

Your Cardiac Chambers Volumetry Report

This is an opportunistic report generated by AutoChamber™ AI based on CT scans ordered for other reasons

Patient Name: Doe, Jack

ID: 9008

Date of Exam: 7/16/2024

Date of Birth: 1/1/1953

Gender: Male

Your
Clinic's
Logo
Here

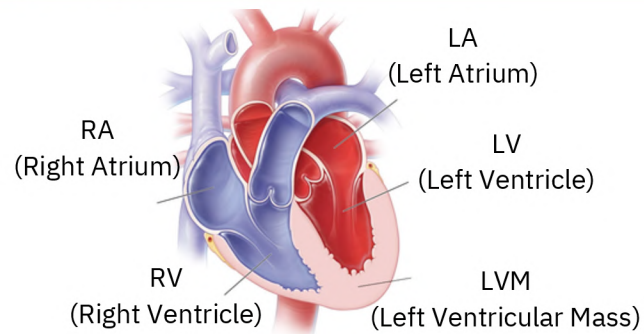


Powered by **HeartLung**
Technologies

AutoChamber Volumetry

Chamber	Value	Percentile
LA	89.1 cc	96th
LV	121.6 cc	80th
RA	88.7 cc	58th
RV	131.8 cc	65th
LVM	118.5 g	90th
LA/RA	0.90	80th
LV/RV	0.75	74th

Chambers of the Heart

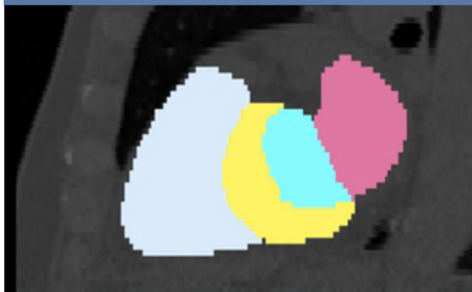


Cardio-Thoracic Ratio (CTR): 0.51

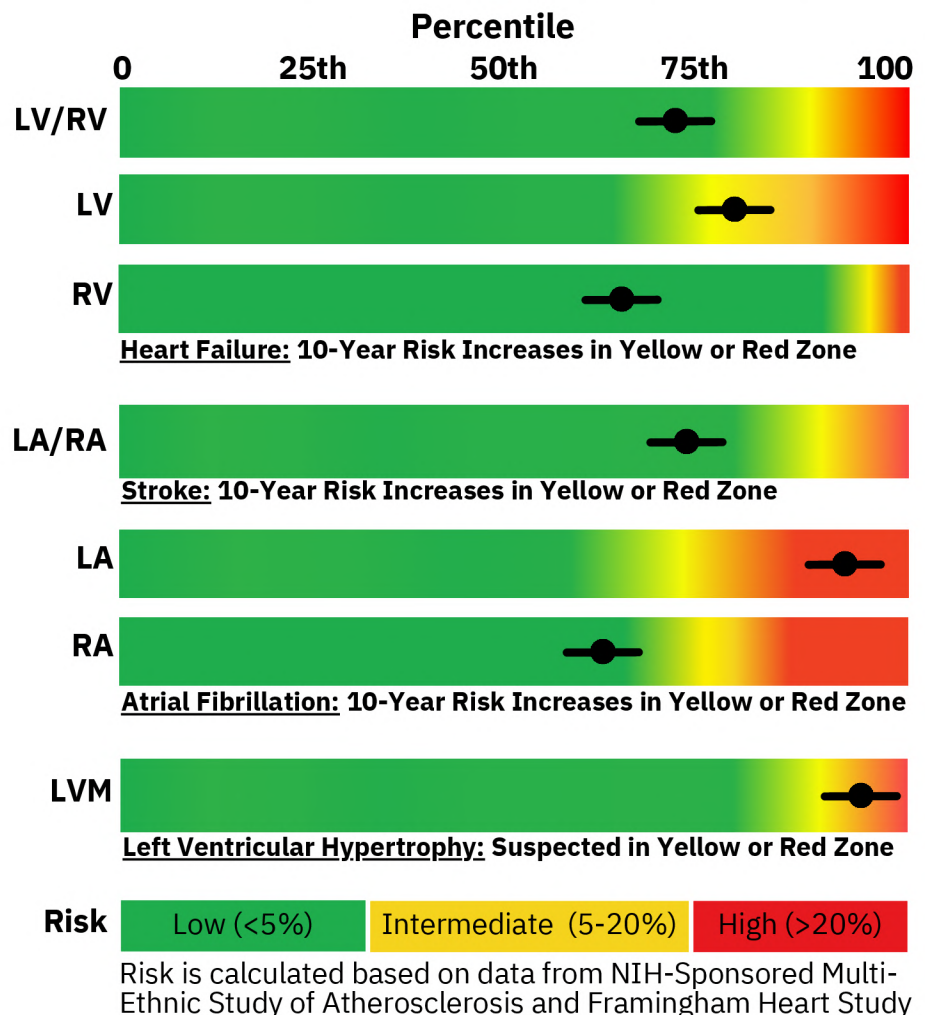
Coronal (Frontal View)



