

# **Management of atrial fibrillation: Rate vs Rhythm Control in 2018**

**Presented by:**

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# A 2-minute review of my life.

- I was born in **Kettering, OH.**
- I grew up in **Beavercreek, OH.**
- When I was 8 years old, my dad had a heart attack.
- I went to **University.**
- I went to **State** **Unive**



# A 2-minute review of my life.

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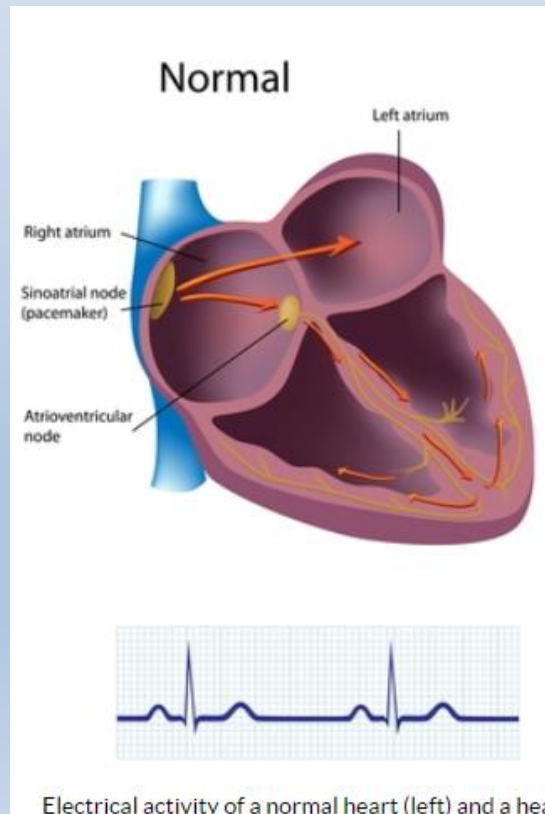
# Rate vs Rhythm Control in 2018

- **Objectives:**

- 1. Know the indications for cardioversion.**
- 2. Know the risks & benefits of anti-arrhythmic drug therapy.**
- 3. Know the indications for pulmonary vein isolation (AF ablation).**

# “What is a-fib, anyway?”

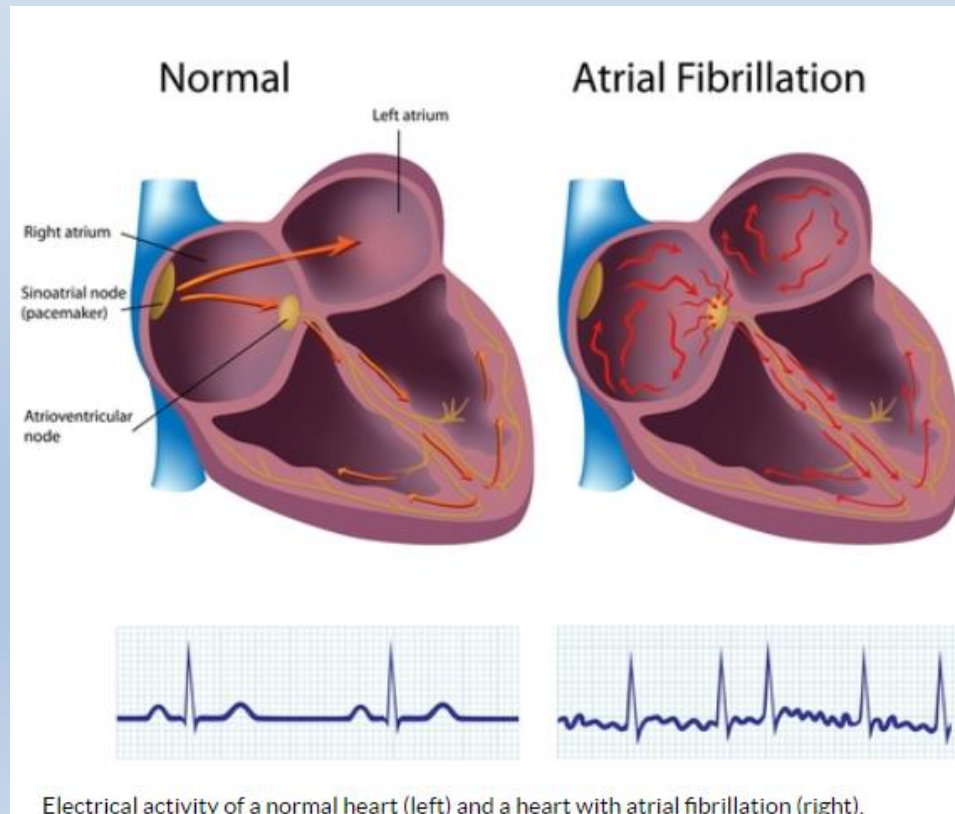
- Normal sinus rhythm is a **regular**, electrical impulse that originates from the **sinus node**, in the high right atrium.





# “What is a-fib, anyway?”

- Normal sinus rhythm is a **regular**, electrical impulse that originates from the **sinus node**, in the high right atrium.
- Atrial fibrillation is an **irregular**, chaotic rhythm caused by multiple **short circuits** in the atria – commonly associated with **scar tissue**.

