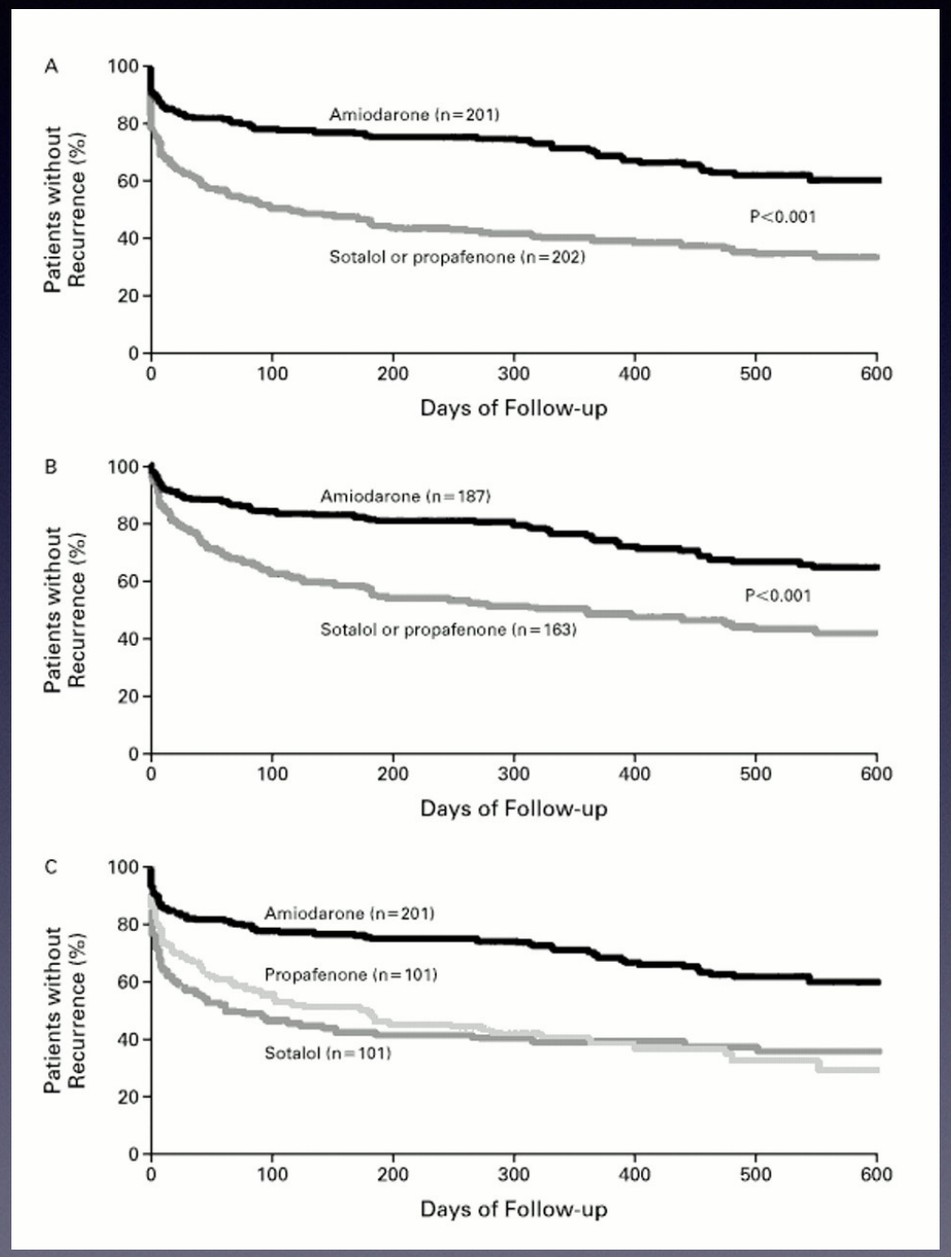
variables, and time-dependent variables. The following baseline varia ificantly associated with an increased risk of death: increasing age, coronary artery disease, congesti diabetes, stroke or transient ischemic attack, smoking, left ventricular dysfunction, and mitral regurgit he time-dependent variables, the presence of sinus rhythm (SR) was associated with a lower risk of death, as was warfarin use. Antiarrhythmic drugs (AADs) were associated with increased mortality only after adjustment for the presence of SR. Consistent with the original intention-to-treat analysis, AADs were no longer associated with mortality when SR was removed from the model.

47% RR

Conclusions—Warfarin use improves survival. SR is either an important determinant of survival or a marker for other factors associated with survival that were not recorded, determined, or included in the survival model. Currently available AADs are not associated with improved survival, which suggests that any beneficial antiarrhythmic effects of AADs are offset by their adverse effects. If an effective method for maintaining SR with fewer adverse effects were available, it might be beneficial. (*Circulation.* 2004;109:1509-1513.)

Rhythm Control Success Rates

Amiodarone: Effectiveness vs Sotalol, Propafenone



Roy, D. et. al. N Engl J Med 2000;342:913-920

Catheter Ablation Versus Antiarrhythmic Drugs for Atrial Fibrillation The A4 Study