Sagittal (Lateral View)



Axial (Transverse View)



Heart Failure: 10-Year Risk Increases in Yellow or Red Zone

Stroke: 10-Year Risk Increases in Yellow or Red Zone

Atrial Fibrillation: 10-Year Risk Increases in Yellow or Red Zone

Left Ventricular Hypertrophy: Suspected in Yellow or Red Zone

Recommendations

The results of your cardiac chambers volumetry indicate that you have a **high risk of future cardiovascular disease**. Consultation with your care provider is recommended. See the following pages for more information.

About Cardiac Chambers & Cardiovascular Disease

FDA Approved AutoChamber™ AI as a “Breakthrough” Medical Device with the Following Indication for Use:

“ The AutoChamber software is an opportunistic AI-powered quantitative imaging tool that measures and reports cardiac chambers volumes comprising left atrium (LA), left ventricle (LV), right atrium (RA), right ventricle (RV), and left ventricular wall (LVW) from non-contrast chest CT scans including coronary artery calcium (CAC) scans and lung CT scans. AutoChamber is not intended to rule out the risk of a cardiovascular disease, and the results should not be used for any purpose other than to enable physicians to investigate patients that AutoChamber shows signs of enlarged heart (cardiomegaly), enlarged cardiac chambers, and left ventricular hypertrophy (LVH) whose conditions are otherwise missed by human eyes in non-contrast chest CT scans. AutoChamber similarly measures and reports LA, LV, RA, RV, and LVW in contrast-enhanced coronary CT angiography (CCTA) scans. Additionally, AutoChamber measures and reports cardiothoracic ratio (CTR) in both contrast and non-contrast CT scans where the entire thoracic cavity is in the axial field of view. AutoChamber quantitative imaging measurements are adjusted by body surface area (BSA) and are reported both in cubic centimeter volume (cc) and percentiles by gender using reference data from 5830 people who participated in the Multi-Ethnic Study of Atherosclerosis (MESA). AutoChamber should not be ordered as a standalone CT scan but instead should be used as an opportunistic add-on to existing and new CT scans of the chest, such as CAC and lung CT scans, as well as CCTA scans.

Using AutoChamber quantitative imaging measurements and their clinical evaluation, healthcare providers can investigate asymptomatic patients who are unaware of their risk of heart failure, atrial fibrillation, stroke and other life-threatening conditions associated with enlarged heart, enlarged cardiac chambers, and LVH that may warrant additional risk-assessment or follow-up. AutoChamber quantitative imaging measurements are to be reviewed by radiologists or other medical professionals and should only be used by healthcare providers in conjunction with clinical evaluation. ”

https://www.accessdata.fda.gov/cdrh_docs/pdf24/K240786.pdf

References for Percentiles, Colors, and Cut-offs

This report uses LA and RA volumes for future risk of atrial fibrillation, LV volume, RV volume and LV/RV ratio for heart failure, and LA/RA volume ratio for stroke. See below:

