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Atrial Fibrillation: An Update for Home Healthcare Clinicians

Atrial fibrillation is a common cardiac arrhythmia in which the atria of the heart do not beat synchronously with the ventricles. It affects 2.7 to 6.1 million people in the United States. The erratic beating of the atria can cause blood clots to form in the atria, and if released into the circulation, an embolism can travel to the brain, causing a stroke. The primary goals of care for the management of atrial fibrillation are stroke-risk reduction, control of heart rate, rhythm management, and prevention of cardiac-related morbidity and mortality. This article reviews the guideline for the management of patients with atrial fibrillation by the American College of Cardiology and American Heart Association Task Force on Clinical Practice Guidelines and provides recommendations for home healthcare clinicians.

Atrial fibrillation is a condition in which the heart beats irregularly, predisposing the affected individual to strokes and heart failure. Normally, the upper chambers of the heart (the atria) beat in coordination with the lower chambers (the ventricles). With atrial fibrillation, the atria are out of synch with the ventricles and beat erratically and sometimes too fast (Mayo Clinic, 2020). The erratic beating of the atria can cause blood clots to form in the atria, and if released into the circulation, an embolism can travel to the brain, causing a stroke. There are no direct heritable causes of atrial fibrillation. It is generally secondary to other heritable and nonheritable, cardiac and noncardiac conditions. Table 1 lists the categories of atrial fibrillation with definitions.

According to the Centers for Disease Control and Prevention (CDC, 2020), atrial fibrillation is a common cardiac arrhythmia. The number of people in the United States with atrial fibrillation is estimated to range between 2.7 and 6.1 million. Caucasian people of European descent are more likely to develop atrial fibrillation compared with African Americans. Because women tend to live longer than men, and atrial fibrillation is associated with aging, more women than men experience atrial fibrillation (CDC). The incidence of atrial fibrillation in people >65 years escalates in the presence of commonly associated comorbidities such as high blood pressure, obesity, diabetes, and other cardiac diseases (CDC). See Table 2 for additional risk factors. Atrial fibrillation is associated with at least a fivefold increased risk for stroke, resulting in 750,000 hospitalizations and 130,000 deaths annually, and costing taxpayers roughly $6 billion per year. Women with atrial fibrillation tend to suffer a higher incidence of thromboembolic events compared with men in the later decades of life. The yearly medical cost burden for individuals with atrial fibrillation is estimated to be $8,705 higher, as compared with patients without atrial fibrillation (January et al., 2014).

Patients have variable responses to atrial fibrillation, with presentation ranging from asymptomatic to hemodynamic instability. Heart palpitations, weakness, and shortness of breath are common. The absence of sinus node impulse propagation through normal cardiac conduction pathways causes loss of the atrial kick which leads to reduced cardiac output. Hemodynamic instability may manifest as angina, dyspnea, palpitations, exacerbation of heart failure, fatigue, hypotension, mental status change, syncope, and impaired

