Clinical Update

ADAPTED FROM:

2023 ACC/AHA/ACCP/HRS Guideline for the Diagnosis and Management of Atrial Fibrillation
Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care

<table>
<thead>
<tr>
<th>CLASS (STRENGTH) OF RECOMMENDATION</th>
<th>LEVEL (QUALITY) OF EVIDENCE‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLASS 1 (STRONG)</strong></td>
<td><strong>LEVEL A</strong></td>
</tr>
<tr>
<td>Suggested phrases for writing recommendations:</td>
<td>• High-quality evidence from more than 1 RCT</td>
</tr>
<tr>
<td>• Is recommended</td>
<td>• Meta-analyses of high-quality RCTs</td>
</tr>
<tr>
<td>• Is indicated/useful/effective/beneficial</td>
<td>• One or more RCTs corroborated by high-quality registry studies</td>
</tr>
<tr>
<td>• Should be performed/administered/other</td>
<td></td>
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<tr>
<td>• Comparative-Effectiveness Phrases†:</td>
<td></td>
</tr>
<tr>
<td>− Treatment/strategy A is recommended/indicated in preference to treatment B</td>
<td></td>
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<tr>
<td>− Treatment A should be chosen over treatment B</td>
<td></td>
</tr>
<tr>
<td><strong>CLASS 2a (MODERATE)</strong></td>
<td><strong>LEVEL B-R</strong> (Randomized)</td>
</tr>
<tr>
<td>Suggested phrases for writing recommendations:</td>
<td>• Moderate-quality evidence from 1 or more RCTs</td>
</tr>
<tr>
<td>• Is reasonable</td>
<td>• Meta-analyses of moderate-quality RCTs</td>
</tr>
<tr>
<td>• Can be useful/effective/beneficial</td>
<td></td>
</tr>
<tr>
<td>• Comparative-Effectiveness Phrases†:</td>
<td></td>
</tr>
<tr>
<td>− Treatment/strategy A is probably recommended/indicated in preference to treatment B</td>
<td></td>
</tr>
<tr>
<td>− It is reasonable to choose treatment A over treatment B</td>
<td></td>
</tr>
<tr>
<td><strong>CLASS 2b (Weak)</strong></td>
<td><strong>LEVEL B-NR</strong> (Nonrandomized)</td>
</tr>
<tr>
<td>Suggested phrases for writing recommendations:</td>
<td>• Moderate-quality evidence from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies</td>
</tr>
<tr>
<td>• May/might be reasonable</td>
<td>• Meta-analyses of such studies</td>
</tr>
<tr>
<td>• May/might be considered</td>
<td></td>
</tr>
<tr>
<td>• Usefulness/effectiveness is unknown/unclear/uncertain or not well-established</td>
<td></td>
</tr>
<tr>
<td><strong>CLASS 3: No Benefit (MODERATE)</strong></td>
<td><strong>LEVEL C-LD</strong> (Limited Data)</td>
</tr>
<tr>
<td>Suggested phrases for writing recommendations:</td>
<td>• Randomized or nonrandomized observational or registry studies with limitations of design or execution</td>
</tr>
<tr>
<td>• Is not recommended</td>
<td>• Meta-analyses of such studies</td>
</tr>
<tr>
<td>• Is not indicated/useful/effective/beneficial</td>
<td>• Physiological or mechanistic studies in human subjects</td>
</tr>
<tr>
<td>• Should not be performed/administered/other</td>
<td></td>
</tr>
<tr>
<td><strong>CLASS 3: Harm (STRONG)</strong></td>
<td><strong>LEVEL C-EO</strong> (Expert Opinion)</td>
</tr>
<tr>
<td>Suggested phrases for writing recommendations:</td>
<td>• Consensus of expert opinion based on clinical experience.</td>
</tr>
<tr>
<td>• Potentially harmful</td>
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<tr>
<td>• Causes harm</td>
<td></td>
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<tr>
<td>• Associated with excess morbidity/mortality</td>
<td></td>
</tr>
<tr>
<td>• Should not be performed/administered/other</td>
<td></td>
</tr>
</tbody>
</table>

‡COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

**The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

For comparative-effectiveness recommendation (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.
Prevalence, Incidence, Morbidity and Mortality of AF

Prevalence and Incidence of AF is increasing and projected to double between 2010 and 2030

**Overall lifetime risk:**
- 30-40% in White individuals
- 20% in African American individuals
- 15% in Chinese individuals

**AF is associated with increased risks:**
- 1.5- to 2-fold risk of death
- 2.4-fold risk of stroke
- 1.5-fold risk of CI/ dementia
- 1.5-fold risk of MI
- 2-fold risk of SCD
- 5-fold risk of HF
- 1.6-fold risk of CKD
- 1.3-fold risk of PAD

**AF accounted for $28.4 billion/year in US healthcare spending in 2016**

**Abbreviations:** AF indicates atrial fibrillation; CI, cognitive impairment; CKD, chronic kidney disease; HF, heart failure; MI, myocardial infarctions; PAD, peripheral arterial disease; SCD, sudden cardiac death; yr, year; and yrs, years.
## Risk Factors for Diagnosed Atrial Fibrillation

### Demographic, Anthropometric, Cardiovascular Risk Factors
- Advancing Age
- Smoking
- Low Physical Activity
- Elevating Resting Heart Rate
- Obesity
- Increasing Height
- Hypertension
- Diabetes

### Cardiovascular Disease
- HF
- CAD
- Atrial inflammation from pericarditis or myocarditis
- Cardiac Surgery
- Valvular Heart Disease
- Systemic Arterial Hypertension
- Structural Heart Diseases

### Non-Cardiac Conditions
- CKD
- OSA
- Sepsis
- Pulmonary disease (COPD, PE)
- Metabolic disturbances from alcohol abuse, hypokalemia, hyperthyroidism
- Postoperative state

### Biological Markers
- ECG markers (prolonged PR, LVH)
- Biomarkers (elevated BNP, IL6/TNF-alpha, LP(a))
- Imaging markers (increased left atrial size, increased LV wall thickness)

### Genetic Markers
- Family history/h eritability
- GWAS (presence of associated loci)

### Socioeconomic Determinants of Health
- Education Level
- Income Level
- Socioeconomic status

**Abbreviations:** BNP indicates brain natriuretic peptide; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; CKD, chronic kidney disease; GWAS, genome wide association studies; HF, heart failure; IL6, interleukin 6; LP(a), lipoprotein a; LV, left ventricle; LVH, left ventricular hypertrophy; OSA, obstructive sleep apnea; PE, pulmonary embolism; PR, PR interval; and TNF, tumor necrosis factor.
# AF Stages: Evolution of Atrial Arrhythmia Progression

