Atrial Fibrillation

For the Primary Care Physician

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Questions
Question 1

When should a symptomatic AF patient be referred to an electrophysiologist?

A. Once AF has become persistent in profile
B. When patient has a stroke
C. As soon as the AF diagnosis is made
D. When medications have failed to control their symptoms
Question 2

Which of the following patients can be helped the most with a catheter ablation procedure involving pulmonary vein isolation?

A. Paroxysmal atrial fibrillation
B. Persistent atrial fibrillation
C. Long-standing atrial fibrillation
D. Post-op atrial fibrillation
Question 3

What is the prevalence of AF in the United States?

A. 300,000
B. 1 million
C. 5 million
D. 10 million
Question 4

What is permanent AF?

A. AF that continues for > 12 months
B. Same as chronic AF
C. AF that does not terminate after repeated cardioversions
D. When patient and clinician make a joint decision to stop attempts to restore sinus rhythm
The trigger for AF is most commonly found in the?

A. Pulmonary veins
B. Right atrium
C. Coronary Sinus
D. Superior vena cava
Question 6

Which of the following OACs can be used in ESRD?

A. Edoxaban
B. Rivaroxaban
C. Dabigatran
D. Apixaban
EKG Features

- QRS “irregularly irregular” (in presence of AV conduction).
- No distinct P waves.
Conduction in AF
Identifying AF

- NSR
- PACs
- AF
- AFL
- MAT
ATRIAL FIBRILLATION

EPIDEMIOLOGY
Prevalence

- Global health care problem with evidence suggesting an increasing prevalence worldwide.

- An estimated 40 million people around the world have AF.²

- Affects 5-6 million American adults ² (expected to double over the next 25 years).
Age/Gender Distribution

- **ATRIA study**, a cross-sectional study of almost 1.9 million subjects in the US.*3

- **Framingham Heart Study**: Men and women without AF at 40 were determined to have a 26% and 23% likelihood of developing AF by 80.*4
Ethnicity

- Compared with Whites, Blacks (hazard ratio [HR] 0.84), Hispanics (HR 0.78), and Asians (HR 0.78) each had a lower AF risk after adjustment.\(^7\)

- In African Americans, although risk factors for AF are more prevalent, incidence of AF appears to be lower.

AF is more frequent in whites than blacks over the age of 50 years (2.2 vs1.5 \%).\(^6\)
Global Trends

- Progressive increase in overall burden, incidence, prevalence, and AF-associated mortality, with significant public health implications.

- Age-adjusted incidence rates AF for men and women in developed vs developing countries (2010)."
Hospitalizations

- AF accounts for > 800,000 hospitalizations/year.\textsuperscript{10}

- Patients with AF are hospitalized twice as often as patients without AF and are 3 times more likely to have multiple admissions.\textsuperscript{11}

- 2.1\% of patients with AF died in the hospital, compared with 0.1\% without it.
Thromboembolic Risk

- AF is associated with a 5-fold increased risk of stroke, and stroke risk increases with age.\textsuperscript{12}

- AF-related stroke is likely to be more severe than non-AF-related stroke.\textsuperscript{13}

\textbf{AFib is Responsible for 15-20\% of all Strokes}

- AFib is responsible for a 5-fold increase in the risk of ischaemic stroke.

Cumulative stroke incidence (\%)

- Women AFib-
- Women AFib+
- Men AFib-
- Men AFib+

Years of follow-up

0 1 2 3 4 5 1 2 3 4 5

*AFib* refers to atrial fibrillation.
Mortality

- AF contributes to an estimated 130,000 deaths/year. *11

- AF associated with double the risk of mortality in both younger & older patients, & both men & women. *13

- The death rate from AF as the primary or a contributing cause of death has been rising for more than two decades.
Medical costs for people who have AF are about $8,705 higher per year than for people who do not have AF.\textsuperscript{14}

It is estimated that treating patients with AF adds > $6 billion to the US healthcare bill annually.\textsuperscript{14}
ATRIAL FIBRILLATION

CLASSIFICATION
AF Classification

- Prognosis & management is dependent on type of AF.