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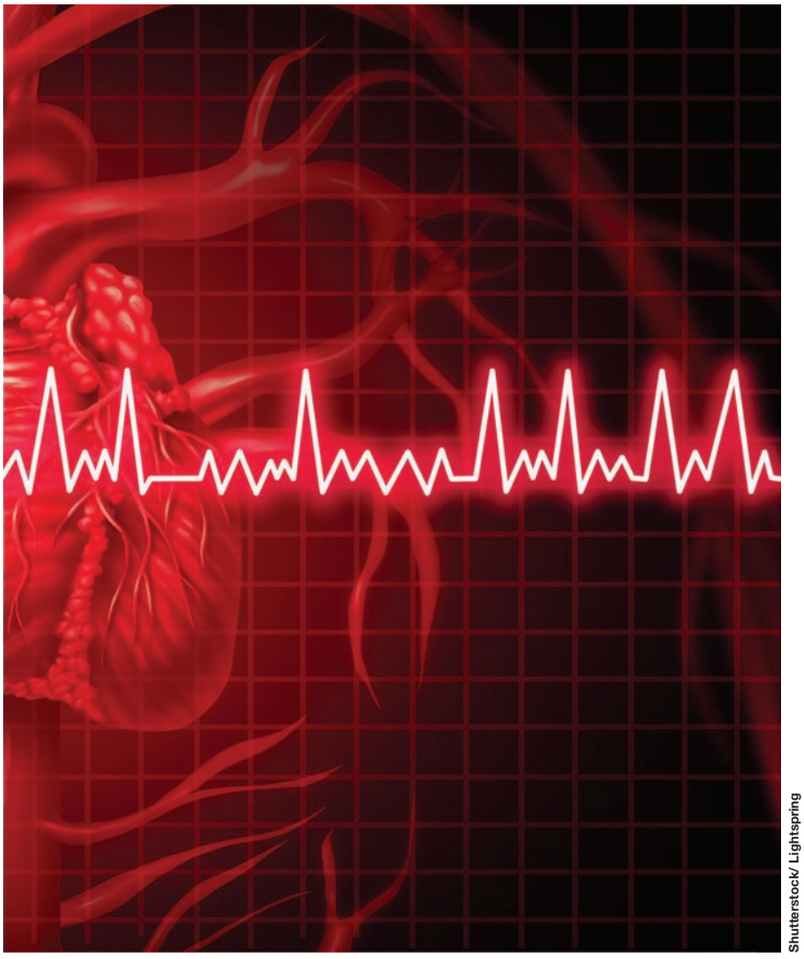
end-organ perfusion from reduced cardiac output. Approximately 10% to 21% of atrial fibrillation patients also have acute coronary syndrome, a finding that increases with advanced age. This constellation of symptoms is generally amplified with rapid ventricular response (i.e., heart rate > 100 beats per minute) and if not controlled, will exacerbate low cardiac output and result in an urgent or emergent condition (January et al., 2019; Norris & Tuan, 2020).



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Patients in home healthcare environments face unique challenges in the management of atrial fibrillation. This patient population is homebound and predisposed to difficulties with transportation, caregiver availability, and/or activity intolerance that preclude attending appointments outside the home. Therefore, not all home care patients will have access to cardiology consultation in this care setting. It is often the case that primary care providers manage medications associated with this diagnosis.

Physicians and advanced practice providers determine their plan of care for patients with atrial fibrillation by using current guidelines that take into consideration multiple factors, such as: the type of atrial fibrillation, severity of symptoms, associated comorbidities, inclusion and exclusionary criteria for medications, cardioversion, surgical procedures, or implantable cardiac devices. Treatment strategies should address the underlying causes of atrial fibrillation. In general, the primary goals of care for patients with atrial fibrillation include stroke-risk reduction, control of heart rate, rhythm management, and prevention of cardiac-related morbidity and mortality. While considering the unique complexities of individual patients, context is important to determine appropriateness of conservative management versus more invasive measures, such as electrophysiological or surgical interventions. Discussions with the patient or caregiver should include a careful exploration of the benefits versus risks of treatment options. During medical decision-making, clinicians should carefully weigh the patient's expressed wishes, preferences, and values.

This article discusses recommendations outlined in the focused 2019 guidelines for management of atrial fibrillation as set forth by the American College of Cardiology, American Heart Association (ACC/AHA), the Heart Rhythm Society, and the Society of Thoracic Surgeons. Special emphasis is placed on Class of Recommendation I, where strong evidence supports that benefits outweigh the risks; and Level of Evidence A and B clinical strategies, meaning high- to moderate-quality evidence from one or more randomized controlled trials. Lower level evidence is provided, as not all possible scenarios can be measured in randomized controlled trials (January et al., 2019).