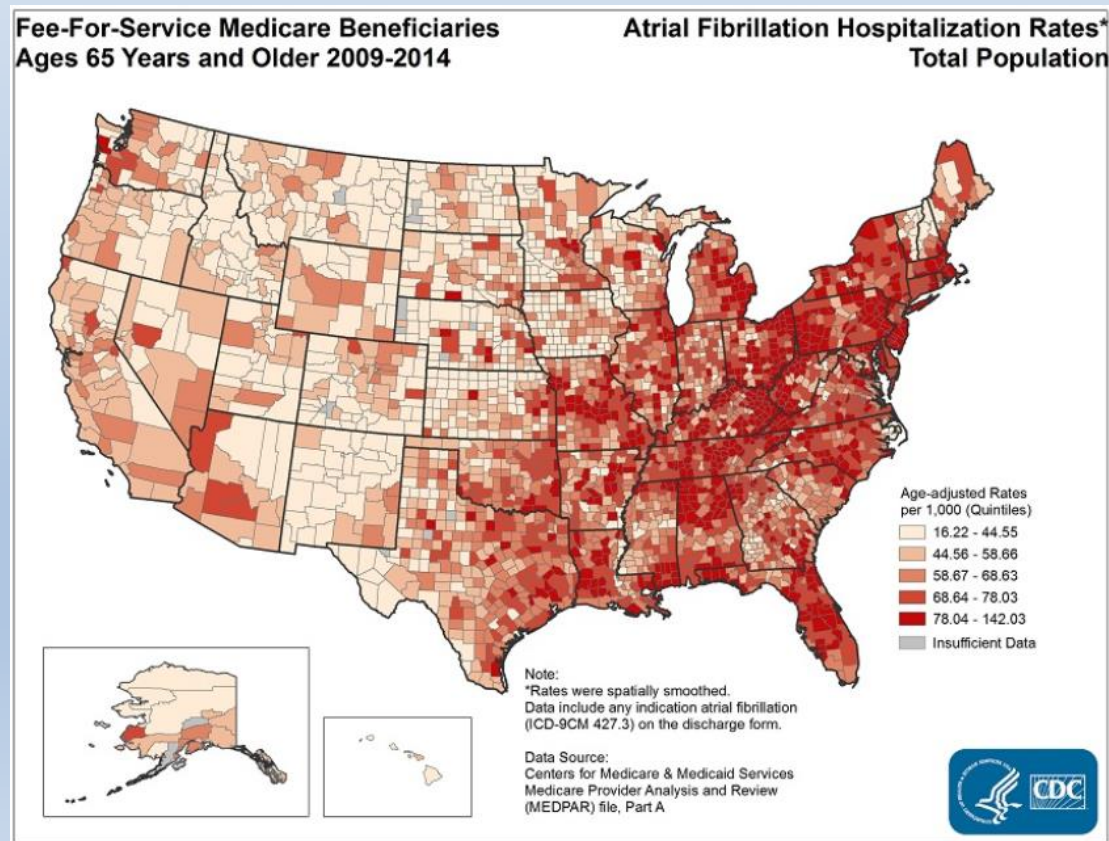


# “What is a-fib, anyway?”

- Normal sinus rhythm is a **regular**, electrical impulse that originates from the **sinus node**, in the high right atrium.
- Atrial fibrillation is an **irregular**, chaotic rhythm caused by multiple **short circuits** in the atria – commonly associated with **scar tissue**.
  - Scar tissue (“stretch-marks”) in the atria can form with:
    - more birthdays (normal wear-and-tear),
    - high blood pressure,
    - high lung pressure (snoring, smoking),
    - high heart pressure (heart failure), or
    - can be hereditary.
  - Electrical short circuits love to hide in **scar tissue**.
  - With extra heartbeat commands (PACs), a-fib can be **triggered** – and these short circuits can switch on.
- 7 ■ Once triggered, each circuit behaves like a “**backseat driver**.”

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# “What is a-fib, anyway?”

- Normal sinus rhythm is a **regular**, electrical impulse that originates from the **sinus node**, in the high right atrium.
- Atrial fibrillation is an **irregular**, chaotic rhythm caused by multiple **short circuits** in the atria – commonly associated with **scar tissue**.
- Other risk factors:
  - Post-operative state,
  - Systemic inflammation or infection,
  - Endocrine abnormalities (hyperthyroidism), or
  - Toxins (high doses of alcohol or stimulants).

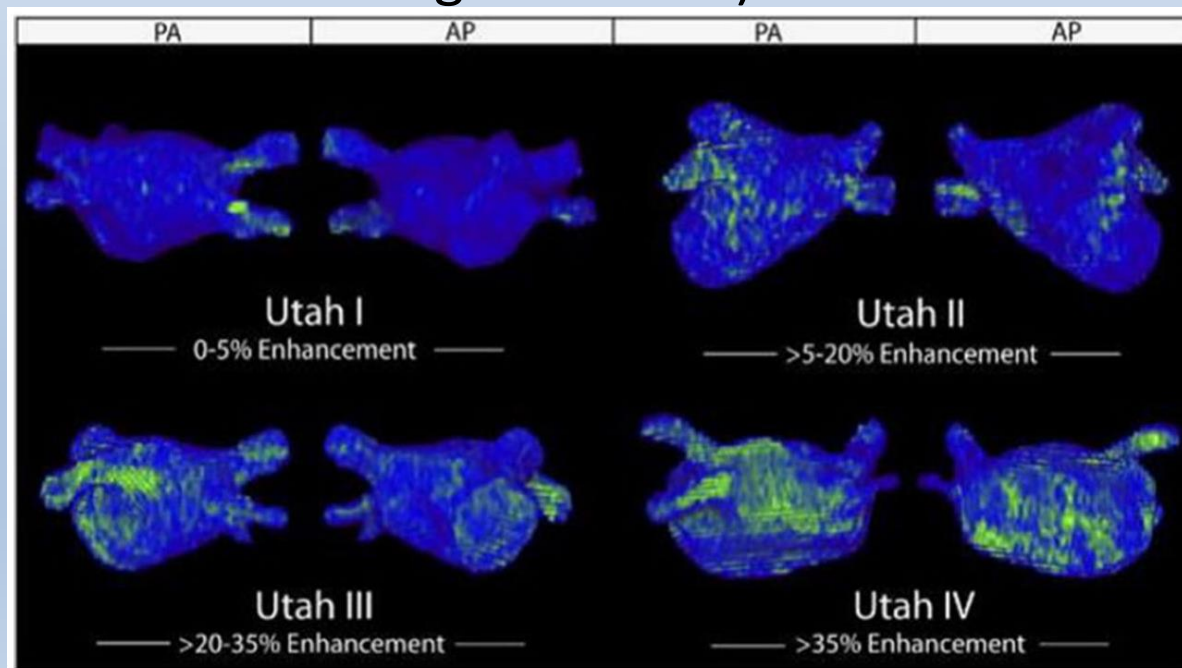
# “What is a-fib, anyway?”

- Stages of atrial fibrillation:
  - **Paroxysmal** (<7 days at a time),
  - **Persistent** (>7 days at a time), or
  - **Permanent** (patient & provider have agreed not to pursue rhythm control strategies further).

**More atrial scar = higher stage.**

# “What is a-fib, anyway?”

- Stages of atrial fibrillation:
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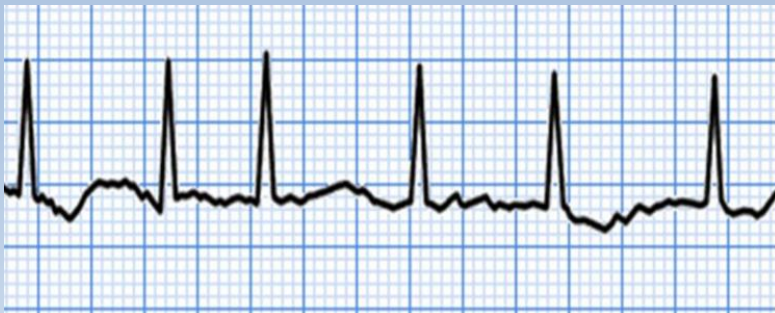
# “What is a-fib, anyway?”