## At Risk for AF

<table>
<thead>
<tr>
<th>Presence of modifiable and nonmodifiable risk factors associated with AF.</th>
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</thead>
<tbody>
<tr>
<td><strong>Modifiable risk factors:</strong></td>
</tr>
<tr>
<td>• Obesity</td>
</tr>
<tr>
<td>• Lack of fitness</td>
</tr>
<tr>
<td>• Hypertension</td>
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<tr>
<td>• Sleep apnea</td>
</tr>
<tr>
<td>• Alcohol</td>
</tr>
<tr>
<td>• Diabetes</td>
</tr>
<tr>
<td><strong>Nonmodifiable risk factors:</strong></td>
</tr>
<tr>
<td>• Genetics</td>
</tr>
<tr>
<td>• Male sex</td>
</tr>
<tr>
<td>• Age</td>
</tr>
</tbody>
</table>

## Pre-AF

<table>
<thead>
<tr>
<th>Evidence of structural or electrical findings further predisposing a patient to AF:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Atrial enlargement</td>
</tr>
<tr>
<td>• Frequent atrial ectopy</td>
</tr>
<tr>
<td>• Short bursts of atrial tachycardia</td>
</tr>
<tr>
<td>• Atrial Flutter</td>
</tr>
<tr>
<td>• Other high AF risk scenarios*</td>
</tr>
</tbody>
</table>

## AF

### Patients may transition among different substages of AF

- **Paroxysmal AF (3A)**
  - AF that is intermittent and terminates within 7 d of onset

- **Persistent AF (3B)**
  - AF that is continuous and sustains for >7d and requires intervention

- **Long-standing persistent AF (3C)**
  - AF that is continuous for >12mo in duration

- **Successful AF ablation (3D)**
  - No AF identified after percutaneous or surgical intervention to eliminate AF

## Permanent AF

| No further attempts at rhythm control after discussion between patient and clinician |

## Treat Modifiable Risk Factors

<table>
<thead>
<tr>
<th>Consider heightened surveillance</th>
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</thead>
<tbody>
<tr>
<td>Ongoing monitoring as clinically appropriate for AF burden</td>
</tr>
<tr>
<td>Is AF associated with pathophysiological changes</td>
</tr>
<tr>
<td>Stroke risk assessment and therapy if appropriate</td>
</tr>
<tr>
<td>Treat symptoms</td>
</tr>
</tbody>
</table>

## Abbreviations:

AF indicates atrial fibrillation, d, day; and mo, month.

*Heart failure, valve disease, coronary artery disease, hypertrophic cardiomyopathy, neuromuscular disorders, thyroid disease.

**Note:**

Mechanisms and Pathways Leading to AF

Abbreviations: AF indicates atrial fibrillation; Ca\textsuperscript{2+}, calcium cation, PACs, premature atrial contractions; and RAAS, renin-angiotensin-aldosterone system.

Contemporary Summary of the Role of the Autonomic Nervous System in AF

Abbreviations: AF indicates atrial fibrillation; Ca²⁺, calcium cation; HRV, heart rate variability; and LA, left atrium.

Genetics of AF

Common and familial AF forms are heritable. Over 100 genetic loci are specific for AF.

TTN loss of function variants are associated with AF.

Disease-associated genetic variants in genes with inherited cardiomyopathy or arrhythmias include TTN, MYH7, MYH6, LMNA, and KCNQ1.

Disease-associated genetic variants are more prevalent at younger age of AF onset.

Rare pathogenic genetic variants in myocardial structural proteins and ion channels may play a role in AF onset at a younger age.

Abbreviation: AF indicates atrial fibrillation.
Health Inequities and Barriers to AF Management

Patients with AF, regardless of sex and gender diversity, race and ethnicity, or adverse SDOH, should be equitably offered guideline-directed stroke risk reduction therapies as well as rate or rhythm control strategies and LRFM as indicated to improve QOL and prevent adverse outcomes. (Class 1)

Inequities in AF care & outcomes

Barriers include:

- Referral for ablation later in disease course
- Less likely to be treated with stroke risk reduction therapies
- More symptomatic and with worse QOL, yet less likely to be referred to EP specialist
- Less likely to receive catheter ablation
- Lower oral anticoagulation rates
- Lower DOAC adherence rates
- Less use of cardioversion
- Increased risk of hospitalization, stroke, HF and death

Abbreviations: AF indicates atrial fibrillation; DOAC, direct oral anticoagulant; EP, electrophysiology; HF, heart failure; LFRM, lifestyle and risk factor modification; QOL, quality of life; SDOH, social determinates of health; and UREG, underrepresented racial and ethnic groups.
Shared Decision Making and Quality of Life in the Management of AF

Shared Decision-Making is essential in AF management

Use of evidence-based decision aids might be useful to guide stroke reduction therapy treatment decisions throughout the disease course to improve engagement, decisional quality and patient satisfaction. (Class 2b)

Publicly Available Decision Aids

<table>
<thead>
<tr>
<th>Agency</th>
<th>Website Link</th>
<th>Focus Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>American College of Cardiology Colorado Program for Patient Centered Decisions</td>
<td><a href="https://patientdecisionaid.org/icd/atrial-fibrillation/">https://patientdecisionaid.org/icd/atrial-fibrillation/</a></td>
<td>Stroke risk reduction therapies</td>
</tr>
<tr>
<td>Anticoagulation Choice Decision Aid</td>
<td><a href="https://anticoagulationdecisionaid.mayoclinic.org/">https://anticoagulationdecisionaid.mayoclinic.org/</a></td>
<td>Stroke risk reduction therapies</td>
</tr>
<tr>
<td>Ottawa Hospital Research Institute Developer Healthwise</td>
<td><a href="https://decisionaid.ohri.ca/AZlist.html">https://decisionaid.ohri.ca/AZlist.html</a></td>
<td>AF ablation Stroke Risk Reduction</td>
</tr>
<tr>
<td>Stanford</td>
<td><a href="https://afibguide.com/">https://afibguide.com/</a></td>
<td>Stroke risk reduction therapies</td>
</tr>
</tbody>
</table>

Abbreviation: AF indicates atrial fibrillation.
### Rhythm Monitoring Tools and Methods

#### Undiagnosed Atrial Fibrillation

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diagnosis should be made with visual interpretation of ECG or intracardiac signals by a clinician.</td>
</tr>
<tr>
<td>2a</td>
<td>For patients who have had a prior thromboembolic event, implantable cardiac monitors have the highest sensitivity in detecting AF.</td>
</tr>
</tbody>
</table>

#### Known Atrial Fibrillation

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
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</thead>
<tbody>
<tr>
<td>2a</td>
<td>AF frequency, duration and burden can be inferred using automated algorithms from ECG monitors, implantable cardiac monitors, and cardiac rhythm devices with an atrial lead.</td>
</tr>
<tr>
<td>2a</td>
<td>Consumer-accessible ECG device that provides a high-quality tracing can be used to detect recurrences.</td>
</tr>
</tbody>
</table>

**Abbreviations:** AF indicates atrial fibrillation; and ECG, electrocardiogram.
Primary Prevention of Atrial Fibrillation

