Postoperative Atrial Fibrillation -2020

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Scope of presentation

- Significance of problem
- Strategies to reduce POAF
- Guidelines and recommendation

Atrial fibrillation after cardiac surgery

- is the most common postoperative complication following cardiac surgical procedures

- 25% after isolated coronary artery bypass grafting (CABG)
- 30% after isolated valvular procedures
- 40– 50% following combination CABG/valvular operations

- remained largely unchanged despite contemporaneous improvements in cardiac surgery-associated morbidity and mortality

Ann Thorac Surg. 2018; 105(1):15–23

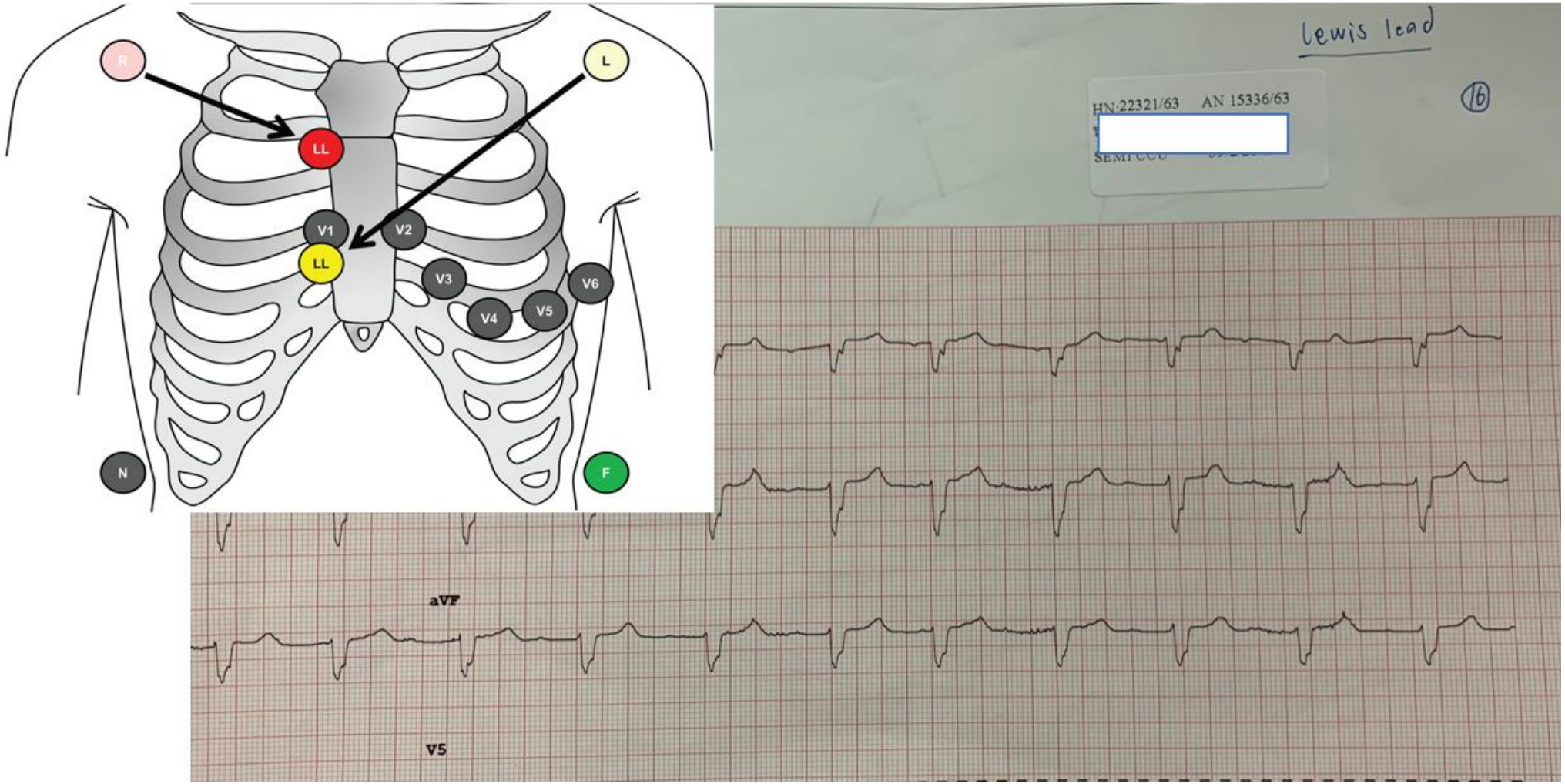
J Thorac Cardiovasc Surg. 2011

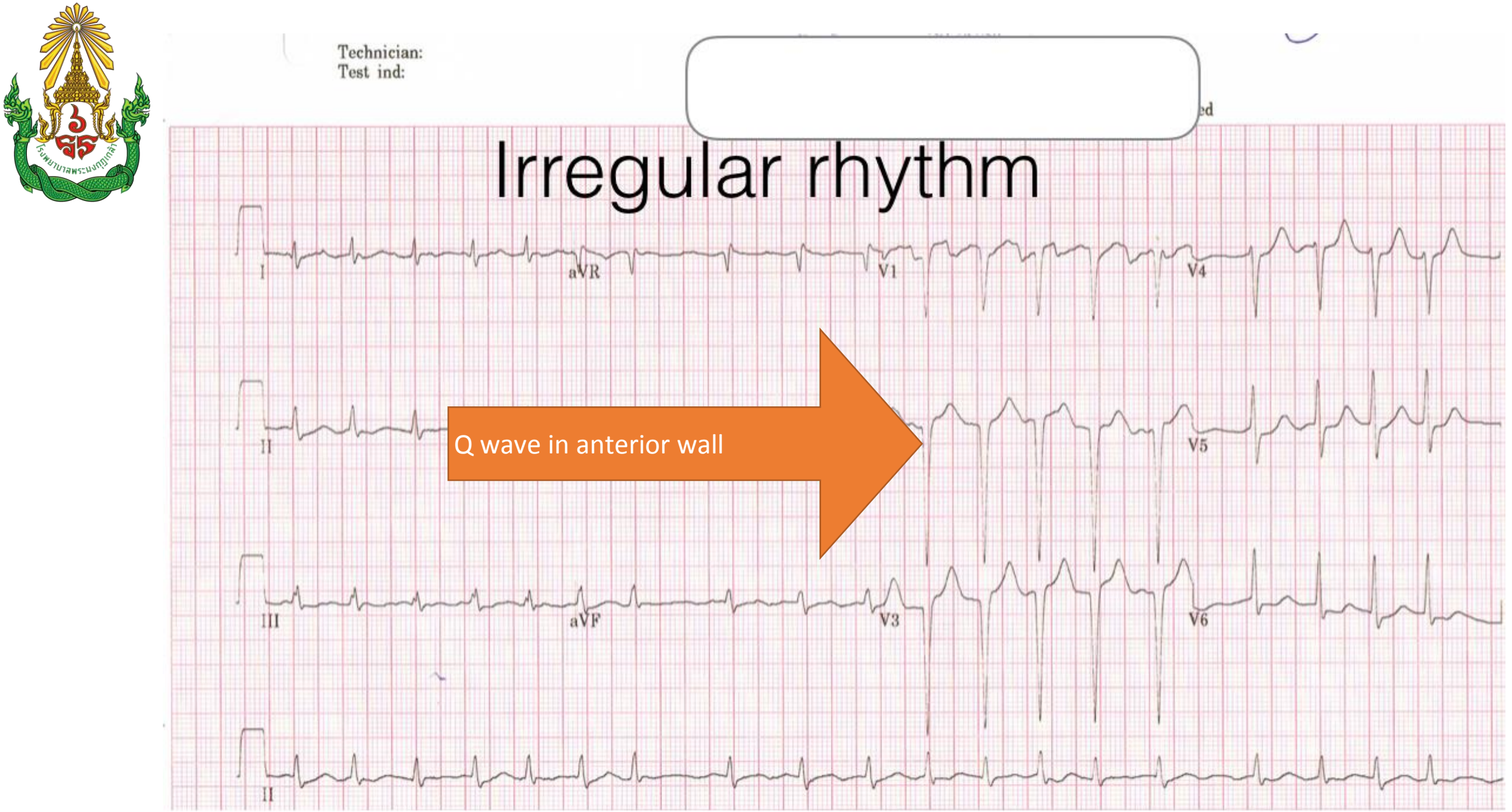
Diagnosis

- 12-lead electrocardiogram (ECG) or a rhythm strip of at least 30-s duration that demonstrates

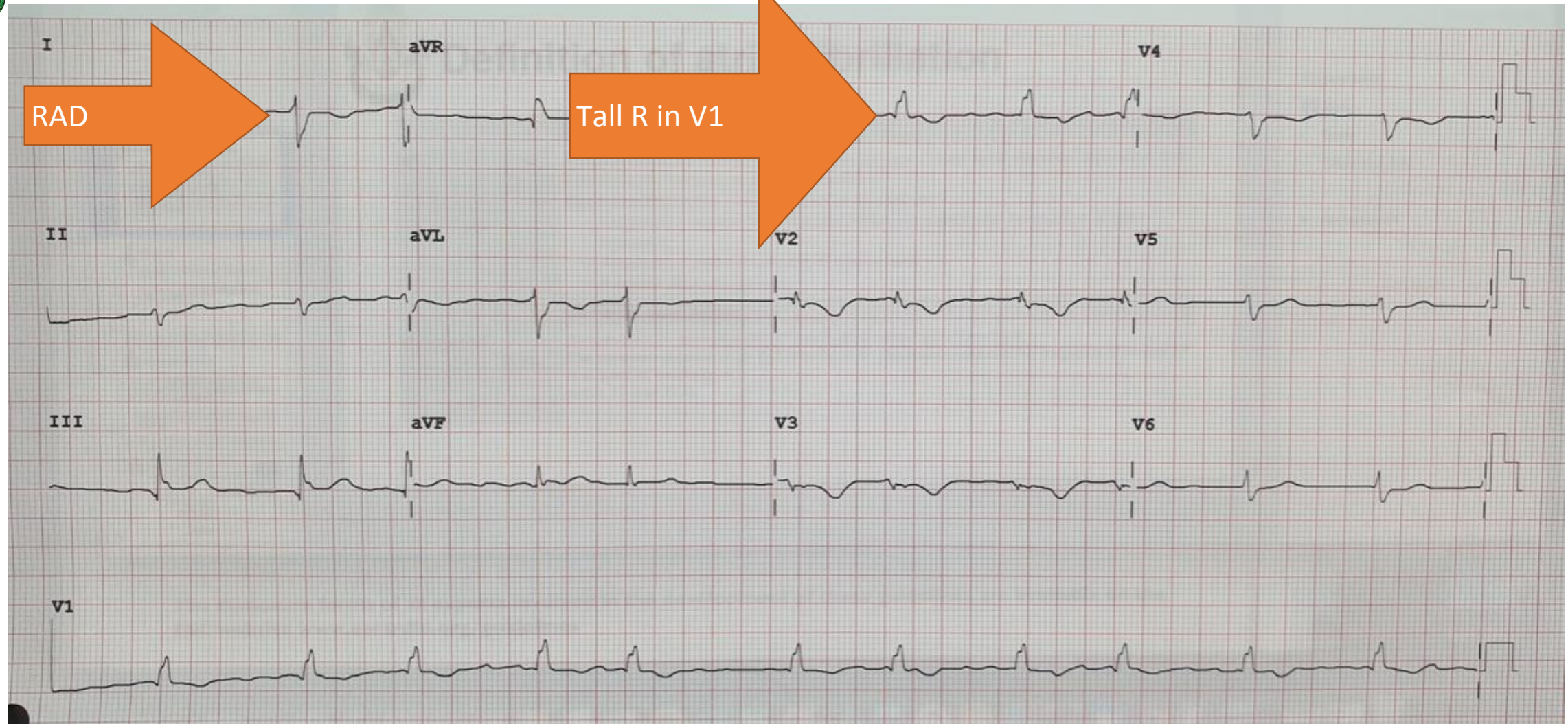
- (1) irregular RR intervals in the absence of complete AV block
- (2) an absence of distinct P waves on surface ECG
- (3) an atrial cycle length that is variable and generally less than 200 ms

Lewis Leads


R
L
LL
V1
V2
LL
V3
V6
V4
V5
N
F
Lewis lead
HN:22321/63 AN 15336/63
16
aVF
V5


Technician:
Test ind:
Irregular rhythm
I
aVR
V1
V4
II
V5
III
aVF
V3
V6
II
Q wave in anterior wall

AF and MS



Risk of POAF (perioperative)

- pre-existing risk factors for atrial dilation including hypertension, myocardial ischemia, and valvular abnormalities such as mitral regurgitation.

