Title

Subtitle

The Role of Surgery in Stand Alone Ablation of Atrial Fibrillation

Venice Arrhythmia

October 17, 2015

The Heart Hospital

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Surgical Director of Atrial Fibrillation Center of Innovation
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Totally Thoracoscopic Surgical Ablation or Catheter Ablation of Atrial Fibrillation

A Systematic Review and Preliminary Meta-Analysis

James R. Edgerton, MD, FHRS[a,b,*], Lindsey M. Philpot, MPH[c], Brandi Falley, MS[c], Sunni A. Barnes, PhD[c]

Card Electrophysiol Clin 4 (2012) 413–423
http://dx.doi.org/10.1016/j.ccep.2012.05.001
1877-9182/12/$ – see front matter

Card Electrophysiol Clin 4 (2012) 413–423

Introduction

- **Goal is to compare the published literature on two methods of ablation of AF**
  - **Catheter Ablation (endocardial)**
  - **Stand alone surgical ablation (epicardial)**

- **Then derive conclusions on which classes of patients should be treated with which method**

Methods

- ❑ **Four meta analyses of Catheter Ablation exist**
- ❑ **Must perform a meta analysis of surgical ablation**
- ❑ **Heterogenous nature of the studies prohibits formal statistical comparison**
- ❑ **We must *Draw Conclusions***

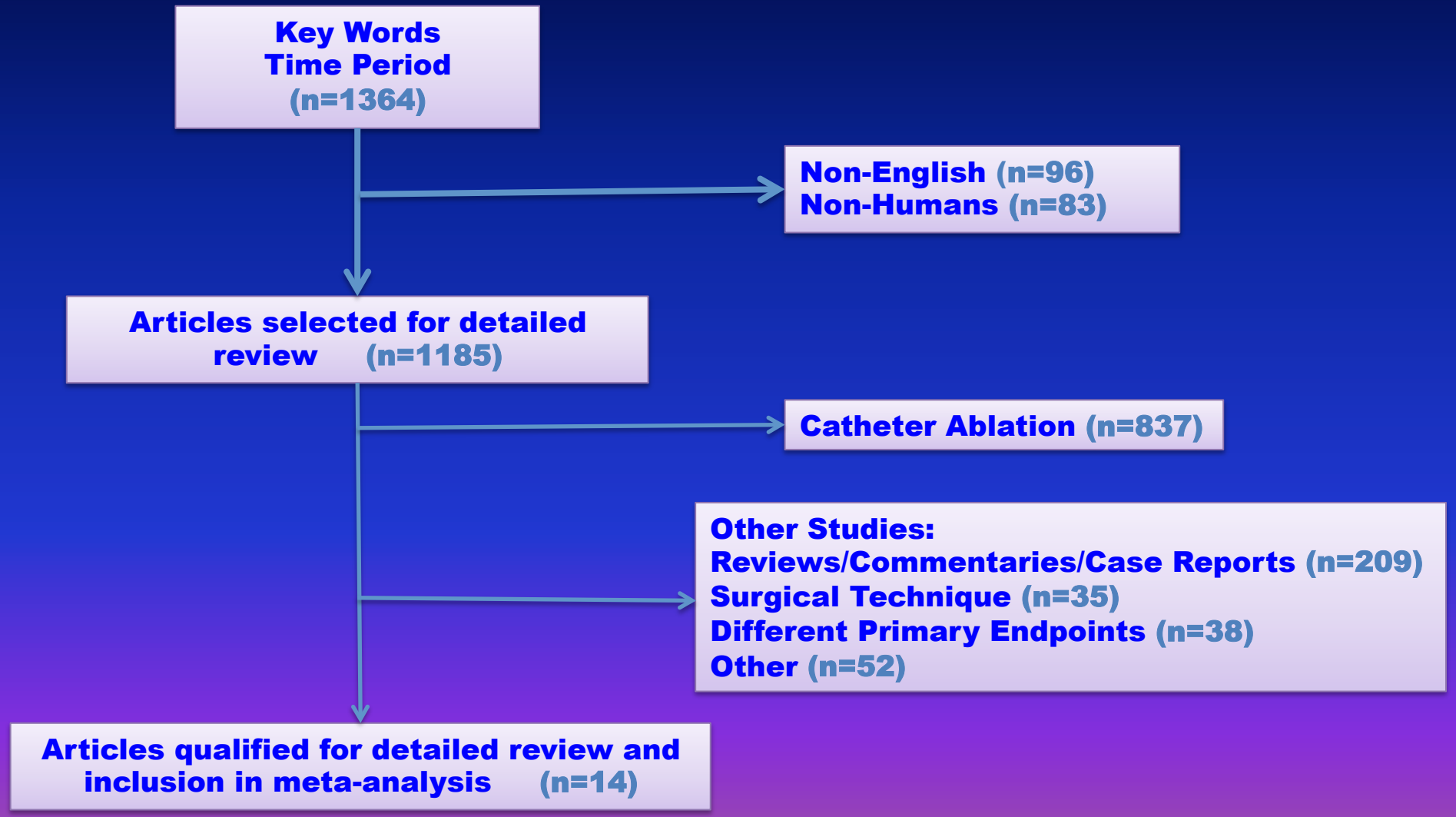
Methods for Meta Analysis

Data Analysis:

Comprehensive Meta Analysis Software Version 2

- **Summary estimate generated by combining success proportions**
  - **Weighted by sample size**
    - **Weighting – Greater emphasis given to studies with larger sample size**

