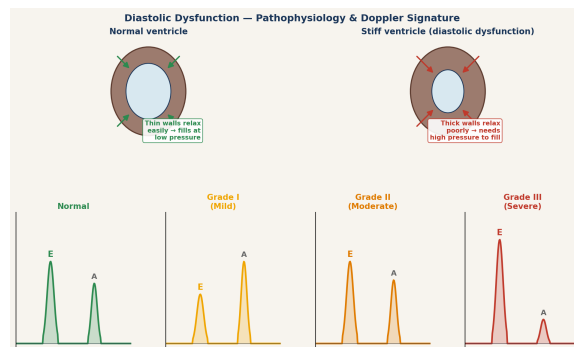


# Understanding Diastolic Dysfunction

When the heart pumps fine but doesn't fill well — what the four grades mean for you

Your ejection fraction can be normal while your heart still struggles. Grade matters.



Online: <https://go.riasalimd.com/dd-guide>

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## Names & Terms You Will Hear

| Term                                                   | Meaning                                                                                                                                                |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diastolic dysfunction (DD)                             | The heart's filling phase is impaired. The squeezing phase may still be normal. Severity is graded I through III.                                      |
| Heart stiffness                                        | The heart muscle is stiffer than normal. It relaxes slowly and needs higher pressure to fill.                                                          |
| HFpEF (Heart Failure with Preserved Ejection Fraction) | Heart failure caused by diastolic dysfunction. The squeezing function (ejection fraction) is normal. But the heart still cannot meet the body's needs. |
| E/A ratio                                              | An echo measure of filling. E is early filling; A is atrial filling. The ratio helps grade diastolic function.                                         |
| E/e' ratio                                             | Another echo measure. A ratio above 14 means filling pressure is elevated.                                                                             |
| LAVI (Left Atrial Volume Index)                        | The size of the left atrium adjusted for body size. A value above 34 mL/m <sup>2</sup> means pressure has been high for a long time.                   |
| PCWP (Pulmonary Capillary Wedge Pressure)              | A direct measure of left atrial pressure. Normal is below 12 mmHg. High PCWP is the key sign of advanced DD and HFpEF.                                 |
| Grade I — Impaired relaxation                          | The mildest form. The heart relaxes slowly. Filling pressure stays normal. Most patients have no symptoms.                                             |
| Grade II — Pseudonormal                                | Moderate severity. Filling pressure rises. The Doppler pattern can look normal. Tissue Doppler and LAVI reveal the truth.                              |
| Grade III — Restrictive filling                        | Severe diastolic dysfunction. Filling pressure is high at rest. Symptoms are common. Prognosis is worse than earlier grades.                           |



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## What Is Diastolic Dysfunction?

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- Diastolic dysfunction means the heart's filling phase is impaired. The muscle relaxes too slowly or is too stiff. Blood does not enter easily between beats.
- Ejection fraction (EF) — how much blood the heart pumps out — can be completely normal. This condition is often missed without a Doppler echocardiogram.
- Grading uses four echo values: the E/A ratio, tissue Doppler velocity (e'), the E/e' ratio, and left atrial size (LAVI).
- Grade I affects about 21% of adults over 45. It is often asymptomatic. Grades II and III are less common but carry more risk.
- When symptoms appear — shortness of breath, fatigue, or fluid retention — the diagnosis becomes HFpEF (heart failure with preserved ejection fraction).



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## The Four Grades — All Parameters Side by Side

| Grade     | E/A Ratio    | e' (cm/s)           | E/e'  | LAVI (mL/m <sup>2</sup> ) | PCWP (mmHg) | Filling Pressure  |
|-----------|--------------|---------------------|-------|---------------------------|-------------|-------------------|
| Normal    | > 0.8–1.5    | 10+ lat / 7+ sept   | < 8   | < 34                      | < 12        | Normal            |
| Grade I   | < 0.8 (A>E)  | < 7 sept / < 10 lat | < 10  | 34 or less                | 12 or less  | Normal            |
| Grade II  | 0.8–2.0      | Low                 | 10–14 | > 34                      | 12–18       | Elevated (rising) |
| Grade III | > 2.0 (E>>A) | Very low            | > 14  | > 34                      | > 18        | Markedly elevated |

**The pseudonormal trap (Grade II):** Grade II is often missed. The E/A ratio falls in the normal range (0.8–2.0). But e' is low and LAVI is enlarged. Filling pressures are already high. A Valsalva maneuver (bearing down) during the echo reveals it — the E/A drops to look like Grade I.