- For our patients:
  - Atrial fibrillation may be considered analogous to asthma – as it **cannot be cured**, but we can try and take the **triggers** for AF away.
  - Atrial fibrillation is a chronic problem that we can help manage.



## normal sinus rhythm

regular atrial activity  
discrete P waves



## atrial fibrillation

irregularly irregular  
no discrete P waves

# “How does a-fib feel?”

- Does the patient have **symptomatic** atrial fibrillation?
  - palpitations
  - fatigue
  - confusion
  - dyspnea
  - lightheadedness
- If the patient has **symptomatic** atrial fibrillation, a **rhythm control** strategy may be considered.
- Success rates for rhythm control are affected by stage:
  - **paroxysmal** (AF <7 days at a time), vs
  - **persistent** (AF that has lasted >7 days).

**Symptoms may occur with or without RVR!**



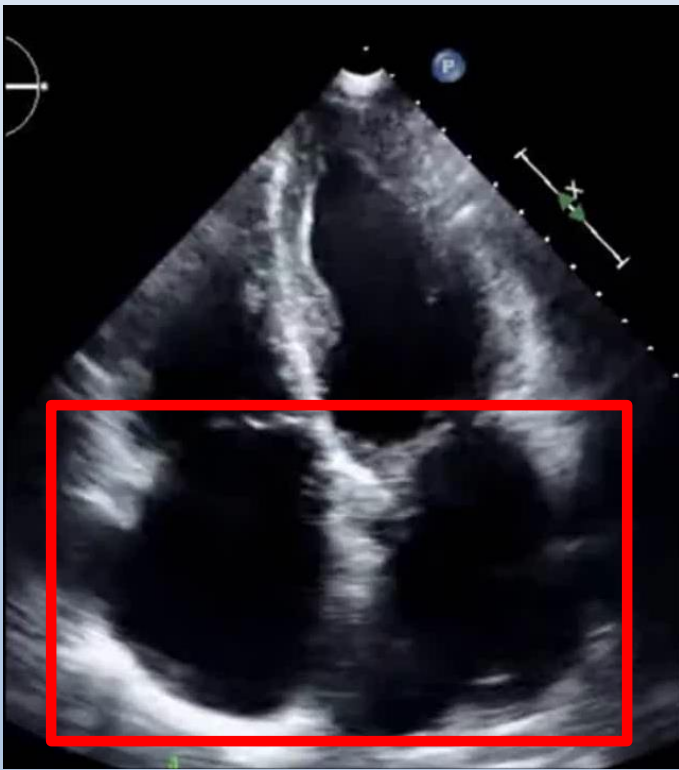
# “How does a-fib feel?”

- Presumed mechanism: loss of **atrial kick**.

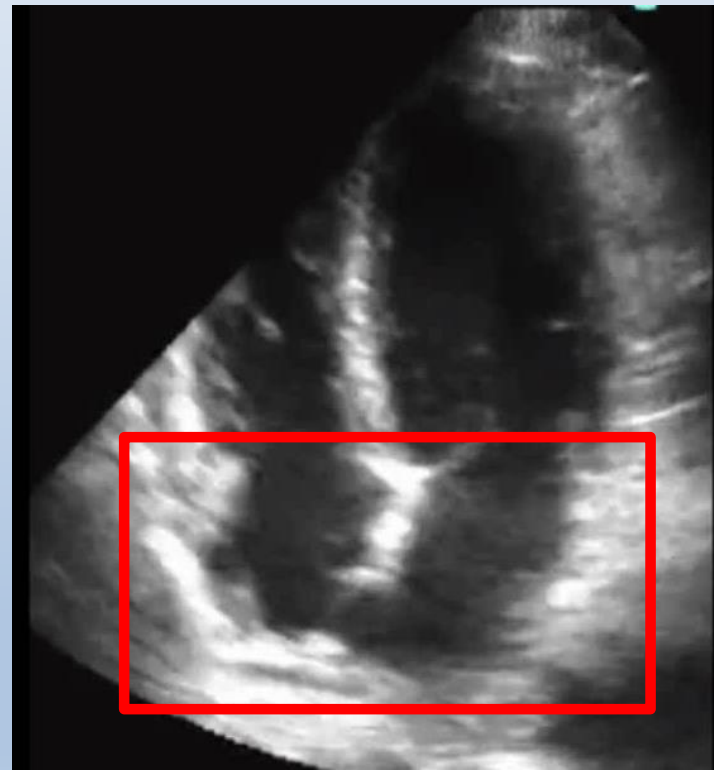


# “How does a-fib feel?”

- Presumed mechanism: loss of **atrial kick**.



**atrial fibrillation**



**normal sinus rhythm**

# Goals in management of AF

1. Control ventricular rates, targeting **<80 bpm at rest**.
2. Discuss **anticoagulation options** (warfarin, newer/direct oral anticoagulants), based on CHADS-VASc risk score.
3. Consider long-term **rate versus rhythm** control.

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# Rate control of atrial fibrillation

- Per current ACC/AHA/HRS AF guidelines (2014), we should be targeting a heart rate of **80 bpm or less** at rest (class 2a, LOE B).
- Many providers will accept **60 – 90 bpm** in the U.S., whereas a “lenient” rate control strategy (**up to 110 bpm**) at rest has largely been adopted in Europe (class 2b, LOE B).
- **Rate-controlling drug options:**
  - Beta blockers:
    - metoprolol (beta-1 selective; may be useful if you need to **preserve** BP)
    - carvedilol (alpha & beta; may be useful if markedly **hypertensive**)
  - Non-dihydropyridine calcium channel blockers:
    - diltiazem (caution in EF 40% or less, decompensated HF),
    - verapamil
  - Other:
    - digoxin (caution in renal insufficiency, but may actually **boost** blood pressure).