Papers Selected for Surgery Meta Analysis



Methods for Meta Analysis

Eligibility Criteria for Papers to be Included

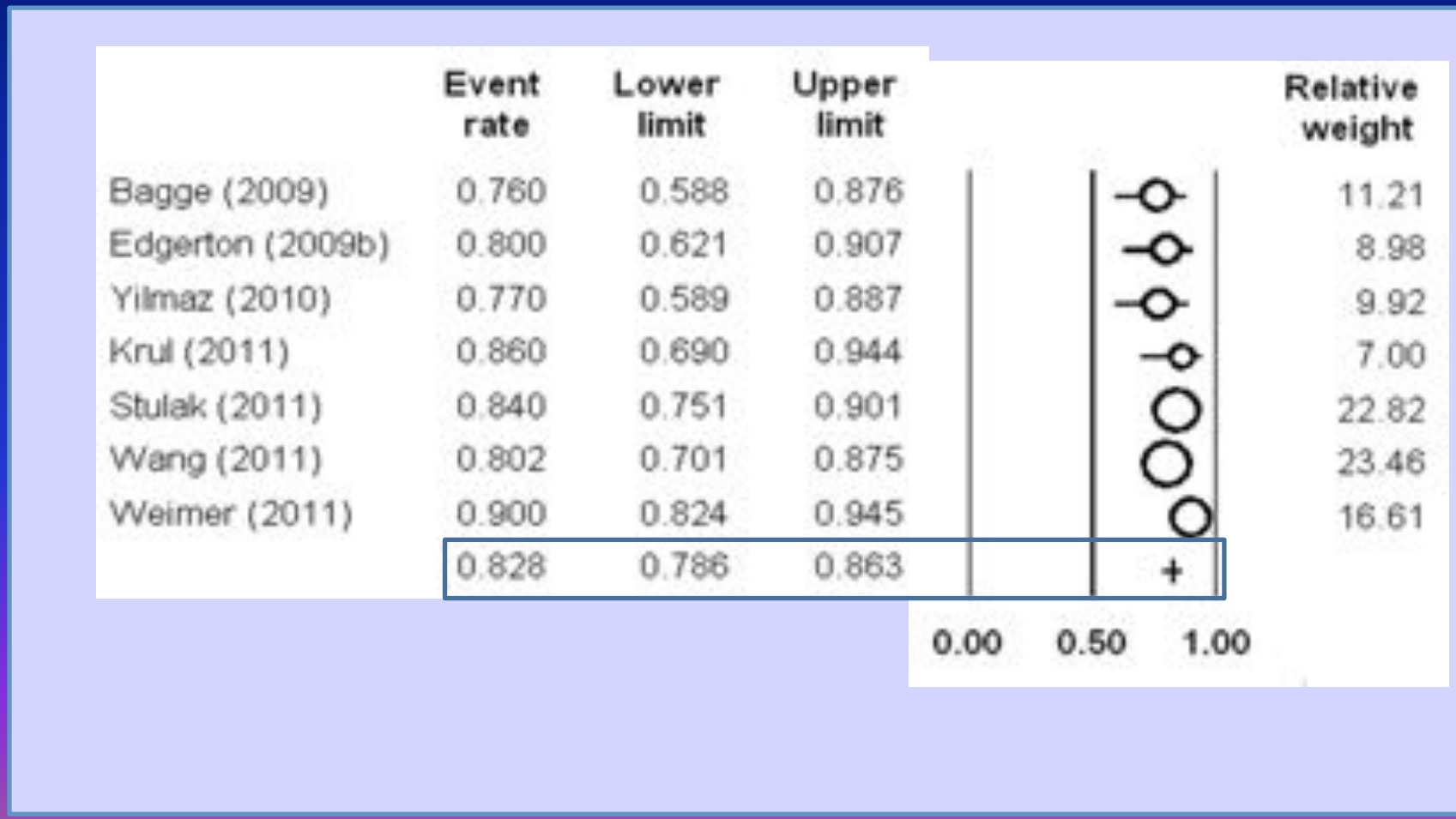
- Exposure: Stand-Alone Ablative Surgery
  - Included:
    - Paper's sole focus is on stand-alone surgical ablation
    - Combined papers when the stand-alone ablation outcomes are listed separately from concomitant cardiac surgery

- Outcome:
  - Post-operative freedom from AF: with/without AAD
  - Post-operative Freedom of AF, AT, Aflutter: with/without AAD
  - Post-operative freedom from AF without AADs
  - Post-operative Freedom of AF, AT, Aflutter: without AAD
  - Post-operative freedom from AF/NSR by *type* of AF
    - Paroxysmal – recurrent AF that terminates spontaneously
    - Persistent – AF sustained beyond 7 days, or lasting less than 7 days be requiring either pharmacologic or electrical cardioversion
    - Long-standing persistent – continuous AF of greater than 1-year duration
  - Post-operative freedom from AF/NSR listed by surgical technique