## At-a-Glance — The Four Grades Side by Side

| Normal                                                                                                                                               | Grade I (Mild)                                                                                                                                                | Grade II (Moderate)                                                                                                                                                        | Grade III (Severe)                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>E/A 0.8–1.5</li> <li>e' 10 cm/s or higher</li> <li>Pressures: normal</li> <li>Usually asymptomatic</li> </ul> | <ul style="list-style-type: none"> <li>E/A &lt; 0.8 (A &gt; E)</li> <li>e' &lt; 7 cm/s</li> <li>Pressures: still normal</li> <li>Often no symptoms</li> </ul> | <ul style="list-style-type: none"> <li>E/A 0.8–2.0 (PSEUDONORMAL)</li> <li>e' low; LAVI &gt; 34</li> <li>Pressures: elevated</li> <li>Exertional dyspnea common</li> </ul> | <ul style="list-style-type: none"> <li>E/A &gt; 2.0 (E &gt;&gt; A)</li> <li>e' very low</li> <li>Pressures: markedly high</li> <li>Symptoms at rest</li> </ul> |



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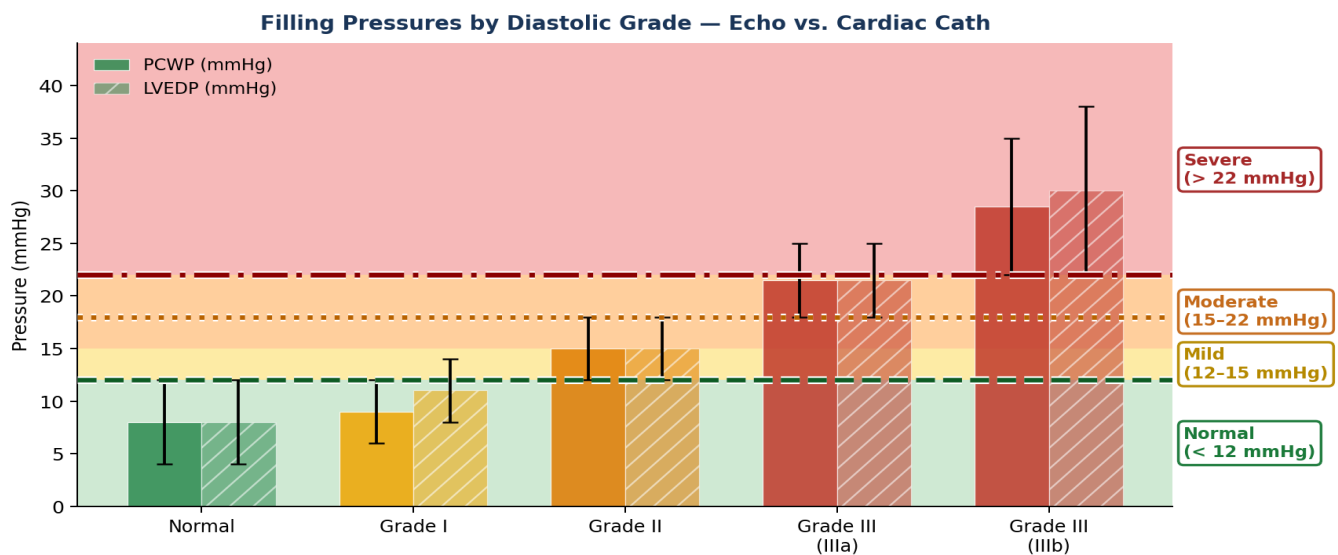
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## Why It Matters

- Diastolic dysfunction is the most common cause of HFpEF. HFpEF now accounts for about half of all heart failure admissions. Death rates are similar to the other type of heart failure (HFrEF).
- Higher grades mean worse outcomes. Grade III raises hospital and death risk on its own. This is true even when ejection fraction is normal.
- Many patients are told their ejection fraction is normal. They assume their heart is fine. But diastolic dysfunction can still cause symptoms.
- This condition is driven by high filling pressures. The chart below shows how pressures rise across grades. Crossing 12 mmHg moves from normal to concerning.
- The trials EMPEROR-Preserved and DELIVER showed SGLT2 inhibitors cut HFpEF admissions. These are the first drugs with proven benefit. Treatment is no longer just about symptoms.