- Lone AF and non-valvular AF are terms that are not used anymore.

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### Definitions of AF: A Simplified Scheme

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Paroxysmal AF                 | - AF that terminates spontaneously or with intervention within 7 d of onset.  
                                | - Episodes may recur with variable frequency.                             |
| Persistent AF                 | - Continuous AF that is sustained >7 d.                                   |
| Long-standing persistent AF   | - Continuous AF >12 mo in duration.                                       |
| Permanent AF                  | - The term “permanent AF” is used when the patient and clinician make a joint decision to stop further attempts to restore and/or maintain sinus rhythm.  
                                | - Acceptance of AF represents a therapeutic attitude on the part of the patient and clinician rather than an inherent pathophysiological attribute of AF.  
                                | - Acceptance of AF may change as symptoms, efficacy of therapeutic interventions, and patient and clinician preferences evolve. |
Natural History of AF
Pathophysiology

- AF requires both a **trigger** for initiation and an appropriate anatomic **substrate** for maintenance.

- **Trigger** - a rapidly firing focus that can initiate AF.

- **Substrate** - Mechanical and anatomic structure of the atria in which AF can sustain.
AF Triggers

- Rapidly firing foci initiating AF arise most commonly from LA myocardial sleeves that extend into the pulmonary veins.

- Unique anatomic & electrophysiological features of the pulmonary veins and atrio-pulmonary vein junctions may account for their arrhythmogenic nature.

Non-PV triggers: Posterior LA, ligament of Marshall, coronary sinus, venae cavae, septum, and appendages.
Remodeling

• Changes that result from the development of AF and increase the propensity for the development and maintenance of AF over time.

  • **Structural remodeling** - Changes in the mechanical and anatomic structure of the atrial substrate.

  • **Electrical remodeling** - Changes in the atrial electrical properties.
Maintenance of AF

Types of AF
- Paroxysmal AF
- Persistent AF requires cardioversion
- Long-standing persistent or permanent AF

Triggers
- Ectopic foci
- Electrophysiologic remodeling fibrosis
- Chronic substrate fibrosis

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Natural History of AF
**Mechanisms of AF**

**Atrial Fibrillation (AF): Pathogenesis**

- **Mainly “structural” effects**
  - Increasing age
  - Male gender
  - Hypertension
  - Valvular heart disease
    - Incl. rheumatic heart disease
  - Heart Failure
    - Systolic and/or diastolic dysfunction, incl. post-MI
  - Cardiomyopathies
    - Including hypertrophic, restrictive & dilated CM
  - Congenital heart disease
  - Hyperthyroidism
  - Diabetes
  - Myocarditis
  - Pulmonary disease
    - Post-surgical state
    - Esp. after cardiac surgery
  - Endurance athletic training
  - Obesity
  - Obstructive sleep apnea
  - Excessive alcohol intake

- **Mainly “electrical” effects**
  - Channelopathies
    - Altered ion channel function
    - E.g., Brugada, Long QT
  - Familial & genetic factors
  - Lone (idiopathic) AF
  - Autonomic imbalance
    - Increased sympathetic drive or high vagal tone
  - Intra cellular Ca²⁺ overload and/or RyR dysfunction
  - Prolonged atrial APD (ex. in long QT syndrome)
  - Delayed afterdepolarizations
  - Early afterdepolarizations
  - Spontaneous Ca²⁺ release
  - Triggering beats (enhanced automaticity / triggered activity)
    - Ectopic atrial beats arising from pulmonary vein(s) or other foci, or other supraventricular tachycardias

**AF Classification**
- **Paroxysmal AF**: AF terminates spontaneously within 7 days of onset
- **Persistent AF**: AF lasts ≥7 days and/or requires cardioversion to restore SR
- **Permanent AF**: Persistent AF and no longer pursuing rhythm control strategies

**Note**: “AF begets AF”. The longer a patient is in AF, the more they are expected to remain in AF.

**Legend**: Pathophysiology, Mechanism, Sign/Symptom/Lab Finding, Complications

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Autonomic dysfunction

• Vagally-mediated AF is often seen in athletic young men without apparent heart disease who have slow heart rates during rest or sleep.