# Rate control of atrial fibrillation

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- Many providers will accept **60 – 90 bpm** in the U.S., whereas a “lenient” rate control strategy (**up to 110 bpm**) at rest has largely been adopted in Europe (class 2b, LOE B).
- **AV node ablation with pacemaker implantation (“ablate-and-pace”)** is reasonable when pharmacological therapy is inadequate and rhythm control is not achievable (class 2a, LOE B).
  - provides **permanent** rate control
  - results in **pacemaker-dependence**

# Rate control of atrial fibrillation

- Why control ventricular rates?
  - Prevention of heart failure (tachycardia-induced cardiomyopathy)
  - Patient comfort & satisfaction

# Rate control of atrial fibrillation

## ■ Why control ventricular rates?

- Prevention of heart failure (tachycardia-induced cardiomyopathy)
- Patient comfort & satisfaction

presentation



67 year old woman who presented with AF with RVR, EF 10-15%.

- Cath: normal coronaries.
- Was on metoprolol at home.
- Cardioversion failed to restore sinus rhythm for any significant length of time.
- IV digoxin failed.
- IV amiodarone failed.
- Underwent **bi-ventricular pacemaker implantation with AV node ablation.**

# Rate control of atrial fibrillation

- Why control ventricular rates?
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  - Patient comfort & satisfaction

presentation



3 months after  
bi-ventricular pacemaker with AV node ablation



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# Goals in management of AF

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# Anticoagulation options

- Start with calculating the CHADS-VASc risk score:

	Score
CHA <sub>2</sub> DS <sub>2</sub> -VASc	
Congestive HF	1
Hypertension	1
Age ≥75 y	2
Diabetes mellitus	1
Stroke/TIA/TE	2
Vascular disease (prior MI, PAD, or aortic plaque)	1
Age 65-74 y	1
Sex category (i.e., female sex)	1
Maximum score	9

	Adjusted Stroke Rate (% per y)
CHA <sub>2</sub> DS <sub>2</sub> -VASc†	
0	0
1	1.3
2	2.2
3	3.2
4	4.0
5	6.7
6	9.8
7	9.6
8	6.7
9	15.20

# Anticoagulation options

- Start with calculating the CHADS-VASc risk score:

0 = **no** anti-thrombotic recommended

1 = consider ASA or anticoagulation

2 or higher = **anticoagulate, if...**  
**consistent with patient values,**  
**and bleeding risk is reasonable.**

Common reasons **not to start**  
anticoagulation:

- **renal insufficiency / ESRD,**
- **frequent falls or injuries,**
- **history of severe bleeding,**
- **high risk of future bleeding,**
- **patient preference.**

Adjusted Stroke Rate (% per y)	
CHA <sub>2</sub> DS <sub>2</sub> -VASc†	
0	0
1	1.3
2	2.2
3	3.2
4	4.0
5	6.7
6	9.8
7	9.6
8	6.7
9	15.20

# Anticoagulation options

- If the CHADS-VASc is **2 or greater**, and the patient is a reasonable candidate for anticoagulation:
  - Vitamin K antagonist:
    - warfarin (frequent INR checks, prior 'gold standard', FFP for reversal)
  - Direct / newer oral anticoagulants (DOACs/NOACs):
    - dabigatran (Pradaxa; direct thrombin inhibitor – factor IIa)
    - apixaban (Eliquis; factor Xa inhibitor)
    - rivaroxaban (Xarelto; factor Xa inhibitor)

# Goals in management of AF

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# Rate vs Rhythm Control in 2018

- **Objectives:**

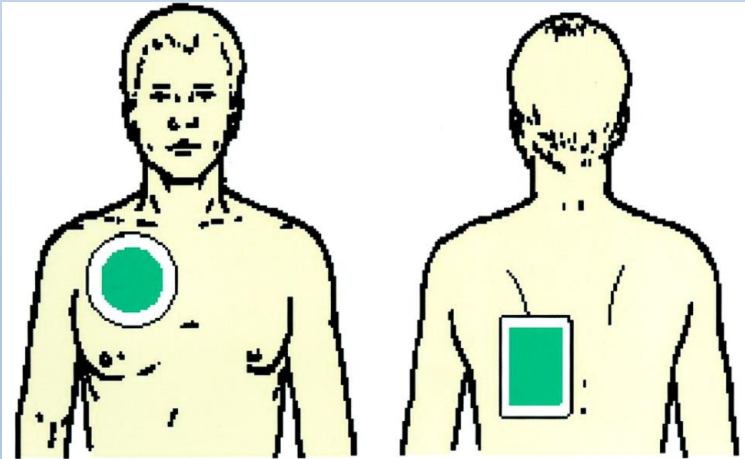
- 1. Know the indications for cardioversion.**
- 2. Know the risks & benefits of anti-arrhythmic drug therapy.**
- 3. Know the indications for pulmonary vein isolation (AF ablation).**

# Why restore normal sinus rhythm?

- When able to maintain **sinus rhythm**, many patients with a diagnosis of AF have:
  - fewer symptoms,
  - better exercise tolerance,
  - a lower risk of stroke,
  - better quality of life, and
  - better survival rates.\*

# Why restore normal sinus rhythm?

- Methods to restore normal sinus rhythm:
  - treating sources of **inflammation or infection**,
  - recovery from a **post-operative state**,
  - **electrical** cardioversion, or
  - **chemical** cardioversion (anti-arrhythmic drug therapy).



# Electrical cardioversion

## ■ Indications:

**For restoration of normal sinus rhythm in patients with:**

- supraventricular tachycardia,
- atrial fibrillation,
- atrial flutter,
- ventricular tachycardia with a pulse, or
- any unstable, re-entrant tachycardia (narrow or wide QRS).

**OBJECTIVE #1!**

- In **atrial fibrillation**, cardioversion is specifically for patients with:
  - **rapid ventricular response**, or
  - those who **desire to restore normal sinus rhythm**.

# Electrical cardioversion

## ■ Risks:

- need for anesthesia (moderate / deep / general),
- induction of alternate arrhythmias,
- myocardial stunning (<1%), and
- thromboembolic events.
  - 5.3% if no anticoagulation, versus **0.8%** with anticoagulation\*.

## ■ Due to thromboembolic risk, current guidelines require:

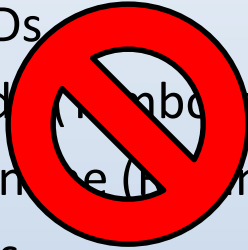
- **anticoagulation for 3 weeks or TEE** prior to cardioversion,
- as well as **anticoagulation** for a minimum of **4 weeks** after.

(If **hemodynamically unstable** or **AF < 48 hours**, pre-cardioversion anticoagulation or TEE can be deferred.)