*Filling pressures rise across grades. Above 12 mmHg is elevated. Above 18 mmHg is moderate. Grade III is above both lines.*



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### Grade I — Mild (Impaired Relaxation)

- Earliest form. The heart relaxes more slowly than normal.
- Filling pressures stay normal at rest. Most patients have no symptoms.
- About 1 in 5 adults over 45 have Grade I. Causes include aging, high blood pressure, and early structural changes.
- Often stable for years with good BP control, exercise, and weight management.

### Grade II — Moderate (Pseudonormal Pattern)

- Filling pressures begin to rise. The Doppler pattern can look normal — that is why it is called 'pseudonormal.'
- Tissue Doppler (e' below 7 cm/s) and an enlarged left atrium reveal the truth.
- Exertional shortness of breath and low exercise tolerance are common. Many HFpEF cases are first found at this grade.
- Treatment can move Grade II back toward Grade I. SGLT2i, BP control, and sleep apnea care all help.

### Grade III — Severe (Restrictive Filling)

- Filling pressures are high even at rest. The heart needs high pressure to accept blood.
- Symptoms appear at low effort: lying flat causes breathlessness, legs swell, fatigue is constant. Hospital and death risk are high.
- IIIa is partly reversible with diuresis and BP control. IIIb is largely fixed (amyloid, advanced restrictive disease).
- A heart failure specialist referral is appropriate. Treatment is more complex than early grades.



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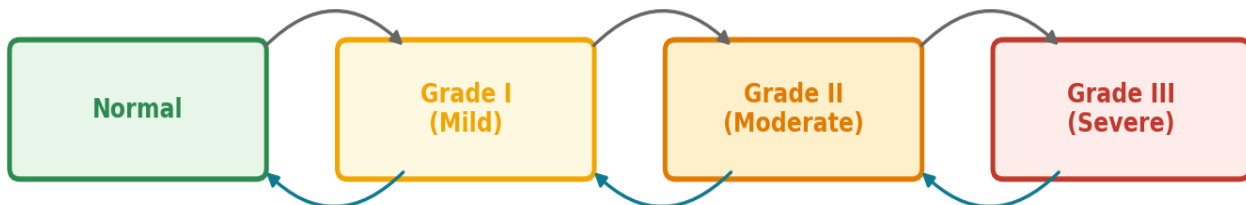


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## Treatment Options

- Control blood pressure to below 130/80. High blood pressure is the main driver of diastolic dysfunction. ACE inhibitors, ARBs, and ARNIs are common choices.
- Manage fluid with diuretics when filling pressures are high. Use smaller doses than in HFrEF. The stiff heart is sensitive to volume drops.
- Start an SGLT2 inhibitor (empagliflozin or dapagliflozin). Proven to cut HFpEF admissions. Works even without diabetes.
- Lose weight, cut salt, and exercise regularly. These lower filling pressures better than most drugs.
- Treat atrial fibrillation (AFib) if present. Losing the atrial kick is poorly tolerated. Rhythm control helps in some patients.
- Screen and treat sleep apnea. Untreated sleep apnea raises blood pressure at night and speeds up diastolic dysfunction.
- The diagram below shows that this condition can move both ways. It worsens without treatment. It can improve with the right care.

*Progression (untreated HTN, obesity, diabetes, AFib)*



*Improvement (BP control, weight loss, SGLT2i, diuresis, AFib treatment)  
Grade III→II possible if reversible (IIIa). Grade IIIb largely fixed.*

*Grades move both ways. With treatment, even Grade III can improve (if IIIa). Without treatment, Grade I drifts toward Grade III over years.*



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## What the Doppler Pattern Actually Looks Like

| Grade     | Doppler signature                   | What it means                                        |
|-----------|-------------------------------------|------------------------------------------------------|
| Normal    | E > A, tall and fast                | Heart fills easily; pressures normal.                |
| Grade I   | A > E (relaxation slow)             | Heart relaxes slowly but pressure stays normal.      |
| Grade II  | E about equal to A — looks 'normal' | PSEUDONORMAL. Pressures are rising despite the look. |
| Grade III | E >> A, very tall E                 | Restrictive — high pressure fills the heart fast.    |



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## Exercise-Induced Diastolic Dysfunction (EIDD)