Male		
LV/RV Ratio Percentile Cutoffs		
Incidence of Heart Failure Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 91 st percentile
5 to 20 in 100 people	Yellow	91 st to 98 th percentile
> 20 in 100 people	Red	> 98 th percentile
Left Ventricular (LV) Volume Percentile Cutoffs		
Incidence of Heart Failure Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 84 th percentile
5 to 20 in 100 people	Yellow	84 th to 95 th percentile
> 20 in 100 people	Red	> 95 th percentile
Right Ventricular (RV) Volume Percentile Cutoffs		
Incidence of Heart Failure Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 95 th percentile
5 to 20 in 100 people	Yellow	95 th to 99 th percentile
> 20 in 100 people	Red	> 99 th percentile
LA/RA Ratio Percentile Cutoffs		
Incidence of Stroke Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 94 th percentile
5 to 20 in 100 people	Yellow	94 th to 96 th percentile
> 20 in 100 people	Red	> 96 th percentile
Left Atrial (LA) Volume Percentile Cutoffs		
Incidence of Atrial Fibrillation Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 65 th percentile
5 to 20 in 100 people	Yellow	65 th to 79 th percentile
> 20 in 100 people	Red	> 79 th percentile
Right Atrial (RA) Volume Percentile Cutoffs		
Incidence of Atrial Fibrillation Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 66 th percentile
5 to 20 in 100 people	Yellow	66 th to 82 nd percentile
> 20 in 100 people	Red	> 82 nd percentile
Left Ventricular Mass (LVM) Percentile Cutoffs		
Left Ventricular Hypertrophy Suspected	Color	Percentile Range
Equivalent to CMRI LVMi < 100g/m ² BSA	Green	< 90 th percentile
Equivalent to CMRI LVMi 100 to 115g/m ² BSA	Yellow	90 th to 98 th percentile
Equivalent to CMRI LVMi > 115g/m ² BSA	Red	> 98 th percentile
*CMRI (Cardiac Magnetic Resonance Imaging)		

Female		
LV/RV Ratio Percentile Cutoffs		
Incidence of Heart Failure Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 92 nd percentile
5 to 20 in 100 people	Yellow	92 nd to 99 th percentile
> 20 in 100 people	Red	> 99 th percentile
Left Ventricular (LV) Volume Percentile Cutoffs		
Incidence of Heart Failure Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 93 rd percentile
5 to 20 in 100 people	Yellow	93 rd to 99 th percentile
> 20 in 100 people	Red	> 99 th percentile
Right Ventricular (RV) Volume Percentile Cutoffs		
Incidence of Heart Failure Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 95 th percentile
5 to 20 in 100 people	Yellow	95 th to 99 th percentile
> 20 in 100 people	Red	> 99 th percentile
LA/RA Ratio Percentile Cutoffs		
Incidence of Stroke Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 95 th percentile
5 to 20 in 100 people	Yellow	95 th to 99 th percentile
> 20 in 100 people	Red	> 99 th percentile
Left Atrial (LA) Volume Percentile Cutoffs		
Incidence of Atrial Fibrillation Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 79 th percentile
5 to 20 in 100 people	Yellow	79 th to 90 th percentile
> 20 in 100 people	Red	> 90 th percentile
Right Atrial (RA) Volume Percentile Cutoffs		
Incidence of Atrial Fibrillation Over 10 Years	Color	Percentile Range
< 5 in 100 people	Green	< 79 th percentile
5 to 20 in 100 people	Yellow	79 th to 96 th percentile
> 20 in 100 people	Red	> 96 th percentile
Left Ventricular Mass (LVM) Percentile Cutoffs		
Left Ventricular Hypertrophy Suspected	Color	Percentile Range
Equivalent to CMRI LVMi < 80g/m ² BSA	Green	< 91 st percentile
Equivalent to CMRI LVMi 80 to 95g/m ² BSA	Yellow	91 st to 98 th percentile
Equivalent to CMRI LVMi > 95g/m ² BSA	Red	> 98 th percentile
*CMRI (Cardiac Magnetic Resonance Imaging)		

The above percentiles and risk estimates are calculated based on data from participants in NIH-sponsored Multi-Ethnic Study of Atherosclerosis and Framingham Heart Study who were followed for over 10 years.