Lifestyle and Risk Factor Management

- Hypertension
- Obesity
- Diabetes mellitus
- Physical Activity
- Smoking
- Alcohol Consumption
Secondary prevention: Lifestyle Factors

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In overweight or obese (BMI &gt; 27 kg/m²) patients, 10% weight loss reduces AF symptoms, burden, recurrence, and progression to persistent AF.</td>
</tr>
<tr>
<td>1</td>
<td>Moderate to vigorous exercise training to a target of 210 minutes/week reduces AF symptoms, burden, increases maintenance of SR, increases functional capacity and improves QOL.</td>
</tr>
<tr>
<td>1</td>
<td>Cigarette smokers should be advised to quit smoking. They should receive GDMT for tobacco cessation to mitigate risks of adverse CV outcomes.</td>
</tr>
<tr>
<td>2b</td>
<td>It is reasonable to screen for OSA, given its high prevalence in patients with AF, although the role of tx of sleep disordered breathing to maintain SR is uncertain.</td>
</tr>
</tbody>
</table>

Abbreviations: AF indicates atrial fibrillation; BMI, body mass index; CV, cardiovascular; GDMT, guideline-directed medical therapy OSA, obstructive sleep apnea; QOL, quality of life; SR, sinus rhythm; and tx, treatment.
Secondary prevention: Dietary Factors

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Patients seeking a rhythm control strategy should minimize or eliminate alcohol consumption to reduce AF recurrence and burden.</td>
</tr>
<tr>
<td>3: No Benefit</td>
<td>Caffeine abstention does not prevent AF episodes. It may reduce symptoms in patients who report caffeine triggers.</td>
</tr>
</tbody>
</table>

Abbreviation: AF indicates atrial fibrillation.

## Secondary prevention: Medical Conditions

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Optimal blood pressure control reduces AF recurrence and AF-related CV events.</td>
</tr>
<tr>
<td>1</td>
<td>Comprehensive care addressing LRFM, AF symptoms, risk of stroke, and associated medical conditions reduces AF burden, progression, and consequences.</td>
</tr>
<tr>
<td>2a</td>
<td>Use of clinical care pathways to promote comprehensive, team-based care enhances adherence to evidence based therapies.</td>
</tr>
</tbody>
</table>

**Abbreviations:** AF indicates atrial fibrillation; CV, cardiovascular; and LRFM, lifestyle and risk factor management.

## Risk Stratification Schemes to Prevent Thromboembolic Events in AF

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Evaluate for annual risk of thromboembolic events using a validated clinical risk score, such as CHA$_2$DS$_2$-VASc.</td>
</tr>
<tr>
<td>1</td>
<td>Evaluate for factors that indicate a higher risk of bleeding* to identify interventions to prevent bleeding on anticoagulation.</td>
</tr>
<tr>
<td>2a</td>
<td>Those at intermediate annual risk of thromboembolic events (eg, equivalent to CHA$_2$DS$_2$-VASc score of 1 in men or 2 in women), who remain uncertain about the benefit of anticoagulation, can benefit from consideration of factors that might modify their risk of stroke to help inform the decision.**</td>
</tr>
<tr>
<td>3: No Benefit</td>
<td>Those deemed at high risk for stroke, bleeding risk scores should not be used in isolation to determine eligibility for oral anticoagulation but instead to identify and modify bleeding risk factors and to inform medical decision-making.</td>
</tr>
</tbody>
</table>

Note: *Prior bleeding, use of medication that increase bleeding risk  
**Higher AF burden/Long duration, persistent/permanent AF vs paroxysmal, obesity (BMI, ≥30 kg/m$^2$), HCM, poorly controlled HTN, eGFR (<45 mL/h), proteinuria (>150 mg/24 h or equivalent), enlarged LA volume (>73 mL) or diameter (>4.7 cm)

### Key Considerations:

- The CHA$_2$DS$_2$-VASc score, is considered the most validated score and most therapies have used that score to prove efficacy, thus is generally the preferred score.

- Newer risk scores, such as the ATRIA and GARFIELD-AF scores may be the better option in selected populations (e.g., renal disease).

**Abbreviations:** AF indicates atrial fibrillation; ATRIA, Anticoagulation and Risk Factors in Atrial Fibrillation; BMI, body mass index; CHA2DS2-VASc, congestive heart failure, hypertension, age ≥75 years (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 years, sex category; cm, centimeter; eGFR, estimated glomerular filtration rate; GARFIELD-AF, Global Anticoagulant Registry in the Field-Atrial Fibrillation; h, hour; HCM, hypertrophic cardiomyopathy; HTN, hypertension; kg, kilogram; LA, left atrium; m$^2$, meters squared; mg, milligram; mL, milliliter; and vs, versus.
Recommendations for Antithrombotic Therapy in AF

Annual Risk stratification using CHA₂DS₂-VASc (Class 1)

High* (≥ 2% per yr)
- Anticoagulation recommended to prevent stroke and systemic thromboembolism (Class 1)
- If no hx of moderate to severe rheumatic MS or mechanical heart valve and candidate for anticoagulation, DOACs are recommended over warfarin to reduce the risk of mortality, stroke, systemic embolism, and ICH (Class 1)
- Candidates for anticoagulation and without an indication for antiplatelet therapy, aspirin either alone or in combination with clopidogrel as an alternative to anticoagulation is not recommended to reduce stroke risk (Class 3: Harm)

Intermediate** (~1-2% per yr)
- Anticoagulation reasonable to prevent stroke and systemic thromboembolism (Class 2a)

Low (< 1% per yr)
- Those without risk factors for stroke, aspirin monotherapy for prevention of thromboembolic events is of no benefit (Class 3: No Benefit)

Decisions based on annual stroke risk rather than specific score
Reassess risk annually

Note: * CHA₂DS₂-VASc score of ≥2 in men and ≥3 in women
** Equivalent to CHA₂DS₂-VASc score of 1 in men and 2 in women

Abbreviations: AF indicates atrial fibrillation; CHA₂DS₂-VASc, congestive heart failure, hypertension, age ≥75 years (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 years, sex category; DOACs, direct-acting oral anticoagulants; hx, history; ICH, intracerebral hemorrhage; MS, mitral stenosis; and yr, year.
Oral Anticoagulation for Device-Detected Atrial High-Rate Episodes Among Patients Without a Previous Diagnosis of AF

**For patients with a device-detected AHRE lasting:**

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>≥24 h and CHA2DS2-VASc score ≥2 or equivalent stroke risk, it is reasonable to initiate oral anticoagulation within a SDM framework that considers episode duration and individual patient risk. (2a)</td>
</tr>
<tr>
<td>2b</td>
<td>Between 5 minutes and 24 hrs and CHA2DS2-VASc score ≥3 or equivalent stroke risk, it may be reasonable to initiate anticoagulation within a SDM framework that considers episode duration and individual patient risk. (2b)</td>
</tr>
<tr>
<td>3: No Benefit</td>
<td>&lt;5 minutes and without another indication for oral anticoagulation should not receive oral anticoagulation. (3: No Benefit)</td>
</tr>
</tbody>
</table>