- direct surgical trauma associated with atriotomy incisions and pericardial disruption —-> local inflammation and subsequent alterations in atrial electrical excitability.

- cardiopulmonary by-pass, the atria can remain electrically active despite sufficient cardioplegia administration for ventricular electrical arrest—-->continuing activity may predispose the atria to ischemia and subsequent arrhythmias

Risk of POAF (Postoperative)

- Large fluid shifts perioperatively and electrolyte disturbances.
- increased endogenous catecholamines, inflammatory and oxidative mediators secondary to surgical stress and the systemic response to cardiopulmonary bypass.
- use of exogenous catecholamines for inotropic support, and variations in both intravascular volume status and systemic blood pressure leading to changes in atrial stretch and myocardial perfusion.

How to predict POAF

Phase of POAF

- The first phase encompasses the first 18 h postoperatively with the greatest risk at hour zero
- the second phase occurs with the risk peaking at 24–48 hrs

- The most consistent independent risk factor across multiple studies has been increasing patient age
- consistent reproducibility of factors between studies has been lacking
- significant heterogeneity in the literature regarding how POAF is defined, identified, and reported

Outcomes of POAF

Perioperative/Postoperative Atrial Fibrillation and Risk of Subsequent Stroke and/or Mortality

A Meta-Analysis

Meng-Hsin Lin, MD; Hooman Kamel, MD; Daniel E. Singer, MD; Yi-Ling Wu, DrPH; Meng Lee, MD; Bruce Ovbiagele, MD, MS

Study, Country	Population Characteristics	Sample Size (Women, %)	Age, y POAF/No. POAF	Percentage of Cardiac Surgery	Study Duration, y	End Points
Hogue et al,[9] United States	CABG and valve surgery					
Stamou et al,[20] United States	Isolated CABG					
Villareal et al,[5] United States	Isolated CABG					
Nielsen et al,[21] United States	Lung transplantation					
Kalavrouziotis et al,[22] Canada	Isolated CABG or concomitant CABG and valve surgery					
Mariscalco and Engström,[23] Sweden	Cardiothoracic surgery					
Mariscalco et al,[24] Italy	Isolated CABG					
Ahlsson et al,[25] Sweden	First isolated CABG					
Filardo et al,[26] United States	First isolated CABG					
Bramer et al,[4] the Netherlands	First isolated CABG					
Filardo et al,[27] United States	without CABG					
El-Chami et al,[28] United States	Isolated CABG					
Ahlsson et al,[29] Sweden	First isolated CABG					
Bramer et al,[3] the Netherlands	Mitral valve repair/replacement with/without CABG or tricuspid valve surgery					
Tarakji et al,[30] United States	Primary isolated or reparative CABG		67/63			
Bhave et al,[31] United States	Major noncardiac surgery	370 447 (57)	74.6±10.6/62.4±16.2	0	1	In-hospital mortality
Almassi et al,[32] United States	Isolated CABG	2103 (NA)	65.3±8.5/61.6±8.2	100	1	Long-term mortality
Saxena et al,[33] Australia	Isolated CABG	19 497 (NA)	68.0±9.0/64.0±10.7	100	3.7	Early stroke and mortality; long-term mortality
Imperatori et al,[12] Italy	Elective pulmonary lobectomy	454 (19)	68.6±6.8/66.0±8.9	0	3	Long-term mortality
Horwich et al,[13] Canada	First isolated CABG	8058 (25)	NA/NA	100	5.7	Long-term stroke or mortality
O'Neal et al,[34] United States	First isolated CABG	13 165 (30)	66±9.3 (Black POAF)/68±9.0 (White POAF)/62±10 (No POAF)	100	8.2	Long-term mortality
Lapar et al,[35] United States	First isolated CABG	49 264 (29)	69±10/63±11	100	12	Early mortality
Whitlock et al,[11] Canada	CABG, isolated valvular surgery, or combined surgery	108 711 (26)	Percentage of age >65: 66%/46%	100	2	Early and long-term stroke
Gialdini et al,[3] United States	Inpatient major surgery	1 729 360 (59)	71.5/56.2	4.2	2.1	Long-term ischemic stroke
Thoren et al,[37] Sweden	First isolated CABG	7428 (21)	69.0±7.7/65.2±9.1	100	9.8	Long-term mortality

Early outcomes were defined as stroke or mortality occurring within **30 days** of operation.

Late outcomes were defined as stroke or mortality occurring after 30 days

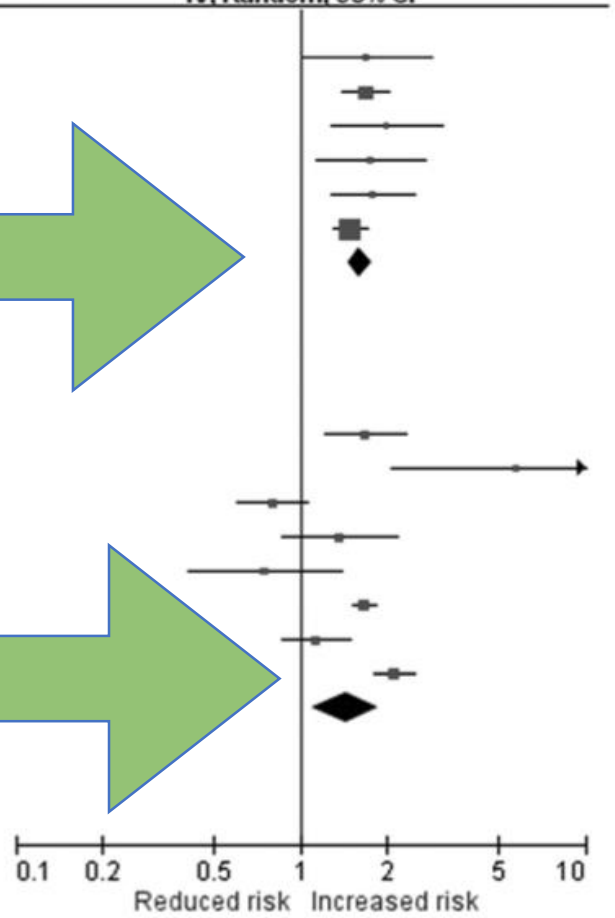
Stroke. 2019;50:1364-1371

Early Outcomes-Stroke and Mortality

Author	Year	POAF Events	POAF Population	No POAF Events	No POAF Population	Weight	Odds Ratio IV, Random, 95% CI
1.1.1 Early Stroke							
Hogue[19]	1999	NA	1022	NA	1950	3.6%	1.70 [1.00, 2.89]
Stamou[20]	2001	NA	NA	NA	NA	27.0%	1.70 [1.40, 2.06]
Villareal[8]	2004	30	994	82	5481	5.1%	2.01 [1.28, 3.15]
Kalavrouziotis[22]	2007	57	2047	64	5300	5.3%	1.77 [1.14, 2.75]
Saxena[13]	2012	73	5547	94	13950	9.2%	1.80 [1.29, 2.51]
Whitlock[10]	2014	NA	18046	NA	81091	4	
Subtotal (95% CI)		**160**	27656	240	107772	10	
Heterogeneity: Tau² = 0.00; Chi² = 2.81, df = 5 (P = 0.73); I² = 0%							
Test for overall effect: Z = 9.40 (P < 0.00001)							
1.1.2 Early Mortality							
Villareal[8]	2004	74	994	186	5481	13.5%	1.70 [1.22, 2.37]
Nielsen[21]	2004	39	78	28	122	5.0%	5.70 [2.10, 15.47]
Kalavrouziotis[22]	2007	61	2047	133	5300	14.3%	0.80 [0.60, 1.07]
Bramer[4]	2010	35	1122	64	3976	11.3%	1.38 [0.87, 2.19]
Bramer[5]	2011	25	361	35	495	8.7%	0.75 [0.40, 1.41]
Bhave[32]	2012	570	10957	6646	359490	16.8%	1.68 [1.52, 1.86]
Saxena[13]	2012	95	5547	170	13950	14.4	
LaPar[36]	2014	370	9255	680	40009	16.1	
Subtotal (95% CI)		**1269**	30361	7942	428823	**100.0**	
Heterogeneity: Tau² = 0.11; Chi² = 53.34, df = 7 (P < 0.00001); I² = 87%							
Test for overall effect: Z = 2.72 (P = 0.007)							