Randomized, multicenter comparison RFA vs. additional AADs

PAF failed ≥ 1 AAD

Allowed up to 3 ablation procedures

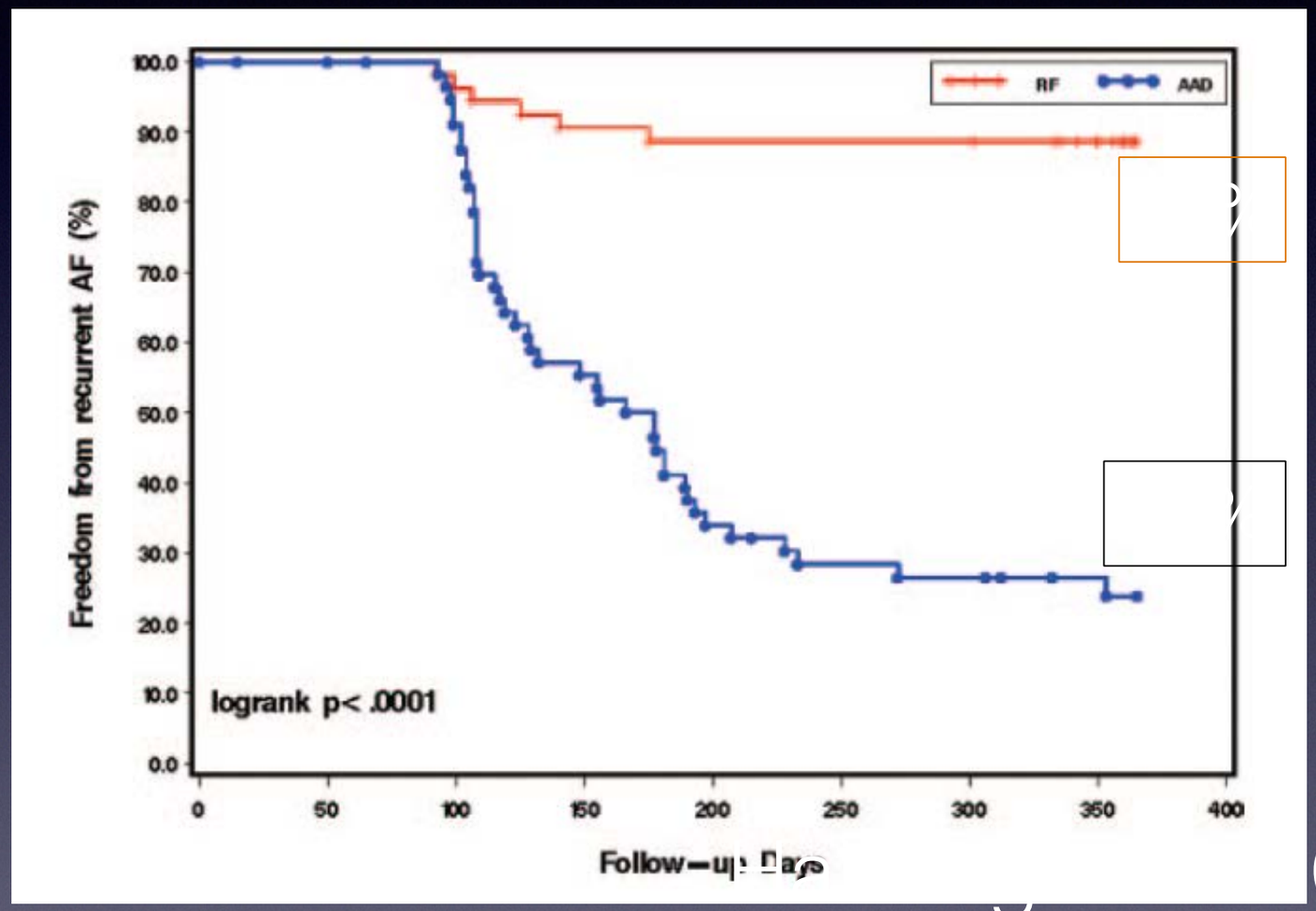
Follow-up 90-365 days, 3 mo. Blanking

AF recurrence >3 min

No restrictions on AADs alone, combo

Haissaguerre. Circ 2008; 188(24):2498-505

AF: Ablation vs. Drugs



Circ
2008; 188(24):2498-
505

Short Term Success Rates

What GRMC tells Pts

1 Procedure at 12 months

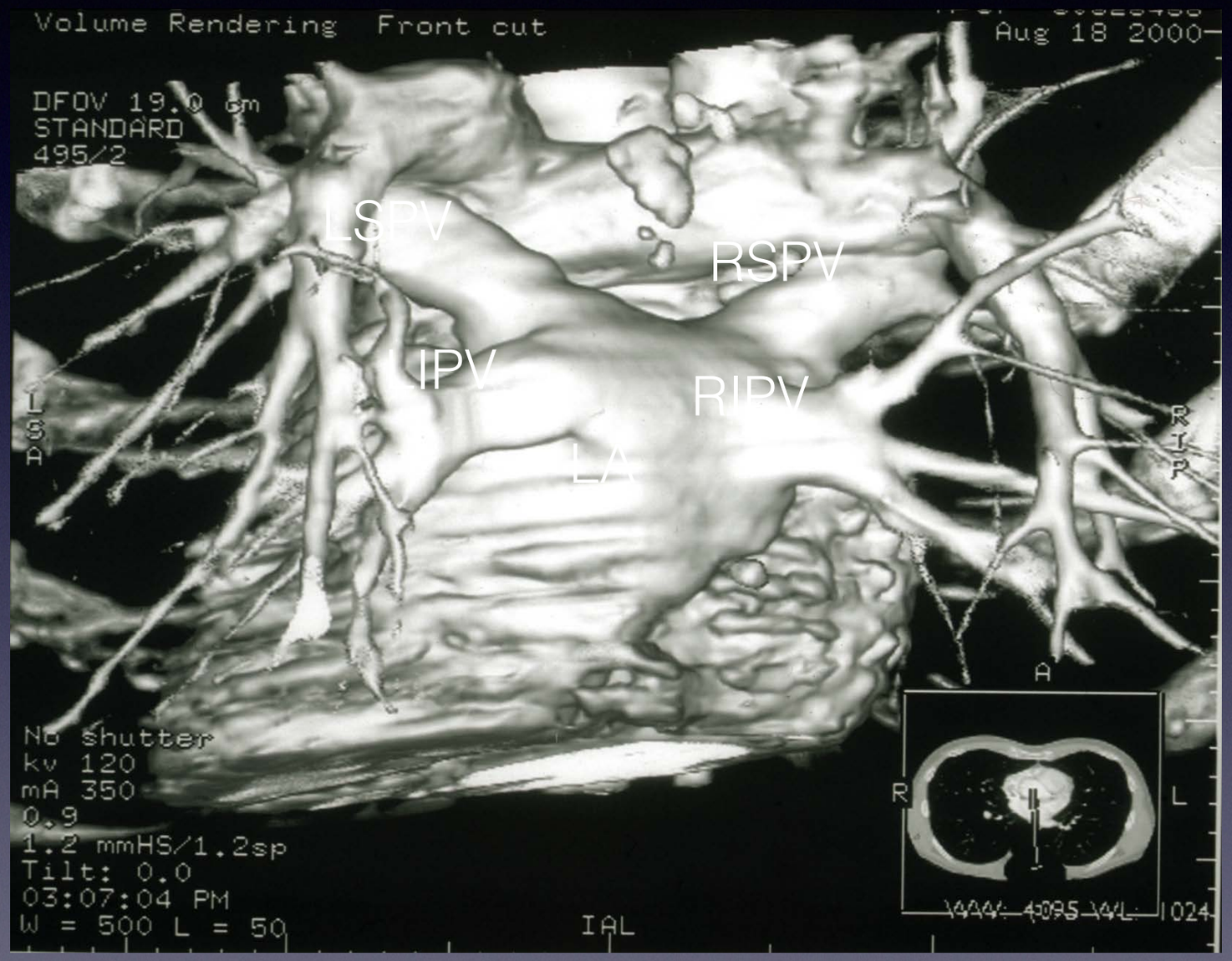
Paroxsysmal 70-80% +/- AAD

25% will require second procedure

- Persistent 60-70% +/- AAD
  - 50% will require second procedure

What is going on in Lab 4
its
4 pm already?

Spiral-CT of the Pulmonary Veins



Evolution of AF Ablation

Linear ablation in RA

Focal PV ablation

Segmental ostial PV isolation

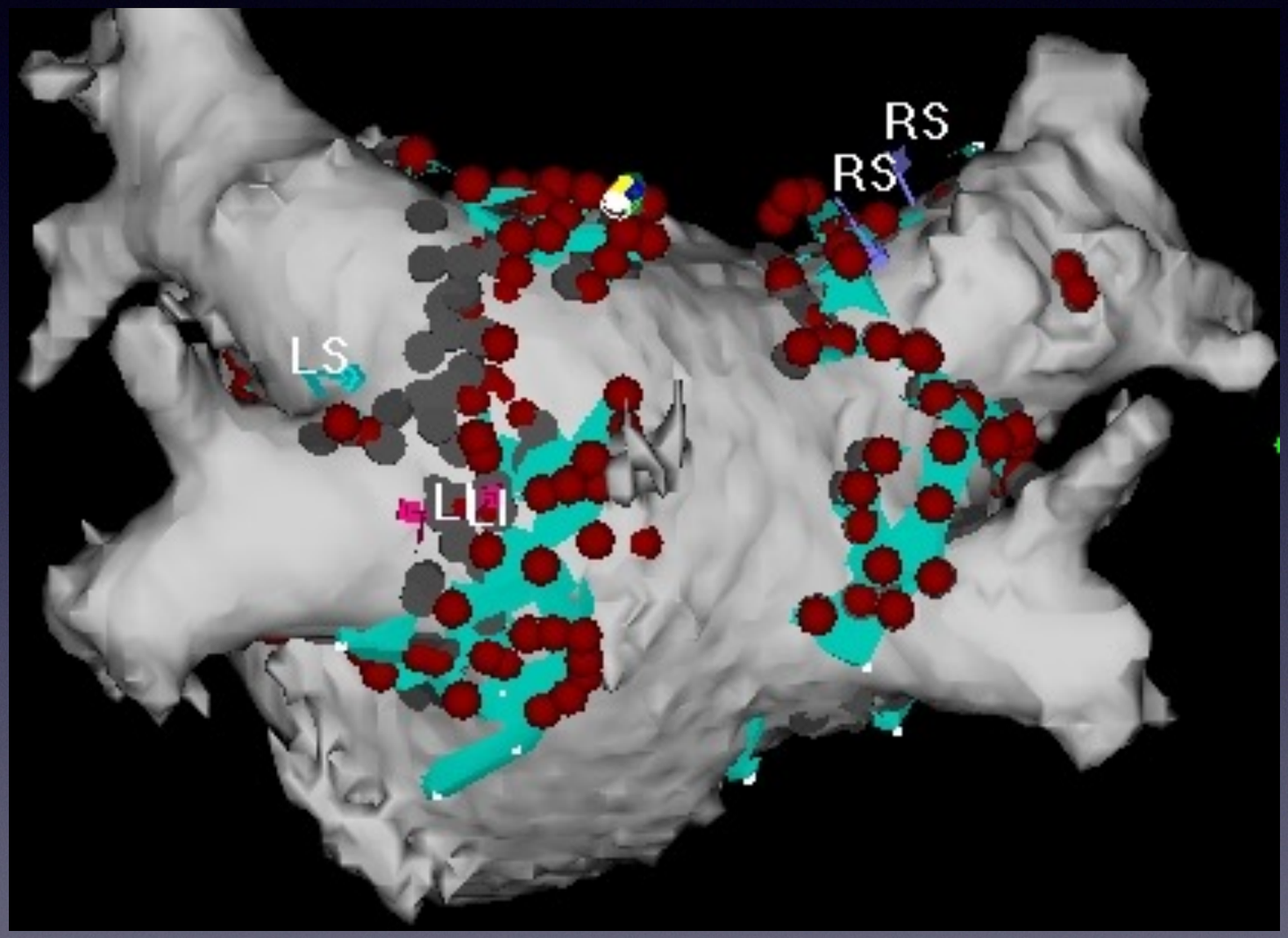
Circumferential PV ablation

Ablation of complex atrial electrograms

Tailored ablation:

- Selective PV isolation + widespread RFA of CFAEs
- Antral Ablation of all PV's ± limited RFA of CFAEs

Antral LA Ablation for PAF:



Complications of Catheter Ablation of AF

No. Patients	4000
TIA/Stroke	0.3%
Tamponade	0.4%
Pericarditis	1.0%
Pulmonary Vein Stenosis	3 (0.1%)
Atrial-Esophageal Fistula	2 (0.1%)
Phrenic Nerve Injury	2 (0.1%)

Candidates for RF Ablation of AF

Paroxysmal or persistent

Symptomatic, with impaired QOL

Inadequate response to meds

Less Ideal Candidates

- LA >55-60 mm
- Prosthetic mitral valve
- Persistent AF > 5 years

When is Catheter Ablation Appropriate 1st-Line Therapy for AF?