**Abbreviations:** AF indicates atrial fibrillation; AHRE, atrial high-rate episode; CHA2DS2-VASc, congestive heart failure, hypertension, age ≥75 years (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 years, sex category; hr, hour; hrs, hours; and SDM, shared decision-making.
Percutaneous Approaches to Occlude the LAA in AF

**Patients with Moderate to High Stroke Risk (CHA$_2$DS$_2$-VASc score > 2)**

- In those who have a contraindication to long-term OAC due to a nonreversible cause, pLAAO is reasonable. (Class 2a)
- In those who have a high risk of major bleeding on oral anticoagulation, pLAAO may be a reasonable alternative to oral anticoagulation based on patient preference, with careful consideration of procedural risk and with the understanding that the evidence for OAC is more extensive. (Class 2b)

**Long-Term Anticoagulation Contraindicated**
- Severe bleeding due to a nonreversible cause involving the gastrointestinal, pulmonary, or genitourinary systems
- Spontaneous intracranial/intraspinal bleeding due to a nonreversible cause
- Serious bleeding related to recurrent falls when cause of falls is not felt to be treatable

**Long-Term Anticoagulation Is Still Reasonable**
- Bleeding involving the gastrointestinal, pulmonary, or genitourinary systems that is treatable
- Bleeding related to isolated trauma
- Bleeding related to procedural complications

**Abbreviations:** AF indicates atrial fibrillation; CHA$_2$DS$_2$-VASc, congestive heart failure, hypertension, age ≥75 years (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 years, sex category; LAA, left atrial appendage; OAC, oral anticoagulation; and pLAAO, percutaneous left atrial appendage occlusion.
Evidence supports a benefit of surgical removal of the LAA occlusion in patients with AF who undergo or valve surgeries.

In patients with AF undergoing cardiac surgery with a CHA²DS₂-VASc score ≥2 or equivalent stroke risk:

<table>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Surgical LAA exclusion, in addition to continued anticoagulation, is indicated to reduce the risk of stroke and systemic embolism.</td>
</tr>
<tr>
<td>2b</td>
<td>The benefit of surgical LAA exclusion in the absence of continued anticoagulation to reduce the risk of stroke and systemic embolism is uncertain.</td>
</tr>
</tbody>
</table>

In patients with AF undergoing cardiac surgery:

<table>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>And LAA exclusion, a surgical technique resulting in absence of flow across the suture line and a stump of &lt;1 cm as determined by intraoperative transesophageal echocardiography should be used.</td>
</tr>
</tbody>
</table>


Abbreviations: AF indicates atrial fibrillation; CABG, coronary artery bypass graft surgery; CHA²DS₂-VASc, congestive heart failure, hypertension, age ≥75 years (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 years, sex category; cm, centimeter; LAA, left atrial appendage; and TEE, transesophageal echocardiography.

# Active Bleeding on Anticoagulant Therapy and Reversal Drugs

## Agent

<table>
<thead>
<tr>
<th>Agent</th>
<th>REVERSAL (%)</th>
<th>RESUMPTION (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apixaban</td>
<td>CLASS 1</td>
<td>Non-ICH</td>
</tr>
<tr>
<td>Edoxaban*</td>
<td>OR 4F-PCC</td>
<td>ICH</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>CLASS 2a</td>
<td></td>
</tr>
<tr>
<td>Dabigatran</td>
<td>PCC</td>
<td></td>
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<tr>
<td>Warfarin</td>
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### Life-threatening bleed

- Apixaban: Andexanet alfa or 4F-PCC
- Edoxaban*: If idarucizumab unavailable
- Rivaroxaban: Idarucizumab
- Dabigatran: 4F-PCC + IV vitamin K recommended to rapidly achieve INR correction over FFP and IV vitamin K treatment
- Warfarin: 4F-PCC or If idarucizumab unavailable

### Acute phase

- **CLASS 1**: Andexanet alfa or 4F-PCC
- **CLASS 2a**: Idarucizumab

### Subacute/Chronic phase

- **Exact time frame**
  - Early: Within 1-2 weeks (2a)
  - Delayed: Within 4-8 weeks (2b)

### Recurrence risk

- Low
- High (e.g. CAA)

### Thromboembolism risk

- Very high (≥ 5%)
  - (e.g. mechanical valve, rheumatic MS)
- Intermediate/high (< 5%)

### Abbreviations:

- 4F-PCC: 4-factor prothrombin complex concentrate
- CAA: Cerebral amyloid angiopathy
- LAAO: Left atrial appendage occlusion
- ICH: Intracerebral hemorrhage
- IV: Intravenous
- C-LD LOE: Level of evidence C and limited data
- MS: Mitral stenosis
- PCC: Prothrombin complex concentrate

*C-LD LOE applies to data on edoxaban

---

**Joglar, J. A. et al., 2023 ACC/AHA/ACCP/HRS Guideline for the Diagnosis and Management of Atrial Fibrillation. Circulation.**
## Timing of Discontinuation of OACs in AF Pts Scheduled to Undergo an Invasive Procedure or Surgery in Whom Anticoagulation is to be Interrupted

<table>
<thead>
<tr>
<th>Anticoagulant</th>
<th>Low Bleeding Risk Procedure</th>
<th>High Bleeding Risk Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apixaban (CrCl &gt;25 mL/min)*</td>
<td>1 d†</td>
<td>2 d</td>
</tr>
<tr>
<td>Dabigatran (CrCl &gt;50 mL/min)</td>
<td>1 d</td>
<td>2 d</td>
</tr>
<tr>
<td>Dabigatran (CrCl 30-50 mL/min)</td>
<td>2 d</td>
<td>4 d</td>
</tr>
<tr>
<td>Edoxaban (CrCl &gt;15 mL/min)</td>
<td>1 d</td>
<td>2 d</td>
</tr>
<tr>
<td>Rivaroxaban (CrCl &gt;30 mL/min)</td>
<td>1 d</td>
<td>2 d</td>
</tr>
<tr>
<td>Warfarin</td>
<td>5 d for a target INR &lt;1.5</td>
<td>2-3 d for a target INR &lt;2</td>
</tr>
</tbody>
</table>

Note: *For patients on DOAC with creatinine clearance lower than the values in the table, few clinical data exist. Consider holding for an additional 1 to 3 days, especially for high bleeding risk procedures.

†The number of days is the number of full days before the day of surgery in which the patient does not take any dose of anticoagulant. The drug is also not taken the day of surgery. For example, in the case of holding a twice daily drug for 1 day, if the drug is taken at 8 pm, and surgery is at 8 am, at the time of surgery, it will be 36 hours since the last dose was taken.