Stroke

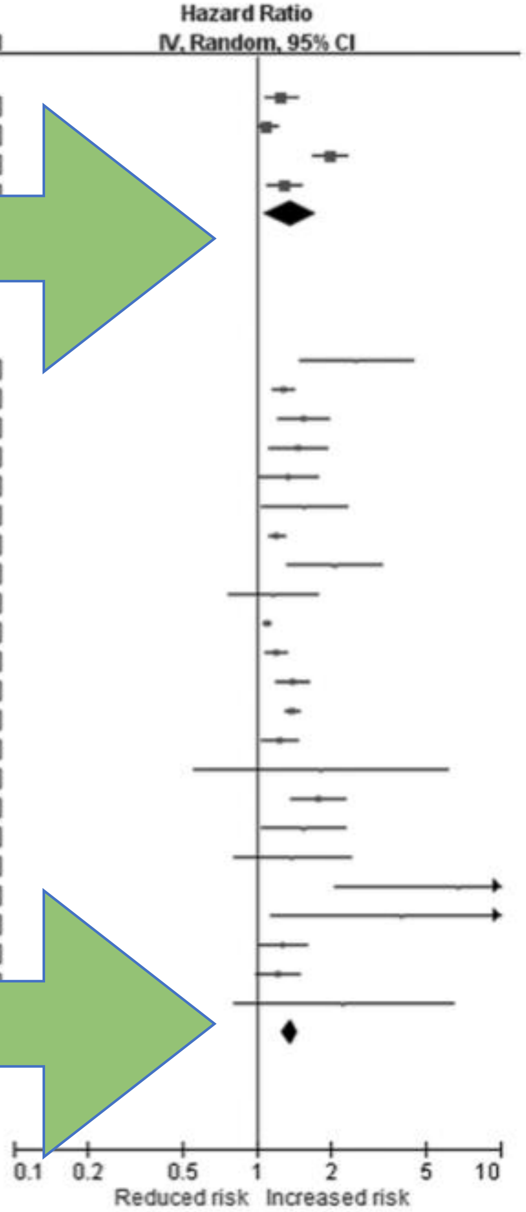
Mortality



Stroke. 2019;50:1364-1371

Longterm outcomes-Stroke and Mortality

Author	Year	POAF Events	POAF Population	No POAF Events	No POAF Population	Weight	Hazard Ratio IV, Random, 95% CI
2.1.1 Long-term stroke							
Horwich[33]	2013	337	2214	581	5844	24.8%	1.26 [1.08, 1.47]
Whitlock[10]	2014	NA	18046	NA	81091	26.3%	1.10 [1.00, 1.21]
Gialdini, non-cardiac[9]	2014	189	12874	5915	1642943	24.5%	2.00 [1.70, 2.35]
Gialdini, cardiac[9]	2014	117	11837	512	61706	24.4%	1.30 [1.10, 1.54]
Subtotal (95% CI)		**643**	**44971**	**7008**	**17[illegible]**	[illegible]	[illegible]
Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 38.77$, df = 3 ($P < 0.00001$); $I^2 = 92\%$							
Test for overall effect: Z = 2.45 (P = 0.01)							
2.1.2 Long-term mortality							
Mariscalco[24]	2008	73	570	122	1262	1.8%	2.56 [1.50, 4.37]
Filardo[26]	2009	452	1814	753	5085	8.0%	1.29 [1.16, 1.43]
Ahlsson[25]	2009	140	419	191	1000	5.0%	1.56 [1.23, 1.98]
Filardo[29]	2010	110	380	112	659	4.3%	1.48 [1.12, 1.96]
Bramer[4]	2010	168	1122	398	3976	4.3%	1.35 [1.02, 1.79]
Ahlsson[27]	2010	49	165	60	406	2.7%	1.57 [1.05, 2.35]
El-Chami[28]	2010	1701	2985	4878	13184	8.6%	1.21 [1.12, 1.31]
Bramer[5]	2011	65	361	45	495	2.4%	2.09 [1.34, 3.26]
Imperatori[12]	2012	31	45	270	409	2.5%	1.17 [0.76, 1.80]
O'Neal, White[34]	2013	1080	2537	2332	8330	9.1%	1.10 [1.06, 1.14]
Horwich[33]	2013	693	2214	1255	5844	8.0%	1.20 [1.08, 1.33]
O'Neal, Black[34]	2013	171	370	446	1928	6.9%	1.40 [1.20, 1.63]
Thoren[37]	2014	381	2152	548	4669	8.6%	1.40 [1.30, 1.51]
Al-Shaar[35]	2014	884	1211	2751	5094	6.4%	1.25 [1.05, 1.49]
Tulla[14]	2015	46	138	26	138	0.4%	1.83 [0.55, 6.11]
Melduni[38]	2015	112	226	119	377	4.6%	1.79 [1.38, 2.32]
Kothari[40]	2016	68	554	584	14594	2.8%	1.56 [1.05, 2.32]
Omer[41]	2016	82	215	320	1033	1.6%	1.40 [0.80, 2.45]
Leibowitz[44]	2017	9	15	73	395	0.4%	6.70 [2.10, 21.37]
Lee, female[43]	2017	9	79	10	314	0.4%	3.96 [1.13, 13.88]
Fengsrud[42]	2017	105	165	191	406	5.1%	1.28 [1.01, 1.62]
Swinkels[15]	2017	169	241	231	[illegible]	5.6%	1.22 [0.99, 1.50]
Lee, male[43]	2017	7	102	5	[illegible]	[illegible]	[illegible]
Subtotal (95% CI)		**6605**	**18080**	**15720**	[illegible]	[illegible]	[illegible]
Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 91.67$, df = 22 ($P < 0.00001$); $I^2 = 76\%$							
Test for overall effect: Z = 7.89 ($P < 0.00001$)							

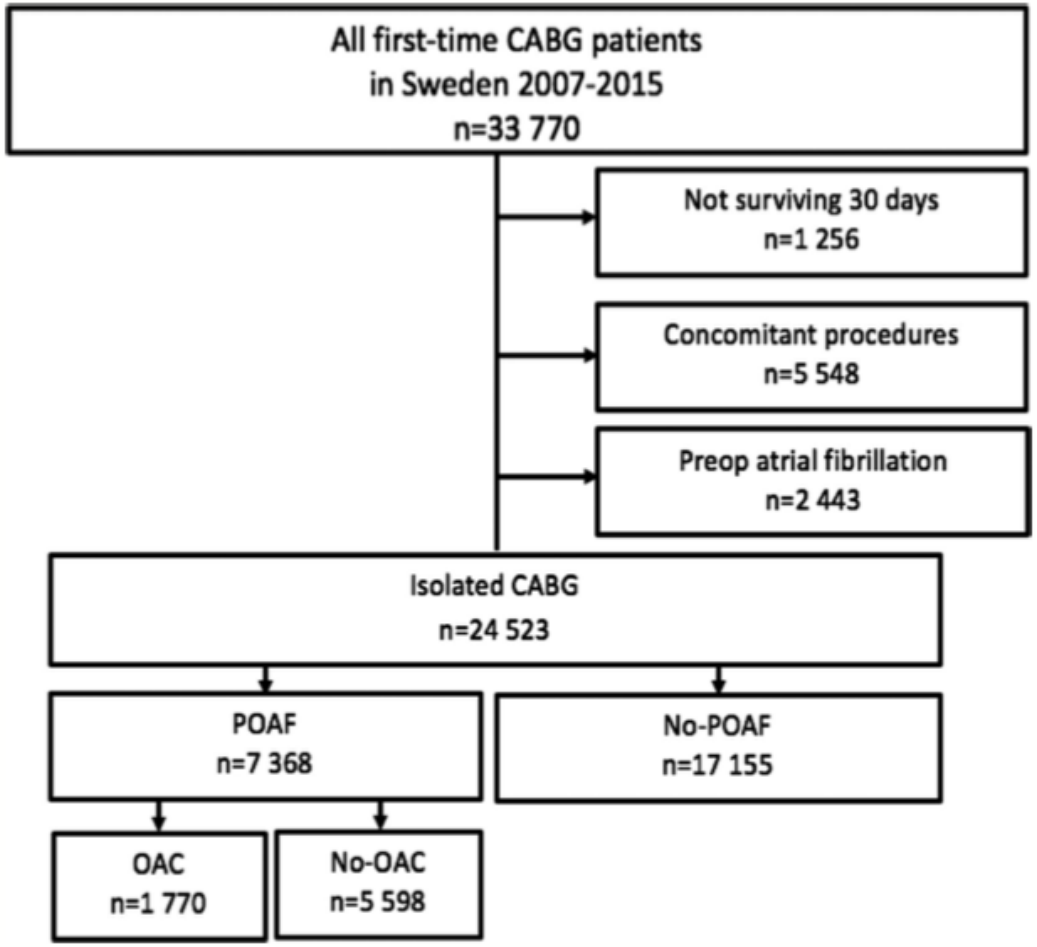


Stroke. 2019;50:1364-1371

Journal of the American Heart Association

ORIGINAL RESEARCH

New-Onset Atrial Fibrillation After Coronary Artery Bypass Grafting and Long-Term Outcome: A Population-Based Nationwide Study From the SWEDEHEART Registry