• In comparison, AF induced by increased sympathetic tone may be observed in patients with underlying heart disease or during exercise or other activity.
How Much Can I Drink Doc?

- Estimated long-term risk of developing AF in the general population with no prior history of AF on the basis of alcohol consumption in large meta-analyses. (average follow-up 12 years). *15

- AF occurs in up to 60% of binge drinkers.

ATRIAL FIBRILLATION

HISTORY
History & Physical Exam

• Symptoms:
  • Palpitations
  • Fatigue/reduced exercise capacity
  • Lightheadedness
  • Dyspnea with exertion

• More severe symptoms include dyspnea at rest, angina, presyncope, or infrequently, syncope.

• The physical examination suggests AF:
  • presence of an irregular pulse
  • irregular jugular venous pulsations
  • variation in the intensity of the first heart sound

• Physical examination may also disclose associated valvular heart disease or myocardial abnormalities.

Confirm with EKG
Initial Assessment

- Presence and nature of symptoms associated with AF
- Clinical type of AF (paroxysmal, persistent, or permanent)
- Onset of first symptomatic attack or date of discovery of AF
- Frequency, duration, precipitating factors, and modes of initiation or termination of AF
- Response to any pharmacological agents that have been administered
- Presence of any underlying heart disease or reversible conditions (e.g., hyperthyroidism or alcohol consumption)
- Assessment of thromboembolic risk
Risks/ Sequalae of AF
Thromboembolic Risk

- Systemic embolization, and particularly stroke, is the most frequent major complication of AF.

- AF increases the risk of stroke 5 times, and AF in the setting of mitral stenosis increases the risk of stroke 20 times over patients in sinus rhythm. *25

- Thromboembolism occurring with AF is associated with a greater risk of recurrent stroke, more severe disability, and mortality. *4

*25

### Stroke Risk Assessment

<table>
<thead>
<tr>
<th>Condition</th>
<th>CHA₂DS₂-VASc Score</th>
<th>CHA₂DS₂-VASc† Score</th>
<th>Adjusted Stroke Rate (% per y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive HF</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Age $\geq 75$ y</td>
<td>2</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Stroke/TIA/TE</td>
<td>2</td>
<td>4</td>
<td>4.0</td>
</tr>
<tr>
<td>Vascular disease (prior MI, PAD, or aortic plaque)</td>
<td>1</td>
<td>5</td>
<td>6.7</td>
</tr>
<tr>
<td>Age 65-74 y</td>
<td>1</td>
<td>6</td>
<td>9.8</td>
</tr>
<tr>
<td>Sex category (i.e., female sex)</td>
<td>1</td>
<td>7</td>
<td>9.6</td>
</tr>
<tr>
<td>Maximum score</td>
<td>9</td>
<td>8</td>
<td>6.7</td>
</tr>
</tbody>
</table>

**Adjusted Stroke Rate:** 15.20%
Tachycardia-mediated Cardiomyopathy

- Persistent, uncontrolled tachycardia can have a cardiomyopathic effect that impairs LV function.

- In most patients, restoration of sinus rhythm or control of the rapid ventricular response markedly improves or even normalizes the LVEF.

- This effect is more pronounced with rhythm control.

Effect of pulmonary vein isolation (PVI) vs AVN ablation+cardiac resynchronisation on LV function & exercise tolerance in the PABA CHF trial. From Khan et al.
Principles of Management

- RISK FACTOR MODIFICATION
- RATE CONTROL
- RHYTHM CONTROL
- THROMBOEMBOLISM PROPHYLAXIS
Principles of Management

- Risk Factor Modification
- Rate Control
- Rhythm Control
- Thromboembolism Prophylaxis
Benefit of warfarin in AF

Efficacy of anticoagulation with warfarin to prevent ischemic stroke and other thromboemboli in four major studies
Who Should be Anticoagulated?

- I: CHA2DS2-VASc score of 2 or greater in men or 3 or greater in women, oral anticoagulants are recommended.

- IIa: CHA2DS2-VASc score of 0 in men or 1 in women, reasonable to omit anticoagulant therapy.