Results of Surgery Meta Analysis

All Patients ~ All Types of AF

Freedom From Atrial Fibrillation: with/ without AAD

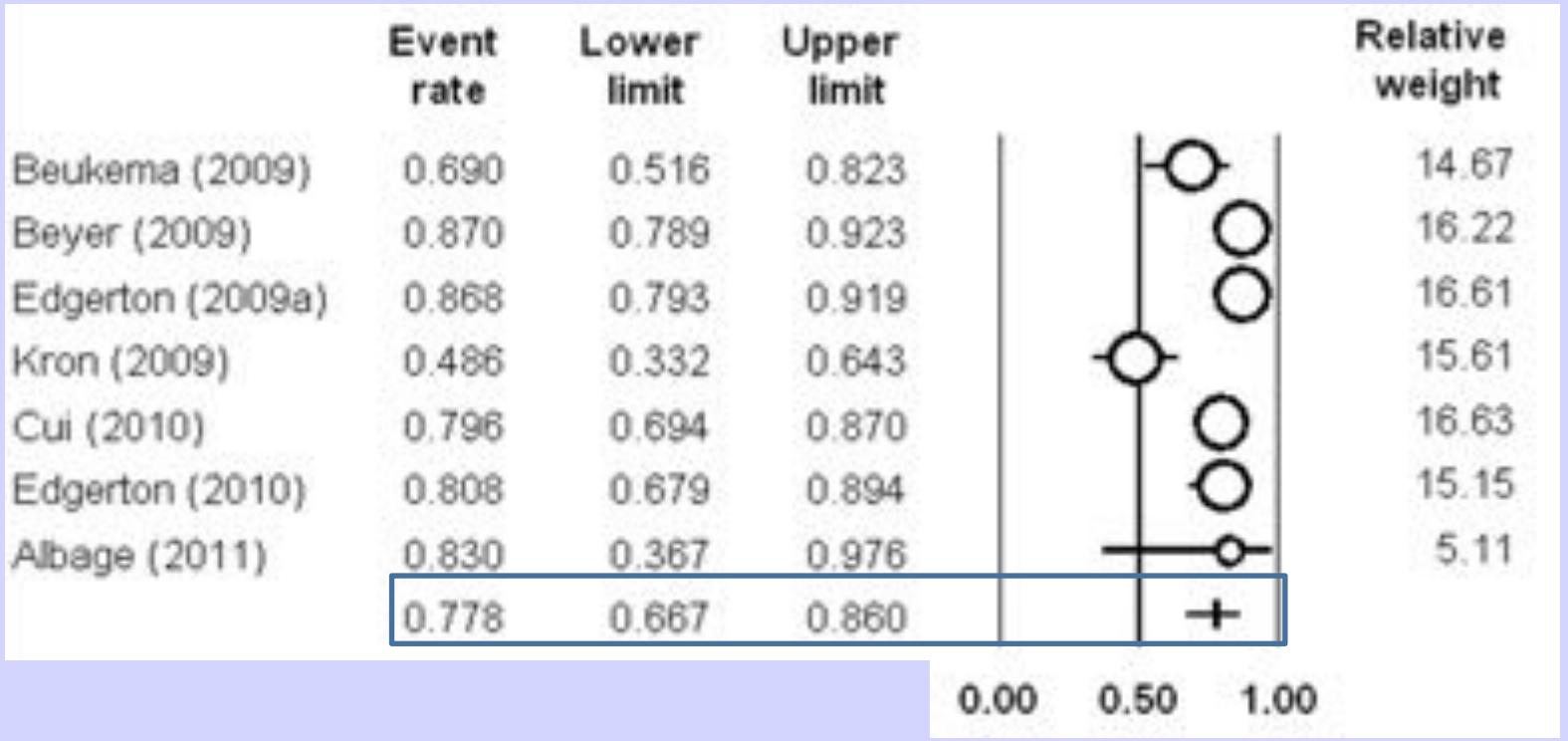


	Event rate	Lower limit	Upper limit	Relative weight
Bagge (2009)	0.760	0.588	0.876	11.21
Edgerton (2009b)	0.800	0.621	0.907	8.98
Yilmaz (2010)	0.770	0.589	0.887	9.92
Krul (2011)	0.860	0.690	0.944	7.00
Stulak (2011)	0.840	0.751	0.901	22.82
Wang (2011)	0.802	0.701	0.875	23.46
Weimer (2011)	0.900	0.824	0.945	16.61
	0.828	0.786	0.863	

Results of Surgery Meta Analysis

All Patients ~ All Type of AF

Freedom From AFib, AT, AFlutter: with/without AAD

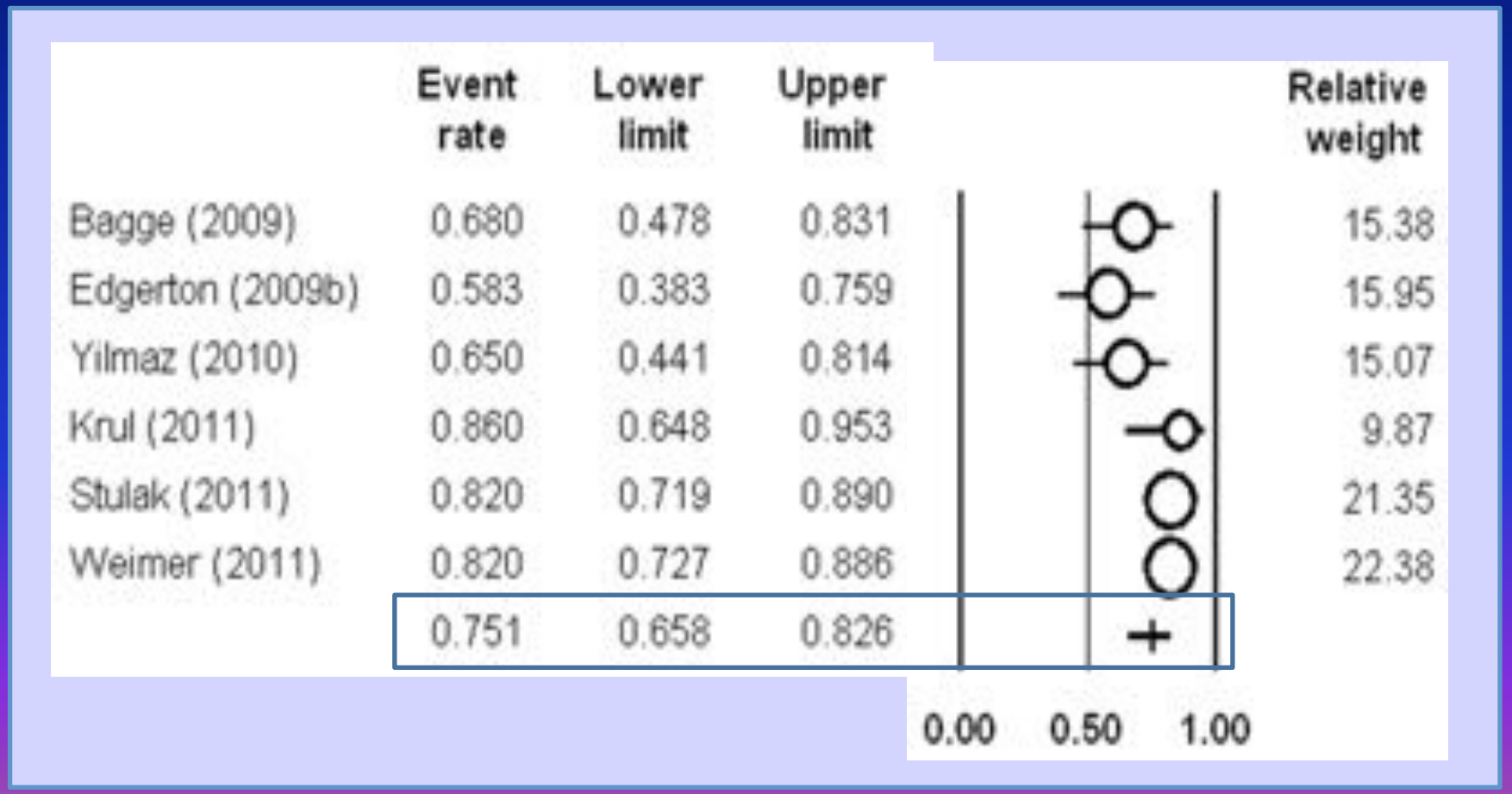


	Event rate	Lower limit	Upper limit	Relative weight
Beukema (2009)	0.690	0.516	0.823	14.67
Beyer (2009)	0.870	0.789	0.923	16.22
Edgerton (2009a)	0.868	0.793	0.919	16.61
Kron (2009)	0.486	0.332	0.643	15.61
Cui (2010)	0.796	0.694	0.870	16.63
Edgerton (2010)	0.808	0.679	0.894	15.15
Albage (2011)	0.830	0.367	0.976	5.11
	0.778	0.667	0.860	