Young patient with idiopathic AF who is averse to long-term drug therapy

When only feasible rhythm control agent is amiodarone

In patients with low resting HR or sinus node dysfunction

Case Example

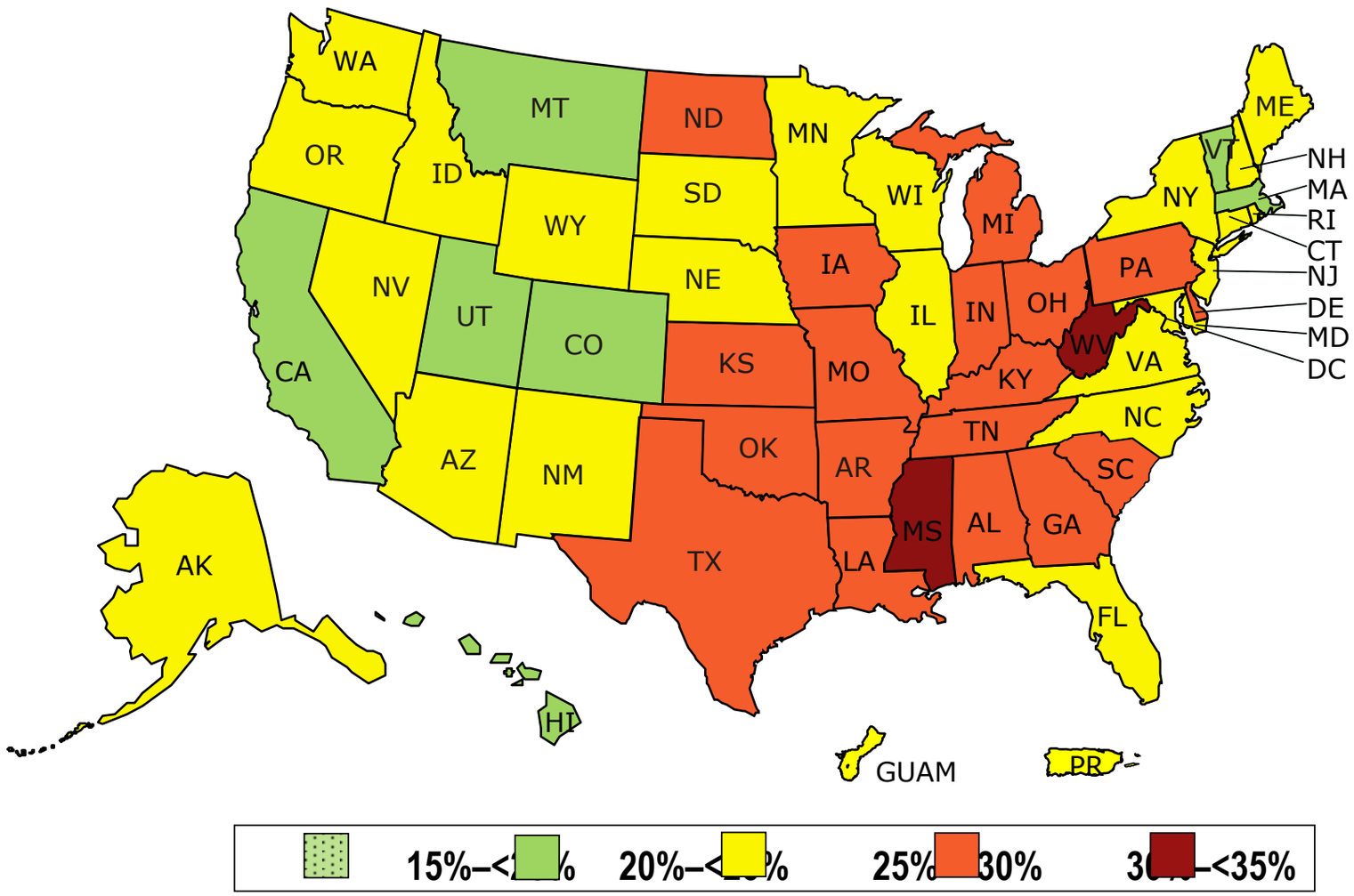
41 year old male with recurrent PAF. Episodes occurring every 3-4 months requiring ED visits and DCCV > 4 times per year. Exercises regularly aerobically with resting heart rate in low 40's but asymptomatic. Unpredictable outside of cold beverages as trigger and significantly effecting life at home and work.

Obesity Epidemic

- 🍔🍰🍻🍟=😕
- Everyone knows its out of contro and its bad
- 78 (34.9%) million adults
- 13 million children

Prevalence* of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2013

***Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.**



Source: Behavioral Risk Factor Surveillance System, CDC.

Prevalence* of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2013

Summary

- No state had a prevalence of obesity less than 20%.
- 7 states and the District of Columbia had a prevalence of obesity between 20% and <25%.
- 23 states had a prevalence of obesity between 25% and <30%.
- 18 states had a prevalence of obesity between 30% and <35%.
- 2 states (Mississippi and West Virginia) had a prevalence of obesity of 35% or greater.
- The prevalence of obesity was 27.0% in Guam and 27.9% in Puerto Rico.[+]

http://www.cdc.gov/obesity/data/prevalence-maps.html

*Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.

[+] Guam and Puerto Rico were the only US territories with obesity data available on the 2013 BRFSS.

Atrial Fibrillation and Obesity:

Connecting the Dots

QUARTERLY FOCUS ISSUE: HEART RHYTHM DISORDERS

The Long- and Short-Term Impact of Elevated Body Mass Index on the Risk of New Atrial Fibrillation

The WHS (Women's Health Study)

Usha B. Tedrow, MD, MSc,*† David Conen, MD, MPH,*§ Paul M. Ridker, MD, MPH,†‡
Nancy R. Cook, ScD,‡ Bruce A. Koplan, MD, MPH,*† JoAnn E. Manson, MD, DrPH,‡
Julie E. Buring, ScD,‡ Christine M. Albert, MD, MPH*†‡

Boston, Massachusetts; and Basel, Switzerland

Atrial Fibrillation and Obesity:

Connecting the Dots

- WHS randomized, double blind trial of low dose aspirin and it E in 39,876 females without CVD
- Randomization ended march 2004 and 4324 opted out of prospective follow up leaving 35,545 puts
- Excluded 787 pts with AF at baseline and 449 with missing BMI info
- 34,309 women with mean follow up of 12.9 yrs

JACC Vol. 55, No. 21, 2010
May 25, 2010:2319–27

Atrial Fibrillation and Obesity:

Connecting the Dots

- BMI self reported as weight(kg) divided by self reported height in meter (KG/m2)
- Reports on 24,36,60,72 and 108 months
- WHO normal<25 kg/m2; overweight 25-29 kg/m2; obese≥ 30 kg/m2
- Covariates of interest included DM, HTN, HLD, smoking, ETOH and physical activity
- Participants asked to report diagnosis of AF and those who responded were sent additional questionnaire to confirm episodes and collect additional info and permission to review medical record
- Total of 1425 self reports; 93% underwent chart review and 834 were confirmed and only confirmed events were included in analysis

JACC Vol. 55, No. 21, 2010
May 25, 2010:2319–27

Atrial Fibrillation and Obesity:

Connecting the Dots

- Baseline 6185 (18%) were obese
- Obese were more likely to have DM,HTN,HLD and were less likely to exercise and ETOH
- Each 1U increase in BMI was associated with 4.7% increase in AF risk even after adjusting for covariates of age, DM,HTN,HLD physical activity and ETOH
- Even after excluding those women who developed CVD the relationship changed little
- Those who changed BMI had expected decrease and increases in risk
    - Small number of patients who decreased BMI category with most >90% staying in same category
- Prevalence of overweight and obese over course of study with 30.8% and 18% at beginning to 34.2% and 24.2% at end

JACC Vol. 55, No. 21, 2010
May 25, 2010:2319–27

Atrial Fibrillation and Obesity:
Connecting the Dots

- Conclusion
  - BMI strongly associated with subsequent development of AF
    - Even after accounting for CVD development and other AF risk factors
  - Relationship linear with each increase in BMI a 4.7% increase in risk of incident AF
  - Study participants who became obese during the first 60 mo had 41% adjusted risk in development in AF compared to those who maintained BMI $\leq$ 30 kg/m2

JACC Vol. 55, No. 21, 2010
May 25, 2010:2319–27

Obesity and AF Relationship: Cause and Effect vs Association?

Electrophysiological, Electroanatomical, and Structural Remodeling of the Atria as Consequences of Sustained Obesity

Rajiv Mahajan, MD, PHD,* Dennis H. Lau, MBBS, PHD,* Anthony G. Brooks, PHD,* Nicholas J. Shipp, PHD,* Jim Manavis, PHD,y John P.M. Wood, D PHIL,z John W. Finnie, BVSC, PHD,x Chrishan S. Samuel, PHD,k Simon G. Royce, PHD,k Darragh J. Twomey, MBBS,* Shivshanker Thanigaimani, PHD,*
Jonathan M. Kalman, MBBS, PHD,{ Prashanthan Sanders, MBBS, PHD*

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 1, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.04.058

Electrophysiological, Electroanatomical, and Structural Remodeling of the Atria as Consequences of Sustained Obesity

OBJECTIVES This study sought to delineate the development of global electrophysiological and structural substrate for AF in sustained obesity.

METHODS Ten sheep fed ad libitum calorie-dense diet to induce obesity over 36 weeks were maintained in this state for another 36 weeks; 10 lean sheep with carefully controlled weight served as controls. All sheep underwent electro-physiological and electroanatomic mapping; hemodynamic and imaging assessment (echocardiography and dual-energy x-ray absorptiometry); and histology and molecular evaluation. Evaluation included atrial voltage, conduction velocity (CV), and refractoriness (7 sites, 2 cycle lengths), vulnerability for AF, fatty infiltration, atrial fibrosis, and atrial trans- forming growth factor (TGF)-b1 expression.