Stroke-Risk Reduction

Stroke-risk reduction starts with a complete appraisal of a patient's risk for stroke. In individuals with atrial fibrillation, comorbidities such as heart failure, hypertension, age >65 years, diabetes mellitus, history of coronary artery disease, myocardial infarction, peripheral artery disease, stroke, transient ischemic attacks, and female gender are associated with greater likelihood of adverse thromboembolic events. The ACC/AHA guidelines for the management of atrial fibrillation include the quantitative tool to stratify stroke risk known as CHA_2DS_2-VASc. The tool is described in Table 3. After discussion about goals of care with the patient and/or caregiver, the clinician should consider oral anticoagulation therapy in the following circumstances: the presence of atrial fibrillation with an elevated CHA_2DS_2-VASc score of ≥ 2–3 in females or score of ≥ 1–2 in males. Elevated CHA_2DS_2-VASc scores > 2 are associated with increased stroke risk. The risk for stroke correlates with an increased score on this scale.

Table 1. Types of Atrial Fibrillation With Definitions

Categories of AF	Definitions of AF according to ACC/AHA Task Force (2014, 2019)
Nonvalvular AF	AF with no moderate–severe mitral stenosis, no mechanical or bioprosthetic heart valve, and no history of mitral valve repair. Absence of rheumatic heart valve. According to the literature, this categorization does not mean the absence of other types of valvular disease.
Valvular AF	AF with moderate–severe mitral stenosis or with a mechanical heart valve. Is considered a long-term indication for anticoagulation with warfarin.
Acute AF	New onset, first detected, may be asymptomatic or symptomatic
Paroxysmal AF	AF recurs with alternating frequency. Self-terminates. Episodes end in less than 1 week with, or without, intervention.
Permanent AF	Previous attempts to restore normal sinus rhythm have failed. AF continues and treatment goal is no longer restoration to sinus rhythm.
Persistent AF	AF continues greater than 7 days or less than 7 days with pharmacological intervention or cardioversion. Usually requires cardioversion. Longstanding persistent AF lasts > 1 year.
Long-term persistent AF	AF continues longer than 12 months.

Note. Adapted from January et al. (2014); January et al. (2019); and Norris & Tuan (2020).

Table 2. Comorbidities Commonly Associated With Atrial Fibrillation

Alcohol abuse	Autonomic neuronal dysfunction
Congestive heart failure (CHF)	Coronary artery disease (CAD)
Coronary artery bypass graft (CABG)	Chronic obstructive pulmonary disease (COPD)
Cerebral vascular accident (CVA)	Chronic kidney disease (CKD)
Diabetes mellitus (DM)	Digitalis toxicity
End-stage renal disease (ESRD)[a]	Fluid and electrolyte imbalance
Ischemic heart disease (IHD)	Hypertension (HTN)
Hyperthyroidism	Mitral valve disease
Obesity	Obstructive sleep apnea (OSA)
Pulmonary hypertension (PH)	Rheumatic heart disease
Sepsis	

[a]Patients with ESRD undergoing hemodialysis have a higher incidence of atrial fibrillation and are more prone to bleeding abnormalities.

Note. Adapted from January et al. (2014) and January et al. (2019).

Hepatic and renal function should be confirmed by laboratory studies prior to initiating non-vitamin K oral anticoagulants or direct oral anticoagulants. Neither should be used in patients with severe hepatic dysfunction due to associated coagulopathies and impaired pharmacokinetics. Hepatic function should be checked annually. Atrial fibrillation baseline lab tests are obtained at the initiation of anticoagulation therapy and more often if clinically warranted (January et al., 2019).

The use of anticoagulation therapy is based on the risk for thromboembolic events. In randomized controlled trials, non-vitamin K oral anticoagulants show greater safety and are of equivalent value in reducing incidence of stroke and embolic events, in comparison to warfarin (January et al., 2019). Anticoagulation therapy mitigates stroke risk by two-thirds, as compared to patients with atrial fibrillation that are not on anticoagulation therapy (Manning et al., 2020). Additionally, evidence supports that in the case of ischemic stroke, anticoagulation therapy reduces severity of stroke episodes and lowers 30-day mortality rates (Manning et al.). To determine the most appropriate anticoagulation therapy, the clinician must

Table 3. Scoring System to Determine Risk of Thromboembolic Events in Atrial Fibrillation

