

Pathology of Atrial Fibrillation and Methods for Testing and Prescribing Exercise

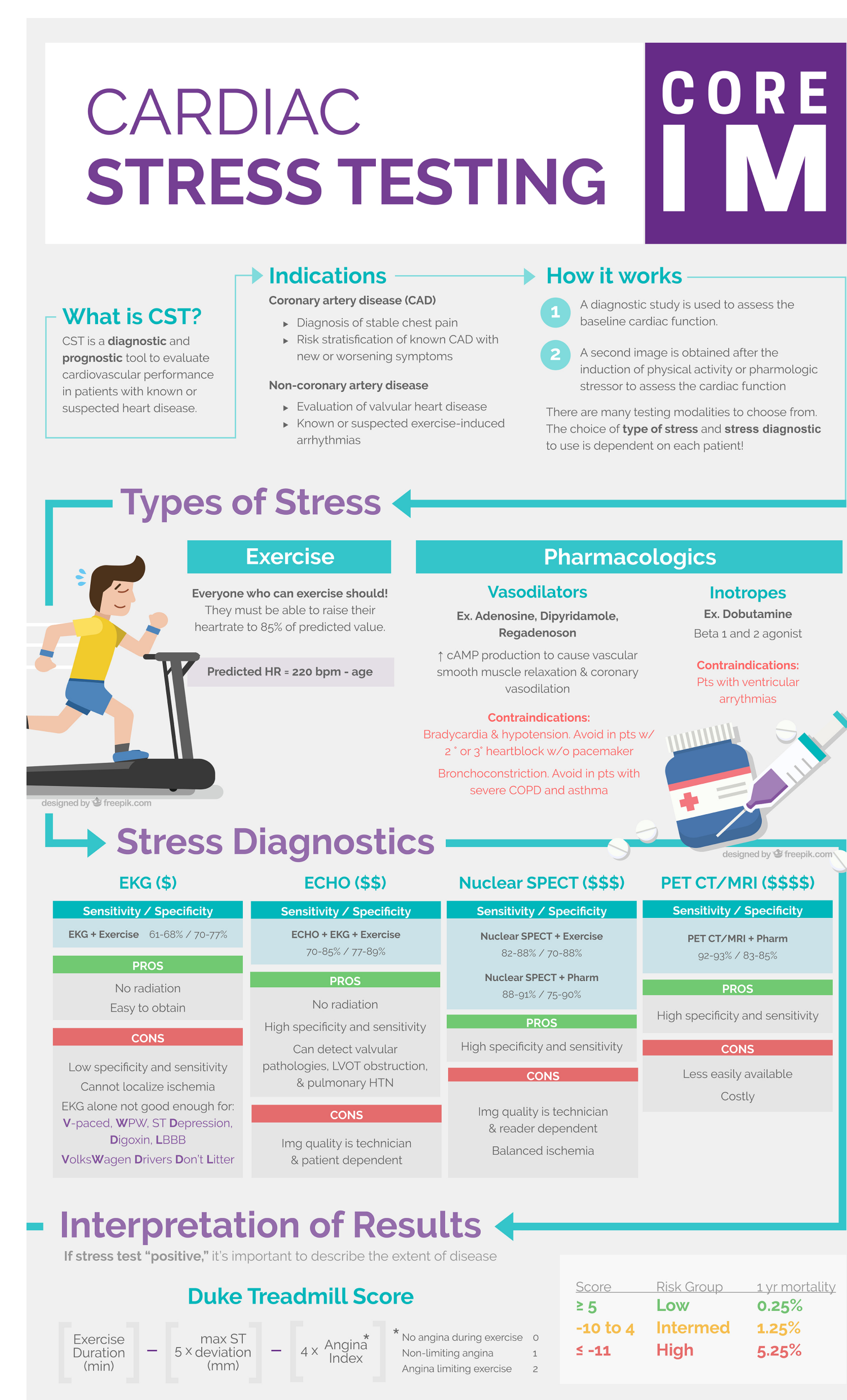
Abby Callahan & Logan Barrett
Gardner-Webb University

Introduction

Atrial fibrillation is one of the most common arrhythmias which is diagnosed to nearly 450,000 Americans each year (CDC, 2021). Atrial fibrillation is a conduction defect of the atria and is often characterized as an irregular heart rate that often causes poor blood flow. Atrial fibrillation is commonly associated with very rapid and chaotic atrial depolarizations that result in an irregular and sometimes rapid response of the ventricles (Jacobs, 2018). This condition can potentially have no symptoms, but when symptoms do appear they can include shortness of breath, fatigue, and palpitations. Treatments of atrial fibrillation include blood thinners, minimally invasive surgery such as an ablation, and cardioversions which are electrical shocks.