- **Why this matters:** Up to **50% of HFpEF patients** have normal filling pressures at rest. Pressures only rise with effort. A normal resting echo does NOT rule out a diastolic problem.
- **What happens with exercise:** A normal heart relaxes faster with effort — the  $e'$  velocity rises 3–5 cm/s. In diastolic dysfunction,  $e'$  barely moves while E shoots up. The  $E/e'$  ratio rises, signaling high left atrial pressure.
- **Who needs the test:** patients with unexplained exertional shortness of breath AND Grade I at rest, an uncertain grade, or an echo that does not match symptoms.
- **How it's done:** a resting echo is done first. Then you exercise on a bike or treadmill. Echo images are taken right at peak effort or within 1–2 minutes after stopping. The whole test takes 30–45 minutes.
- **POSITIVE result:** average  $E/e'$  of 14 or higher (or septal  $E/e'$  of 15 or higher) AND peak TR velocity above 3.2 m/s. This confirms HFpEF.
- **NORMAL result:** average  $E/e'$  below 10 AND peak TR velocity below 2.8 m/s. EIDD is unlikely. Look for other causes such as deconditioning, lung disease, or anemia.
- **INDETERMINATE result:** values in between, or mixed findings. Next step is invasive testing — a right heart catheter with exercise. PCWP above 25 mmHg with effort (or above 15 mmHg at rest) is the gold standard.
- **What to expect:** EKG and blood pressure cuff throughout. Brief breath-holds for imaging. Bike workload rises slowly. Feeling breathless is expected — that is what the test measures.
- **After a positive result:** we treat as HFpEF. Start an SGLT2 inhibitor, tighten BP, address weight, sleep apnea, and AFib. Symptoms often improve within 3–6 months.



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## Risks, Benefits, and Alternatives

Every choice has trade-offs. Use this table to start the shared decision conversation.

| Option                                                     | Risks                                                                          | Benefits                                                                                                          | Alternatives                                                                                         |
|------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Blood pressure control (goal < 130/80)                     | Dizziness, kidney changes, salt shifts. May need more than one drug.           | Slows heart stiffening. Eases symptoms. Lowers AFib risk.                                                         | Looser BP goal (frail elderly). Single drug (often not enough).                                      |
| SGLT2 pill (empagliflozin or dapagliflozin)                | Yeast infections, dehydration with water pills, rare ketoacidosis. Cost.       | Cuts HFpEF hospital stays by ~21% (EMP EROR-Preserved, DELIVER). Works with or without diabetes. Once-daily pill. | Lifestyle alone (mild Grade I). Spironolactone (some benefit in HFpEF, TOPCAT).                      |
| Water pill (loop or thiazide diuretic)                     | Dehydration, kidney changes, low potassium. Too much dries the heart out fast. | Relieves shortness of breath and swelling when filling pressure is high.                                          | Watchful waiting (mild symptoms). SGLT2 pill alone (similar benefit, less volume shift).             |
| Sleep apnea treatment (CPAP or other)                      | Mask discomfort, adherence issues. Setup cost.                                 | Lowers nighttime BP. Cuts AFib burden. May slow heart stiffening.                                                 | Weight loss and positional therapy (mild OSA). Mouth guard. Inspire implant (selected patients).     |
| AFib treatment (rate control, rhythm control, or ablation) | Drug side effects. Ablation risk ~1–2%. Bleeding from blood thinners.          | Restoring normal rhythm often helps a lot. Ablation benefit seen in selected patients.                            | Rate control only (if normal rhythm is not possible). No treatment (only if no symptoms and stable). |



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## Common Misconceptions

| Myth                                                                 | Reality                                                                                                                                                                                                      |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| My ejection fraction is normal, so my heart is fine.                 | EF only measures the squeezing phase. Diastolic dysfunction affects the filling phase. A normal EF does not rule out a heart problem. It is a separate, common cause of heart failure symptoms.              |
| Grade I means I have heart failure.                                  | Grade I is common — about 1 in 5 adults over 45 have it. It is usually not heart failure on its own. It can progress. It is a signal that risk factors are starting to affect the heart.                     |
| There's nothing you can do about diastolic dysfunction.              | This was true a decade ago. Not anymore. SGLT2 inhibitors have proven benefit in HFpEF. BP control, weight loss, sleep apnea treatment, and AFib care all change the course.                                 |
| I'm too young to have diastolic dysfunction.                         | Most cases are in adults over 45. But diabetes, high blood pressure, and obesity can speed it up at any age. Age alone does not rule it out.                                                                 |
| Diuretics will fix this.                                             | Diuretics ease symptoms. They do not fix the root problem. Used alone, they can over-dry the heart and worsen function. They are one tool, not the cure.                                                     |
| If my echo says 'Grade II — pseudonormal,' my heart is normal again. | Pseudonormal means the Doppler looks normal on the surface. But filling pressures are already elevated. It is worse than Grade I. Tissue Doppler and LAVI reveal the truth. Do not be reassured by the name. |
| Exercise is dangerous for me.                                        | The opposite is true. Supervised exercise is one of the best tools for diastolic dysfunction. It improves filling, lowers blood pressure, and cuts symptoms. Cardiac rehab fits many patients.               |
| Diastolic dysfunction is just normal aging.                          | Aging plays a role. But most cases are driven by high blood pressure, diabetes, obesity, and sleep apnea. Most adults can do better than they think with the right changes.                                  |