**Abbreviations:** AF indicates atrial fibrillation; CrCl, creatinine clearance; d, day; DOAC, direct oral anticoagulation; INR, international normalized ratio; and OAC, oral anticoagulant.
Management of Periprocedural Anticoagulation in Patients with AF

- **Patients with AF undergoing invasive procedure or surgery**
  - Procedure cannot be performed safely on uninterrupted anticoagulation
    - Temporary cessation or oral anticoagulation without bridging is recommended excluding those with recent stroke or TIA, or a mechanical valve. (1)
    - Timing of interruption of DOAC should be guided by the specific agent, renal function, and the bleeding risk. (1)

- **Procedure is a pacemaker or ICD implant**
  - On warfarin, risk of TEs ≥ 5% (1)
  - CHA₂DS₂-VASc score ≥ 2 or equivalent risk of stroke, on DOAC
    - Continued anticoagulation in preference to interruption of warfarin and bridging (1)
    - Either uninterrupted or interrupted DOAC (2a)

- **Resumption of anticoagulation the day after low bleeding risk surgery and between the evening of the second day and the evening of the third day after high bleeding risk surgery. (2a)**

- **Holding Warfarin**
  - Bridging with LMWH should not be administered (except in patients with mechanical valve or recent stroke or TIA) (3: Harm)

**Abbreviations:** AF indicates atrial fibrillation; CHA₂DS₂-VASc, congestive heart failure, hypertension, age ≥ 75 y (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 y, sex category; DOAC, direct oral anticoagulant; ICD, implantable cardioverter-defibrillator; LMWH, low-molecular-weight heparin; TE, thromboembolism; and TIA, transient ischemic attack.
### Anticoagulation in AF Specific Populations

<table>
<thead>
<tr>
<th>ACS or PCI</th>
<th>CCD</th>
<th>PAD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COR</strong></td>
<td><strong>RECOMMENDATIONS</strong></td>
<td><strong>COR</strong></td>
</tr>
<tr>
<td>1</td>
<td>For increased stroke risk in PCI, DOACs preferred over VKAs in combination with APT to reduce risk of clinically relevant bleeding.</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>In those on OAC undergoing PCI, early discontinuation of ASA (1-4 wk) and continuation of dual antithrombotic therapy with OAC and a P2Y12 inhibitor is preferred over triple therapy (OAC, P2Y12 inhibitor, and ASA) to reduce risk of clinically relevant bleeding.</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:** ACS indicates acute coronary syndrome; AF, atrial fibrillation; APT, antiplatelet therapy; ASA, aspirin; CAD, coronary artery disease; CCD, chronic coronary disease; DOACs, direct-acting oral anticoagulant; hx, history; OAC, oral anticoagulant; PAD, peripheral artery disease; PCI, percutaneous coronary intervention; VHD, valvular heart disease; VKAs, vitamin K antagonist; and wk, week.
## Anticoagulation in AF Specific Populations

### CKD/Kidney Failure

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If at elevated risk for stroke and CKD stage 3, tx with warfarin or, preferably, evidence-based doses of direct thrombin or factor Xa inhibitors is recommended to reduce stroke risk.</td>
</tr>
<tr>
<td>2a</td>
<td>If at elevated risk for stroke and CKD stage 4, tx with warfarin or labeled doses of DOACs is reasonable to reduce stroke risk.</td>
</tr>
<tr>
<td>2b</td>
<td>If at elevated risk for stroke &amp; end-stage CKD (CrCl &lt;15 mL/min) or on dialysis, it might be reasonable to prescribe warfarin (INR 2.0-3.0) or an evidence-based dose apixaban for oral anticoagulation to reduce stroke risk.</td>
</tr>
</tbody>
</table>

### VHD

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In rheumatic mitral stenosis or MS of moderate or greater severity and hx of AF, long-term anticoagulation with warfarin is recommended over DOACs, independent of the CHA₂DS₂-VASc score to prevent CV events, including stroke or death.</td>
</tr>
<tr>
<td></td>
<td>In valve disease other than moderate or greater mitral stenosis or a mechanical heart valve, DOACs are recommended over VKAs.</td>
</tr>
</tbody>
</table>

**Abbreviations:** AF indicates atrial fibrillation; CHA₂DS₂-VASc, congestive heart failure, hypertension, age ≥75 years (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 years, sex category; CKD, chronic kidney disease; CrCl, creatinine clearance; CV, cardiovascular; DOACs, direct-acting oral anticoagulant; hx, history; INR, international normalized ratio; min, minute; ml, milliliter; MS, mitral stenosis; tx, treatment; VHD, valvular heart disease; and VKAs, vitamin K antagonists.
Treatment: Rate Control in AF

Objectives of Rate Control:

- Resting heart rate < 100-110 bpm
- Reduce symptoms
- Reduce risk of tachycardia-induced cardiomyopathy or improve heart function of patients with tachycardia-induced cardiomyopathy
- Reduce inappropriate shock in patients with implantable defibrillators
- Enhance biventricular pacing in patients with cardiac resynchronization therapy use
- Reduce risk of hospitalization

Comorbidities
Clinical presentation
Medication Profile
Presence of Heart Failure

Different factors that guide decision of Rate vs Rhythm therapy

Shared decision making & patient preference

Abbreviations: AF indicates atrial fibrillation; bpm, beats per minute; and vs, versus.

Pharmacological Agents for Rate Control in AF

**Rate Control Agents**

### Beta-Blockers
- Slows AV nodal conduction
- Block B-1 receptors

### Digoxin
- Positive inotropic and vagotonic effects
- Could be useful in HFrEF pts

### IV Magnesium
- Blocks slow inward calcium channels of SA and AV node

### Amiodarone
- Useful in critical ill pts who cannot tolerate AV nodal slowing agents
- Can result in pharmacologic cardioversion

### NDCC
- Slow AV nodal conduction
- Negative inotropic and chronotropic effect

### Agent | IV | Oral Maintenance dose
--- | --- | ---
Diltiazem | 0.25 mg/kg IV over 2 mins. May repeat 0.35 mg/kg over 2 mins; then 5-15 mg/hr continuous infusion | 120 – 360 mg daily (ER)
Verapamil | 5 to 10 mg over ≥2 minutes (may repeat twice); then 5 mg/hr continuous infusion (max 20 mg/hr) | 180 – 480 mg daily (ER)
Amiodarone | 150-300 mg IV over 1 hr, then 10-50 mg/h over 24 hrs | 100 – 200 mg daily
Digoxin* | 0.25 – 0.5 mg over mins; repeat doses of 0.25 mg every 6 hrs (max 1.5 mg/24 hrs) | 0.0625 – 0.25 mg daily

*Increased mortality at plasma concentrations exceeding 1.5 mg/mL

**Abbreviations:** AF indicates atrial fibrillation; AV, atrioventricular; ER, extended release; HFrEF, heart failure with reduced ejection fraction; hr, hour; hrs, hours; IV, intravenous; kg, kilogram; min; minute; mins, minutes; mg, milligram; mcg, microgram; ng, nanogram; NDCC, nondihydropyridine calcium channel blocker; PRN, as needed; pts, patients; and SA, sinoatrial.
Approach to Acute Rate Control in AF with Rapid Ventricular Response

Hemodynamically Stable?