Introduction

Cardiovascular disease (CVD) remains the leading cause of morbidity and mortality worldwide, and four key conditions—heart failure (HF), left ventricular hypertrophy (LVH), stroke, and atrial fibrillation (AF)—represent critical targets for prevention and early detection. Heart failure, a terminal stage of many cardiac disorders, often evolves silently from LVH and enlarged cardiac chambers, which reflects chronic pressure overload and are a powerful predictor of adverse outcomes. Early identification of enlarged chambers and LVH can enable timely intervention to halt progression to HF. Similarly, stroke, a major cause of disability, is frequently preceded by undiagnosed or asymptomatic AF, an irregular heart rhythm that increases thromboembolic (blood clot) risk fivefold. AF is often silent, yet it underlies nearly one-third of ischemic strokes. Detecting individuals with enlarged chambers and LVH before the onset of HF, AF, or stroke offers a vital opportunity to intervene earlier and reduce the burden of catastrophic CVD events. Therefore, proactive and opportunistic screening for these precursors is essential for effective cardiovascular risk management and improved population health.



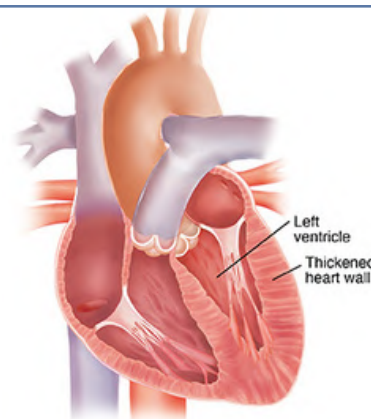
HEART FAILURE (HF)



ATRIAL FIBRILLATION (AF)



STROKE



**LEFT VENTRICULAR
HYPERTROPHY (LVH)**

About Heart Failure (HF)

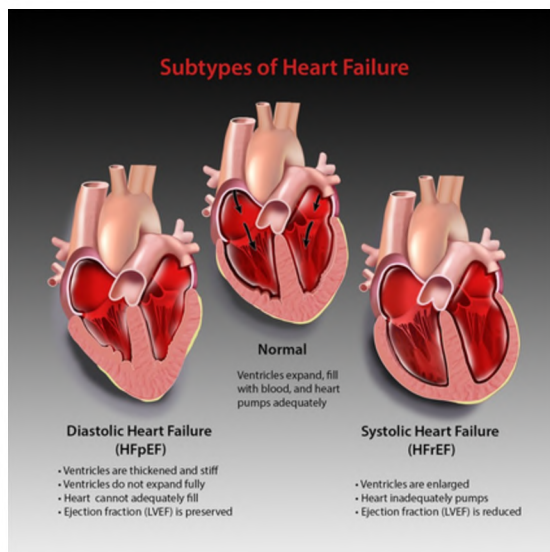
Heart failure occurs when your heart doesn't pump blood as effectively as it should, causing fluid buildup and fatigue. It can affect daily activities and quality of life. Early diagnosis leads to treatments that dramatically improve quality of life.

In the U.S., over 6.7 million are affected by Heart Failure (HF), with numbers projected to reach 8 million by 2030, leading to healthcare costs of over \$53 billion.



How Common is Undiagnosed HF?

Undiagnosed heart failure is surprisingly common, especially in early stages. Up to half of patients with mild symptoms may not realize they have heart failure, attributing tiredness or breathing difficulty to aging or fitness issues.



Dangers of Undiagnosed HF

- Shortness of breath and fatigue, impacting daily life
- Swelling of ankles, legs, or abdomen
- Increased risk of hospitalization due to fluid buildup
- Reduced life expectancy without treatment
- Higher risk of sudden cardiac death and stroke

HF Risk Factors

- High blood pressure (hypertension)
- Coronary artery disease
- Diabetes
- Obesity
- History of heart attacks
- Chronic kidney disease
- Excessive alcohol use
- Older age (>65 years)

Detecting and Managing HF

- Early detection through screening can significantly improve your quality of life and reduce the risk of severe health consequences.
- Diagnosis involves echocardiograms, blood tests, and regular check-ups. Effective management includes medications, lifestyle adjustments (low salt, exercise), and occasionally medical devices like pacemakers.

About Stroke

A stroke happens when blood flow to the brain is blocked or a blood vessel ruptures, causing brain damage. It can lead to permanent disabilities or death if not treated quickly.

The combined direct and indirect annual costs of stroke are expected to reach approximately \$240.67 billion by 2030, marking a 129% increase from 2010 levels. By 2030, approximately 3.88% of U.S. adults over 18 years of age are projected to have experienced a stroke.