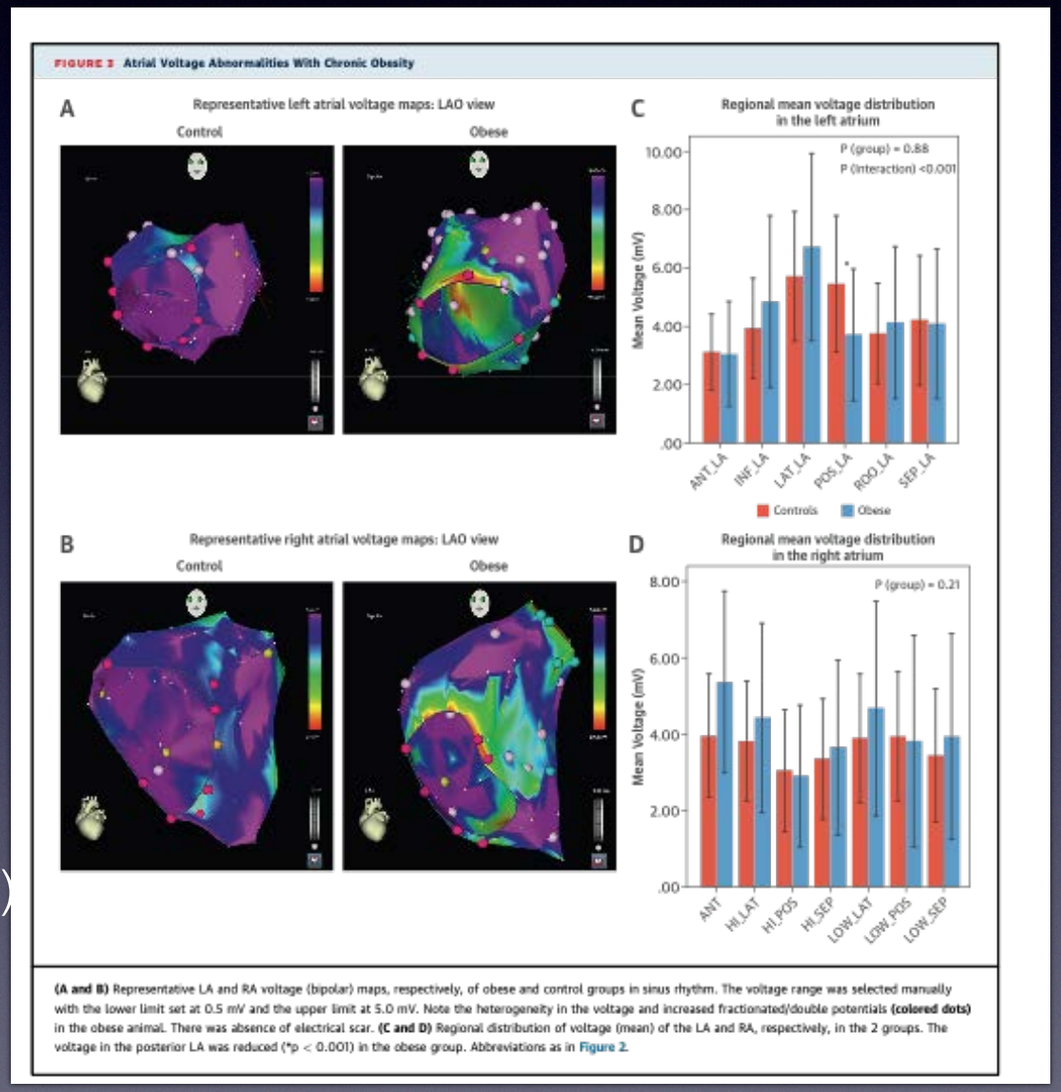
JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 1, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.04.058

Electrophysiological, Electroanatomical, and Structural Remodeling of the Atria as Consequences of Sustained Obesity

- Study Group
  - 10 Obese sheep
  - 10 Control sheep
- All had the following studies performed
  - 2D echo,Hemodynamic Assesment, EPS (ERP, AF Vunerability and duration) Electroanatomic Mapping, Histological Assesment(fatty infiltration, fibrosis assesment TGF1 espression)



JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 1, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.04.058

Electrophysiological, Electroanatomical, and Structural Remodeling of the Atria as Consequences of Sustained Obesity

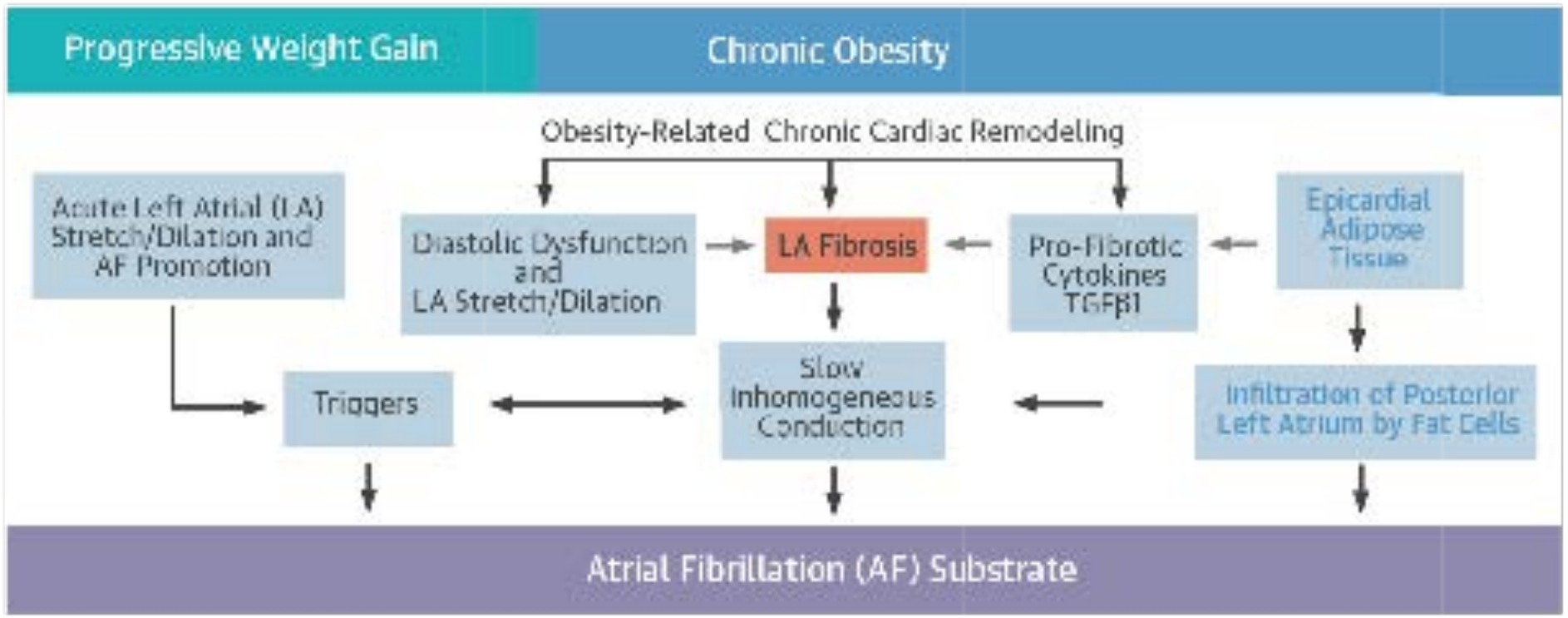
- Results
  - Structural and Hemodynamics
    - LA was enlarged with increases in pressure without change in LVEF
    - More Fibrosis, Scarring and Fatty Infiltration in Obese Sheep
  - Electrophysiologic Changes
    - Atrial Refractoriness was unchanged while conduction velocities were significantly longer in obese sheep
    - Increases in Complex Fractionated Electrograms
    - Posterior LA voltages were significantly reduced in Obese Sheep
    - Mean number of AF episodes and duration was greater in Obese Sheep

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY
ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 1, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.04.058

CENTRAL ILLUSTRATION **Obesity and the Substrate for AF**



Mahajan, R. et al. J Am Coll Cardiol. 2015; 66(1):1-11.

Progressive weight gain has been demonstrated to result in atrial stretch and leads to the development of high-frequency triggers and the substrate for AF. With chronic obesity, there is greater epicardial adipose tissue, activation of the cytokines, and the development of fibrosis. In addition, there is infiltration of the contiguous atrial myocardium by fat cells. All of these result in the milieu of slowed and inhomogeneous conduction that forms the substrate for AF. AF = atrial fibrillation; LA = left atrial; TGF = transforming growth factor.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 1, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.04.058

Electrophysiological, Electroanatomical, and Structural Remodeling of the Atria as Consequences of Sustained Obesity

- Conclusion

- Sustained chronic obesity results in chronic stretch, fibrosis, conduction abnormalities and increased vulnerability to AF.