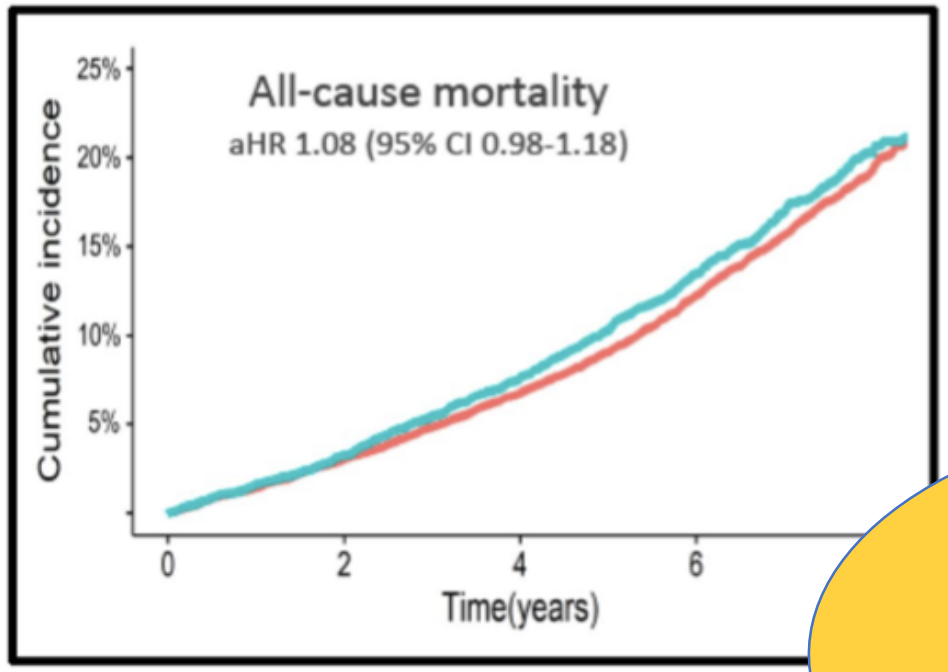


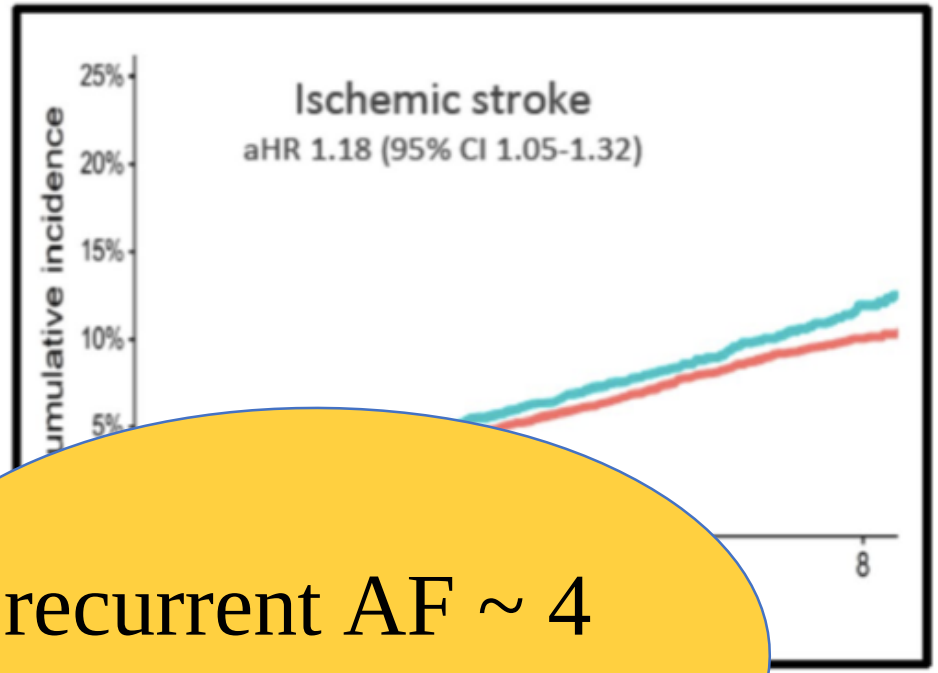
J Am Heart Assoc. 2020;9:e017966

Crude Event Rates After First-Time Isolated CABG

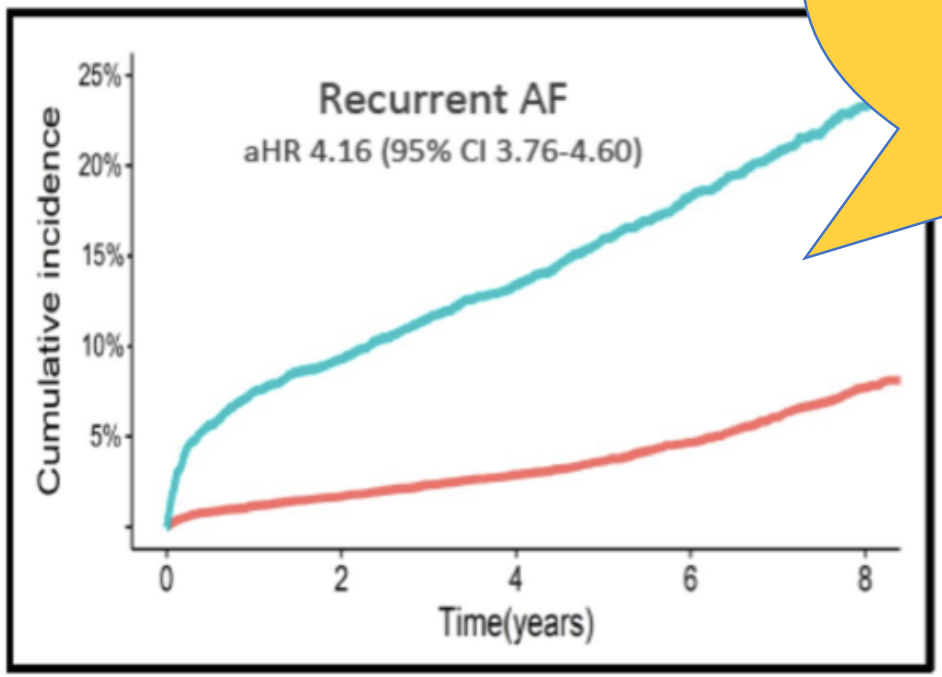
Outcomes	POAF Event Rate	No POAF Event Rate	Unadjusted HR (95% CI)	Adjusted* HR (95% CI)	*P* Value
All-cause mortality	2.9	2.1	1.42 (1.31–1.54)	1.08 (0.98–1.18	0.106
Ischemic stroke	1.8	1.3	1.40 (1.26–1.5	Ischemic Stroke	0.004
Peripheral arterial embolism	0.1	0.1	1.00 (0.65–1.55)	0.79 (0.50–1.23	0.293
Transitory ischemic attack	0.8	0.6	1.29 (1.11–1.51)	1.10 (0.94–1.30)	0.237
Any thromboembolism	2.4	1.8	1.37 (1.25–1.51)	1.16 (1.05–1.28	0.003
Heart failure	2.1	1.1	1.80 (1.62–1.9	Heart failure	<0.001
Recurrent AF	4.0	0.8	4.63 (4.20–5.09)	4.16 (3.76–4.60	<0.001
Pulmonary embolism	0.3	0.2	1.46 (1.13–1.89)	1.26 (0.95–1.67)	0.106
Major bleeding	2.0	1.6	1.30 (1.18–1.43)	1.05 (0.95–1.17)	0.337