- IIb: CHA2DS2-VASc score of 1 in men and 2 in women, prescribing an oral anticoagulant to reduce thromboembolic stroke risk may be considered.

- NOACs are recommended over warfarin (except “valvular AF”)

- ESRD: Warfarin or Apixaban

- Reversal agents
  - Idarucizumab - Dabigatran
  - Andexanet Alfa - Xa inhibitors
Anticoagulation in real world

Despite Increasing DOAC Adoption, Overall Rate of Anticoagulation in High Risk NVAF Patients has Not Improved

Anticoagulant Use in Patients with NVAF and CHADS\textsubscript{2} $\geq 2$

- Total on Oral Anticoagulation
- Warfarin
- DOACs

Results from the NCDR PINNACLE Registry\textsuperscript{1}

\textsuperscript{1} Jais, et al. Uptake of Novel Oral Anticoagulants in Patients with Non-Valvular and Valvular Atrial Fibrillation: Results from the NCDR-Pinnacle Registry. ACC 2014

LAA Occluding Devices

WATCHMAN device
(Boston Scientific, Natick, MA)

Amplatzer cardiac plug
(St. Jude Medical, Plymouth, MN)
LAAO Occluding Devices

- **Class IIb:**

  Percutaneous LAAO should be considered for those AF patients at an increased risk of stroke who have contraindications to long-term anticoagulation and who are at high risk of thromboembolic events.
Principles of Management

- Risk Factor Modification
- Rate Control
- Rhythm Control
- Thromboembolism Prophylaxis
Lifestyle Modification

Greater freedom from AF seen with greater degree of weight loss (WL) as a marker of overall management of risk factors. *17

Risk factor management (RFM) confers greater AF-free survival following catheter ablation procedure versus usual care. *18

Gain in cardiorespiratory fitness confers independent & incremental AF-free survival to changes in weight. *19
Lifestyle Modification
Rate vs Rhythm Control
Rate vs Rhythm Control

• Rate control
  • Drugs that slow AV nodal conduction, such as beta blockers, non-dihydropyridine calcium channel blockers, or digoxin.
  • AV node ablation and permanent pacemaker implant

• Rhythm control
  • Electrical cardioversion
  • Antiarrhythmic drug therapy
  • Percutaneous catheter ablation, and/or a surgical procedure.

• Data suggest that rhythm and rate control strategies are associated with similar rates of mortality and serious morbidity, such as embolic risk.

• However, there are several reasons why pursuing a rhythm-control strategy would be preferred, including symptom improvement, younger patient age, and irreversible structural and electrical remodeling that occurs with longstanding persistent AF.
## Rate Control

### TABLE 10: Common Medication Dosage for Rate Control of AF

<table>
<thead>
<tr>
<th>Medication</th>
<th>Intravenous Administration</th>
<th>Usual Oral Maintenance Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beta blockers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metoprolol tartrate</td>
<td>2.5–5.0 mg IV bolus over 2 min; up to 3 doses</td>
<td>25–100 mg BID</td>
</tr>
<tr>
<td>Metoprolol XL (succinate)</td>
<td>N/A</td>
<td>50–400 mg QD</td>
</tr>
<tr>
<td>Atenolol</td>
<td>N/A</td>
<td>25–100 mg QD</td>
</tr>
<tr>
<td>Esmolol</td>
<td>500 mcg/kg IV bolus over 1 min, then 50–300 mcg/kg/min IV</td>
<td>N/A</td>
</tr>
<tr>
<td>Propranolol</td>
<td>1 mg IV over 1 min, up to 3 doses at 2-min intervals</td>
<td>10–40 mg TID or QID</td>
</tr>
<tr>
<td>Nadolol</td>
<td>N/A</td>
<td>10–240 mg QD</td>
</tr>
<tr>
<td>Carvedilol</td>
<td>N/A</td>
<td>3.125–25 mg BID</td>
</tr>
<tr>
<td>Bisoprolol</td>
<td>N/A</td>
<td>2.5–10 mg QD</td>
</tr>
<tr>
<td><strong>Nondihydropyridine calcium channel antagonists</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verapamil</td>
<td>0.075–0.15 mg/kg IV bolus over 2 min; may give an additional 10.0 mg after 30 min if no response, then 0.005 mg/kg/min infusion</td>
<td>180–480 mg QD (ER)</td>
</tr>
<tr>
<td>Diltiazem</td>
<td>0.25 mg/kg IV bolus over 2 min, then 5–15 mg/h</td>
<td>120–360 mg QD (ER)</td>
</tr>
<tr>
<td><strong>Digitalis glycosides</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digoxin</td>
<td>0.25 mg IV with repeat dosing to a maximum of 1.5 mg over 24 h</td>
<td>0.125–0.25 mg QD</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amiodarone*</td>
<td>300 mg IV over 1 h, then 10–50 mg/h over 24 h</td>
<td>100–200 mg QD</td>
</tr>
</tbody>
</table>
Optimal Rate Control