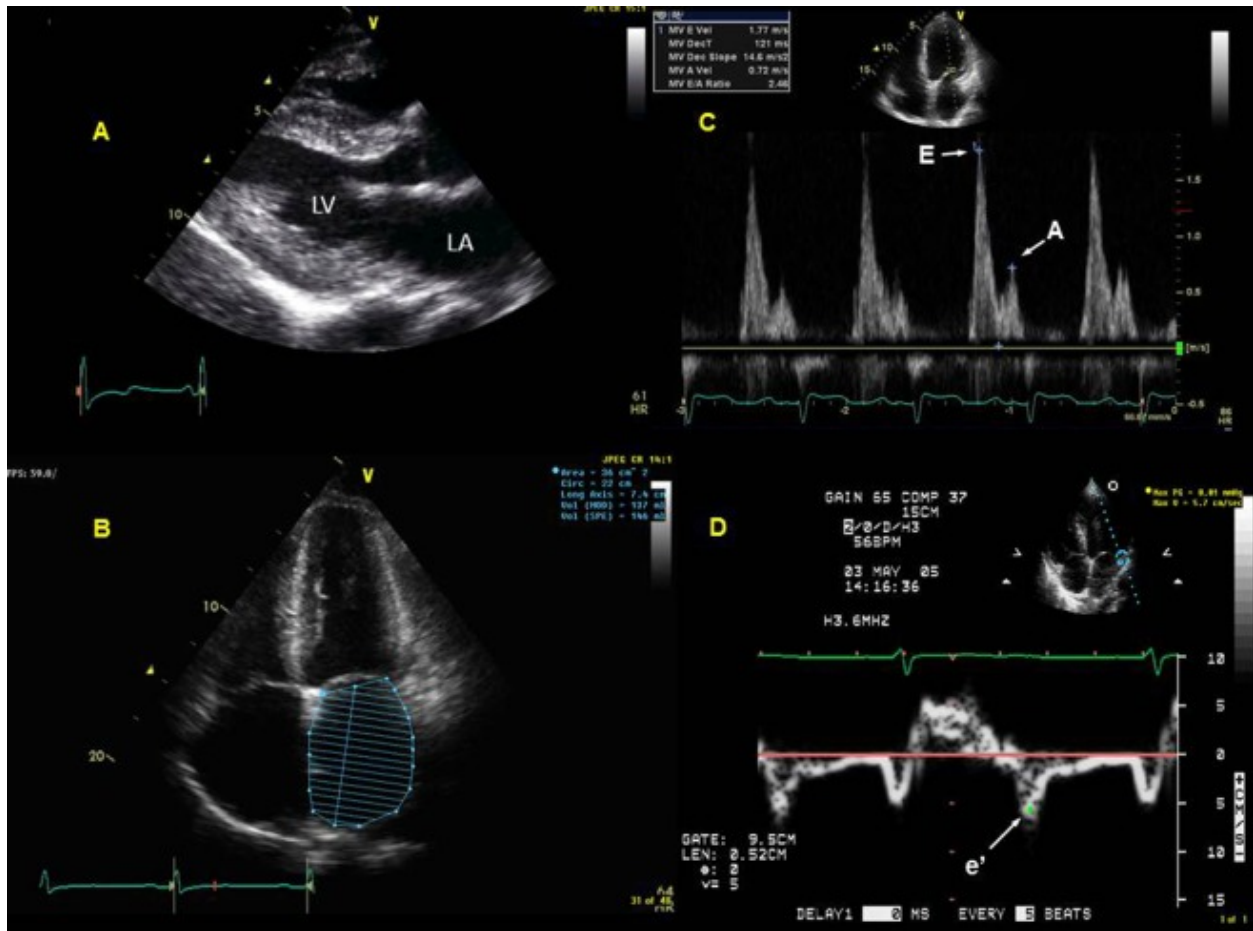


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A real patient's echocardiogram, not a drawing. Panel A: the thickened (hypertrophied) heart wall from years of high blood pressure. Panel B: the enlarged left atrium (blue outline) that forms when filling pressure stays high. Panel C: the mitral inflow Doppler trace — the tall E wave and small A wave ( $E/A = 2.46$ ) are the restrictive pattern of Grade III. Panel D: tissue Doppler at the mitral ring shows a low  $e'$  velocity (5.7 cm/s), confirming the heart muscle relaxes poorly. Image: Dokainish, Global Cardiology Science & Practice 2015 (CC BY 4.0).



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## Possible Complications

Knowing what can go wrong helps you spot problems early. Most complications are uncommon, especially with treatment.

| Where / What                                | What Can Happen                                                                                                                                                                                                              |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HFpEF (heart failure with normal EF)        | When diastolic dysfunction causes symptoms — shortness of breath, fatigue, fluid retention — the diagnosis is HFpEF. It now accounts for half of all heart failure stays. Death rates match the other type of heart failure. |
| Atrial fibrillation (AFib)                  | High left atrial pressure enlarges the atrium and triggers AFib. AFib then makes filling even worse. Stroke risk rises too.                                                                                                  |
| High lung pressure (pulmonary hypertension) | High filling pressures back up into the lungs. This raises lung blood pressure. It worsens breathing and limits exercise.                                                                                                    |
| Sudden fluid overload (decompensation)      | A stiff heart can shift fast from stable to severe fluid buildup. Even small triggers set it off: high BP, AFib, too much salt, or missed pills. IV water pills in the hospital are often needed.                            |
| Poor exercise tolerance                     | Filling pressures spike with even light activity. Patients get short of breath more than expected. Cardiac rehab can help a lot.                                                                                             |