Results of Surgery Meta Analysis

All Patients ~ All Types of AF

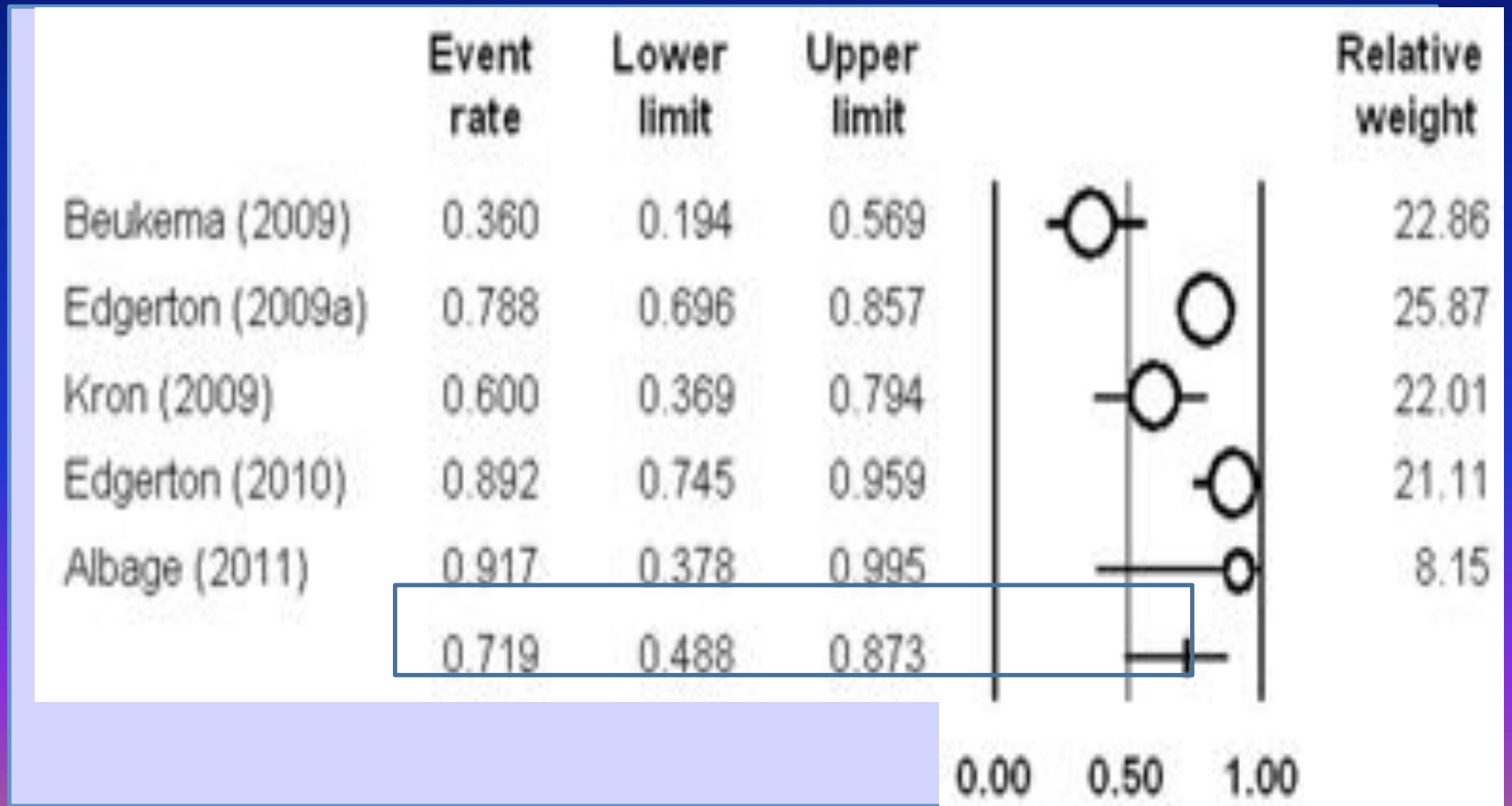
Freedom from AF without AADs



Results of Surgery Meta Analysis

All Patients

Freedom from AFib, AT, A Flutter: without AADs



Results of Surgery Meta Analysis

All Patients

Summary of Last Four Slides:

- **Freedom From Atrial Fibrillation: with/without AAD: .828**
- **Freedom From AFib, AT, AFlutter: with/without AAD: .778**
- **Freedom from AF without AADs: .751**
- **Freedom from AF/ AT/ Aflutter without AADs: .719**

Results of Surgery Meta Analysis

Freedom from AF by Type of AF with /without AAD's *

Type	Point Estimate	Lower Limit	Upper Limit
Paroxysmal	**0.773**	0.647	0.864
Persistent	**0.802**	0.719	0.866
Long Standing Persistent	**0.651**	0.466	0.800

* Sample size too small to separate these groups into with AAD and without AAD

Results of Surgery Meta Analysis

Freedom from AF, AT, A Flutter by Surgical Technique with/without AAD's*

	Point Estimate	Lower Limit	Upper Limit
Freedom from AF			
Cox III/IV	**0.848**	0.788	0.893
PVI + Dallas	**0.829**	0.706	0.907
PVI	**0.792**	0.697	0.863
Return to NSR			
Cox III/IV	**0.830**	0.287	0.983
PVI	**0.775**	0.656	0.861

* Sample size too small to separate these groups

Results of Catheter Meta Analysis

Catheter Review and Meta-Analysis Articles

	Type of Study	# of Studies	Types of Studies Included	Inclusion Criteria
Brooks (2010)	Systematic Review	32	RCTs + Observational	Persistent/long-standing persistent AF cohort undergoing RF catheter ablation
Calkins (2009)	Meta-Analysis	63	RFA: RCTs + Observational	RFA: RFA was intervention used to treat cardiac arrhythmias; safety, efficacy, cost outcomes related to ablation procedure
		34	AAD: RCTs + Observational	AAD: relating to treatment of ventricular tachycardia and AF with AAD therapy; treatment of arrhythmia with amiodarone, dofetilide, propafenone, sotalol, or flecainide agents
Kong (2011)	Meta-Analysis	6	RCTs	RCTs, patients with AF referred to catheter ablation, study population >18 years old, follow-up ≥ 3 months
Li (2011)	Meta-Analysis	7	RCTs + Observational	Efficacy of CFAE ablation as additional procedure to PVAI-based procedure; follow-up sinus rhythm maintenance data available
Tilz, Kuck Ouyang (2012)	Single Center Hamburg	1	Observational	Long standing persistent