**RACE II: Lenient versus Strict Rate Control in Patients with Atrial Fibrillation**

Multicenter, open-label, parallel-group, randomized controlled noninferiority trial

Objective: To compare rate control of HR <110 bpm versus strict rate control of HR <80 bpm in preventing cardiovascular events in patients with permanent AF

614 patients Age ≤80 years with permanent AF for up to 12 months were randomized to

- **Lenient rate control** (n=311)
  - HR <110 bpm

- **Strict rate control** (n=303)
  - HR <80 bpm

**Primary Outcomes**

- Composite of CV mortality, CHF, stroke and major CV and arrhythmia events (HR 0.84; 95% CI 0.58-1.21; P<0.001 for non-inferiority)

- **12.9%** vs **14.9%**

**Cumulative Incidence of Primary Outcome (%)**

<table>
<thead>
<tr>
<th>Months</th>
<th>Strict control</th>
<th>Lenient control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>14.9</td>
<td>12.9</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td></td>
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</tr>
</tbody>
</table>

**No. at Risk**

- Strict control: 303, 282, 273, 262, 246, 212, 131

**Strict rate control strategy did not improve outcomes.**
Cardioversion

- **Pharmacological Cardioversion**
  - Flecainide Oral 200-400 mg
  - Propafenone Oral 450-600 mg
  - Ibutilide IV 1 mg over 10 min; may repeat 1 mg once if necessary (if weight <60 kg, use 0.01 mg/kg)

- **Electrical Cardioversion**
  - A-P pads
  - SYNC
## Antiarrhythmic Medications

**Vaughan Williams classification of antiarrhythmic drugs**

<table>
<thead>
<tr>
<th>Class IA - slows conduction velocity (less than class IC) and prolongs action potential duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disopyramide</td>
</tr>
<tr>
<td>Procainamide*</td>
</tr>
<tr>
<td>Quinidine</td>
</tr>
<tr>
<td>Class IB - has no effect on conduction velocity and may shorten APD</td>
</tr>
<tr>
<td>Lidocaine*</td>
</tr>
<tr>
<td>Mexiletine</td>
</tr>
<tr>
<td>Phenytoin</td>
</tr>
<tr>
<td>Class IC - slows conduction and may prolong APD (mild)</td>
</tr>
<tr>
<td>Flecainide</td>
</tr>
<tr>
<td>Propafenone</td>
</tr>
<tr>
<td>Class II - blocks beta adrenergic receptors</td>
</tr>
<tr>
<td>Beta blockers</td>
</tr>
<tr>
<td>Class III - prolongs APD and has no effect on conduction</td>
</tr>
<tr>
<td>Amlodipine</td>
</tr>
<tr>
<td>Dofetilide</td>
</tr>
<tr>
<td>Ibutilide*</td>
</tr>
<tr>
<td>Sotalol*</td>
</tr>
<tr>
<td>Dronedarone</td>
</tr>
<tr>
<td>Class IV - calcium channel blockers</td>
</tr>
<tr>
<td>Non-dihydropyridine calcium channel blockers (verapamil and diltiazem)</td>
</tr>
</tbody>
</table>
AAD Efficacy

- Amiodarone is the most effective AAD for maintenance of sinus rhythm in paroxysmal or persistent AF. In direct comparisons, it is more effective than dronedarone, sotalol, or propafenone.