- No
  - Direct-Current Cardioversion (1)

- Yes
  - Decompensated HF?
    - No
      - BB, verapamil, or diltiazem (1)
      - Digoxin (2a)
      - Amiodarone (2b)
      - Addition of Magnesium to AV nodal blockage (2a)
    - Yes
      - IV Amiodarone* (2b)
      - Verapamil, diltiazem (3: Harm)

*Contraindicated in patients with moderate-severe LV dysfunction regardless of decompensated HF.

**Abbreviations:** AF indicates atrial fibrillation; AV, atrioventricular; BB, beta-blocker; HF, heart failure; IV, intravenous; and LV, left ventricular.
Approach to Long Term Rate Control of AF

Abbreviations: AF indicates atrial fibrillation; BB, beta-blocker; LVEF, left ventricular ejection fraction; and NDCC, nondihydropyridine calcium channel blocker.
## Recommendations for Atrioventricular Nodal Ablation

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In patients with AF and a persistently rapid ventricular repose who undergo AVNA, initial pacemaker lower rate programming should be 80 to 90 bpm to reduce the risk of sudden death.</td>
</tr>
<tr>
<td>2b</td>
<td>In patients with AF and uncontrolled rapid ventricular response refractory to rate-control medications, AVNA can be useful to improve symptoms and QOL.</td>
</tr>
<tr>
<td>1</td>
<td>In patients with AF scheduled to have an AVNA, implantation of a pacemaker prior to procedure is recommended to ensure adequacy of the pacing leads before performing the ablation.</td>
</tr>
<tr>
<td>2b</td>
<td>In patients with AF and normal EF undergoing AVNA, conduction system pacing of the His bundle or left bundle area may be reasonable.</td>
</tr>
</tbody>
</table>

**Abbreviations:** AF indicates atrial fibrillation; AVNA, atrioventricular nodal ablation; bpm, beats per minute; EF, ejection fraction; and QOL, quality of life.
Goals of Rhythm Control Therapy in AF

**Rhythm control in patients with**

- **Recent AF Diagnosis (< 1 year)**
  - Rhythm control can be useful to reduce hospitalizations, stroke, and mortality (2a)

- **Reduced LV function & Persistent AF**
  - A trial of rhythm control recommended to evaluate if AF is contributing to reduced LV function (1)

- **AF and HF**
  - Rhythm control can be useful for improving symptoms and outcomes such as mortality and hospitalizations for HF and ischemia (2a)

- **Symptomatic AF**
  - Rhythm control can be useful to improve symptoms (2a)

**In patients with AF, rhythm-control strategies can be useful to reduce the likelihood of AF progression.** (2a)

**In patients with AF where symptoms associated with AF are uncertain, a trial of rhythm control (eg, cardioversion or pharmacological therapy) may be useful to determine what if any symptoms are attributable to AF.** (2b)

**In patients with AF, rhythm-control strategies may be useful to reduce the likelihood of development of dementia or worsening cardiac structural abnormalities.** (2b)

**Abbreviations:** AF indicates atrial fibrillation; HF, heart failure; and LV, left ventricular.
### Electrical and Pharmacological Cardioversion of AF

#### Recommendations for pharmacologic cardioversion

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>Ibutilide is reasonable for pharmacological cardioversion for pts w/o depressed LV function (LVEF &lt;40%). (1)</td>
</tr>
<tr>
<td>2a</td>
<td>IV amiodarone is reasonable for pharmacological cardioversion, although time to conversion is generally longer than other agents (8-12 hours). (2a)</td>
</tr>
<tr>
<td>2a</td>
<td>Recurrent AF occurring outside the hospital, the PITP approach with a single oral dose of flecainide or propafenone, with concomitant AV nodal blocking agent, is reasonable for pharmacological cardioversion if previously tested in a monitored setting. (2a)</td>
</tr>
<tr>
<td>2b</td>
<td>Use of IV procainamide may be considered for pharmacological cardioversion when other intravenous agents are contraindicated or not preferred. (2b)</td>
</tr>
</tbody>
</table>

#### Recommendations for electrical cardioversion

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electrical cardioversion, energy delivery should be confirmed to be synchronized to the QRS to reduce the risk of inducing VF. (1)</td>
</tr>
<tr>
<td>2a</td>
<td>In elective electrical cardioversion, the use of biphasic energy of at least 200 J as initial energy can be beneficial to improve success of initial electrical shock. (2a)</td>
</tr>
<tr>
<td>2a</td>
<td>In pts undergoing elective cardioversion, with longer duration of AF or unsuccessful initial shock, optimization of electrode vector, use of higher energy, and pretreatment with antiarrhythmic drugs can facilitate success of electrical cardioversion. (2a)</td>
</tr>
<tr>
<td>2b</td>
<td>In pts with obesity and AF, use of manual pressure augmentation and/or further escalation of electrical energy may be beneficial to improve success of electrical cardioversion. (2b)</td>
</tr>
</tbody>
</table>

### Abbreviations:

AF indicates atrial fibrillation; AV, atrioventricular; IV, intravenous; LV, left ventricular; LVEF, left ventricular ejection fraction; pts, patients; PITP, pill-in-the-pocket; QRS, QRS interval; and VF, ventricular fibrillation.

Antiarrhythmic Drugs for Maintenance of Sinus Rhythm

Atrial fibrillation

Normal LV function, no prior MI or significant structural heart disease
- Dofetilide
- Dronedarone
- Flecainide
- Propafenone (2a)
- Amiodarone (2a)
- Sotalol (2b)

Prior MI or significant structural heart disease, including HFrEF (LVEF ≤40%)
- Amiodarone
- Dofetilide (2a)
- Sotalol (2b)

Prior MI or significant structural heart disease, including HFrEF (LVEF ≤40%)
- NYHA FC III or IV or recent decompensated Hf
  - No
  - Yes

Dronedarone (2a)
Dronedarone (3: Harm)
Flecainide
Propafenone (3: Harm)

Considerations:
- Risk of development of MI and structural heart disease
- The need for in-hospital initiation of antiarrhythmic drugs
- Baseline and follow-up tests

Abbreviations: HF indicates heart failure; HFrEF, heart failure reduced ejection fraction; LV, left ventricle; LVEF, left ventricular ejection fraction; MI, myocardial infarction; and NYHA FC, New York Heart Association Functional Class.
## Antiarrhythmic Drug Initiation in Facility