Discussion

Overall freedom from AF, AT, A Flutter, with or without AADs, *All Patients* (PAF, Persistent, LSP)

LONE SURGICAL ABLATION

Freedom from AF

Less than 1-year Follow-up

Our estimate = 78.5%

One year + Follow-up

Our estimate = 83.7%

Freedom from AF, AT, A Flutter

Less than 1-year Follow-up

Our estimate = 76.0%

One year + Follow-up

Our estimate = 80.6%

CATHETER ABLATION

Free of AF/AT

After *1 procedure* with or without AAD (Kong, 2011)

- PVI = 48%
- PVI+CFAE = 66%

Free from AF/AT-

MULTIPLE procedures with or without AAD (Kong, 2011 f/u 9+ years)

- PVI = 68%
- PVI+CFAE = 82%

Discussion

Freedom from AF without AADs

LONE SURGICAL ABLATION	CATHETER ABLATION
Freedom from AF without AADs Our estimate = **75.1%**	**Freedom from AF without AADs** **Single** procedure, off AAD = **57%** (50-64%; n=2,800) (Calkins, 2009)
Free of AF, AT, A Flutter without AADs Our estimate = **71.9%**	**Multiple** catheter procedures success off AAD = **71%** (65-77%; n=3,481) (Calkins, 2009)

Discussion

Freedom from AF by AF Type

LONE SURGICAL ABLATION

Paroxysmal

Our estimate = **77.3%**

Persistent

Our estimate = **80.2%**

Long-standing persistent

Our estimate = ***65.1%***

CATHETER ABLATION

Paroxysmal

PVI = **75%** (F/U: 10+mo) (Li, 2011)

Persistent/LSP

Brooks (2010)

PVI = **21-54%** (F/U: 17+ mo)

PVI/PVI+CFAE = **36-68%** (F/U: 10+ mo)

Stepwise = **38-62%** (F/U: 11+ mo)

Li (2011)

PVI = **45.25%** (F/U: 10+mo)

LSP (Tilz et al - 2012)

Single procedure = **20.3%**

Multiple procedures = ***45%***

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Card Electrophysiol Clin 4 (2012) 413–423

Surgery Success

- SUCCESS by AF TYPE
  - PAF: 85%
  - Persistent: 79%
  - LSP: 64%

Catheter Success

- Kong and colleagues,[22] freedom from AF/AT
  - After 1 procedure with or without AADs
    - PVI = 48%
    - PVI + CFAE = 66%
  - After all procedures, with or without AADs
    - PVI = 68%
    - PVI + CFAE = 82%
- Calkins and colleagues,[21] freedom from AF without AADs
  - Single procedure = 57%
  - Multiple procedures = 71%
- Li and colleagues[23]
  - PAF = 75%
  - Persistent/LSP = 45.25%
- Brooks, freedom from AF/AT[24]
  - LSP: 47%

Fast Trial

2011

First Prospective Randomized Trial

of

Surgery vs Catheter Ablation

Fast Trial

Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association.

Learn and Live.

Atrial Fibrillation Catheter Ablation Versus Surgical Ablation Treatment (FAST) : A 2-Center Randomized Clinical Trial

Lucas V.A. Boersma, Manuel Castella, WimJan van Boven, Antonio Berruezo, Alaaddin Yilmaz, Mercedes Nadal, Elena Sandoval, Naiara Calvo, Josep Brugada, Johannes Kelder, Maurits Wijffels and Lluis Mont

Circulation. 2012;125:00-00.

Circulation published online November 14, 2011

Atrial Fibrillation Catheter Ablation Versus Surgical Ablation Treatment (FAST)

A 2-Center Randomized Clinical Trial

Lucas V.A. Boersma, MD, PhD, FESC; Manuel Castella, MD, PhD; WimJan van Boven, MD; Antonio Berruezo, MD; Alaaddin Yilmaz, MD; Mercedes Nadal, MD; Elena Sandoval, MD; Naiara Calvo, MD; Josep Brugada, MD, PhD, FESC; Johannes Kelder, MD; Maurits Wijffels, MD, PhD; Lluís Mont, MD, PhD, FESC

Fast Trial

- 124 pts randomized to CA (63) vs SA (61)
  - CA → PVI +/- linear ablation
  - SA→ PVI, GP, LAA resected, +/- linear ablation
- f/u 6 &12 mo. w/ 7 day Holter
- Endpoint: freedom from *left,* atrial arrhythmia and off AADs
  - CA: 36.5%
  - SA: 65.6%
- Adverse events
  - SA: 34.4%
  - CA: 15.9%

Problems

Fast Trial

- More PAF in Surgical Group

	CA	SA	
PAF group	13/37 (35.1%)	31/45 (68.9%)	$P=0.0047$
PersAF group	9/25 (36%)	9/16 (56%)	$P=0.3411$

- Surgical group did not routinely use Dallas Lesion set…
  - often only PVI in LSP group
  - No substrate modification
- Did not use Consensus Statement def of Success

- *BUT STILL…..*
  - **CA 35.6%**
  - **SA 65.6%**
- First randomized trial of CA vs SA

Several Recent Series/Meta-analyses

- Weimer…Cox, Damiano, 2012 Two Decade Retrospective Single Center
- Matt, Tan, Weisfeld, Mariani, 2014
  - Surgery vs CA, retrospectively matched
  - Minimally invasive surgical **PVI** with Transcatheter **PVI**
  - Compare *First* invasive procedure
- Kearney, Stephenson, Yan, Phan, Chan, Huang, Yan: 2014 A systematic review of surgical ablation versus catheter ablation for atrial fibrillation
  - Systematic Review 2010-2013 of 7 studies comparing CA to Surgical ablation
- Phan 2014, Meta-analysis of 8 studies of Thorascopic SA vs CA

The Cox-Maze Procedure for Lone Atrial Fibrillation

A Single-Center Experience Over 2 Decades

Timo Weimar, MD; Stefano Schena, MD, PhD; Marci S. Bailey, RN, MSN; Hersh S. Maniar, MD; Richard B. Schuessler, PhD; James L. Cox, MD; Ralph J. Damiano, Jr, MD