How Common is Undiagnosed Stroke?

Estimates suggest that between 2% to 3% of Americans experience a silent stroke each year. Unlike typical strokes, silent strokes occur without obvious signs, making them challenging to detect without medical imaging.



Dangers of Undiagnosed Stroke

- Sudden and permanent paralysis or muscle weakness
- Severe speech or vision difficulties
- Memory loss and cognitive impairment
- Loss of independence and mobility
- Higher risk of repeated strokes

Stroke Risk Factors

- High blood pressure
- Atrial fibrillation (irregular heartbeat)
- Diabetes
- High cholesterol
- Smoking
- Family history of stroke
- Sedentary lifestyle and obesity
- Previous stroke or cardiovascular disease

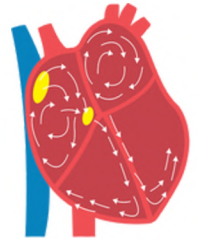
Detecting and Managing Stroke Early

- Early detection through screening can detect risk of stroke and reduce the risk of severe health consequences.
- Routine medical checkups, ECGs for AF, carotid artery imaging, and blood tests identify stroke risks early. Effective management includes medications, lifestyle changes, and timely treatment of identified conditions.

About Atrial Fibrillation (AF)

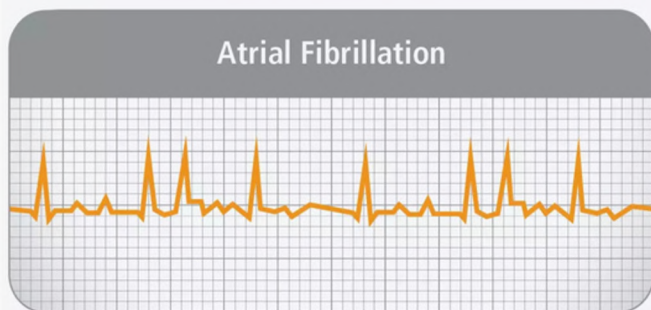
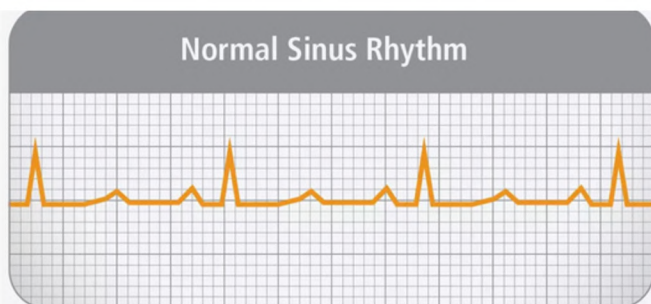
Atrial fibrillation is a common heart rhythm disorder affecting millions of people worldwide. AF occurs when the upper chambers of the heart, called the atria, beat irregularly and rapidly.

In the U.S., over 10.5 million are affected by Atrial Fibrillation (AF), with numbers projected to reach 12.1 million by 2030, leading to healthcare costs of over \$40 billion.



How Common is Undiagnosed AF?

Around 1 in every 4 adults over the age of 40 will experience AF at some point. Studies suggest up to 30-40% of people with AF may not even realize they have it.



Dangers of Undiagnosed AF

- Increased hospitalizations
- Increased risk of stroke
- Reduced quality of life due to persistent symptoms like fatigue, dizziness, shortness of breath, and palpitations
- Higher risk of dementia due to reduced blood flow to the brain over time

AF Risk Factors

- Age: Incidence rises sharply after age 65
- Hypertension (high blood pressure)
- Structural heart disease: valvular disease, prior myocardial infarction, heart failure
- Obesity, diabetes, sleep apnea
- Hyperthyroidism
- Excessive alcohol or stimulant use

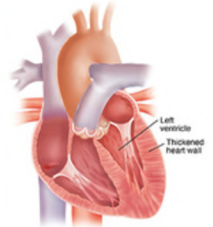
Detecting and Managing AF Early

- Early detection through screening or wearable devices can significantly improve your quality of life and reduce the risk of severe health consequences.
- Treatment options include medications to control heart rhythm, blood thinners to prevent strokes, and lifestyle changes to improve overall heart health.