- Increases in TGF-1 previously associated cytokine linked to atrial fibrosis was five times higher in Obese Sheep and is hypothesized to be related to epicardial fat and the associated hypoxia of expanding atrial adipose tissue.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 1, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.04.058

Treatment of Obstructive Sleep Apnea Reduces the Risk of Atrial Fibrillation Recurrence After Catheter Ablation

Adam S. Fein, MD, Alexei Shvilkin, MD, PHD, Dhaval Shah, MD, Charles I. Haffajee, MD, Saumya Das, MD, Kapil Kumar, MD, Daniel B. Kramer, MD, Peter J. Zimetbaum, MD, Alfred E. Buxton, MD, Mark E. Josephson, MD, Elad Anter, MD

Boston, Massachusetts

Journal of the American College of Cardiology

Vol. 62, No. 4, 2013 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2013.03.052

Treatment of OSA Reduces the Risk of Atrial Fibrillation Recurrence After Catheter Ablation

- Well Documented Association of OSA and AF (nocturnal hypoxemia, increased sympathetic tone, LA stretch, Oxidative stress)
- Beth Israel Deaconess Pts with OSA referred for AF Ablation
- Pts divided into four groups
- Assignment into treatment group CPAP happened preoperative period so + CPAP had therapy for 3 mo prep

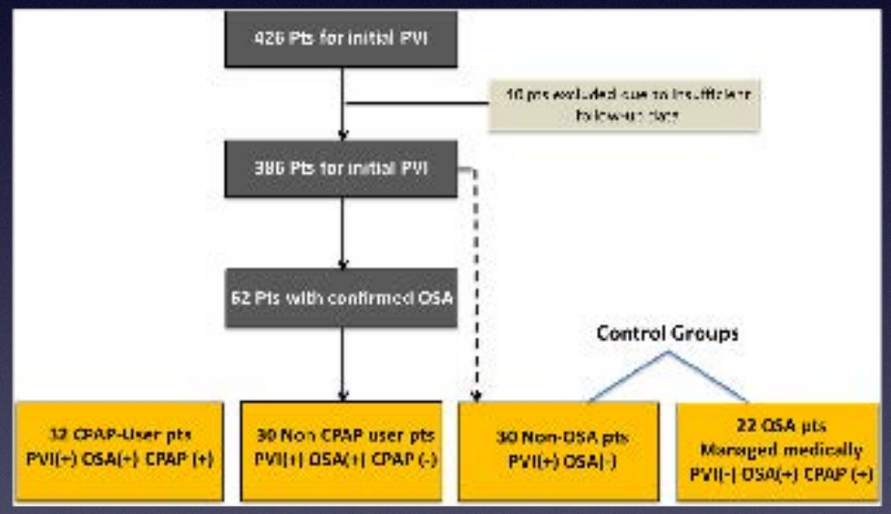


Figure 1 Study Cohort: Flowchart

Flow diagram showing the establishment of the study cohort and division into treatment groups (shown in **dark gray** and control groups in **light gray**). CPAP = continuous positive airway pressure; OSA = obstructive sleep apnea; pts = patients; PVI = pulmonary vein isolation.

Journal of the American College of Cardiology
! 2013 by the American College of Cardiology Foundation Published by Elsevier Inc.

Vol. 62, No. 4, 2013 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2013.03.052

Treatment of OSA Reduces the Risk of Atrial Fibrillation Recurrence After Catheter Ablation

- Ablation protocol was standard PVI approach with AAD discontinued 5 t1/2 prior to procedure and amiodarone 2 weeks prior
- Follow-up pts administered AAD and warfarin with clinic visits (1,3,6,12 mo) and two weeks of transtelephonic monitoring at 3,6,12 mo
- Absence of arrhythmia AAD were discontinued between 3 an 6 mo
- Follow up of 1 yr

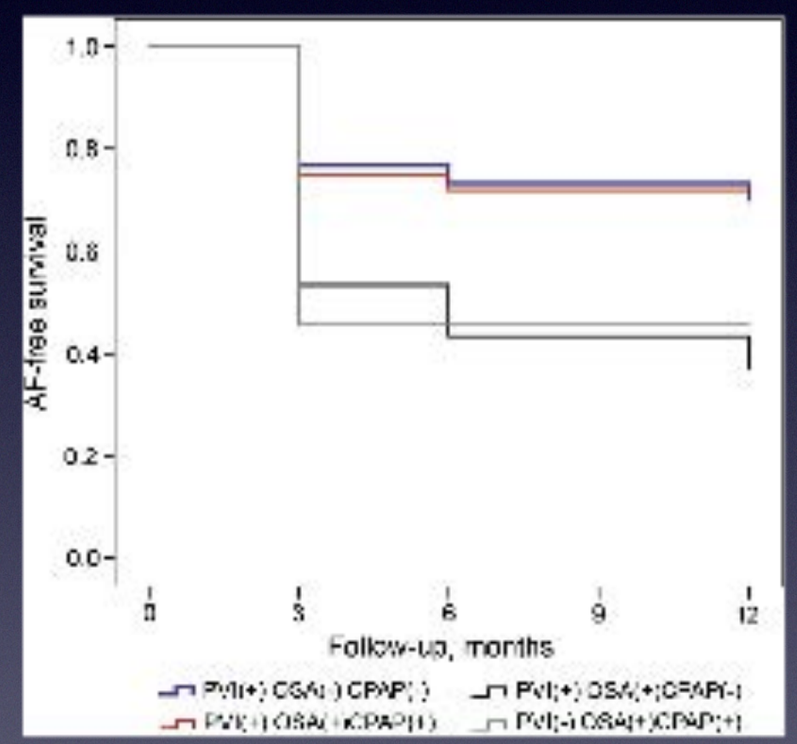


Figure 2 Kaplan-Meier Survival Curves According to Treatment Group

Log-rank p = 0.02. AF = atrial fibrillation; other abbreviations as in Figure 1.

Journal of the American College of Cardiology

Vol. 62, No. 4, 2013 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2013.03.052

Treatment of OSA Reduces the Risk of Atrial Fibrillation Recurrence After Catheter Ablation

- Arrhythmia free survival on AAD was significantly higher in CPAP User vs Non-users 65.6% vs 33.3%
- OSA (+) CPAP (-) pts had 2 fold increase in recurrence of AF as compared to treated group
- CPAP treated had event free survival similar to that of pts without OSA

Journal of the American College of Cardiology

Vol. 62, No. 4, 2013 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2013.03.052

Can We Do Anything??

😎👍🏻

Influencing Obesity

Long-Term Effect of Goal-Directed Weight Management in an Atrial Fibrillation Cohort

A Long-Term Follow-Up Study (LEGACY)

Rajeev K. Pathak, MBBS,* Melissa E. Middeldorp,* Megan Meredith,* Abhinav B. Mehta, MAcrSr,†
Rajiv Mahajan, MD, PhD,* Christopher X. Wong, MBBS, PhD,*‡ Darragh Twomey, MBBS,* Adrian D. Elliott, PhD,*§
Jonathan M. Kalman, MBBS, PhD,¶ Walter P. Abhayaratna, MBBS, PhD,# Dennis H. Lau, MBBS, PhD,*
Prashanthan Sanders, MBBS, PhD*

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 65, NO. 20, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.03.002

Long-Term Effect of Goal-Directed Weight Management in an Atrial Fibrillation Cohort A Long-Term Follow-Up Study (LEGACY)

- Obesity and AF epidemics connected
- ? critical weight loss required to influence AF burden
- ? If fluctuations in weight may affect AF burden

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 65, NO. 20, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.03.002

Long-Term Effect of Goal-Directed Weight Management in an Atrial Fibrillation Cohort A Long-Term Follow-Up Study (LEGACY)

- Study Population: Consecutive pts referred for management of parox/persistent AF
- BMI $\geq$ 27 kg/m2 were included
- Exclusion Criteria: Permanent AF, MI, valvular AF, LV dysfunction or < 24mo F/U
- Pts counseled on importance of risk factor management with option to participate in physician led weight program
- Face to face counseling with initial weight reduction by meal plan and behavior modification

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 65, NO. 20, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.03.002

Long-Term Effect of Goal-Directed Weight Management in an Atrial Fibrillation Cohort A Long-Term Follow-Up Study (LEGACY)

- <3% weight loss in first 3 mo go super low calorie diet
- Low intensity exercise prescribed 20 min 3x week increased to 200min of moderate exercise weekly
- Goal was 10% reduction of body weight
  - target BMI $\leq$ 25 kg/m2
- Weight loss divided into 3 groups:
  - group (1)> 10% , group (2)3-9%, group (3)<3%
- Weight trend: linear gain or loss or fluctuation if $\geq$1% on 2 consecutive weigh ins