| Progression to mixed dysfunction            | Some patients later develop low ejection fraction as well. Risk is higher with poor BP control, diabetes, and repeat hospital stays. Good risk-factor care slows this.                                                       |



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## Points to Know

If you remember nothing else, remember these key points.

- A normal ejection fraction does NOT rule out heart failure. Diastolic dysfunction is a separate, common cause.
- Grade matters. Grade I is usually mild. Grades II and III often mean HFpEF and need active treatment.
- Blood pressure control is the most powerful tool. Aim for below 130/80 if tolerated.
- SGLT2 inhibitors (empagliflozin, dapagliflozin) have proven benefit in HFpEF. Ask if you qualify.
- AFib is especially harmful with diastolic dysfunction. Restoring normal rhythm often helps a lot.
- Untreated sleep apnea worsens diastolic function. Get tested if you snore or wake unrefreshed.
- Weight loss lowers filling pressures better than most medications.
- Get an echo every 1–2 years. Diastolic function changes over time.



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## When to Call Us - and When to Call 911

If you are not sure, call. We would rather hear from you twice than miss a real problem.

- New or worsening shortness of breath, especially when lying flat — call us today.
- Sudden swelling of legs, ankles, or abdomen — call us today.
- Weight gain over 3 lb in 2 days, or 5 lb in a week — call us today.
- New palpitations or irregular heartbeat — call us this week (possible AFib).
- Inability to sleep flat — call us today.
- Chest pain or pressure — call 911.
- Fainting or near-fainting — call us today; severe cases call 911.
- Need to use 2+ pillows or sleep upright at night — call us this week.

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## Trusted Resources

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The links below are the trusted resources Dr. Ali used to write this guide and that he recommends you visit for more information. Each is a clickable link in the digital version and a Short.io tracked URL on the printed version.

- [Cleveland Clinic — Diastolic Dysfunction](#) - Patient-friendly overview of diastolic dysfunction, grading, and management.
- [Mayo Clinic — Heart Failure](#) - Comprehensive heart failure guide covering HFpEF and diastolic dysfunction in plain language.
- [American Heart Association — Heart Failure](#) - AHA patient education hub for heart failure, including HFpEF.
- [AAFP — Diagnosis and Evaluation of Heart Failure](#) - Primary-care framework for diagnosing heart failure including diastolic dysfunction.