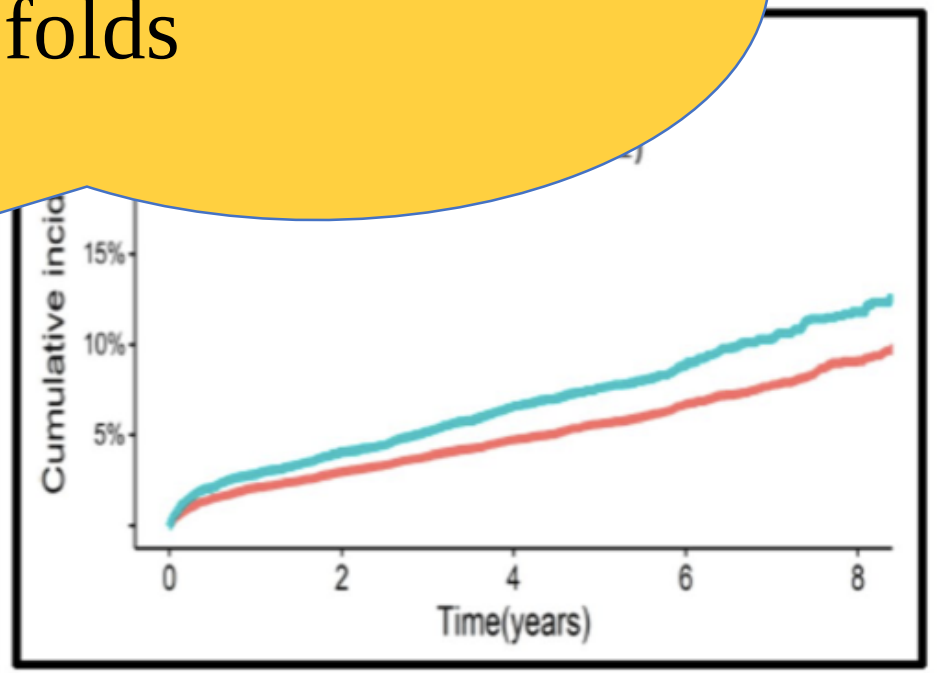
J Am Heart Assoc. 2020;9:e017966





recurrent AF ~ 4 folds





J Am Heart Assoc. **2020;9:e017966**

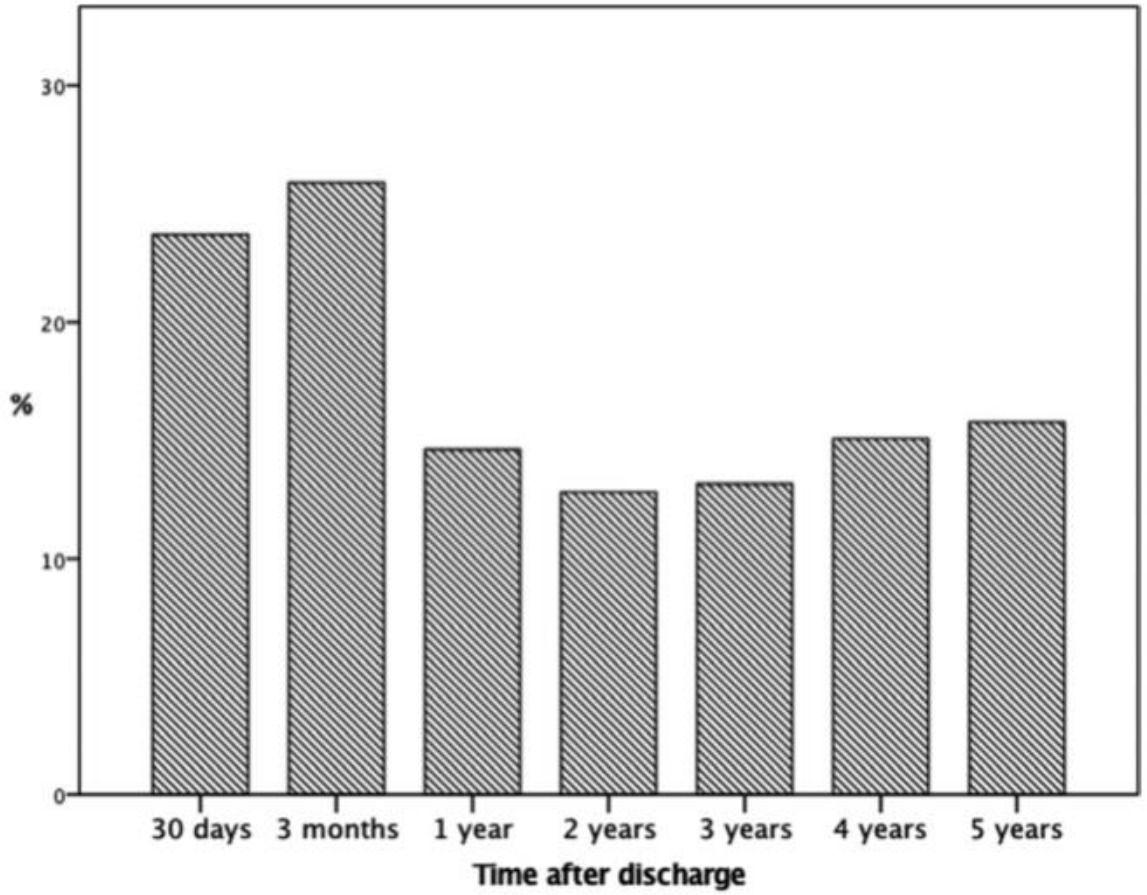
Outcomes of OAC

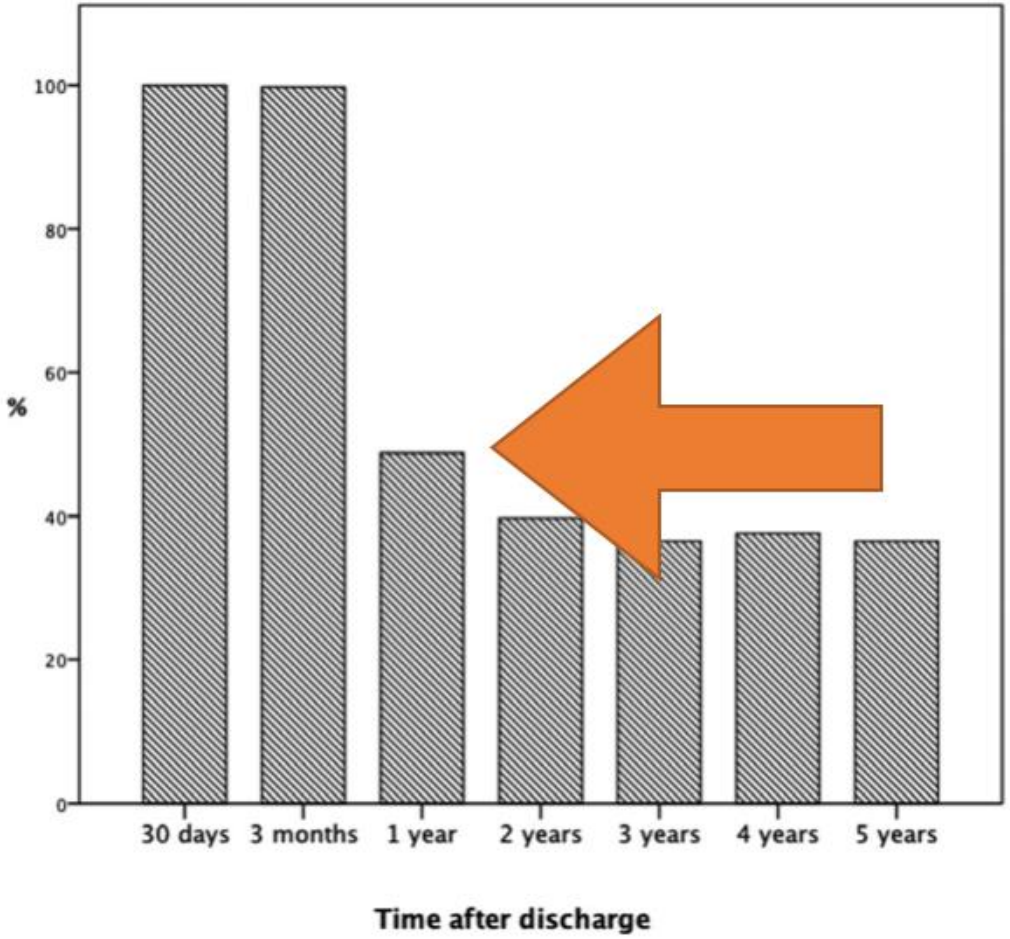
Outcomes	Event Rate With OAC	Event Rate Without OAC	Unadjusted HR (95% CI) OAC vs No-OAC	Adjusted* HR (95% CI OAC vs no-OAC	*P* Value
All-cause mortality	3.0	2.8	1.08		0.257
Ischemic stroke	2.0	1.7	1.13		0.625
Any thromboembolism	2.6	2.4	1.10		0.942
Transitory ischemic attack	0.9	0.8	1.09 (0.81–1.49)	0.97 (0.58–1.63)	0.915
Pulmonary embolism	0.2	0.3	0.75 (0.42–1.34)	0.50 (0.22–1.13)	0.096
Major bleeding	2.4	1.9	1.26 (1.04–1.52)	1.40 (1.08–1.82)	0.011

ischemic stroke

J Am Heart Assoc. 2020;9:e017966

Oral Anticoagulation





J Am Heart Assoc. 2020;9:e017966

Circulation

ORIGINAL RESEARCH ARTICLE

Postoperative Atrial Fibrillation and Long-Term Risk of Stroke After Isolated Coronary Artery Bypass Graft Surgery

Clinical Perspective

What Is New?

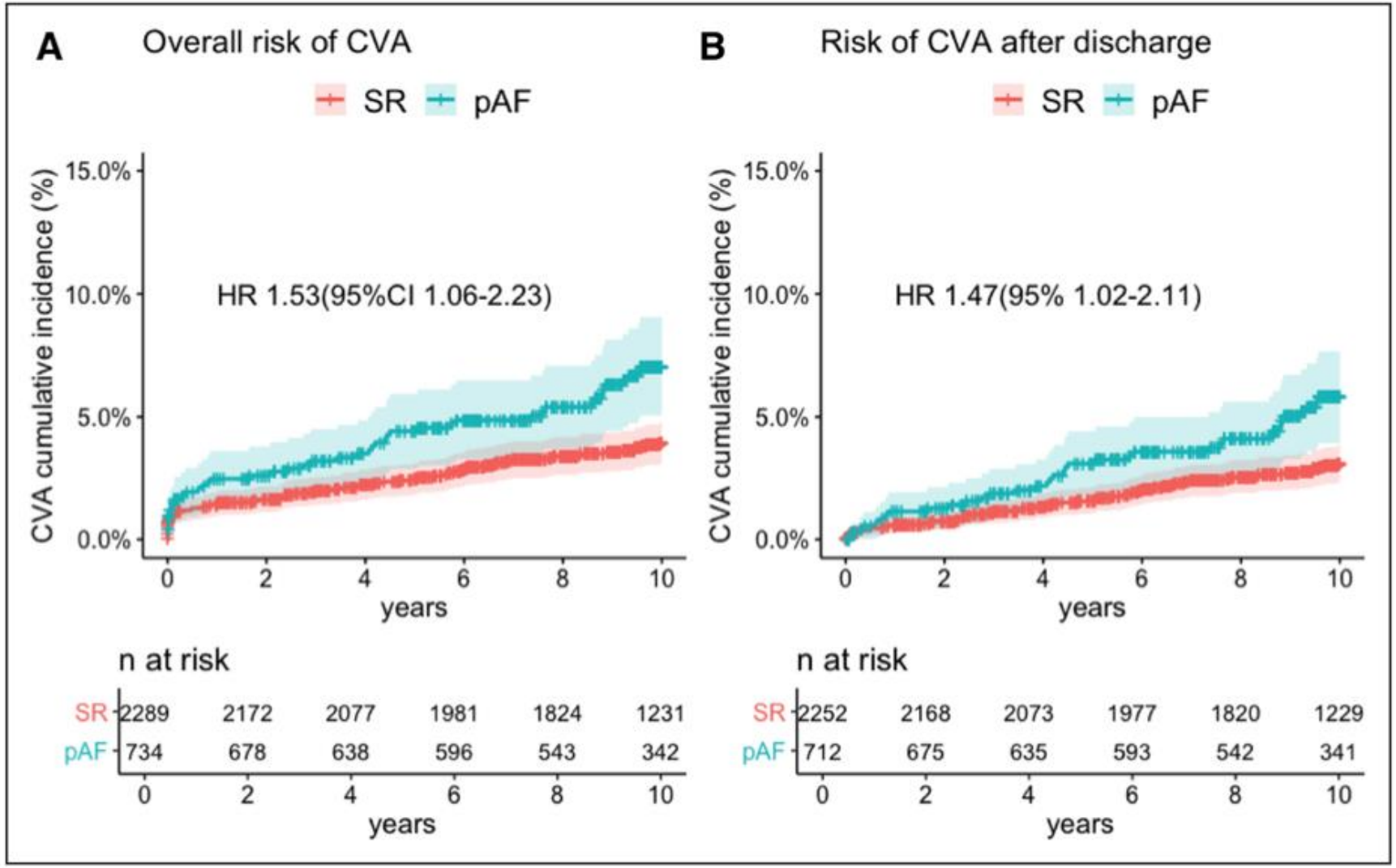
- Postoperative atrial fibrillation (pAF) after coronary artery bypass grafting is independently associated with a higher risk of cerebrovascular accidents at 10 years.
- The association between pAF and risk of cerebrovascular accident persists when cerebrovascular accidents that occurred before discharge are excluded.
- pAF is also independently associated with a higher risk of cardiovascular and all-cause mortality.

What Are the Clinical Implications?

- Our findings highlight the need to revisit the notion that pAF is a transient, benign condition.
- Patients with pAF after coronary artery bypass grafting should be considered for stricter surveillance with continuous heart rhythm monitoring and anticoagulation therapy in those at very high risk (ie, CHA_2DS_2-VASc score ≥4).

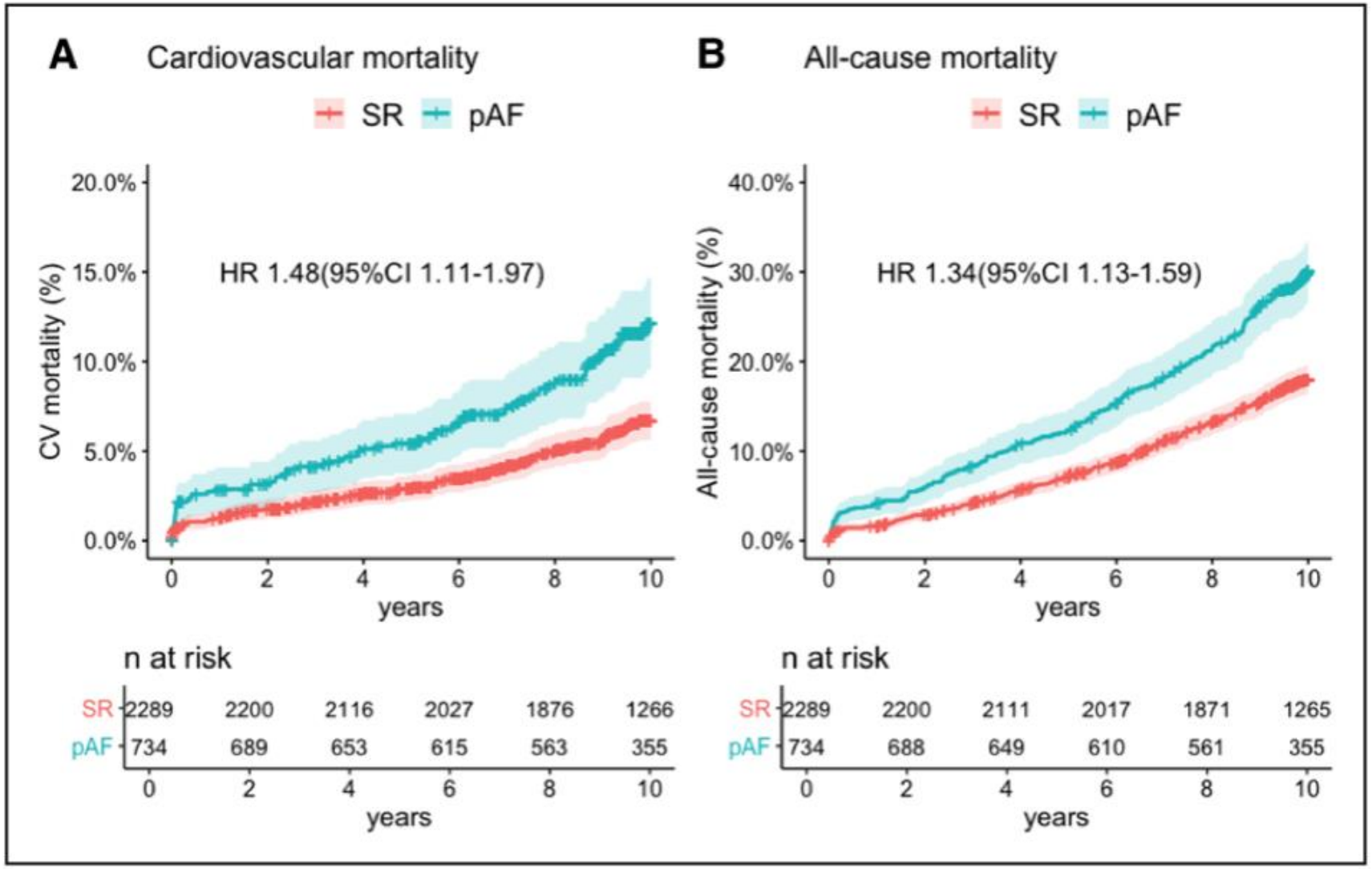
Circulation. 2020;142:1320–1329.