# Maintaining Sinus Rhythm

## ■ Anti-arrhythmic drugs:

- Class 1c AADs
  - flecainide (Embocon)
  - propafenone (Rythmol)
- Class 3 AADs
  - amiodarone (Cordarone)
  - dronedarone (Multaq)
  - sotalol (Betapace)
  - dofetilide (Tikosyn)



**if CAD, LVH, or CHF**

**monitor QTc,  
heart rate, AV block**



# Maintaining Sinus Rhythm

## ■ **Benefit: Improve the odds of staying in sinus rhythm.**

■ Class 1c AADs	<u>suppression at 1 year</u>
■ flecainide (Tambocor)	~45%
■ propafenone (Rythmol)	~40%
■ Class 3 AADs	
■ amiodarone (Cordarone)	~65%
■ dronedarone (Multaq)	~35%
■ sotalol (Betapace)	~40%
■ dofetilide (Tikosyn)	~40%

## ■ **Risks:**

- May **increase** risk of **hospitalization** (especially with any episodes of renal failure)
- Increase risk of **arrhythmia induction** (sinus bradycardia, AV block or tachyarrhythmia) – some requiring an inpatient stay for loading, and q3-12 month outpatient monitoring.

[Roy D et al., NEJM 2000; 342:913-20.](#)

[Singh BN et al., NEJM 2007; 357:987-99.](#)

[Capucci A et al., Europace 2016; 11:1698-1704.](#)

# Maintaining Sinus Rhythm

## ■ **Benefit: Improve the odds of staying in sinus rhythm.**

	<u>suppression at 1 year</u>
■ Class 1c AADs	
■ flecainide (Tambocor)	~45%
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■ Class 3 AADs	
■ amiodarone (Cordarone)	~55%
■ dronedarone (Multaq)	~35%
■ sotalol (Betapace)	~40%
■ dofetilide (Tikosyn)	~40%

**OBJECTIVE #2!**

## ■ **Risks:**

- Drug-specific side effects – most notably **amiodarone-related lung, thyroid, or liver toxicity.**

[Roy D et al., NEJM 2000; 342:913-20.](#)

[Singh BN et al., NEJM 2007; 357:987-99.](#)

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# Data for Rate vs Rhythm Control



# Let's travel back in time...



# Rate vs Rhythm Control in 2002

- In 2002:
  - Kelly Clarkson won the first season of American Idol.
  - The AFFIRM study was published in the NEJM.



# Rate vs Rhythm Control in 2002

- In 2002:
  - Kelly Clarkson won the first season of American Idol.
  - The AFFIRM study was published in the NEJM.
    - Randomized, controlled trial of 4,060 AF patients
    - 2 groups: medical **rate** control vs medical **rhythm** control
      - **Rate** control: B blockers, CCBs, and/or digoxin
      - **Rhythm** control: amiodarone, disopyramide, flecainide, moricizine, procainamide, propafenone, quinidine, and/or sotalol
    - During this era, ablation was **not yet** common
    - Primary study endpoint: **mortality**

# Rate vs Rhythm Control in 2002

- In 2002:
  - Kelly Clarkson won the first season of American Idol.
  - The AFFIRM study was published in the NEJM.
    - Results:
      - Mortality at 5 years --
        - Rate control group: 310 deaths (21.3%)
        - Rhythm control group: 356 deaths (23.8%)
        - P value = 0.08
        - Hence, the result was **not** statistically significant – but close!
  - Take-home message:
    - Medications for rate control **were not clearly better** than medications for rhythm control, with respect to **mortality**.



# Rate vs Rhythm Control in 2002

- In 2002:
  - Kelly Clarkson won the first season of American Idol.
  - The AFFIRM study was published in the NEJM.
    - Results:
      - Hospitalization at 5 years --
        - Rate control group: 1,220 hospitalized (73%)
        - Rhythm control group: 1,374 hospitalized (80%)
        - P value = 0.001
        - Hence, the result **was** statistically significant.
        - Absolute risk reduction 7% = NNT of 14
  - Take-home message:
    - Medications for rate control **were better** than medications for rhythm control, with respect to **keeping people out of the hospital (73% vs 80%)**.

# Rate vs Rhythm Control in 2002

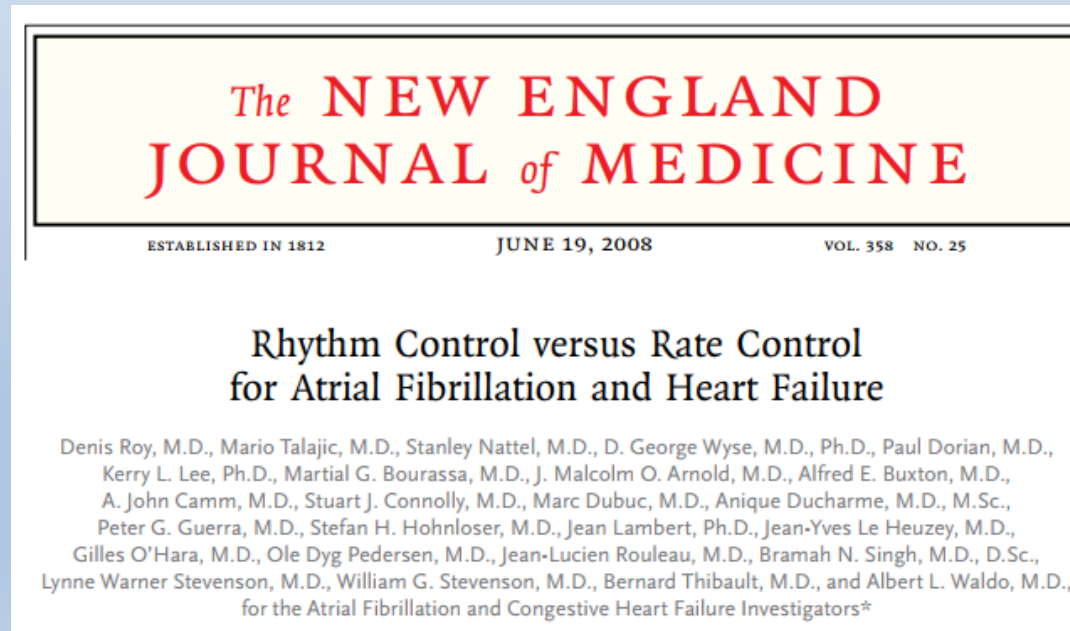
- In 2002:
  - Kelly Clarkson won the first season of American Idol.
  - The AFFIRM study was published in the NEJM.
    - In clinical practice...
      - some providers began **shunning** a rhythm control strategy,
      - while others **continued to use** anti-arrhythmic drugs for **symptom relief**.