<table>
<thead>
<tr>
<th>COR</th>
<th>MEDICATION</th>
<th>DURATION OF IN-FACILITY OBSERVATION</th>
<th>FACILITY SHOULD BE CAPABLE OF:</th>
</tr>
</thead>
</table>
| 1   | Dofetilide (1)                    | Admission for ≥3 days               | • Continuous ECG monitoring  
• Periodic CrCl  
• Cardiac resuscitation |
| 2a  | Sotalol (2a)                      | 3 days                              | • Continuous ECG monitoring  
• Periodic creatinine clearance calculations  
• Cardiac resuscitation |
| 2a  | Flecainide and Propafenone as PTTP (2a) | First dose in a facility            | • Continuous ECG monitoring |

**Abbreviations:** CrCl indicates creatinine clearance; ECG, electrocardiogram; and PTTP, pill-in-the-pocket.
# Antiarrhythmic Drug Follow-up

<table>
<thead>
<tr>
<th>Drug</th>
<th>Baseline Tests</th>
<th>Within 6 Months Tests</th>
<th>Every 3-6 Months After Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dofetilide</td>
<td>ECG, K and Mg, CrCl</td>
<td>ECG, K and Mg, CrCl</td>
<td>ECG, K and Mg, CrCl</td>
</tr>
<tr>
<td>Dronedarone</td>
<td>ECG, AST and ALT</td>
<td>AST and ALT</td>
<td>--</td>
</tr>
<tr>
<td>Ibutilide</td>
<td>ECG, K and Mg</td>
<td>Continuous ECG at least 4 hours following infusion</td>
<td>--</td>
</tr>
<tr>
<td>Procainamide</td>
<td>ECG, BP</td>
<td>ECG, BP during infusion</td>
<td>--</td>
</tr>
<tr>
<td>Sotalol</td>
<td>ECG, K and Mg, CrCl</td>
<td>ECG, K and Mg, CrCl</td>
<td>ECG, K and Mg, CrCl</td>
</tr>
<tr>
<td>Amiodarone</td>
<td>TSH, AST, ALT, CXR, ECG</td>
<td>TSH, AST, ALT</td>
<td>TSH, AST, ALT; If symptoms -&gt; Assess for ILD, epithelial keratopathy; Annual dermatologic and neurologic exam</td>
</tr>
</tbody>
</table>

**Abbreviations:** ALT indicates alanine transaminase; AST, aspartate aminotransferase; BP, blood pressure; CrCl, creatinine clearance; CXR, chest x-ray; ECG, electrocardiogram; ILD, interstitial lung disease; K, potassium; Mg, magnesium; and TSH, thyroid stimulating hormone.
Anticoagulation Management Strategy
Before & After AF Ablation

### Prior to ablation

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Catheter ablation should be performed on uninterrupted therapeutic anticoagulation with a goal INR of 2.0 to 3.0.</td>
</tr>
<tr>
<td>1</td>
<td>If patient on a DOAC, catheter ablation should be performed with either continuous or minimally interrupted oral anticoagulation.</td>
</tr>
</tbody>
</table>

### After ablation

<table>
<thead>
<tr>
<th>COR</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OAC should be continued for at least 2 to 3 months after the procedure with a longer duration determined by underlying risk.</td>
</tr>
<tr>
<td>1</td>
<td>Continuation of longer-term OAC should be dictated according to the patients’ stroke risk (eg, CHA₂DS₂-VASc score ≥2).</td>
</tr>
</tbody>
</table>

**Abbreviations:** AF indicates atrial fibrillation; CHA₂DS₂-VASc, congestive heart failure, hypertension, age ≥75 years (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 years, sex category; DOAC, direct oral anticoagulant; INR, international normalized ratio; and OAC, oral anticoagulant.
AF Management in Patients with HF

GDMT, Thromboembolism prophylaxis, Risk factor modification

Cardioversion if indicated
- Electrical Cardioversion (1)
- Pharmacological Cardioversion (2a)

Rate Control
- LVEF < 40%
  - NDCC (Diltiazem, Verapamil) (3:Harm)
  - Beta-Blockers (1)
  - Digoxin (2a)
  - IV Amiodarone Acute rate control (2a)
- LVEF > 40%
  - Beta-Blockers or NDCC (1)
  - Digoxin (2a)
  - IV Amiodarone Acute rate control (2a)

Evaluate if appropriate for rhythm control with catheter ablation – see next slide

Abbreviations: AF indicates atrial fibrillation; HF, heart failure; IV, intravenous; and NDCC, non-dihydropyridine calcium channel blockers.
AF Management in Patients with HF

Evaluate if appropriate for rhythm control with catheter ablation – see previous slide

Likely to benefit from catheter ablation
- AF-mediated CMP suspected
- Early stage of HF
- No significant ventricular scar on CMR
- No or mild atrial fibrosis
- Paroxysmal and early persistent AF
- Younger pts w/o significant other comorbidities

Less Likely to benefit from catheter ablation
- Advanced HF
- Significant ventricular scar on CMR
- Severe atrial myopathy (dilation/fibrosis)
- Long-standing persistent AF
- Prior failed ablations
- Advanced age or multiple comorbidities

HFrEF
- AF catheter ablation (1)
- No clinical AF
- Long-term surveillance for recurrent AF (in AF-induced CMP and recovered LVEF (2a))

HFpEF
- AF catheter ablation (2a)
- Recurrent AF

Decision for pharmacological rhythm vs rate-control strategy

Pharmacological cardioversion and maintenance of SR after cardioversion
- Repeat ablation
- Dronedarone NYHA Class III/IV HF or decompensated HF in past 4 wk (3:Harm)

HFrEF (LVEF≤50%)
- Uncontrolled rate + rhythm control failed or not appropriate: AV nodal ablation + pacing (2a)

HFpEF
- Left bundle of His bundle pacing as alternative to biventricular pacing (2b)
- Uncontrolled rate with biventricular pacemaker in place without effective pacing %: AV Nodal ablation (2a)

Abbreviations: AF indicates atrial fibrillation; AV, atrioventricular; CMP, cardiomyopathy; CMR, cardiac magnetic resonance; GDMT, guideline-directed medical therapy; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; IV, intravenous; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; and wk, week.
Management of Early Onset AF, Athletes, Obesity, Hyperthyroidism, Pulmonary disease

**Abbreviations:** AF indicates atrial fibrillation; COPD, chronic obstructive pulmonary disease; DOACs, direct-acting oral anticoagulants; EP, electrophysiologic; HF, heart failure; HTN, hypertension; kg/m², kilogram per meters squared; MI, myocardial ischemia; PH, pulmonary hypertension; PV, pulmonary vein; SR, sinus rhythm; and SVT, supraventricular tachyarrhythmias.