Circ Arrhythm Electrophysiol. 2012;5:8-14

- 212 Cox Maze pts 1992 – 2010
  - 48% PAF
  - 52% Persistant or LSP
- F/U : EKG/24 hr Holter
- Mean f/u 3.6 yrs
- 30 day mortality: 1.4
- Freedom from AF: 93%
- Freedom from AF off AAD: 82%
- Though Retrospective, an important & impressive series from Cox/Damiano

Europace (2014) **16**, 33–39
doi:10.1093/europace/eut208

Surgical vs. transcatheter pulmonary vein isolation as first invasive treatment in patients with atrial fibrillation: a matched group comparison

Gijs E. De Maat[1,2], Isabelle C. Van Gelder[1]*, Michiel Rienstra[1], Anne-Floor B.E. Quast[1], Eng S. Tan[1], Ans C.P. Wiesfeld[1], Alberto Pozzoli[2], and Massimo A. Mariani[1]

[1]Department of Cardiology, Thoraxcenter, University of Groningen, University Medical Center Groningen, PO Box 30.001, Groningen 9700 RB, The Netherlands; and [2]Department of Cardio-Thoracic Surgery, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands

Surgical vs. transcatheter pulmonary vein isolation as first invasive : a matched group comparison - Mariani

- Retrospective 1:2 match of PVI by surgery or CA
- PAF 77%, Persistent 23%
- 33 minimally invasive Surgical PVI
  - 4 (12%) had touch-up CA,
  - 3 of 4 were successful
- 66 trans-catheter PVI
  - 25 (38%) had a second PVI (with additional lines +/- CAFE
  - 1 (1%) had a third PVI
  - At one year: 22% awaiting 2nd or 3rd CA
- F/U: 24 hr. Holter at 1 year
- Success defined as: Freedom from atrial arrhythmia off AAD

Surgical vs. transcatheter pulmonary vein isolation as first invasive : a matched group comparison - Mariani

- Results
- Freedom of Atrial arrhythmia >30sec off AAD at 1 year
- Surgery 87%
- CA 42% *(52% if you exclude those pts awaiting an additional ablation)*
- P < .001
- Complications
  - Surgery 21% (4 significant, 3 prolonged hospitalization)
  - CA 5% (2 significant, 1 prolonged hospitalization)
  - P= .015
- No mortality

Surgical vs. transcatheter pulmonary vein isolation as first invasive : a matched group comparison - Mariani

- Significant and important study
  - Reflects real world practice with touch-up ablation allowed in both groups
  - Used Consensus Statement def of success
- Problems
  - Retrospective
  - Small volume
  - No LSP(?) (which is where the real game is played)

A systematic review of surgical ablation versus catheter ablation for atrial fibrillation

Katherine Kearney[1], Rowan Stephenson[2], Kevin Phan[1], Wei Yen Chan[3], Min Yin Huang[3], Tristan D. Yan[1,4]

[1]The Collaborative Research (CORE) Group, Macquarie University, Sydney, Australia; [2]St Vincent's Hospital, Sydney, Australia, [3]University of Western Sydney; [4]Department of Cardiothoracic Surgery, Royal Prince Alfred Hospital, University of Sydney, Sydney, Australia

Corresponding to: Associate Professor Tristan D. Yan. The Collaborative Research Group (CORE), 2 Technology Place, Macquarie University Hospital, Sydney, Australia; Department of Cardiothoracic Surgery, Royal Prince Alfred Hospital, the University of Sydney, Sydney, Australia.