$CHAD_2DS_2$-VASc		$CHAD_2$	
Heart failure	1 point	Heart failure	1 point
Hypertension	1 point	Hypertension	1 point
Age >75 years	2 points	Age >75 years	1 point
Diabetes mellitus	1 point	Diabetes mellitus	1 point
History of stroke/transient ischemic attack/thromboembolism	2 points	History of stroke/transient ischemic attack/thromboembolism	2 points
Vascular disease with age > 65 years	1 point		
Female	1 point		
Note: The evidence shows annual risk of ischemic stroke is increased in patients with atrial fibrillation who are not on anticoagulation therapy.			
CHA_2DS_2-VASc	% annual risk for stroke		
0	0.2		
1	0.6		
2	2.2		

Note. Adapted from January et al. (2014); January et al. (2019); and Manning et al. (2020).

consider the stability of the patient's overall health status, drug affordability, diet, ability for self-care, and compliance with prescribed regimen. The necessity for laboratory, point-of-care or home testing to monitor coagulation studies is also factored into the decision of which anticoagulation therapy to select (Jacek, 2017). See Table 4 for a comparison of warfarin and other anticoagulants.

Heart Rate Control

Multiple studies support that clinical outcomes are no different between rate control and rhythm control strategies (National Heart, Lung, and Blood Institute, 2019b). Rate control is adequate in older adult patients to avoid adverse effects of drug therapy (January et al., 2014). If there are no contraindications, clinicians may utilize beta-blockers or nondihydropyridine calcium antagonists, such as diltiazem. Clinicians should be mindful about dosage to avoid complications associated with aggressive rate control, such as depression of left ventricular function. The goal is to maintain heart rate within the lower end of the normal range (60–80 beats per minute) without exacerbating left ventricular dysfunction (January et al., 2019). See Table 5 for common medications used for rate and rhythm control of atrial fibrillation.

Rhythm Control

The patient may be a candidate for pharmacologic rhythm conversion or electro-cardioversion. If cardioversion is under consideration, typically the patient is anticoagulated prior to the procedure. This is generally determined by the duration of atrial fibrillation in the time frame preceding cardioversion. A transesophageal echocardiogram should be performed to evaluate cardiac structures, valves, and the presence of thrombus within the left atria. If there is no thrombus, pharmacological rhythm conversion or cardioversion may be performed. The presence of thrombus precludes the patient from having cardioversion. If the patient is high-risk for conscious sedation, this may preclude the patient from undergoing transesophageal echocardiogram. In these cases, rate control would be the most appropriate treatment strategy (January et al., 2014). See Table 5 for medications used for rate and rhythm control.

Prevention of Cardiac-Related Morbidity and Mortality

Home healthcare clinicians should be vigilant in observing for new onset of atrial fibrillation in their patient population. Some patients are asymptomatic, placing them at a 5-fold increase in stroke risk or peripheral thromboembolic event in cases when atrial fibrillation is unrecognized and untreated. In asymptomatic cases, assessment of heart sounds, and characteristics of pulse and pulse rate are the observations that initially help to uncover this diagnosis. Clinicians may note an irregularly irregular rhythm upon auscultation of heart sounds. The pulse oximetry heart rate will be observed to vary when the device is placed on the patient, with beats

per minute rapidly jumping from one number to the next in random order. In devices with pulse oximeter waveform, the noninvasive waveform may have heterogeneity and variability in wave morphology. An irregular shaped wave form with a crisp clean line will confirm the variable heart rate is correct. In this case, a 12-lead EKG will confirm the diagnosis and differentiate the variable heart rate from other arrhythmias.