- In multiple placebo controlled RCTs, each of the 5 common AADs is superior to placebo at AF suppression.
AFFIRM Trial

- 4060 patients with AF that was likely to be recurrent were randomly assigned to rhythm or rate control. The primary end point was overall mortality. *20

- There was an almost significant trend toward lower mortality with rate control (21.3 versus 23.8 %, hazard ratio 0.87, 95 percent CI 0.75 to 1.01).
RACE Trial

• 522 patients with recurrent persistent AF were randomly assigned to rhythm or rate control. *21

• Primary end point was composite of CV death, HF, thromboembolism, bleeding, pacemaker placement & AAD side effects.

• There was an almost significant trend toward a lower incidence of the primary end point with rate control (17.2 versus 22.6 percent with rhythm control, hazard ratio 0.73, 90 percent CI 0.53 to 1.01).
All-cause mortality

- Forest plot for all-cause mortality assessed in 8 RCTs (7499 patients) comparing rate vs rhythm control. To determine the overall effect, a meta-analysis was done and the calculated death RR was 0.95 (95% CI: 0.86-1.05)\textsuperscript{22}
Quality of Life

• Successful sinus rhythm maintenance associated with improvement in symptoms & QOL. ²³

• Other factors that may favor attempts at rhythm control include:
  • difficulty in achieving adequate rate control
  • younger patient age
  • tachycardia-mediated cardiomyopathy
  • first episode of AF
  • AF precipitated by an acute illness
  • patient preference.

Early intervention with a rhythm-control strategy to prevent progression of AF may be beneficial.
Natural History of AF
Catheter Ablation

Radiofrequency

Cryo
Efficacy of Ablation

- Studies have demonstrated a reduction of AF-related symptoms post-ablation.

- In the CABANA trial, ablation reduced mortality or CV hospitalization by 17% compared to drug therapy.
  - 47% reduction in recurrent AF.
  - 40% reduction in mortality (per protocol).
Benefits of Catheter ablation

Although the initial cost of ablation is high, after ablation, utilization of healthcare resources is significantly reduced.

<table>
<thead>
<tr>
<th></th>
<th>No ablation</th>
<th>Catheter ablation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical visits per year</td>
<td>7.4 (2.5)</td>
<td>1.1 (0.6)</td>
</tr>
<tr>
<td>Emergency room visits per year</td>
<td>1.7 (0.9)</td>
<td>0.03 (0.17)</td>
</tr>
<tr>
<td>Hospitalization days per year</td>
<td>1.6 (0.8)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Healthcare costs per year</td>
<td>$1920 (889)</td>
<td>$87 (68)</td>
</tr>
</tbody>
</table>

Catheter Ablation

**CLASS I**

1. AF catheter ablation is useful for symptomatic paroxysmal AF refractory or intolerant to at least 1 class I or III antiarrhythmic medication when a rhythm-control strategy is desired. (Level of Evidence: A)

**CLASS IIa**

1. AF catheter ablation is reasonable for some patients with symptomatic persistent AF refractory or intolerant to at least 1 class I or III antiarrhythmic medication. (Level of Evidence: A)

2. In patients with recurrent symptomatic paroxysmal AF, catheter ablation is a reasonable initial rhythm-control strategy before therapeutic trials of antiarrhythmic drug therapy, after weighing the risks and outcomes of drug and ablation therapy. (Level of Evidence: B)

3. Catheter ablation of AF is reasonable in symptomatic AF patients with HF and reduced LVEF.
Tips for Creating a Successful Fluoroscopy-Free Cryoablation Program

In November 2018, we performed our first fluoroscopy-free cryoablation PVI, only five weeks into the launch of the program. To our knowledge, this was the first fluoroless cryoablation case in the state of Iowa. In this article, we describe the details of this first case as well as the lessons we have learned from our pursuit.