Exercise Testing

Test are used to screen patients for myocardial ischemia or evaluate chronotropic responses during exertion (Keteyian et. al, 2019). The most common ways to test for Afib is by conducting an ECG or a stress test. An ECG can be performed during physical activity or during rest. A stress test is performed to determine how well your heart works during physical activity due to exercise making one's heart pump harder and faster a stress test can reveal problems with blood flow within the heart (Mayo Clinic, 2022).



CARDIAC STRESS TESTING CORE IM

What is CST?
CST is a diagnostic and prognostic tool to evaluate cardiovascular performance in patients with known or suspected heart disease.

Indications
Coronary artery disease (CAD)
• Diagnosis of stable chest pain
• Risk stratification of known CAD with new or worsening symptoms
Non-coronary artery disease
• Evaluation of valvular heart disease
• Known or suspected exercise-induced arrhythmias

How it works
1. A diagnostic study is used to assess the baseline cardiac function.
2. A second image is obtained after the induction of physical activity or pharmacologic stress to assess the cardiac function.
There are many testing modalities to choose from. The choice of type of stress and stress diagnosis to use is dependent on each patient.

Types of Stress
Exercise
Everyone who can exercise should! They must be able to raise their heart rate to 85% of predicted value.
Predicted HR = 220 bpm - age

Pharmacologic
Vasodilators
Ex. Adenosine, Dipyridamol, Regadenoson
↑ cAMP production to cause vascular smooth muscle relaxation & coronary vasodilation
Contraindications: Bradycardia & hypotension. Avoid in pts w/ 2° or 3° heartblock w/o pacemaker. Bradycardia/conduction block pts with severe COPD and asthma.
Inotropes
Ex. Dobutamine
Beta 1 and 2 agonist
Contraindications: pts with ventricular arrhythmias

Stress Diagnostics

EKG (S)	ECHO (SS)	Nuclear SPECT (SSS)	PET CT/MRI (SSSS)
Sensitivity / Specificity EKG + Exercise 55-65% / 70-75%	Sensitivity / Specificity ECHO + EKG + Exercise 70-80% / 70-80%	Sensitivity / Specificity Nuclear SPECT + Exercise 80-85% / 70-80%	Sensitivity / Specificity PET CT/MRI + Pharm 80-85% / 70-80%
PROS No radiation Easy to obtain	PROS No radiation High specificity and sensitivity Can detect valvular pathologies, LVOT obstruction, & pulmonary HTN	PROS High specificity and sensitivity	PROS High specificity and sensitivity
CONS Low specificity and sensitivity Cannot localize ischemia EKG alone not good enough for V-pacer, WMS, ST Depression, Dizziness, LBBB, Walk/Wagen Drivers Don't Like!	CONS Imaging quality is technician & patient dependent Balanced ischemia	CONS Imaging quality is technician & nuclear dependent Balanced ischemia	CONS Less easily available Costly

Interpretation of Results
If stress test "positive," it's important to describe the extent of disease

Duke Treadmill Score

Exercise Duration (min)	max ST Depression (mm)	4 x Angina Index	Score	Risk Group	1-yr mortality
≥ 5	≥ 5	0	≥ 5	Low	0.25%
3-5	3-5	1	4	Intermediate	1.25%
1-3	1-3	1-2	1-3	High	5.25%