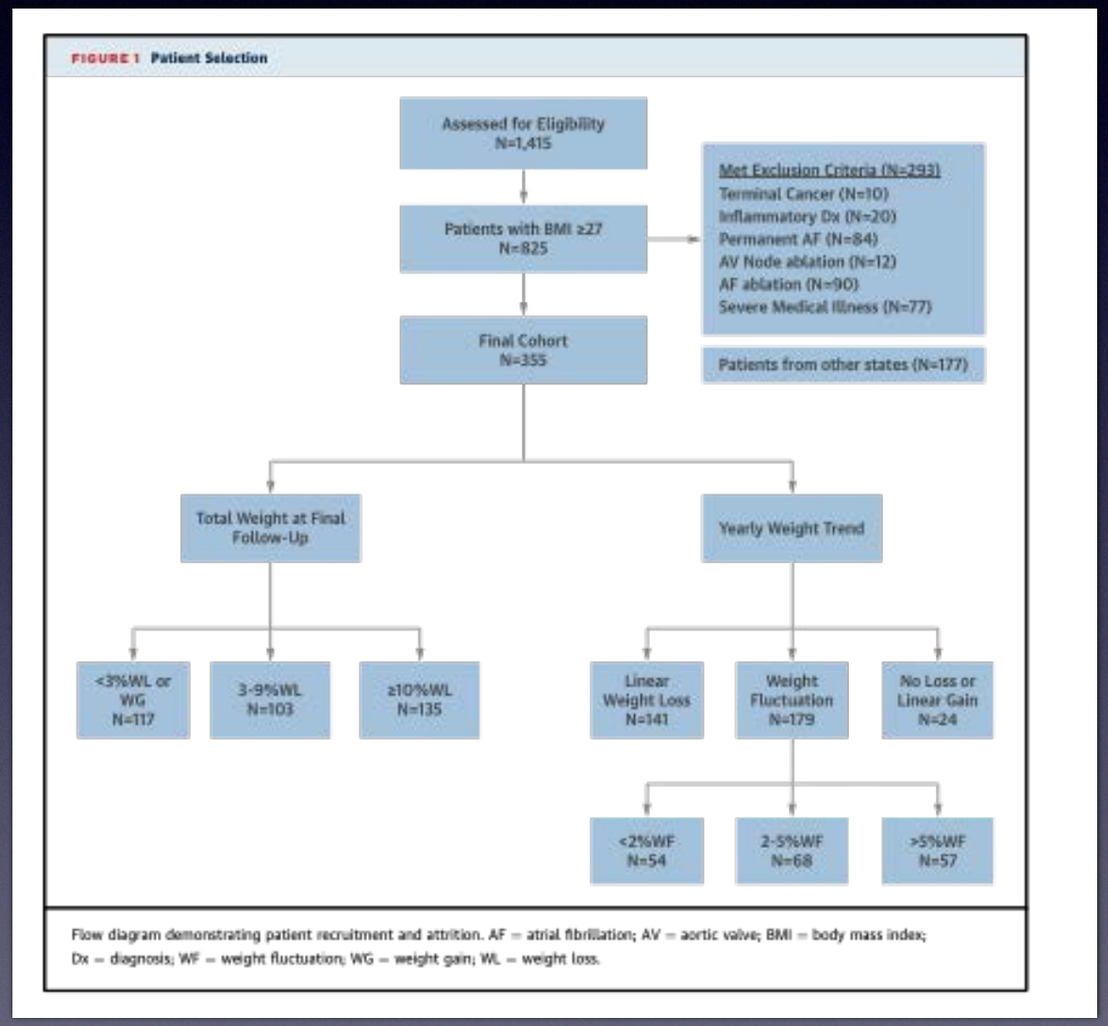
JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 65, NO. 20, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.03.002

Long-Term Effect of Goal-Directed Weight Management in an Atrial Fibrillation Cohort A Long-Term Follow-Up Study (LEGACY)

- Weight Fluctuation: >5% (wide), 2-5% (average), <2% (stable)
- Arrhythmia Management: dedicated AF clinic with use of rate vs rhythm control up to physicians
  - Flecanide and Sotalol most common with rare Amio
  - Ablation for symptomatic pts failing AAD
  - AF determined at least annually by ECG and 7 day Holter
  - AF ablation pts eval 3mo post procedure
  - AF was considered any atrial arrhythmia for ≥ 30 s



Flow diagram demonstrating patient recruitment and attrition. AF = atrial fibrillation; AV = aortic valve; BMI = body mass index; Dx = diagnosis; WF = weight fluctuation; WG = weight gain; WL = weight loss.

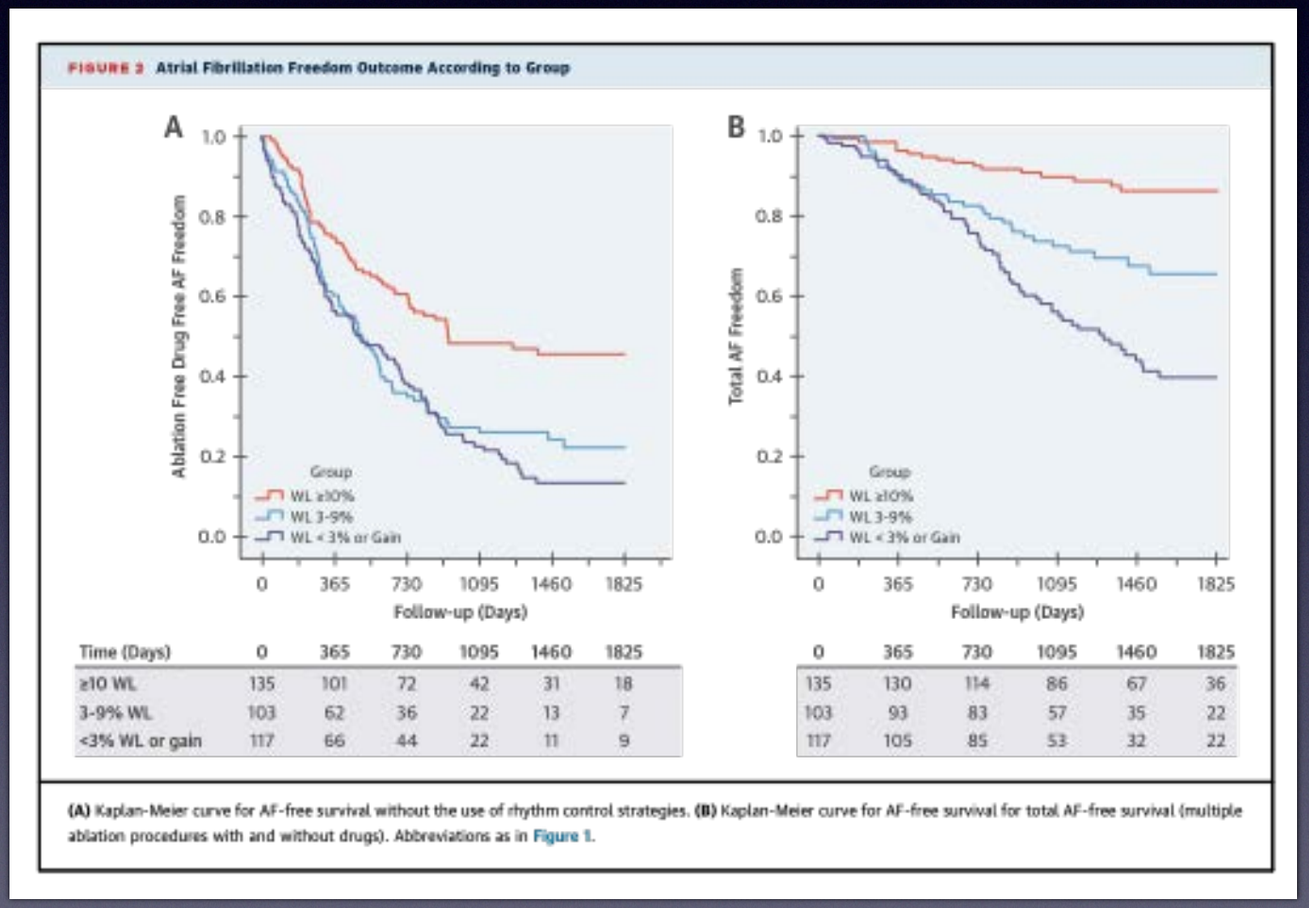
JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 65, NO. 20, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.03.002

Long-Term Effect of Goal-Directed Weight Management in an Atrial Fibrillation Cohort A Long-Term Follow-Up Study (LEGACY)

- Freedom from AF without rhythm control:
  - 45.5% (1) 22.2% (2) 13.4% (3)
- Total Freedom from AF
  - 86.2% (1), 65.5% (2), 39.6% (3)
    - no difference in ablation # in three groups
    - sig less AAD in group 1



(A) Kaplan-Meier curve for AF-free survival without the use of rhythm control strategies. (B) Kaplan-Meier curve for AF-free survival for total AF-free survival (multiple ablation procedures with and without drugs). Abbreviations as in Figure 1.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

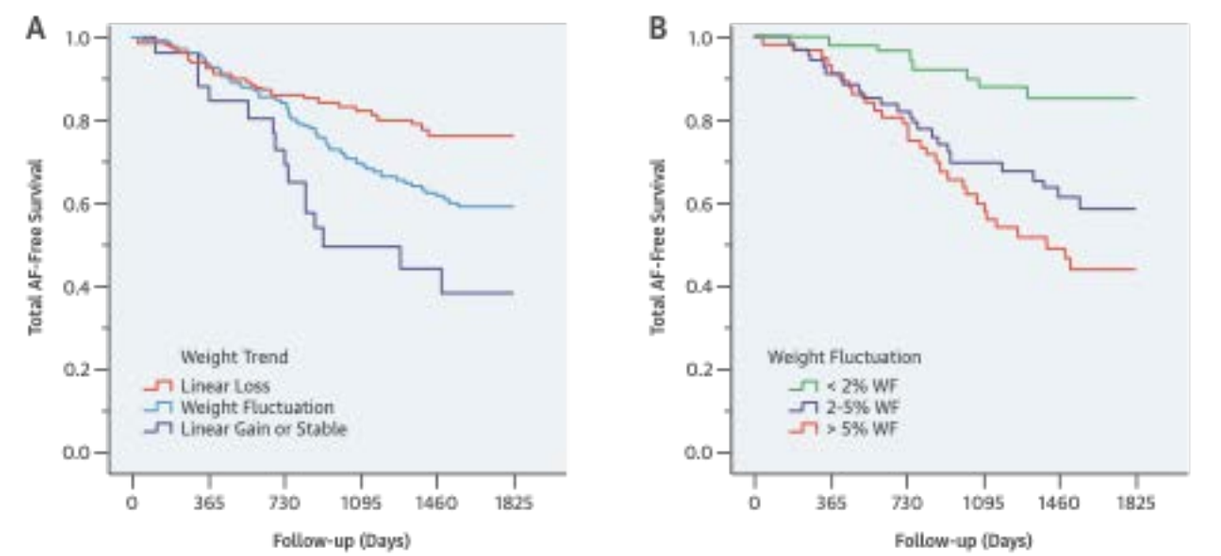
ORIGINAL INVESTIGATIONS

VOL. 65, NO. 20, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.03.002

Long-Term Effect of Goal-Directed Weight Management in an Atrial Fibrillation Cohort A Long-Term Follow-Up Study (LEGACY)