In patients who are symptomatic with new onset of atrial fibrillation, symptoms range from mild fatigue to those consistent with acute coro-

Table 4. Comparison of Warfarin and Other Oral Anticoagulants

Oral Anticoagulants		Inclusion/Exclusionary Criteria
K-dependent inhibitor	Warfarin Dose is adjusted to maintain International Normalized Ratio (INR) between 2.0–3.0	Indicated for the treatment of valvular atrial fibrillation, including moderate-to-severe mitral valve stenosis and/or mechanical heart valves. May be used in patients with bioprosthetic valve implantation or with chronic kidney disease. Bridging with heparin products: required for patients with high thromboembolic risk interruption of warfarin due to elective surgical procedures. Heparinization is achieved when partial thromboplastin time is 2–3× the normal range. Upon initiation of warfarin, the INR should be monitored frequently, at a minimum weekly; then at least monthly when the INR and warfarin dosing are stabilized. The efficacy of warfarin is highly dependent on the duration the patient spends within the therapeutic range, INR 2.0–3.0. If there is a change in health status, increase the frequency of INR testing and adjust the dose of warfarin accordingly. Discontinue if abnormal bleeding occurs. Antidote: Vitamin K administration is recommended in life-threatening bleeding events.
Non-vitamin K oral anticoagulants (NOACs)		1) Noninferior and superior to warfarin in preventing stroke or thromboembolism. 2) Overall reduced intracranial bleeding compared with warfarin. 3) Contraindicated in all patients with mechanical heart valves. 4) Data are emerging for drug interactions. 5) Commercial assays to measure serum levels are currently available. Not well correlated with clinical outcomes, efficacy, and safety.
Direct thrombin inhibitor	Dabigatran Dose: 150 mg oral twice daily	Indicated for anticoagulation in patients with atrial fibrillation. May be used in patients with chronic kidney disease. However, it is highly reliant on renal clearance (80%). It is contraindicated in severe renal disease. Exclusionary criteria: patients with moderate-to-severe mitral valve stenosis and/or mechanical heart valve. Do not use in patients on hemodialysis. It is associated with increased risk of death or hospitalization from bleeding in end-stage renal disease (ESRD). Antidote: Idarucizumab is recommended for reversal of life-threatening bleeding events. It is a monoclonal antibody fragment that binds to dabigatran to normalize hemostasis.
Factor Xa inhibitor also known as direct-acting oral anticoagulant (DOAC)	Rivaroxaban Dose: 20 mg oral once daily	Indicated for anticoagulation in patients with atrial fibrillation. May use as first-line agent in nonvalvular atrial fibrillation. May be used in patient with chronic kidney disease. Exclusionary criteria: patients with moderate-to-severe mitral valve stenosis and/or mechanical heart valve. Do not use in patients on hemodialysis. It is associated with increased risk of death or hospitalization from bleeding in ESRD. Antidote: Andexanet alfa is recommended for reversal of life-threatening bleeding events. It reverses the effects of rivaroxaban.
Factor Xa inhibitor/DOAC	Apixaban Dose: 5 mg oral twice daily	Indicated for anticoagulation in patients with atrial fibrillation. May use as first-line agent in nonvalvular AF. Has a favorable safety profile in older adults compared with other DOACs. May be used in patients with chronic kidney disease. It is less reliant on renal clearance (25%). Occasional short-term use in patients with bioprosthetic valves is noted. No data available in studies for long-term use in patients with bioprosthetic valves. Exclusionary criteria: patients with moderate-to-severe mitral valve stenosis and/or mechanical heart valve. Antidote: Andexanet alfa is recommended for reversal of life-threatening bleeding events. It is a bio-engineered recombinant modified protein. It reverses the effects of apixaban.
Factor Xa inhibitor/DOAC	Edoxaban Dose: 60 mg oral once daily	Indicated for anticoagulation in patients with atrial fibrillation. May use as first-line agent in nonvalvular atrial fibrillation. This drug is associated with less bleeding complications and mortality from cardiovascular events. Occasional short-term use in patients with bioprosthetic valves is noted. No data available in studies for long-term use in patients with bioprosthetic valves. Exclusionary criteria: patients with moderate-to-severe mitral valve stenosis and/or mechanical heart valve. This drug is not approved for use in patients with compromised renal function. It is renally excreted. It is important to note that with high creatinine clearance or supranormal renal function, there is a risk for suboptimal dosing and lower efficacy as compared with warfarin.