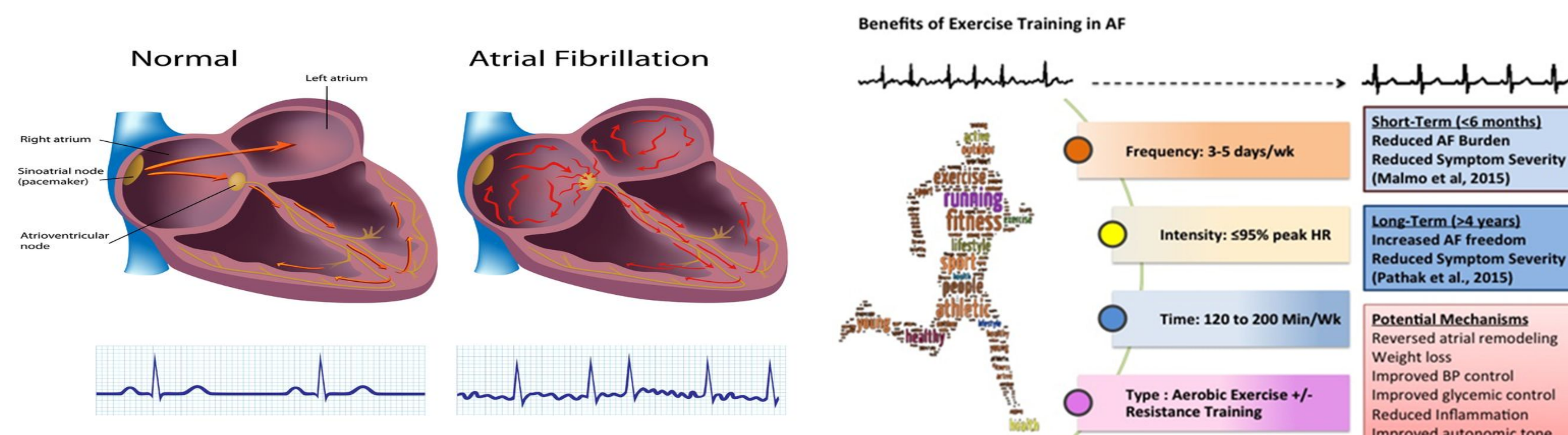
Exercise Prescription

Individuals who have atrial fibrillation have a reduced tolerance for exercise, but the extent to this reduction depends on the severity of any coexisting heart disease. Due to safety reasons and variability, it is recommended that clients seek a graded exercise test under the supervision of a medical professional to provide information for exercise prescription depending on the perceived exertion and ventricular responses to exercise (Jacobs, 2018).

- Aerobic exercise recommendations include large muscle group activities such as cycling, walking, or running at an intensity assessed by RPE of 13 to 16 out of 20, which correspond to workloads of 50% to 85% of peak VO₂. Exercise may be performed four to seven days a week with either accumulated or continuous durations of 30 to 60 minutes per day (Jacobs, 2018).
- Resistance training may be performed with a circuit weight training format and moderate intensity with 8 to 10 exercises performed between 40% to 80% of a person's 1RM. Like other cardiovascular conditions, performance of activities of daily living for the client with atrial fibrillation should be encouraged throughout the day (Jacobs, 2018).
- For the properly screened client, high-intensity interval training may be suitable and valuable for increasing training outcomes.

Parameter	Guideline
Frequency	4-7 days per week
Intensity	50-85% VO ₂ peak; or 13-16 RPE (on Borg 6- to 20-point scale)
Mode	Activities that engage large muscle groups such as walking, jogging, or cycling
Duration	30-60 minutes per day of continuous or accumulated activity

Parameter	Guideline
Frequency	2-3 days per week
Intensity	Light to moderate; 40-80%
Repetitions	10-15
Sets	1 set per exercise in circuit format
Rest periods between sets	≤ 30 seconds
Exercises	8-10



Benefits of Exercise Training in AF

Normal vs **Atrial Fibrillation** diagrams showing the heart's electrical system and the sinoatrial node (pacemaker).

Frequency: 3-5 days/wk

Intensity: $\leq 95\%$ peak HR

Time: 120 to 200 Min/Wk

Type: Aerobic Exercise +/- Resistance Training

Short-Term (≤ 6 months): Reduced AF Burden, Reduced Symptom Severity (Marmo et al, 2015)

Long-Term (>4 years): Increased AF freedom, Reduced Symptom Severity (Pathak et al., 2015)

Potential Mechanisms: Reversed atrial remodeling, Weight loss, Improved BP control, Improved glycemic control, Reduced inflammation, Improved autonomic tone

Special Considerations

Patients that live with Afib have a heart rhythm that is rapid and irregular with no distinct pattern. Afib occurs due to conditions of disorder impulses across the AV node to the lower ventricles and can result in atrial contractions that affect cardiac output and vulnerability for blood clots to form (Cantillon, 2018). Patients who exercise with Afib have a higher risk of their heart rates speeding up and if that occurs it could eventually lead to heart failure. Exercise capacity is 15-20% lower and peak heart rate is higher in patients with Afib than in patients with sinus rhythm (Keteyian et. al, 2019). Patients with Afib have a reduced exercise tolerance so they are recommended to seek medically supervised help to be given information on what exercises to perform. Exercises that the patients are recommended to perform are to be assessed by an RPE of 13-16 and workloads of 50% to 85% of peak VO₂ (Jacobs, 2018). Circuit weights are to be performed in the format of 8 to 10 exercises between 40% to 80% IRM (Jacobs, 2018). The exercise professionals should pay attention to the ventricular response that makes the heart rate unreliable by a rating of perceived exertion (Jacobs, 2018).

Conclusion

Afib is a conduction defect of the atria that is associated with chaotic and very rapid atrial depolarizations that can result in irregular and rapid ventricular responses (Jacobs, 2018). Individuals can live with their heart rhythm being Afib. Exercise is known to be beneficial to overall health by increasing cardiopulmonary and skeletal muscle fitness. Exercise is safe for patients with Afib, but it is safe to stay away from sports that involve contact and collisions due to a higher risk of bleeding (Cataldo, 2022). Afib has the potential to reduce exercise capacity due to the reduction of atrial contribution to the stroke volume and cardiac output. Patients with Afib have a higher risk of having heart failure. Afib can be treated with medications that are able to prevent clot formation, slow the conduction of the AV node, and decrease the ventricular response (Jacobs, 2018).

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