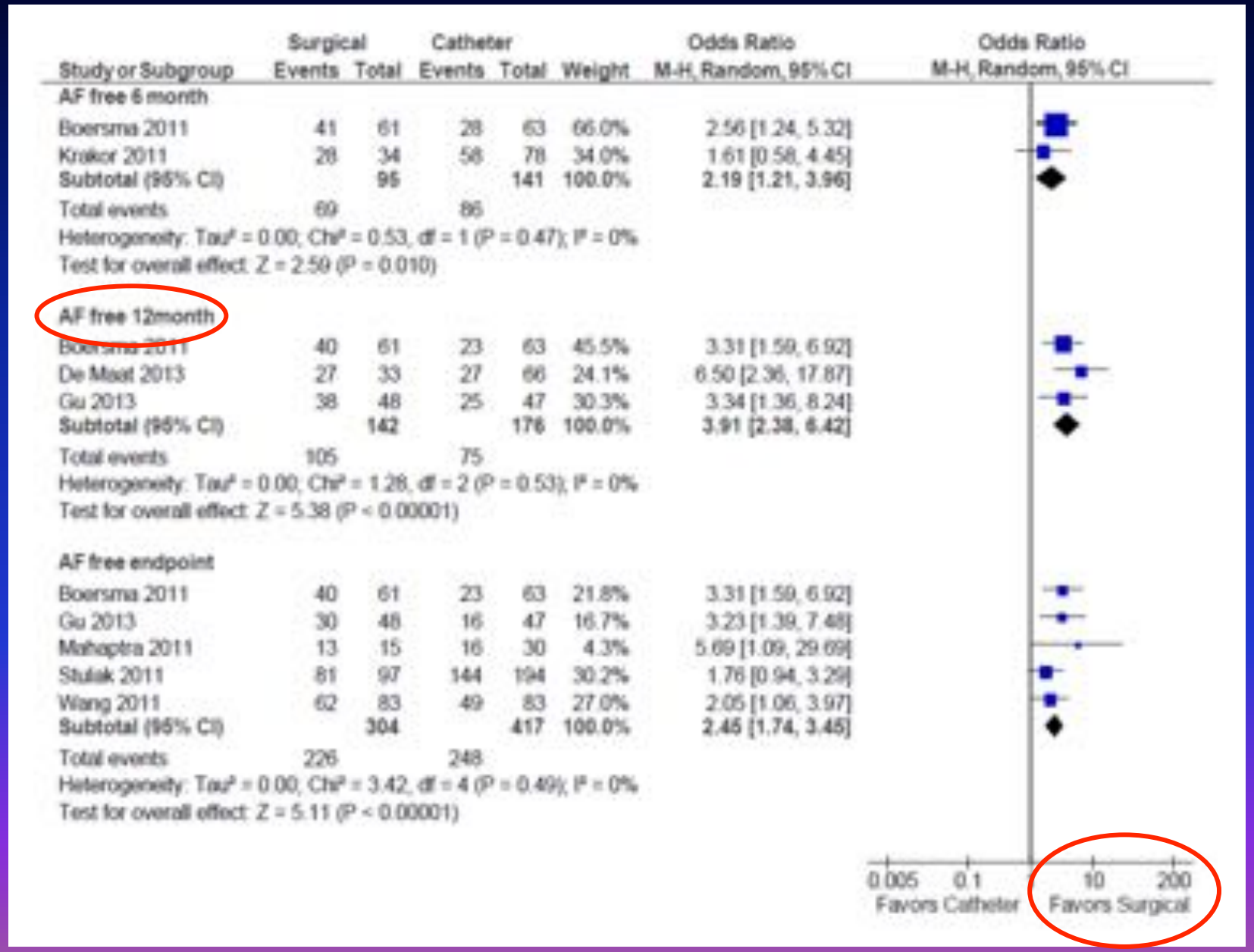
Ann Cardiothorac Surg 2014;3(1):15-29

- Seven studies found for meta-analysis
- 12 month follow-up → favors Surgery
  - No difference in Stroke or Tamponade
  - Surgery had more pacemakers

Systematic review of articles comparing surgical ablation to catheter ablation.

Kearney, 2014

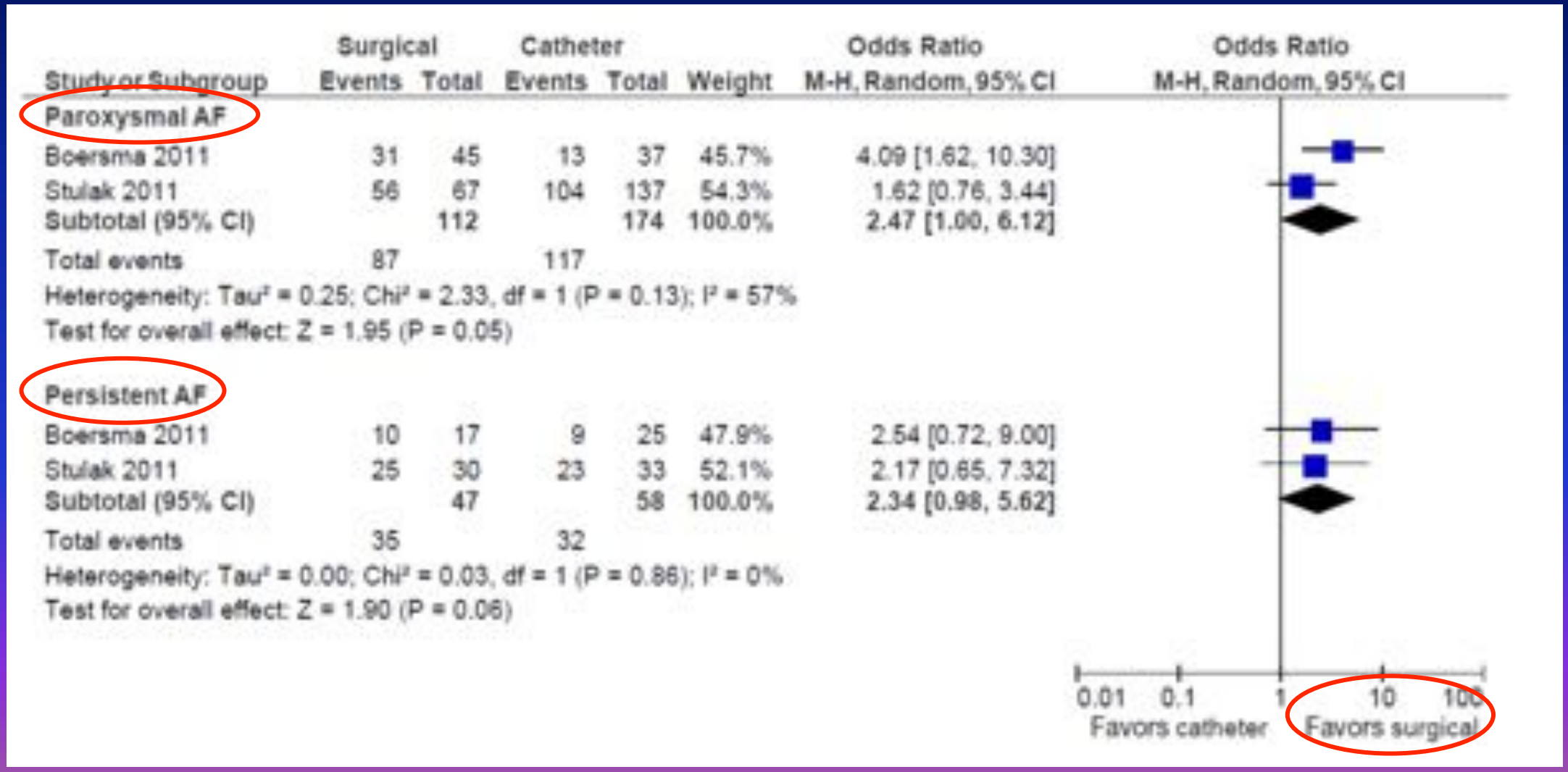
Freedom from AF



Systematic review of articles comparing surgical ablation to catheter ablation.

Kearney, 2014

PAF vs Persistent



European Journal of Cardio-Thoracic Surgery Advance Access published May 23, 2015

European Journal of Cardio-Thoracic Surgery (2015) 1–8
doi:10.1093/ejcts/ezv180

REVIEW

Cite this article as: Phan K, Phan S, Thiagalingam A, Medi C, Yan TD. Thoracoscopic surgical ablation versus catheter ablation for atrial fibrillation. Eur J Cardiothorac Surg 2015; doi:10.1093/ejcts/ezv180.