Note. Adapted from Jacek (2017); January et al. (2019); El Hussein (2020); and Manning et al. (2020).

Table 5. Medications for Rate and Rhythm Control in AF

Goal: Resting Heart Rate between 60 bpm and 80 bpm	
Medication	**Medication Information**
Beta-blockers Metoprolol tartrate (immediate release): Dose: 12.5–100 mg orally twice daily Metoprolol XL (succinate): 50–400 mg daily Propranolol: 10–40 mg orally TID or QID Atenolol: 25–100 mg orally once daily Nadolol: 10–240 mg daily Dose: 40–160 mg orally once daily Bisoprolol: 2.5–10 mg orally once daily Carvedilol: 3.125–25 mg BID	Blocks sympathetic stimulation. In the home setting, oral administration of beta-blockers is effective for ventricular rate control. Beta-blockers are more efficacious, as compared with calcium channel blockers. Patients with atrial fibrillation (AF) complicated by rapid ventricular rate (RVR) with acute coronary syndrome (ACS) should be referred to an acute care setting for further management. Patients may require IV beta-blockers to slow heart rate to desirable rate. Beta-blockers may not be administered with symptomatic congestive heart failure, hemodynamic instability, or wheezing.
Nondihydropyridine calcium antagonists Diltiazem (immediate release): Dose: 60–120 mg orally three times a day Diltiazem (extended release): 120–360 mg daily Verapamil (immediate release): Dose: 40–120 mg orally three times a day Verapamil (extended release): 180–480 mg daily	Mechanism of action is on the L-type calcium channels in the atrioventricular (AV) node. Oral dosing is appropriate in the home setting. This medication does have a negative inotropic effect. Contraindications: should not be used in patients with left ventricular (LV) systolic dysfunction and decompensated heart failure.
Heart rhythm control	
Amiodarone Cardioversion (oral): Loading dose: 600–800 mg/day orally divided bid-tid, up to 10 g total Rate control: 100–200 mg orally daily Rhythm control: start 400–600 mg/daily orally divided bid-tid × 2–4 weeks, then maintenance dose: 100–200 mg orally daily	This drug exerts sympatholytic and calcium antagonistic action to depress the AV node. May be given by oral route. Should be given with food. May be used to slow ventricular response in patients presenting with AF and RVR, ACS and LV dysfunction, heart failure (HF), or hemodynamic instability. Monitor electrolytes and liver function. Contraindicated in hepatic impairment.
Digoxin Loading dose: 10–15 mcg/kg orally, divided into 3 doses and given as first dose 50% of calculation, followed by 25% × 2 q 6–8 hr Maintenance dose: 0.125–0.25 mg daily	Requires laboratory monitoring. Therapeutic range: 0.8–2.0 ng/mL. Not a first-line drug for AF with RVR. May be used to slow ventricular response in patients presenting with AF and RVR, ACS and LV dysfunction, HF, or hemodynamic instability. It does not have a negative inotropic effect. Dosage should be adjusted down in the presence of advanced age and kidney disease. It is known to drug–drug interactions that may interfere with excretion and safety. Complications include: AV heart block, arrhythmias, digitalis toxicity. In renal impairment, drug dose will need to be negatively adjusted or discontinued.

Note. Adapted from January et al. (2014) and January et al. (2019).

nary syndrome. Home healthcare clinicians should raise their index of suspicion of atrial fibrillation if known risk factors are present and the patient reports dizziness, dyspnea, fatigue, nausea, or palpitations. Additionally, observations such as hypotension or exacerbation of heart failure may be associated with new-onset atrial fibrillation. Symptoms of this nature are associated with decreased cardiac output and should be regarded as an emergent condition. Patients should be advised to seek treatment in the emergency department if this is consistent with their goals for care.