About Left Ventricular Hypertrophy (LVH)

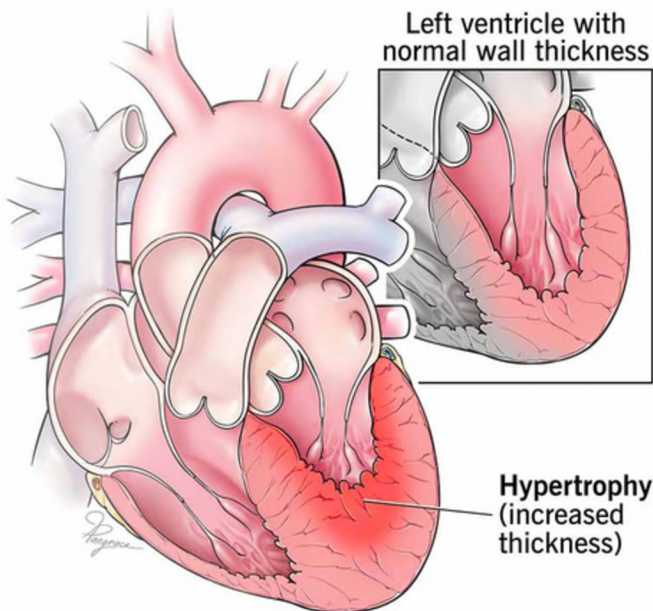
Left Ventricular Hypertrophy is the thickening of your heart's main pumping chamber (left ventricle). Usually caused by high blood pressure or other heart stresses, LVH can silently harm your heart.

Annual healthcare expenses for late-stage LVH patients average around \$43,586, compared to \$6,768 for matched controls without LVH. These patients experience higher rates of hospitalization (38.0% vs. 6.9%) and longer hospital stays (3.7 days vs. 0.4 days) compared to controls.



How Common is Undiagnosed LVH?

LVH often remains unnoticed until revealed through medical tests. Nearly half of people with LVH may not realize their heart is under stress, especially if they feel generally healthy.



Dangers of Undiagnosed LVH

- Increased risk of heart attack
- Development of heart failure
- Irregular heart rhythms (arrhythmias)
- Higher risk of stroke
- Progressive heart muscle weakening and stiffness

LVH Risk Factors

- Uncontrolled high blood pressure
- Obesity
- Sleep apnea
- Sedentary lifestyle
- Family history of cardiovascular disease
- Diabetes
- Chronic alcohol abuse

Detecting and Managing LVH Early

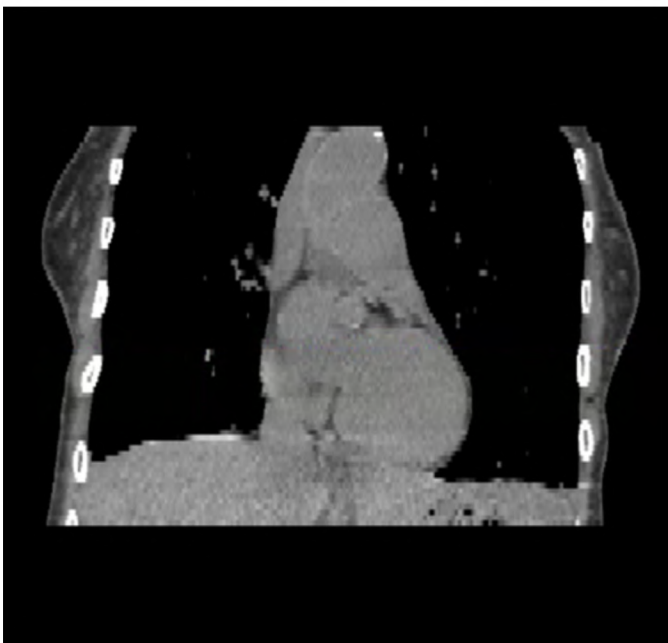
- Early detection through screening can significantly improve your quality of life and reduce the risk of severe health consequences.
- Electrocardiograms (ECGs) can identify dangerous arrhythmia associated with certain LVH. Management includes blood pressure medications, lifestyle modifications, and regular monitoring to prevent progression.