Thoracoscopic surgical ablation versus catheter ablation for atrial fibrillation

Kevin Phan[a,b], Steven Phan[a], Aravinda Thiagalingam[b], Caroline Medi[c] and Tristan D. Yan[a,d,*]

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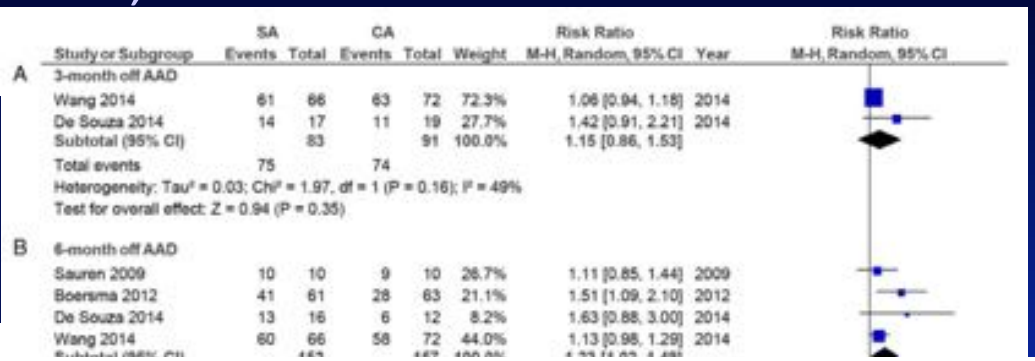
[b] Department of Cardiology, Westmead Hospital, University of Sydney, Sydney, Australia
[c] Department of Cardiology, Royal Prince Alfred Hospital, Sydney, Australia
[d] Department of Cardiothoracic Surgery, Royal Prince Alfred Hospital, Sydney, Australia

- Meta-analysis of *Thorascopic* SA vs CA
- Six databases from inception to December, 2014
- Eight studies selected: 3 prospective, 5 retrospective
- 6 gave 12 month data off AADs

Thoracoscopic surgical ablation versus catheter ablation

Phan, 2014

Results at 12 months off AADs

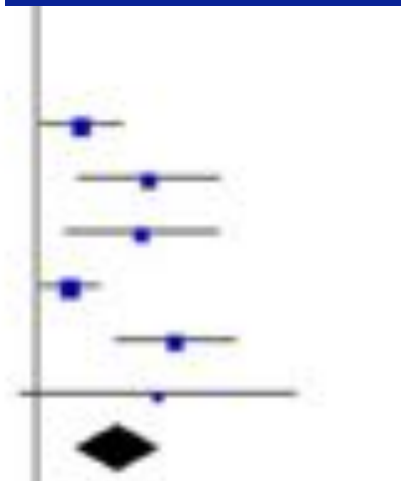


C 12-month off AAD

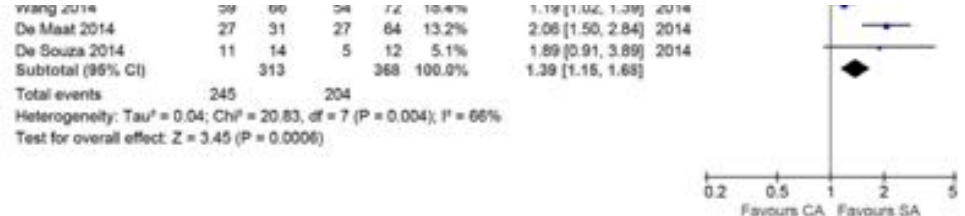
Wang 2011	62	83	49	83	21.8%	1.27 [1.02, 1.57]	2011
Boersma 2012	40	61	23	63	15.3%	1.80 [1.24, 2.61]	2012
Pokushalov 2013	26	32	15	32	14.2%	1.73 [1.16, 2.60]	2013
Wang 2014	59	66	54	72	24.4%	1.19 [1.02, 1.39]	2014
De Maat 2014	27	31	27	64	17.5%	2.06 [1.50, 2.84]	2014
De Souza 2014	11	14	5	12	6.8%	1.89 [0.91, 3.89]	2014
Subtotal (95% CI)		287		326	100.0%	1.54 [1.24, 1.91]	
Total events	225		173				

Heterogeneity: Tau² = 0.04; Chi² = 15.20, df = 5 (P = 0.010); I² = 67%

Test for overall effect: Z = 3.90 (P < 0.0001)



Favours CA Favours SA



Thoracoscopic surgical ablation versus catheter ablation

a Meta-Analysis

Phan, 2014

- Freedom from AF, AT, A-Flutter at 12 months off AADs
  - Thorascopic SA 78.4 %
  - CA 58%
  - P < .0001 RR= 1.54
- Complications
  - SA 28.2%
  - CA 7.8%
  - P = .0003 RR 3.3

Observations

- The literature for “stand alone”, on pump, Maze III or IV is long, rich and well established.
- The surgical literature for concomitant Maze is substantial and respectable
- The literature on minimally invasive stand alone Maze is inadequate
  - Small series
  - Few of them
  - But remember….. This field is in its infancy
- CA literature is more mature, but….
  - Often impossible to sort out how many interventions a patient prior to endpoint
  - Characterized be a confusing array of varying definitions of “success”
  - *“Just wait till next year! Things will be great!”* … New Widget every year
- Surgery has a clear efficacy advantage over CA, but with higher rate of non-fatal complications

Recommendations

PAF should have Catheter Ablation,

LSP AF: surgery reasonable as 1st intervention

- **Long term results for surgery in non-paroxysmal is 65 -82%**
- **Long-term results for CA in NON-paroxysmal patients is 21- 45% - ?68% (multiple procedures)**

Persistent -- ?

Surgical Atrial Fibrillation Ablation

An Electrophysiologist's Perspective

Elad Anter, MD[a], David J. Callans, MD[b,*]

Card Electrophysiol Clin 4 (2012) 395–402

Box 1
Reasonable indications for surgical AF ablation

- Concomitant heart surgery
- Failed catheter-based procedures
- Moderate or severe mitral regurgitation
- Hypertrophic cardiomyopathy
- Long persistent AF
- Contraindication for anticoagulation
- Severe obesity

Questions

- Surgery has clear success advantage over CA, yet EPs are not embracing this modality for their patients. **WHY?**

- Surgery is getting less invasive, less complex
- CA is becoming more invasive and more complex
- **WILL THEY MEET?**

- There are suggestions that PVI is equally efficacious as extensive substrate modification… **WHATS UP WITH THAT?**
  - Kaseragian/Ellenbogen article
  - Star-AF II Trial (NEJM May 7, 2015)
  - Recent CTSN concomitant trial (NEJM April 9, 2015)

- **I THINK *(hope)* that in 2028,**
  - Rx will be tailored by real time mapping
  - and all these considerations will be obsolete and seem naive


Thank you…


Thank you