- 179 Pts with weight fluctuation
  - 54 (<2%) , 68 (2-5%), 57 (>5%)
  - Pts with dedicated weight management plan had sig less weight fluctuation
- After adjustment for baseline BMI effect of weight fluctuation had sig impact on AF recurrence

FIGURE 3 Outcomes of Atrial Fibrillation Freedom According to Weight Trend and Weight Fluctuation



Time (Days)	0	365	730	1095	1460	1825
Linear Loss	141	130	122	80	52	29
Fluctuation	179	165	140	99	71	44
Linear Gain	24	20	18	12	8	5

Time (Days)	0	365	730	1095	1460	1825
< 2% WF	54	52	49	39	33	19
2-5% WF	68	62	54	39	27	15
> 5% WF	57	53	45	31	19	14

(A) Kaplan-Meier curve for total AF-free survival (multiple ablation procedures with and without drugs) according to weight trend. **(B)** Kaplan-Meier curve for total AF-free survival (multiple ablation procedures with and without drugs) according to weight fluctuation. Abbreviations as in Figure 1.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 65, NO. 20, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.03.002

Long-Term Effect of Goal-Directed Weight Management in an Atrial Fibrillation Cohort A Long-Term Follow-Up Study (LEGACY)

- Conclusions:
  - Long term weight loss is achievable and results in 6 fold greater freedom from AF
  - Weight fluctuations of >5% had adverse effect and may offset benefit of weight loss with 2 fold greater likelihood of AF recurrence
  - Physician led weight loss program had significant impact on weight loss and weight fluctuation
  - >10% weight loss resulted in no longer requiring AAD or needing ablation in 45.5% in this group!!!
  - in the group that lost >10% and were involved in dedicated weight loss program 66% were able to keep weight loss over study duration

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 65, NO. 20, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.03.002

CARDIO-FIT

Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

The CARDIO-FIT Study

Rajeev K. Pathak, MBBS,* Adrian Elliott, PhD,* Melissa E. Middeldorp,* Megan Meredith,*
Abhinav B. Mehta, M Act St,† Rajiv Mahajan, MD, PhD,* Jeroen M.L. Hendriks, PhD,* Darragh Twomey, MBBS,*
Jonathan M. Kalman, MBBS, PhD,‡ Walter P. Abhayaratna, MBBS, PhD,§ Dennis H. Lau, MBBS, PhD,*
Prashanthan Sanders, MBBS, PhD*

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.06.488

Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

- Objectives: Evaluate the role of cardiorespiratory fitness and its incremental benefit in rhythm control in obese AF puts
- Same study group of LEGAGCY trial and selected those who had BMI≥ 27 kg/m2 and had exercise stress testing at enrollment
- After exclusion 308 pts included in this study arm
- Same offering of dedicated physician lead weight and exercise program

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.06.488

Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

- Exercise program: Baseline exercise stress test to look at METs achieved
  - low intensity exercise was prescribed initially for 20 min three times weekly and consisted of aerobic and resistance/ strength training
  - exercise loads increased weekly to at least 200 min of moderate intensity exercise per wk

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.06.488

Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

- Assessment of Fitness level:
  - Divided into groups based on predicted METS for age: St. James Model Predicted METs = 14.7 - (0.13 x age) w and 14.7 - (0.15 x age) m
    - low (<85% predicted METs)
    - adequate (86-100% predicted METs)
    - high (>100% predicted Mets)
  - Secondary Grouping of Gain ($\geq$ 2 METs) or Loss ($\leq$ 2 METs)

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.06.488

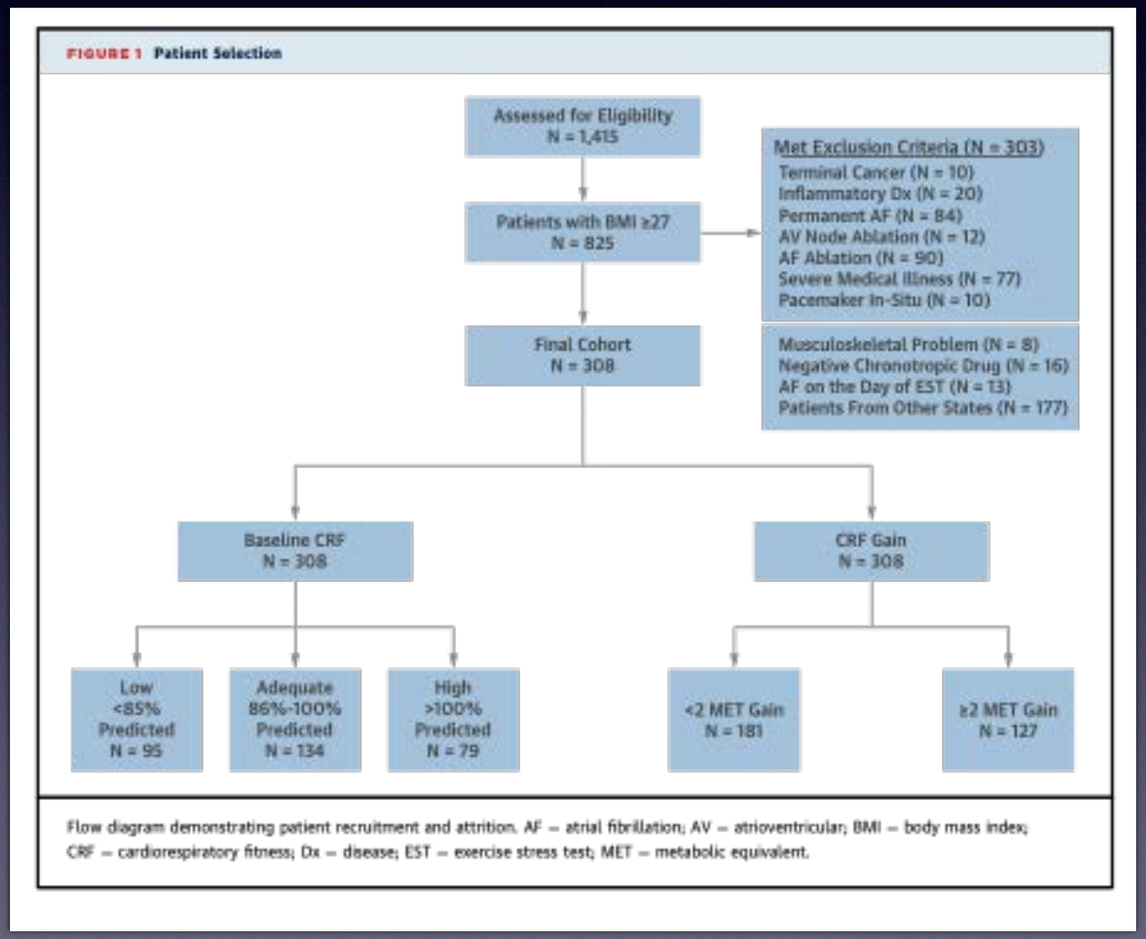
Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

- Arrhythmia Management: dedicated AF clinic with use of rate vs rhythm control up to physicians
  - Flecanide and Sotalol most common with rare Amio
  - Ablation for symptomatic pts failing AAD
  - AF determined at least annually by ECG and 7 day Holter
  - AF ablation pts eval 3mo post procedure
  - AF was considered any atrial arrhythmia for ≥ 30 s

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER INC.

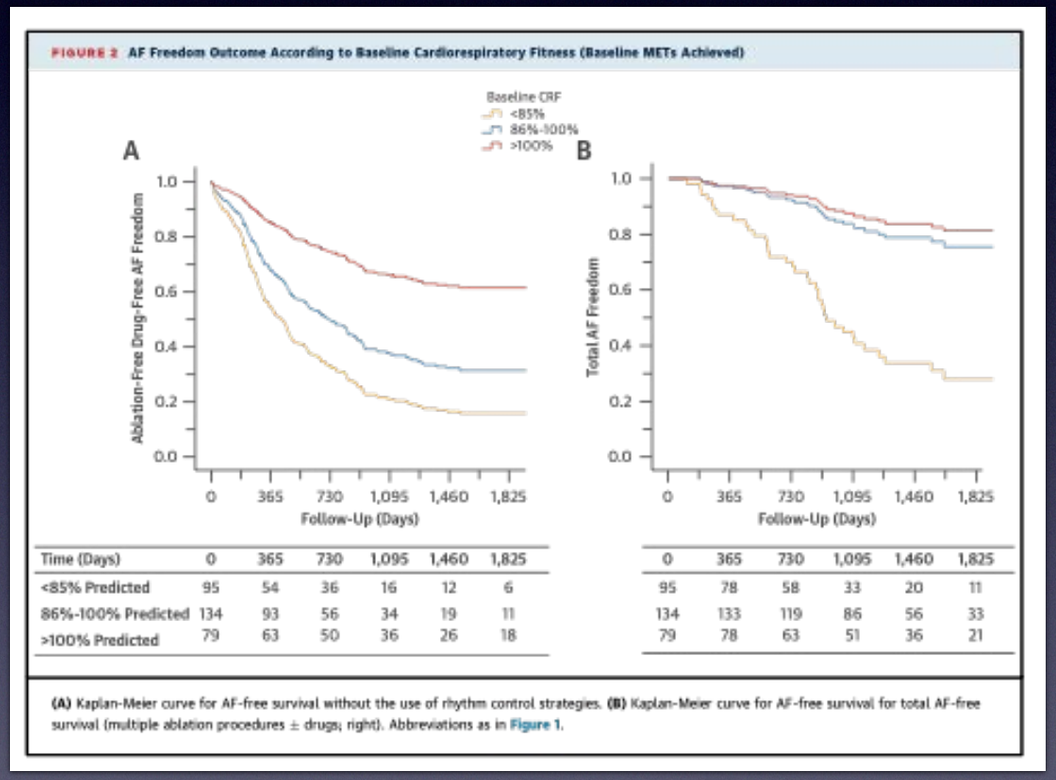
ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.06.488



Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

- Figure A: Ablation Free and Drug Free (without use of rhythm control therapy)
  - Low 12% AF Free
  - Adequate 35% AF Free
  - High 66% AF Free
- Figure B : Rhythm Control Therapy
  - Low 17% AF Free
  - Adequate 76% AF Free
  - High 84% AF Free
- After Adjusting for weight loss there was 20% reduction in AF for each additional MET at baseline cardiorespiratory fitness at baseline



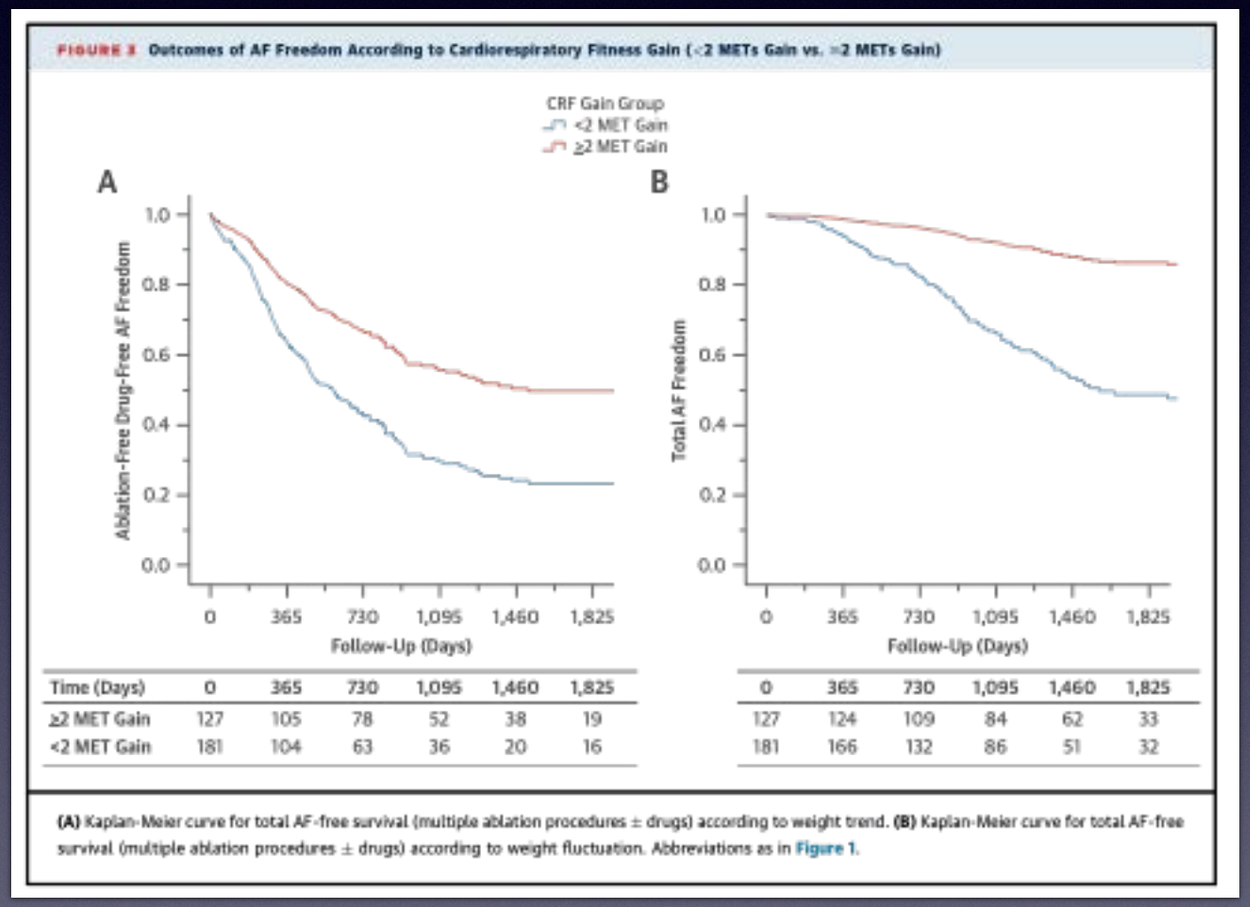
JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.06.488

Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

- Figure A: Ablation Free and Drug Free (without use of rhythm control therapy)
  - > 2METS 61% AF free
  - < 2METS 18% AF free
- Figure B : Rhythm Control Therapy
  - > 2METS 89% AF free
  - < 2METS 40% AF free Fitness Gain:
  - Higher participation in physician directed ≥ 2METs 83% were in dedicated workout vs 39%
- >2METS gain had sig: More Weight loss, Better BP control, Better lipid profiles and greater decline in LA vol
- As an independent risk factor for every MET gained 12% decline in AF recurrence



JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

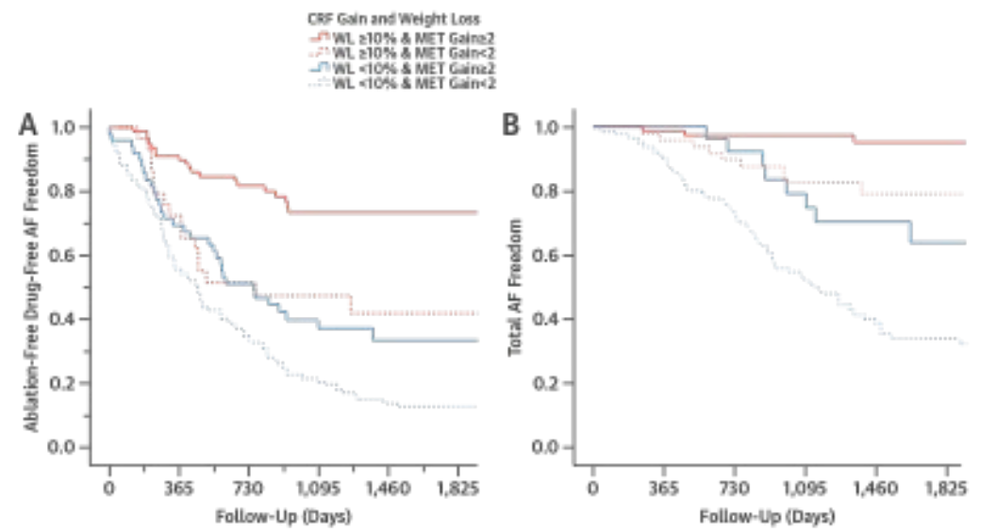
ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.06.488

Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

- Synergistic Effect
  - Group 4 (≥10% wt loss and ≥2 METS gain) 75.6% AF free with no rhythm control😱
  - Group 4 (≥10% wt loss and ≥2 METS gain) 94% in AF treatment group👍👏

FIGURE 4 Outcomes of AF Freedom According to Cardiorespiratory Fitness Gain (<2 METs Gain vs. ≥2 METs Gain) and Weight Loss (<10% vs. ≥10% Weight Loss)



Time (Days)	0	365	730	1,095	1,460	1,825
≥10% WL+ MET Gain ≥2	77	71	53	37	28	13
≥10% WL+ MET Gain <2	28	20	11	9	7	6
<10% WL+ MET Gain ≥2	48	33	24	14	8	4
<10% WL+ MET Gain <2	151	84	50	26	12	10

0	365	730	1,095	1,460	1,825
77	76	66	51	40	20
28	28	22	16	15	8
48	47	42	31	22	11
151	136	109	74	36	23

(A) Kaplan-Meier curve for total AF-free survival (multiple ablation procedures ± drugs) according to weight trend. **(B)** Kaplan-Meier curve for total AF-free survival (multiple ablation procedures ± drugs) according to weight fluctuation. WL = weight loss; other abbreviations as in Figure 1.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
a 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION PUBLISHED BY ELSEVIER INC.

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.06.488

Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation

- Strong correlation between cardiorepiratory fitness and AF recurrence
- Independent but synergistic to weight loss
- Dramatic results even off rhythm control therapy
- Strength in this study is that fitness was measured objectively by a highly reproducible test.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

ORIGINAL INVESTIGATIONS

VOL. 66, NO. 9, 2015 ISSN 0735-1097/$36.00 http://dx.doi.org/10.1016/j.jacc.2015.06.488

Conclusion

- Wow we made it
- Strong correlation between obesity and AF
- Not just associated comorbidities
- Results in poorer outcomes if untreated
- We can make profound impact with weight loss and exercise
- Objective measures for our pts
- Should be part of a AF treatment program

Things to Think About😕

- Primary Prevention of AF
  - 
  - 

Thank You