Stroke



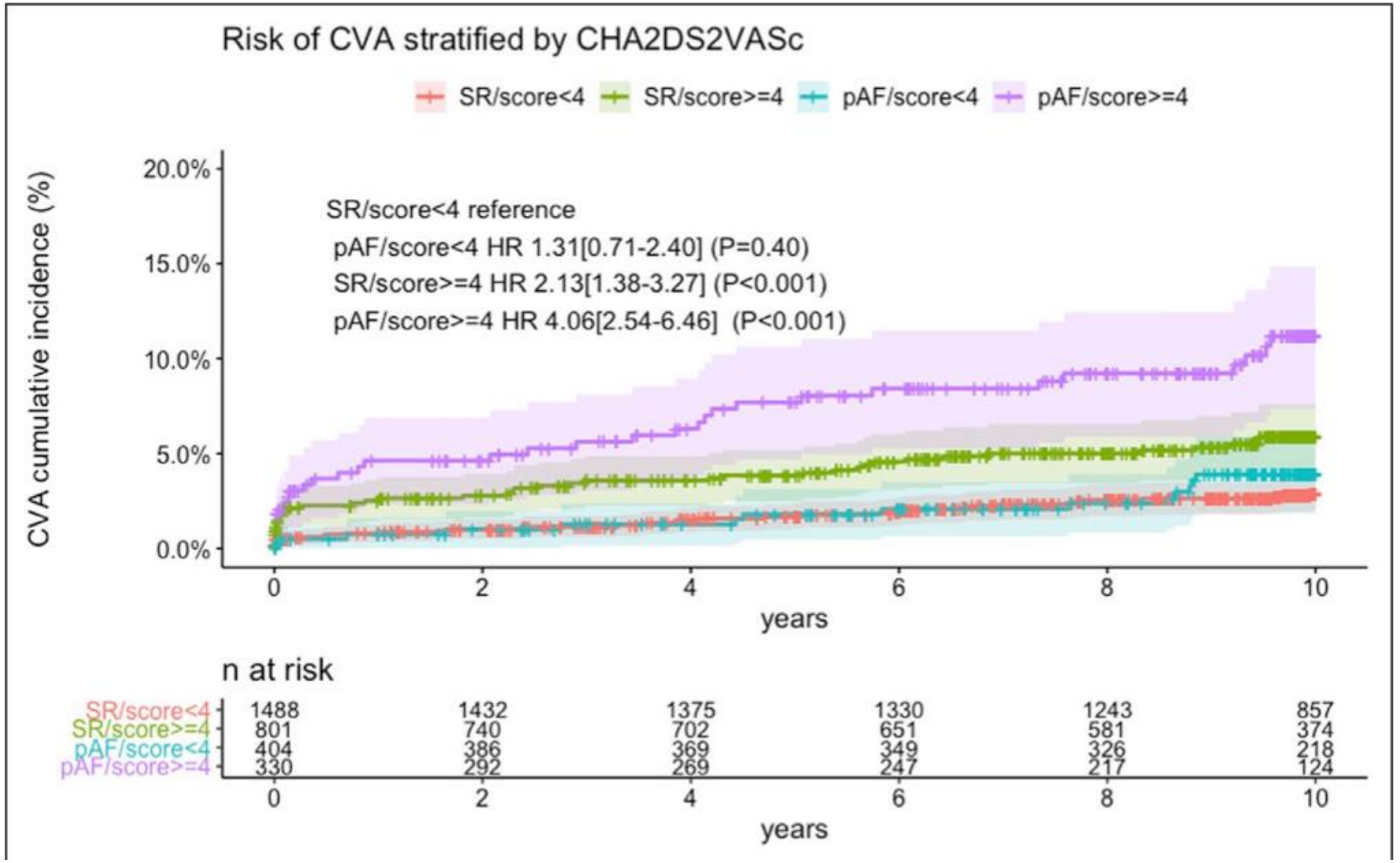
Circulation. 2020;142:1320–1329.

Mortality



Circulation. 2020;142:1320–1329.

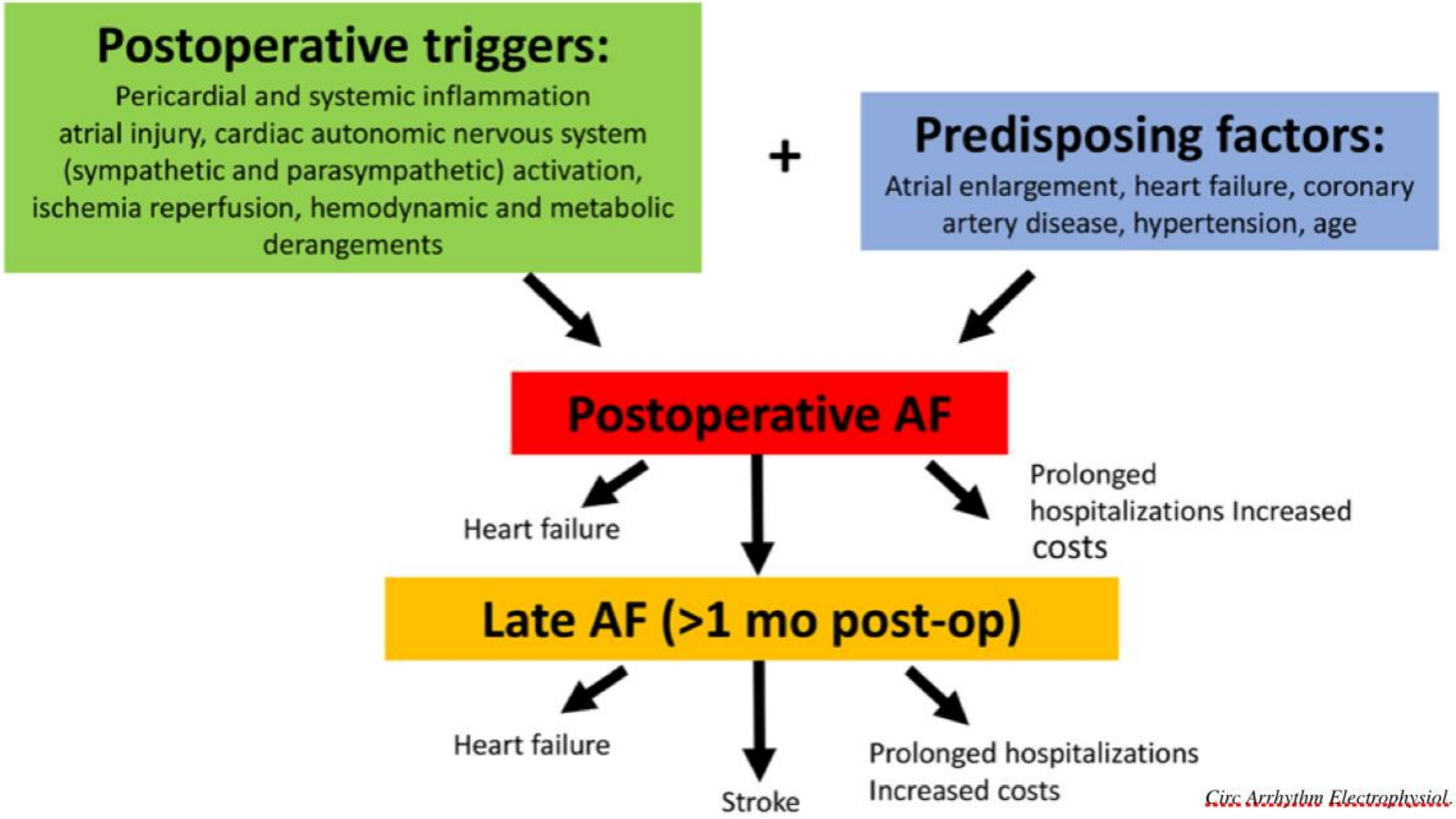
CHADSVASC score



Circulation. 2020;142:1320–1329

How to prevent POAF?

Preventative Strategies and Associated Evidence Base



Circ Arrhythm Electrophysiol. 2019;12:e007865

Preventative Strategies and Associated Evidence Base

- Correct electrolytes ..K , Mg
- Beta blockers—any BB
- Amiodarone
- Ranolazine
- Colchicine
- Statin-preexisting indication
- Fish oil
- Weak evidence(do not support) —Vitamin C/E, N-Acetylcysteine, Levosimandan, NSIADS, Steroid

Surgical Manipulations

- Posterior Pericardiotomy
- Epicardial Fat Pad Manipulations
- Anterior Fat Pad Preservation vs Dissection or Removal
- Fat Pad Botulinum Toxin Injection
- Off-pump Coronary Artery Bypass Grafting
- Concomitant Surgical Ablation

How to treat POAF?

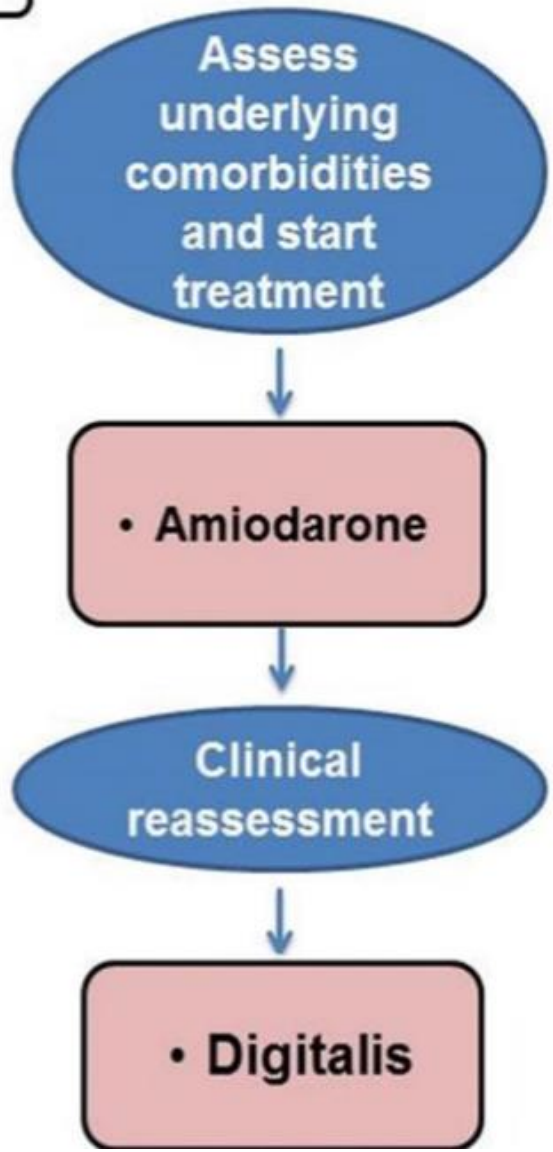
Treatment Strategies

- Rate control (CCB , BB , digoxin)
- Electrical cardioversion (with anti-arrhythmic Rx)
- Pharmacological cardioversion- Amiodarone , Vernakalant, Ibutilide
- Anticoagulation- Heparin ,LMWH ,NOACs
- AF lasting more than 48 hrs or of unknown duration,TEE should be carried out to exclude the presence of any intracardiac thrombus.