## The bottom line:

- If a patient was willing to accept a **1 out of 14 higher chance** of **rehospitalization (73% compared to 80%)** in order to try and stay in normal rhythm, **anti-arrhythmic drug therapy** was reasonable.

# Rate vs Rhythm Control in 2008

- In 2008:
  - A writers' strike in Hollywood resulted in 3 extra months of re-runs. Terrible!
  - The AF-CHF study was published in the NEJM.



# Rate vs Rhythm Control in 2008

- In 2008:
  - A writers' strike in Hollywood resulted in 3 extra months of re-runs. Terrible!
  - The AF-CHF study was published in the NEJM.
    - Randomized, controlled trial of 1,376 patients with EF  $\leq$ 35%, NYHA class 2-4 symptoms, and AF
    - 2 groups: medical **rate** control vs medical **rhythm** control
      - **Rate** control: B blockers and/or digoxin
      - **Rhythm** control: amiodarone, sotalol, or dofetilide
    - During this era, ablation was **becoming** common, but was not evaluated in this study
    - Primary study endpoint: **mortality**

# Rate vs Rhythm Control in 2008

- In 2008:
  - A writers' strike in Hollywood resulted in 3 extra months of re-runs. Terrible!
  - The AF-CHF study was published in the NEJM.
    - Results:
      - Mortality at an average of 3 years --
        - Rate control group: 175 deaths (25%)
        - Rhythm control group: 182 deaths (27%)
        - P value = 0.59
        - Hence, the result was **not** statistically significant.
  - Take-home message:
    - There was ***no significant difference*** between medications for rate control versus medications for rhythm control, with respect to **mortality** in patients with **AF & CHF**.

# Rate vs Rhythm Control in 2008

- In 2008:
  - A writers' strike in Hollywood resulted in 3 extra months of re-runs. Terrible!
  - The AF-CHF study was published in the NEJM.
    - Results:
      - Hospitalization at an average of 3 years --
        - Rate control group: 406 hospitalized (59%)
        - Rhythm control group: 440 hospitalized (64%)
        - P value = 0.06
        - Hence, the result was **not** statistically significant – but close!
  - Take-home message:
    - Medications for rate control **were not clearly better** than medications for rhythm control, with respect to **hospitalization** in patients with **AF & CHF**.

# Rate vs Rhythm Control in 2010

## ■ In 2010:

- Ohio State beats Michigan, **37-7**, at Ohio Stadium.
- Present-day **pulmonary vein isolation** (AF ablation) becomes common throughout the world for **rhythm control**.
- **Indication** for AF ablation: **suppression of symptomatic AF**.

## OBJECTIVE #3!

## ■ Approach:

- Venous groin access (unilateral or bilateral femoral veins), via incisions about 3 mm in size.

# Rate vs Rhythm Control in 2010

**About 90% of triggering PACs originate from the pulmonary veins.**

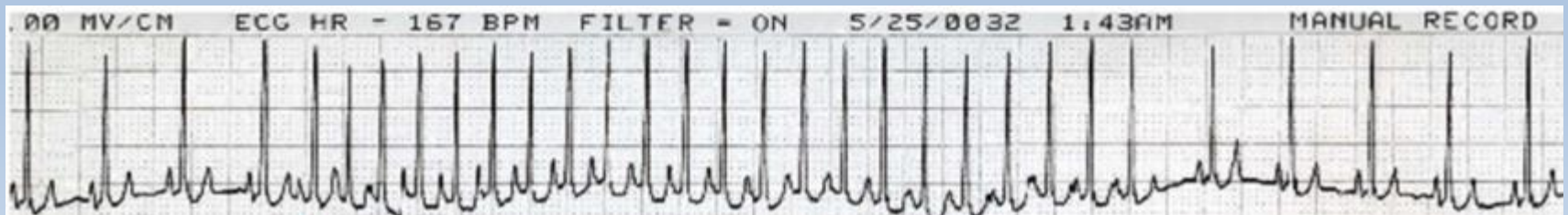


[Haissaguerre M et al., NEJM 1998; 339:659-66.](#)



# Rate vs Rhythm Control in 2010

Those pesky pulmonary veins!



# Rate vs Rhythm Control in 2010

- Pulmonary vein isolation – success rates:
  - Paroxysmal (<7 days' duration)
    - 60 – 80% suppression at 1 year\*
  - Persistent (>7 days' duration)
    - 40 – 60% suppression at 1 year\*\*
- Caveats:
  - Ablation is **not a cure** for atrial fibrillation, as healing across ablation lines can occur.
  - **More than 1** ablation procedure is sometimes required to achieve a satisfactory result.

\*[Kis Z et al., Curr Cardiol Rev 2017; 13:199-208.](#)

\*\*[Fink T et al., Circ Arrhythm Electrophysiol 2017; 10:e005114](#)