CASE DESCRIPTION
The patient was a 67-year-old male

Dr. Chaudhry joined our group in August 2018, and we introduced cryoablation at our center in October 2018 as an alternative means for pulmonary vein isolation (PVI). In keeping with our vision to be a fluoreless EP lab, we wasted no time in working on ways to perform cryoablation without fluoroscopy. Many of the techniques developed for fluoroscopy-free radiofrequency ablation carried over neatly for cryoablation, with only slight modification. Thus, it took only a month for us to perfect our technique. In November 2018, we performed our first fluoroscopy-free cryoablation PVI, only five weeks into the launch of the program. To our knowledge, this was the first fluoroless cryoablation case in the state of Iowa. In this article, we describe the details of this first case as well as the lessons we have learned from our pursuit.

CASE DESCRIPTION
The patient was a 67-year-old male
Convergent Procedure

Voltage Map Showing Electrical Silence of the Posterior LA post-Convergent.
Mobile Rhythm Monitoring

**Central Illustration:** Automated Atrial Fibrillation Detection Algorithm Using Novel Smartwatch Technology

- The smartwatch strap with an electrode sensor that records heart rhythm.
- Patient places thumb on the sensor to record rhythm.
- The application utilizes an algorithm to differentiate sinus rhythm (SR) from atrial fibrillation (AF), or would label the recording as unclassified if it does not meet certain criteria.
- The app informs the patient if AF is detected; the results are transmitted to the patient’s physician.

<table>
<thead>
<tr>
<th>Method for interpreting the recording</th>
<th>% of patients with interpretable results</th>
<th>Accuracy of AF diagnosis compared to 12 lead electrocardiogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>App algorithm only</td>
<td>66%</td>
<td>93% sensitivity; 84% specificity</td>
</tr>
<tr>
<td>Physician only</td>
<td>87%</td>
<td>99% sensitivity; 83% specificity</td>
</tr>
<tr>
<td>Recordings labeled as &quot;unclassified&quot; by the app algorithm when reviewed by physician</td>
<td>100%</td>
<td>100% sensitivity; 80% specificity</td>
</tr>
</tbody>
</table>

AF and COVID

396 consecutive patients admitted between March & June 2020. Mean age, 68.2 years, 52.3% were men, & 15.7% had prior history of AF/AFL.

19.9% had in-hospital AF/AFL; 8% did not have a prior history of AF/FL. Patients with in-hospital AF/FL had significantly higher risk of cardiovascular complications compared with those who did not.

In-hospital AF/FL was associated with significantly worse COVID-19-related outcomes, including mortality.

Patients with in-hospital a-fib were also 2.5 times more likely to die or go into hospice.
AF and COVID

- COVID-19 patients developing AF were older and most of them had at least one preexisting risk factor, including hypertension.

- Older age and occurrence of heart failure were also associated with greater likelihood of incident AF during the COVID-19 infection.

- Therefore, COVID-19 patients with newly diagnosed AF may have a preexisting substrate for AF and the acute COVID-19 infection may provide the trigger for AF initiation,
When should a symptomatic AF patient be referred to an electrophysiologist?

A. Once AF has become persistent in profile  
B. When patient has a stroke  
C. As soon as the AF diagnosis is made  
D. When medications have failed to control their symptoms
Question 2

Which of the following patients can be helped the most with a catheter ablation procedure involving pulmonary vein isolation?

A. Paroxysmal atrial fibrillation
B. Persistent atrial fibrillation
C. Long-standing atrial fibrillation
D. Post-op atrial fibrillation
What is the prevalence of AF in the United States?

A. 300,000
B. 1 million
C. 5 million
D. 10 million
Question 4

What is permanent AF?

A. AF that continues for > 12 months
B. Same as chronic AF
C. AF that does not terminate after repeated cardioversions
D. When patient and clinician make a joint decision to stop attempts to restore sinus rhythm
Question 5

The trigger for AF is most commonly found in the?

A. Pulmonary veins
B. Right atrium
C. Coronary Sinus
D. Superior vena cava
Question 6

Which of the following OACs can be used in ESRD?

A. Edoxaban
B. Rivaroxaban
C. Dabigatran
D. Apixaban