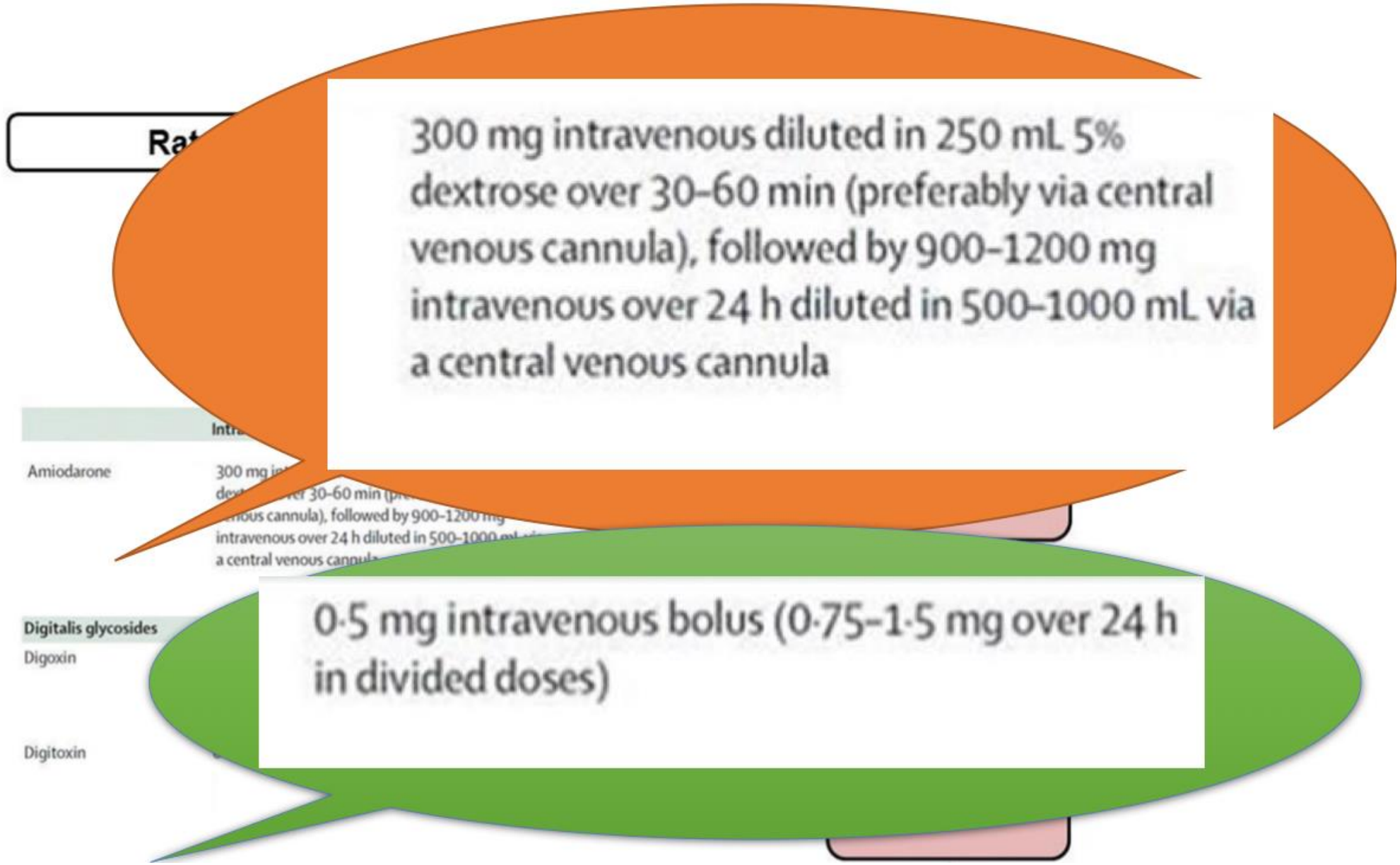
Rate control in acute HF (with or without HF)

Rate control in acute heart failure

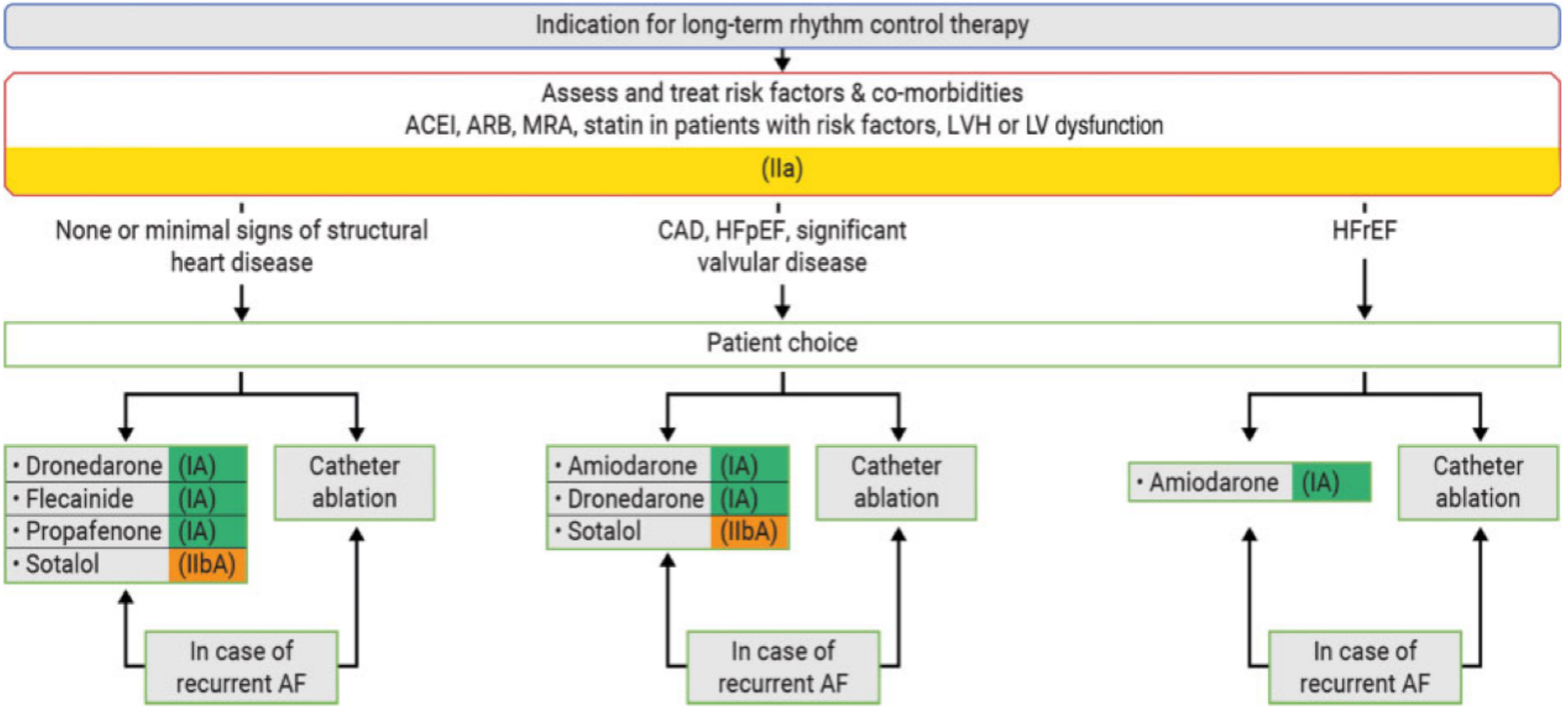
	Intravenous administration	Usual oral maintenance dose
Amiodarone	300 mg intravenous diluted in 250 mL 5% dextrose over 30–60 min (preferably via central venous cannula), followed by 900–1200 mg intravenous over 24 h diluted in 500–1000 mL via a central venous cannula	200 mg once a day
Digitalis glycosides		
Digoxin	0·5 mg intravenous bolus (0·75–1·5 mg over 24 h in divided doses)	0·0625–0·25 mg once a day
Digitoxin	0·4–0·6 mg	0·05–0·3 mg once a day



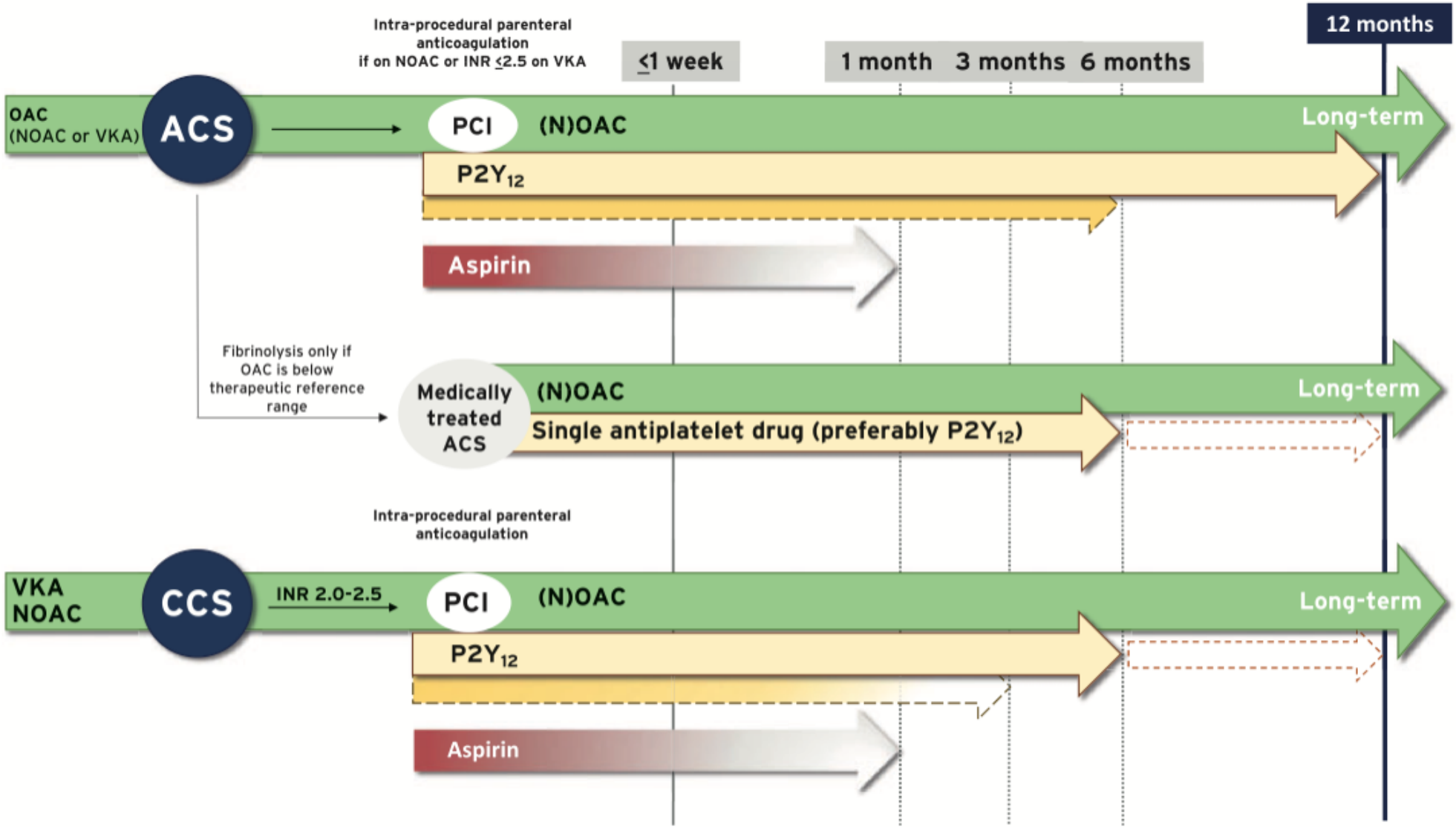
Rate control in acute HF (with or without HF)