# Rate vs Rhythm Control in 2010

## ■ Pulmonary vein isolation – risks:

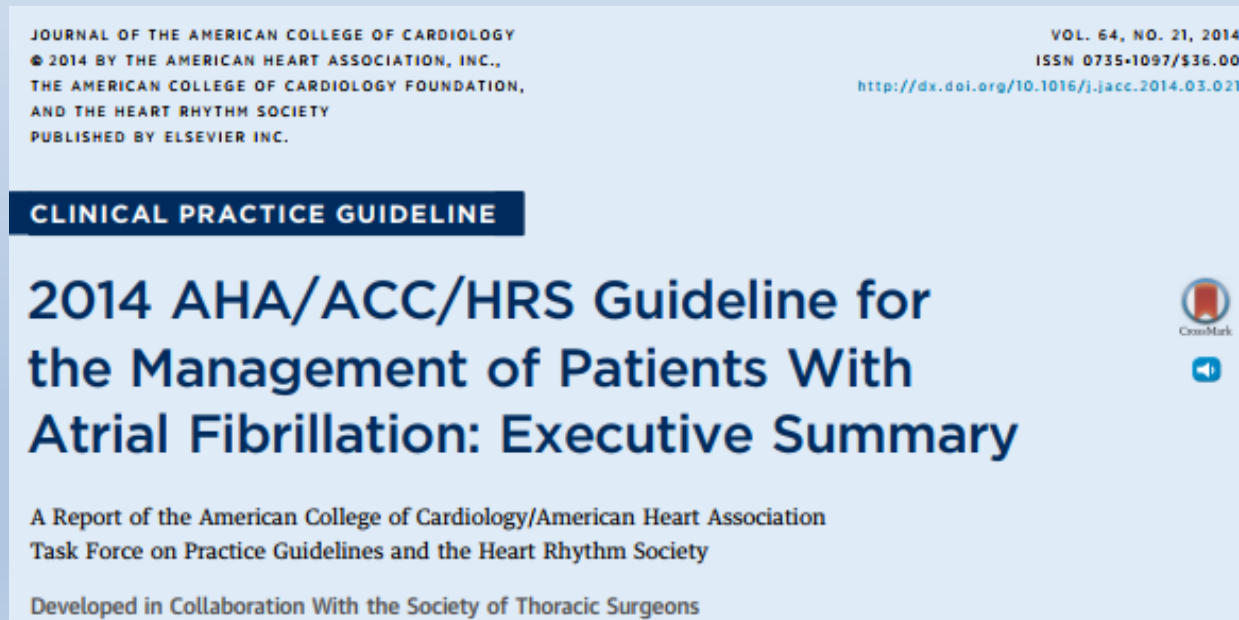
- Pain, bleeding, or infection at access sites (2%)
- Cardiac perforation / tamponade (1%)
- Esophageal injury or atrio-esophageal fistula (<1%)
- Ventilator-associated pneumonia (1%)
- Stroke / TIA (2%)

### Take-home message on risk:

At **high volume centers** (>50 AF ablations per year), the **risk of significant injury or procedural complication** is **3-4%**.

# Rate vs Rhythm Control in 2014

- In 2014:
  - The price of a Bitcoin rose to \$800, in what Economist magazine called “a bubble.”
  - Current AF guidelines were published in JACC.



# Rate vs Rhythm Control in 2014

- In 2014:
  - The price of a Bitcoin rose to \$800, in what Economist magazine called “a bubble.”
  - Current AF guidelines were published in JACC.
    - If a return to normal sinus rhythm is desired, **electrical cardioversion** is recommended (**class I, level B**).
    - The following drugs are recommended to **maintain sinus rhythm**, depending on underlying heart disease & comorbidities (**class I, level A**):
      - **Class 1 AADs**: flecainide, propafenone.
      - **Class 3 AADs**: amiodarone, dofetilide, dronedarone, sotalol.
    - **Catheter ablation** is useful for suppression of **symptomatic, paroxysmal (class I, level A)** or **persistent (class IIa, level A) AF**, refractory or intolerant to at least one class I or III anti-arrhythmic medication.

# Rate vs Rhythm Control in **2017**

- **In 2017:**
  - I put up a Christmas tree that is still sitting in the same spot.
  - The CASTLE-AF study was reported at the ESC Congress.



# Rate vs Rhythm Control in 2017

- In 2017:
  - I put up a Christmas tree that is still sitting in the same spot.
  - The CASTLE-AF study was reported at the ESC Congress.
    - Randomized, controlled trial of 397 patients with LVEF  $\leq 35\%$ , an implanted ICD, and AF
    - 2 groups: **ablative** rhythm control vs **medical** therapy
      - **Ablation** group: pulmonary vein isolation.
      - **Medical therapy** group: rate or rhythm control.
    - Study endpoints: **mortality & hospitalization for HF**

# Rate vs Rhythm Control in 2017

- In 2017:
  - I put up a Christmas tree that is still sitting in the same spot.
  - The CASTLE-AF study was reported at the ESC Congress.
    - Results:
      - **Mortality** at an average of **3 years** --
        - **Ablation** group: 23 deaths (13%)
        - **Medical therapy** group: 46 deaths (25%)
        - **P value = 0.011**
        - Hence, the result **was** statistically significant.
        - **Absolute risk reduction ~12% = NNT of 8!**
  - **Take-home message:**
    - Ablation was ***significantly better*** than medical therapy alone, with respect to **mortality** in patients with **AF & CHF**.



# Rate vs Rhythm Control in 2017

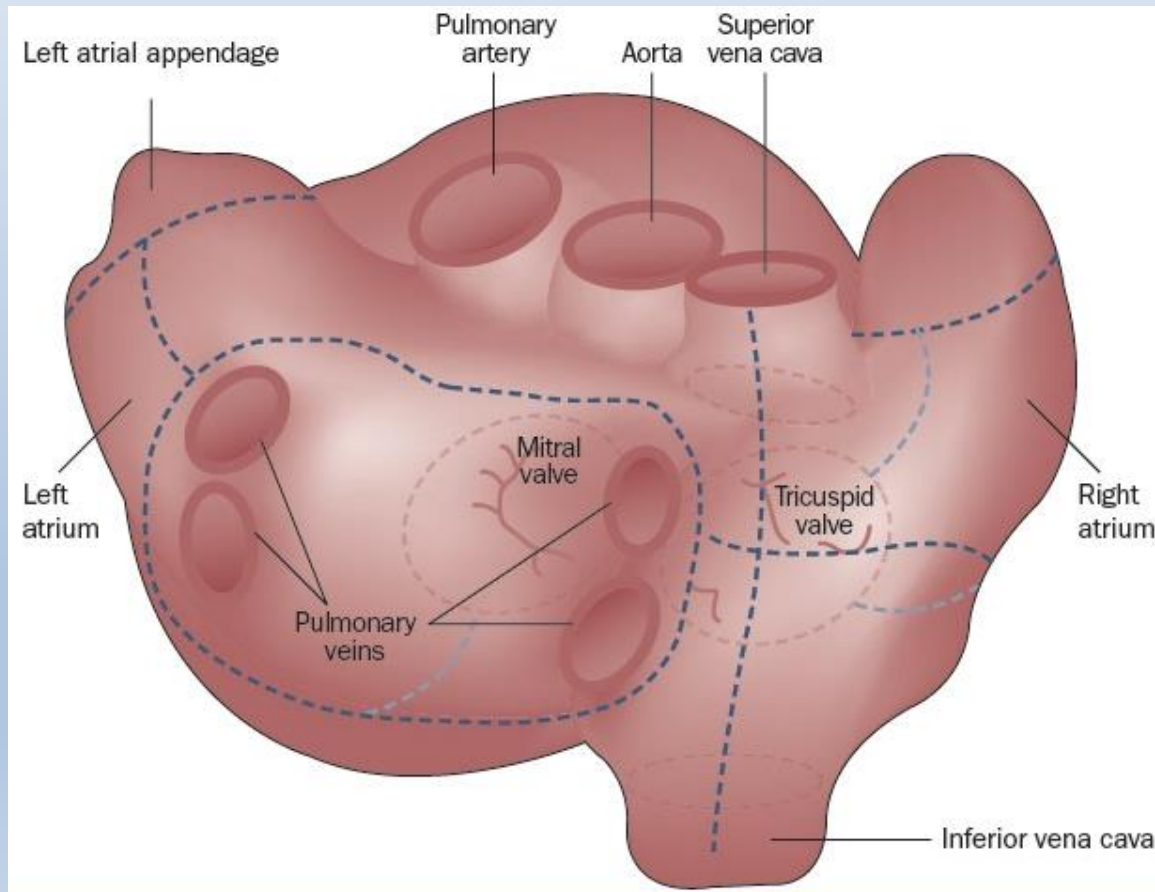
- In 2017:
  - I put up a Christmas tree that is still sitting in the same spot.
  - The CASTLE-AF study was reported at the ESC Congress.
    - Results:
      - Hospitalization at an average of 3 years --
        - Ablation group: 38 hospitalizations (21%)
        - Medical therapy group: 66 hospitalizations (36%)
        - P value = <0.004
        - Hence, the result was statistically significant.
        - Absolute risk reduction ~15% = NNT of 7!
  - Take-home message:
    - Ablation was *significantly better* than medical therapy alone, with respect to **hospitalization** in patients with **AF & CHF**.