The goal for care is to prevent worsening cardiac-related morbidity and avert preventable mortality in patients with atrial fibrillation. Patient education is important. Those on anticoagulation therapy should be taught to observe for bleeding events—such as blood in the sputum, stool, or urine, as well as hypotension and dizziness. If patients are on rate- and/or rhythm-control medication, they should be taught their heart rate goal, the correct way to take their medication, side effects of their medication, when to call the primary care provider or home healthcare nurse, and when to seek treatment in the emergency department. Additionally, patient education about other comorbidities that may exacerbate or trigger the onset of atrial fibrillation should be ongoing in the treatment plan. For example, patients should learn how optimal control of diabetes, hypertension, and weight is essential to successful management of atrial fibrillation (National Heart, Lung, and Blood Institute, 2019a).

Conclusion

Atrial fibrillation is a common yet potentially serious arrhythmia that increases the risk of stroke

and hemodynamic instability. Patients may be candidates for pharmacologic rhythm conversion or electro-cardioversion, or the treatment goal may be pharmacologic heart rate or rhythm control. Clinicians play an important role in the detection of undiagnosed atrial fibrillation through routine physical assessment. Home healthcare clinicians also play a key role in patient education to prevent morbidity and mortality related to atrial fibrillation management. ⌂

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The author declares no conflicts of interest.

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DOI:10.1097/NHH.0000000000000946

REFERENCES

Centers for Disease Control and Prevention. (2020). *Atrial fibrillation*. https://www.cdc.gov/heartdisease/atrial_fibrillation.htm

El Hussein, M. T. & Cuncannon, A. (2020). DARE to prescribe: Strategy to guide direct oral anticoagulant therapy. *The Journal for Nurse Practitioners, 19*(7), 509-513.

Jacek, G. (2017). Risks and benefits of warfarin versus new oral anticoagulant drugs. *Home Healthcare Now, 35*(4), 231–232.

January, C. T., Wann, L. S., Alpert, J. S., Calkins, H., Cigarroa, J. E., Cleveland, J. C. Jr., Conti, J. B., Ellinor, P. T., Ezekowitz, M. D., Field, M. E., Murray, K. T., Sacco, R. L., Stevenson, W. G., Tchou, P. J., Tracy, C. M., & Yancy, C. W. (2014, December 2). 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society. *Journal of the American College of Cardiology, 64*(21), e1–e76. https://doi.org/10.1016/j.jacc.2014.03.022

January, C. T., Wann, L. S., Calkins, H., Chen, L. Y., Cigarroa, J. E., Cleveland, J. C. Jr., Ellinor, P. T., Ezekowitz, M. D., Field, M. E., Furie, K. L., Heidenreich, P. A., Murray, K. T., Shea, J. B., Tracy, C. M., & Yancy, C. W. (2019, July 9). 2019 AHA/ACC/HRS focused update of the 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society in collaboration with the Society of Thoracic Surgeons. *Circulation, 140*(2), e125–e151. https://doi.org/10.1161/CIR.0000000000000665

Manning, W., Singer, D., & Lip, G. (2020, July 10). Atrial fibrillation: Anticoagulant therapy to prevent thromboembolism. *UpToDate*. https://www.uptodate.com/contents/atrial-fibrillation-anticoagulant-therapy-to-prevent-thromboembolism#H898176147

Mayo Clinic. (2020). *Atrial fibrillation.* https://www.mayoclinic.org/diseases-conditions/atrial-fibrillation/symptoms-causes/syc-20350624

National Heart, Lung, and Blood Institute. (2019a). *Atrial fibrillation*. https://www.nhlbi.nih.gov/health-topics/atrial-fibrillation

National Heart, Lung, and Blood Institute. (2019b). *Surgery no better than medication at preventing serious complications of atrial fibrillation.* https://www.nhlbi.nih.gov/news/2019/surgery-no-better-medication-preventing-serious-complications-atrial-fibrillation

Norris, T. L., & Tuan, R. L. (2020). Atrial fibrillation. Disorders of cardiac conduction and rhythm. *Porth's Essentials of Pathophysiology* (5th ed., p. 741). Wolters Kluwer.