Rhythm control

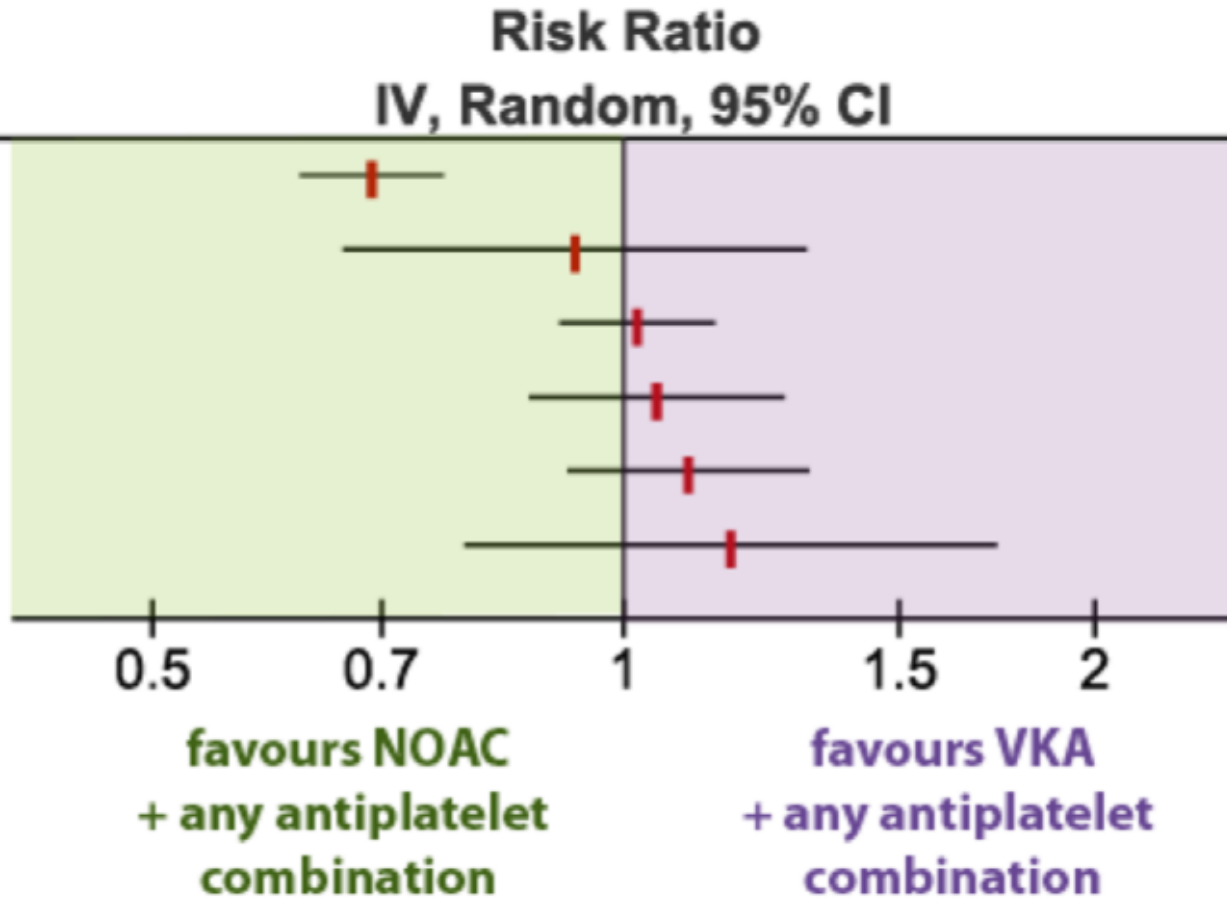


ACS and CAD


Intra-procedural parenteral anticoagulation if on NOAC or INR ≤2.5 on VKA
≤1 week
1 month
3 months
6 months
12 months
OAC (NOAC or VKA)
ACS
PCI
(N)OAC
Long-term
P2Y12
Aspirin
Fibrinolysis only if OAC is below therapeutic reference range
Medically treated ACS
(N)OAC
Long-term
Single antiplatelet drug (preferably P2Y12)
Intra-procedural parenteral anticoagulation
VKA NOAC
CCS
INR 2.0-2.5
PCI
(N)OAC
Long-term
P2Y12
Aspirin

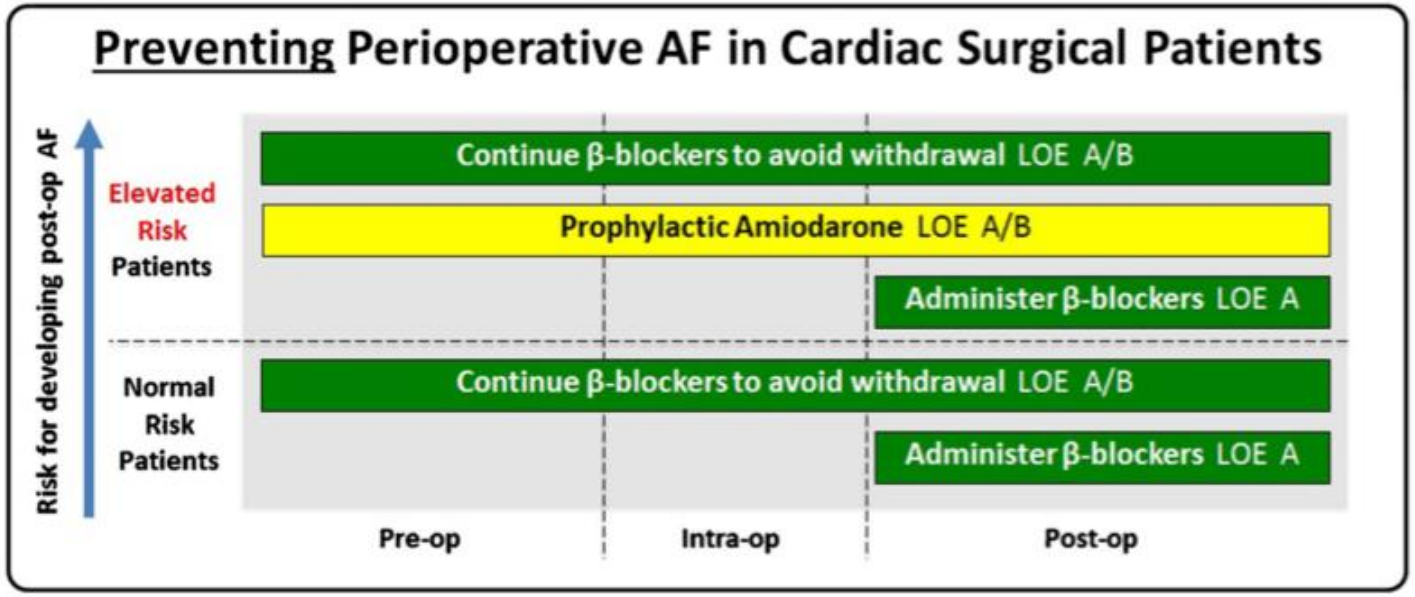
Dual therapy in CAD

ISTH major/CRNM bleeding	0.69 [0.62, 0.77]
Stroke	0.93 [0.66, 1.31]
MACE	1.02 [0.91, 1.14]
Myocardial infarction	1.05 [0.87, 1.27]
All - cause death	1.10 [0.92, 1.31]
Stent thrombosis	1.17 [0.79, 1.73]



J. Clin. Med. **2020**, *9*, 1120

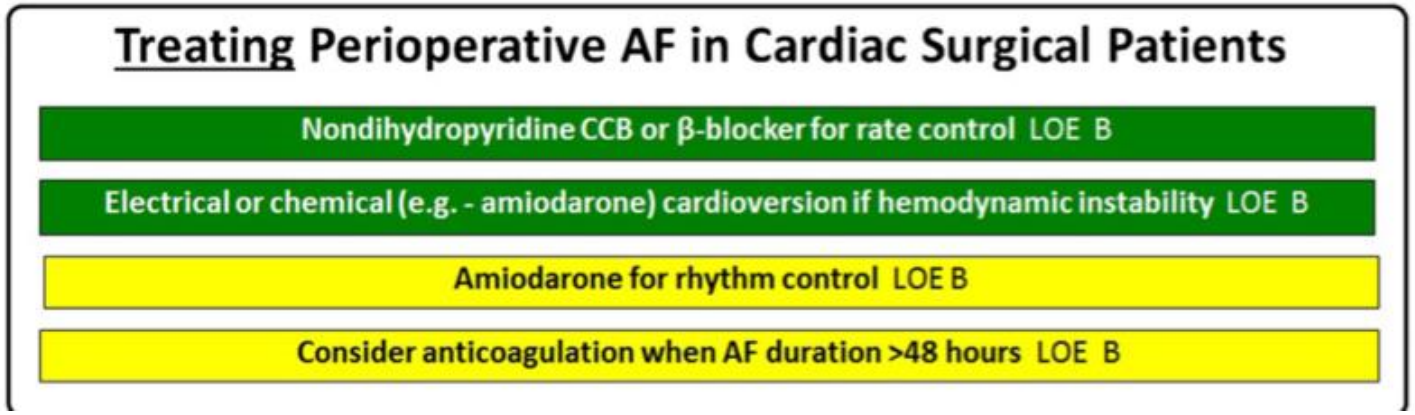
Guidelines- 2019 EACTA



Risk Factors for Perioperative AF

- Age > 75
- History of AF
- Renal Failure
- Mitral valve surgery/ disease
- Heart Failure
- COPD

There may be other important risk factors to consider in any individual patient



eacta

European Association of Cardiothoracic Anaesthesiologists

Guidelines- 2019 SCA

Additional Therapies with only Class IIb Recommendation

Sotalol LOE A/B	**Post-op Corticosteroids** LOE A
Intra-op biatrial pacing LOE B	**Post-op Colchicine** LOE B

Class of Recommendation

- Class I
- Class IIa
- Class IIb

SOCIETY OF CARDIOVASCULAR ANESTHESIOLOGISTS

Knowledge • Care • Investigation

2020 ESC -Post operative Cardiac/Non-cardiac surgery

Recommendations	Class[a]	Level[b]
Perioperative amiodarone or beta blocker therapy is recommended for the prevention of postoperative AF after cardiac surgery.[1390,1492]	I	A
Long- OAC therapy to prevent thrombo- s should be considered in patients at risk stroke with postoperative AF after non-cardiac surgery, considering the anticipated net clinical benefit of OAC therapy and informed patien references.[1404,1405,1408,1409]	IIa	B
Long- OAC therapy to prevent thrombo- may be considered in patients at risk fo ke with postoperative AF after cardiac su gery, considering the anticipated net clinical benefit of OAC therapy and informed patient preferences.[1404,1405,1408,1409]	IIb	B

Should be considered

may be considered

Conclusions

- Post operative AF increased stroke (short and long term).
- Post operative AF increased heart failure.
- Recurrent AF is likely.
- Oral anticoagulant/ LMWH may play a significant role.
- Beta blockers are recommended.
- Amiodarone is the the initial rhythm or rate control.
- CHA_2DS_2VAC consideration is mandatory.