# Rate vs Rhythm Control in 2017

- **In 2017:**
  - **Surgical AF ablation (CryoMaze) becomes more common.**
    - **Indications:**
      - If catheter ablation (pulmonary vein isolation) has **not adequately suppressed** AF, or
      - If open heart surgery is already planned, in a patient with symptomatic AF.
    - **Approach:**
      - Lateral thoracotomy, with or without use of thoracoscopy.
    - **Results:**
      - In a series of 136 patients who underwent surgical CryoMaze from 2007-2011, **76%** experienced freedom from AF at 1 year.

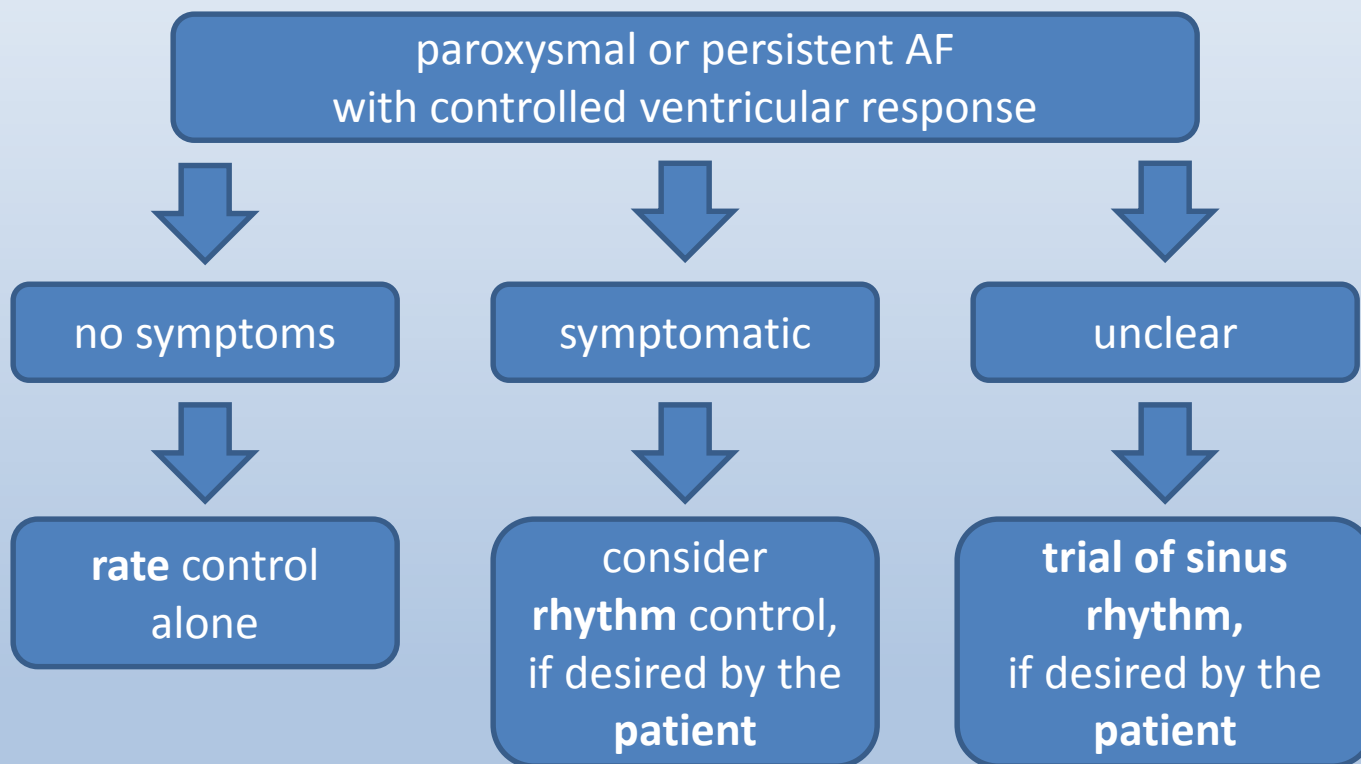
# Rate vs Rhythm Control in 2017

- In 2017:
  - Surgical AF ablation (CryoMaze) becomes more common.



# Rate vs Rhythm Control in 2018

- In 2018, by current guidelines & CMS rules:



**CASTLE-AF results** are so new that they have **not yet been considered** in the guidelines.

# Rate vs Rhythm Control in 2018

- If **rhythm control** is desired:



## SIMPLIFYING YOUR ATRIAL FIBRILLATION TREATMENT PLAN

Encourage your patients to take an active role in their healthcare by using this tool to help them understand appropriate treatment options available for them.



[http://www.heart.org/idc/groups/heart-public/@wcm/@hcm/documents/downloadable/ucm\\_324032.pdf](http://www.heart.org/idc/groups/heart-public/@wcm/@hcm/documents/downloadable/ucm_324032.pdf)

# #MAGA: Make the Atria Great Again!



**Thank you!**

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