Differences Between AutoChamber™ Measurements in ECG-gated Cardiac CT Scans vs. Non-gated Lung CT Scans



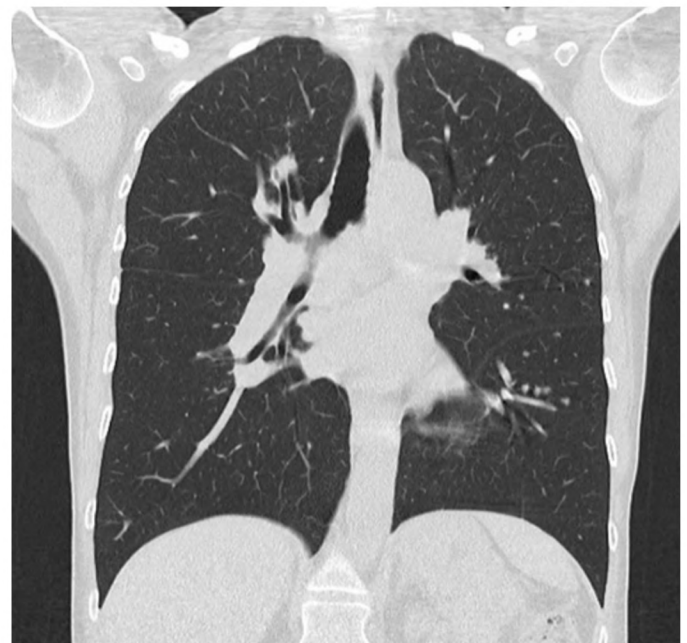
ECG-gated Cardiac CT

Because the heart is constantly moving, a Cardiac scan utilizes electrocardiogram (ECG) to image the heart at a point when the heart is relaxed. This is usually around 75% of the cardiac cycle, which lasts 5-10 milliseconds. This allows taking clear images of your heart when it is still and not moving. For accurate measurement, AutoChamber™ requires ECG-gated scans.



Non-gated Lung/Chest CT

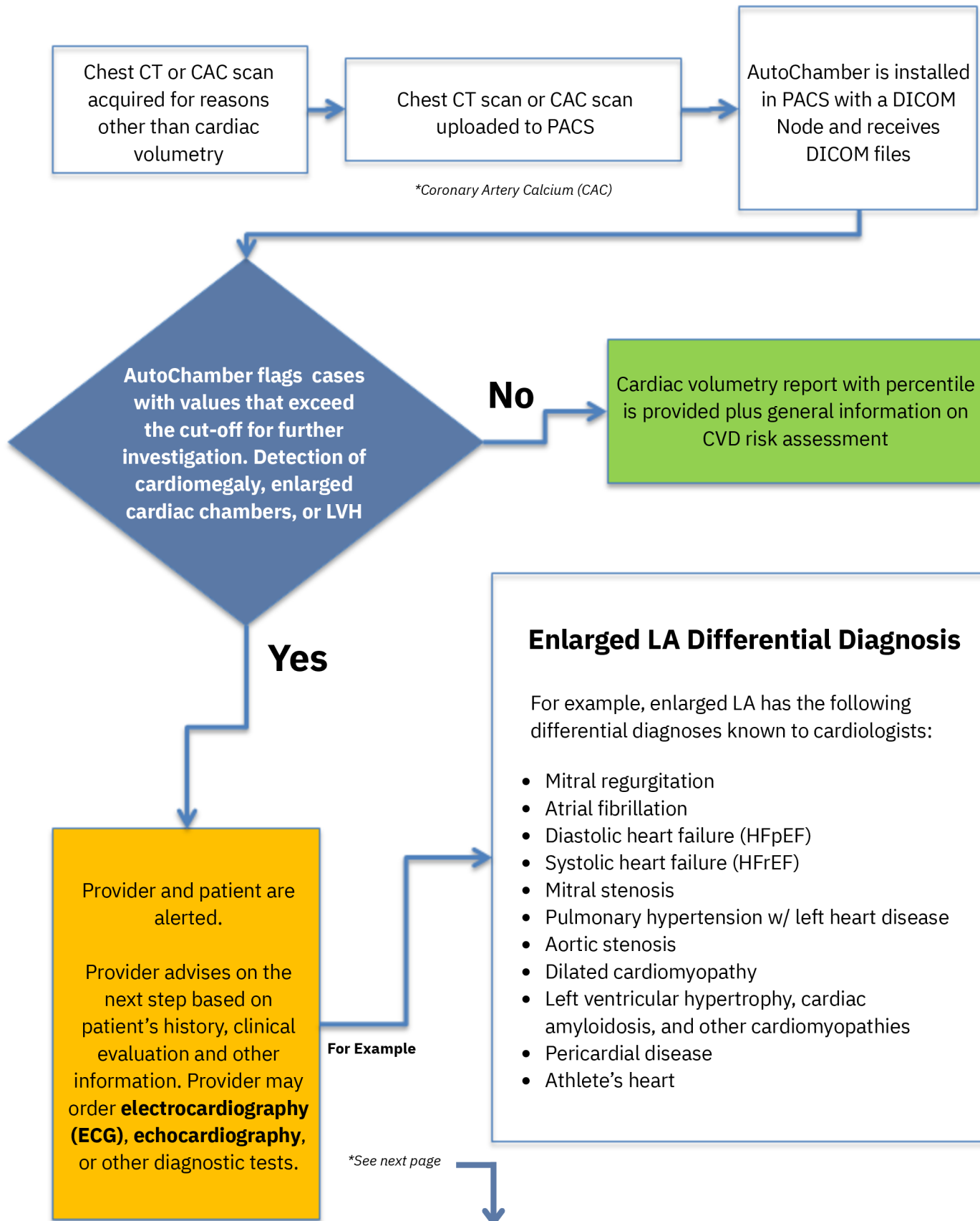
A lung or chest CT scan is designed to accurately analyze the entire thorax, not just the heart. The images are captured during a breath hold rather than being timed to your heartbeat. Although the images are sharp, this can result in a slight variation in heart chamber size depending on how the heart is beating at the time of the exam.