---

**Age**
- **<30 yr**
  - EP study to evaluate and treat reentrant SVT (2b)
  - Targeted ablation may be reasonable (2b)

- **<45 yr**
  - The following may be reasonable:
    - Referral for genetic counseling
    - Genetic testing for rare pathogenic variants
    - Surveillance for cardiomyopathy or arrhythmia syndromes (2b)

---

**Athletes (Class III)**
- Rhythm control-catheter ablation with PV isolation is reasonable (2a)

---

**Obesity (BMI ≥40 kg/m²)**
- DOACs reasonable over warfarin (2a)

---

**Hyperthyroidism**
- Warfarin may be reasonable over DOACs due to DOAC drug absorption concerns (Class 2b)
- Anticoagulation until euthyroid and SR maintained (1)

---

**Pulmonary Disease**
- COPD
  - Rate control-Cardio-selective beta-blockers especially in MI and HF (2a)
- PH with Pulmonary Vascular Disease
  - Rhythm control-strategy is reasonable (2a)

---

Management of AF in Cardio-Oncology, Liver disease, and CKD

**Cardio-Oncology**
- Cancer and AF
- Cancer with risk for AF
  - Multidisciplinary communication & SDM (Reduce drug interactions; QTc prolongation; proarrhythmia; bleeding; and thromboembolism) (1)
  - DOACs preferred over VKAs for stroke risk reduction (2a)
- Increased vigilance for incident AF and treatment of contributing factors (2a)

**Mild or Moderate Liver Disease (Child-Pugh Class A or B)**
- OACs in the absence of clinically significant liver disease-induced coagulopathy or thrombocytopenia (2a)
  - Class A: Any DOAC (2a)
  - Class B: Apixaban, Dabigatran, or Edoxaban preferred over warfarin (2a)

**CKD/Kidney Failure at Elevate Stroke Risk**
- CKD Stage 3
  - Evidence based doses of direct thrombin or factor Xa inhibitors OR Warfarin (1)
  - Warfarin OR labelled doses of DOACs (2a)
- CKD Stage 4
  - It might be reasonable to prescribe warfarin (INR 2-3) OR Apixaban evidence-based dose (2b)

**ESRD/ Dialysis**
- Patients with AF and moderate liver disease (Class B): Rivaroxaban is contraindicated due to increased risk of bleeding (3:Harm)

**Abbreviations**: AF indicates atrial fibrillation; CKD, chronic kidney disease; DOACs, direct-acting oral anticoagulants; ESRD, end stage renal disease; INR, international normalised ratio OACs, oral anticoagulants; QTc, QT interval corrected for heart rate; SDM, shared decision-making; and VKAs, vitamin K antagonists.

Pregnancy and the AF Patient

Abbreviations: AF indicates atrial fibrillation; IV, intravenous; and SDM, shared decision-making.

Prevention and Treatment of AF After Cardiac Surgery

**Prevention of AF After Cardiac Surgery**
- Patients at high risk for postop AF: Short-term prophylactic beta-blockers or amiodarone (2a)
- CABG, aortic valve, ascending aortic aneurysm operations: posterior left pericardiotomy (2a)

**Treatment of AF After Cardiac Surgery**
- Hemodynamically stable
  - Rate control (target HR <100 bpm) with beta-blocker or CCB (1)
  - Rhythm control (1)
- Hemodynamically unstable or poorly tolerated AF
  - Direct current cardioversion with antiarrhythmic drug therapy (1)
- Consider anticoagulation when deemed safe from surgical bleeding (2a)
- Rate control: Beta-blocker OR CCB (1)

**30 to 60-day postop rhythm assessment ± cardioversion if AF does not revert to SR (2a)**

**Abbreviations:** AF indicates atrial fibrillation; bpm, beats per minute; CABG, coronary artery bypass graft surgery; CCB, calcium channel blocker; HR, heart rate; pts, patients; and SR, sinus rhythm.
Wolff-Parkinson-White and Pre-Excitation syndromes, ACHD, and HCM

**AF with rapid anterograde conduction (pre-excited AF)**
- If hemodynamically unstable, should be treated with electrical cardioversion (1)
- Catheter ablation of accessory pathways is recommended (1)
- If hemodynamically stable, pharmacological cardioversion with intravenous ibutilide or IV procainamide is recommended as an alternative to elective cardioversion (1)

**ACHD and AF**
- Evaluate and treat precipitating/reversible causes (1)
- Rhythm control: If symptomatic/paroxysmal/persistent AF (1)
- If undergoing PVI, may be reasonable to include ablative strategy in the right atrium (2b)

**Simple CHD**
- Ablation: If symptomatic and antiarrhythmic drug refractory (2a)

**Moderate or Complex/Severe ACHD**
- EP procedures in collaboration with ACHD cardiologist at specialized centers (1)
- Anticoagulation in pts with low-flow states: Fontan circulation, blind-ending cardiac chambers & cyanosis (2b)

**HCM and AF**
- DOACs are first line in pts with clinical or subclinical AF (duration > 24 hours) (1)
- VKAs are second line independent of CHA2DS2-VASc score (1)
- Rate control: beta blocker/verapamil/diltiazem (1)
- If AF is poorly tolerated, rhythm control strategy with cardioversion or anti-arrhythmic drugs can be beneficial (2a)
- Catheter ablation can be effective if drug therapy is ineffective, contraindicated or not patient preference (2a)
- In pts undergoing surgical myectomy, surgical AF ablation can be beneficial (2a)

**Do not use AV Nodal blocking agents:** Verapamil, Diltiazem, Amiodarone, Digoxin, Adenosine, or Beta-blockers (3:Harm)

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**Abbreviations:** ACHD indicates adult congenital heart disease; AF, atrial fibrillation; AV, atrioventricular; CHA2DS2-VASc, congestive heart failure, hypertension, age ≥75 years (doubled), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (doubled), vascular disease, age 65 to 74 years, sex category; CHD, congenital heart disease; DOACs, direct-acting oral anticoagulants; EP, electrophysiologic; HCM, hypertrophic cardiomyopathy; IV, intravenous; pts, patients; PVI, pulmonary vein isolation; VKA, vitamin K antagonists; and WPW, Wolff-Parkinson-White.

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AF in the setting of Acute Medical Illness or Surgery

- Counseling regarding risk of recurrent AF (Class 1)
- Outpatient follow-up: Thromboembolic risk stratification and decision making on OAC initiation/continuation AF surveillance (Class 2a)
- Anticoagulation in the setting of sepsis: uncertain benefits (Class 2b)

Abbreviations: AF indicates atrial fibrillation and OAC, oral anticoagulation.
Future Research Needs

Evaluation of the AF Patient:
- AF as a disease continuum
- Individualization of AF and stroke risk
- Race, gender and sex differences
- Incorporating other stroke risk scores
- Standardized measures
- Social determinants of health
- Genetic testing
- Subclinical AF
- Sleep

Management of the AF Patient:
- Wearable heart monitoring devices
- Strategies for anticoagulation
- Downstream consequences of AF
- Standardization of ablation procedures
- Surgical exclusion and occlusion of LAA
- Candidates for ablation
- Role of risk modifiers in AF stroke prevention
- Shared decision making
- AI for AF management
- Better goal and outcome definition

Abbreviations: AF indicates atrial fibrillation; AI, artificial intelligence; and LAA, left atrial appendage.

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