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## Sources Used to Build This Guide

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Every recommendation in this guide is grounded in one or more of the studies, guidelines, or trusted resources below. Short links are tracked so Dr. Ali can see which references patients are reading; nothing personally identifying is captured.

- [Nagueh SF et al. Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography \(JASE 2016\) \[Guideline\]](#)  
Current ASE/EACVI consensus grading framework: 4 parameters ( $e'$ ,  $E/e'$ , LAVI, TR velocity) and 4-step algorithm for diagnosing and grading diastolic dysfunction.
- [Redfield MM et al. Burden of Systolic and Diastolic Ventricular Dysfunction in the Community \(JAMA 2003\) \[Epidemiological Study\]](#)  
Community prevalence data: grade I diastolic dysfunction in ~21% of the general population; grade II-III in 6.6%; most are asymptomatic.
- [Borlaug BA, Paulus WJ. Heart Failure with Preserved Ejection Fraction: Pathophysiology, Diagnosis, and Treatment \(Eur Heart J 2011\) \[Review\]](#)  
Pathophysiology of elevated filling pressures in HFpEF — the downstream consequence of advanced diastolic dysfunction; hemodynamic correlation framework.
- [Ommen SR et al. Clinical Utility of Doppler Echocardiography and Tissue Doppler Imaging in the Estimation of Left Ventricular Filling Pressures \(Circulation 2000\) \[Prospective Study\]](#)  
Original validation of  $E/e'$  ratio vs invasive PCWP/LVEDP —  $E/e' > 15$  correlated with PCWP > 15 mmHg; foundational for echo-cath hemodynamic correlation.
- [Lancellotti P et al. European Association of Cardiovascular Imaging — Recommendations for the Echocardiographic Assessment of Diastolic Function \(Eur Heart J Cardiovasc Imaging 2017\) \[Guideline\]](#)  
EACVI companion to 2016 ASE guidelines; grading algorithm, parameter cut-offs, and clinical integration recommendations.
- [Zile MR, Brutsaert DL. New Concepts in Diastolic Dysfunction and Diastolic Heart Failure \(Circulation 2002\) \[Review\]](#)  
Physiological basis of diastolic dysfunction: impaired active relaxation (Grade I) vs elevated passive stiffness (Grade III); separates reversible from fixed dysfunction.
- [Dokainish H et al. Incremental Predictive Power of B-Type Natriuretic Peptide and Tissue Doppler Echocardiography in the Prognosis of Patients with Congestive Heart Failure \(JASE 2005\) \[Prospective Cohort\]](#)  
Prognostic data for diastolic dysfunction grades — Grade III associated with highest event rates (hospitalization, mortality) independent of EF.
- [Owan TE et al. Trends in Prevalence and Outcome of Heart Failure with Preserved Ejection Fraction \(NEJM 2006\) \[Cohort\]](#)  
Natural history data: HFpEF (driven by diastolic dysfunction) prevalence is rising, mortality comparable to HFrEF; Grade matters for prognosis.
- [Borlaug BA et al. Global Cardiovascular Reserve Dysfunction in Heart Failure with Preserved Ejection Fraction \(JACC 2010\) \[Prospective Study\]](#)  
Invasive hemodynamic data during exercise in HFpEF — PCWP rises excessively with exercise even when resting pressures are normal (Grade II correlate).



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- [Shah AM et al. Cardiac Structure and Function in Heart Failure with Preserved Ejection Fraction \(Circ Heart Fail 2014\) \[Cohort\]](#)  
LAVI and e' as structural markers of chronically elevated filling pressure; supports use in staging diastolic dysfunction grade.
- [AHA/ACC 2022 Guideline for the Diagnosis and Management of Heart Failure \[Guideline\]](#)  
Current treatment recommendations tied to diastolic dysfunction and HFpEF; clinical management framework referenced in treatment section.



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**Reviewer note:** Reviewed: Cleveland Clinic, Mayo Clinic, AHA, ASE patient pages. This guide adds a 4-panel Doppler chart, grade comparison table, per-grade deep dives, a filling-pressure chart, a progression flowchart, and an RBA section using EMPEROR-Preserved and DELIVER data.

### Disclaimer

This guide is for educational purposes only and does not replace medical advice from your physician. Recommendations may not apply to every patient. Always follow the specific instructions of Dr. Ali and your care team. In an emergency call 911 or go to the nearest emergency department.



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