Limitations of Lung or Chest CT for Heart Measurements

- Chamber sizes can vary depending on the cardiac cycle phase at the time of imaging.
- **If your AutoChamber™ report is generated from non-gated lung CT scans, the results may not be as accurate as an ECG-gated cardiac scan.**

AutoChamber™ Workflow





Enlarged LV Differential Diagnosis

For example, enlarged LV has the following differential diagnoses known to cardiologists:

- Aortic regurgitation
- Aortic stenosis
- Mitral regurgitation
- Systolic heart failure (HFrEF)
- Dilated cardiomyopathy
- Hypertensive heart disease
- Ischemic heart disease
- Myocarditis
- Volume overload (e.g., chronic anemia, arteriovenous fistula)
- Athlete's heart



LVH Differential Diagnosis

For example, increased LV mass (LVH) has the following differential diagnoses known to cardiologists:

- Hypertension (most common cause)
- Aortic stenosis
- Hypertrophic cardiomyopathy
- Athletic heart syndrome
- Infiltrative diseases (e.g., cardiac amyloidosis, Fabry disease)
- Coarctation of the aorta
- Chronic kidney disease (uremic cardiomyopathy)
- Endocrine disorders (e.g., acromegaly, hyperthyroidism, pheochromocytoma)
- Genetic syndromes (e.g., Noonan syndrome)



Enlarged RA Differential Diagnosis

For example, enlarged RA has the following differential diagnoses known to cardiologists:

- Tricuspid regurgitation
- Pulmonary hypertension
- Atrial septal defect
- Right heart failure
- Chronic lung disease (e.g., COPD, interstitial lung disease)
- Left-sided heart failure (via pulmonary pressure transmission)
- Constrictive pericarditis
- Severe mitral stenosis
- Atrial fibrillation
- Pacemaker or ICD leads with mechanical irritation



Enlarged RV Differential Diagnosis

For example, enlarged RV has the following differential diagnoses known to cardiologists:

- Pulmonary hypertension (primary or secondary)
- Pulmonary embolism
- Chronic obstructive pulmonary disease (COPD)
- Left heart disease with pulmonary venous hypertension
- Congenital heart disease (e.g., atrial septal defect)
- Arrhythmogenic right ventricular cardiomyopathy (ARVC)
- Tricuspid regurgitation
- RV infarction
- Sleep apnea
- High-output states (e.g., cirrhosis with portopulmonary hypertension)