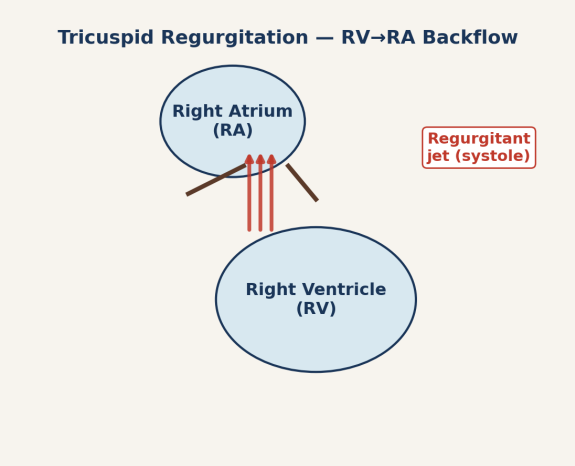
Understanding Tricuspid Regurgitation

The forgotten valve — when the tricuspid leaks and how we fix it

Most TR is secondary — fix the root cause first. New transcatheter options (TriClip, EVOQUE) for severe symptomatic TR.



Online: https://go.riasalimd.com/tr-guide

Rias KS Ali, MD FACC

Board Certified in Interventional Cardiology & Cardiovascular Disease

4740 Mile Stretch Drive, Holiday FL 34690 | Office: (727) 943-5200 | Fax: (727) 943-5201 | RiasAliMD.com

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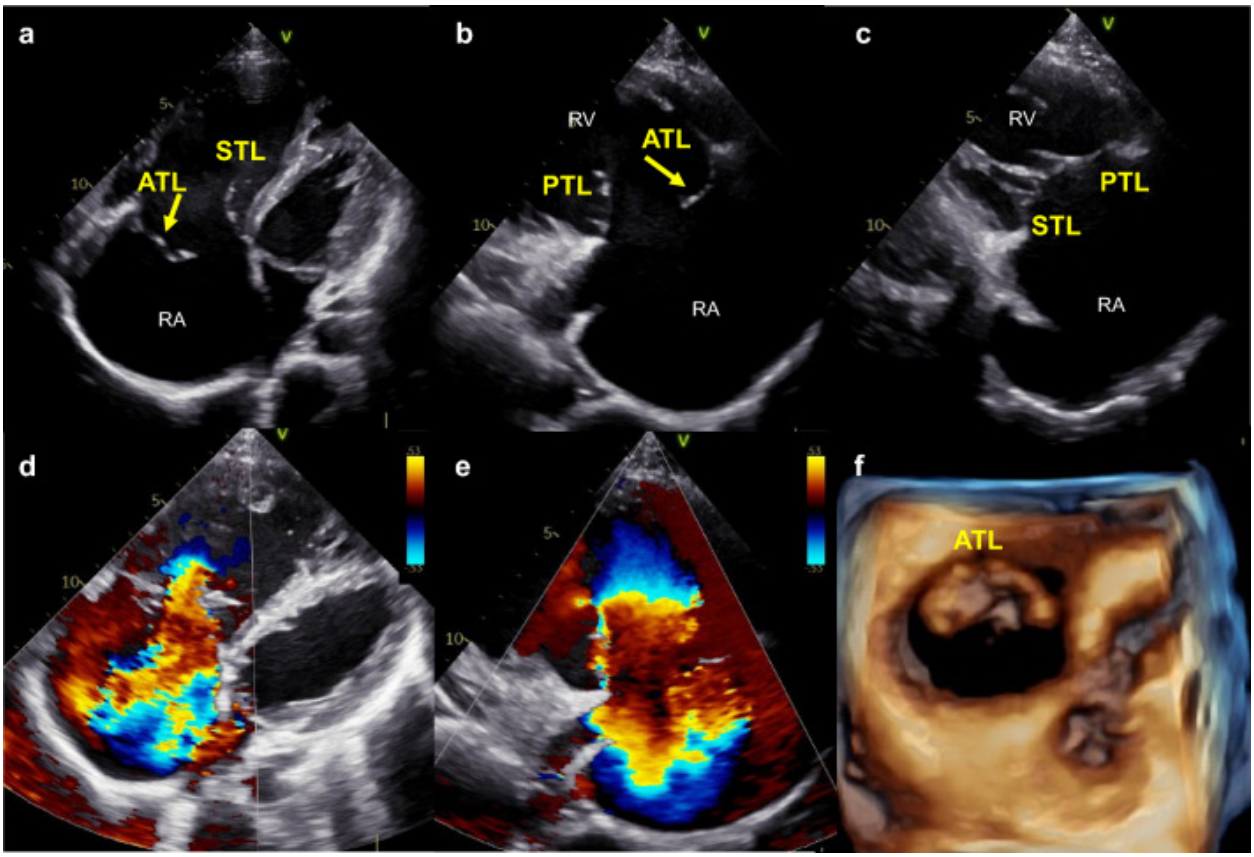
Names & Terms You Will Hear

Term	Meaning
TR (tricuspid regurgitation)	Blood leaks backward from the right ventricle (RV) into the right atrium (RA) when the tricuspid valve doesn't close fully.
Tricuspid insufficiency (TI)	Older term for the same condition.
Primary TR	The valve itself is abnormal. Causes include rheumatic disease, endocarditis, Ebstein anomaly, carcinoid, and pacemaker lead damage.
Secondary / functional TR	The valve is normal, but the RV or annulus has dilated. This is the MOST COMMON FORM.
Atrial functional TR (newer entity)	Chronic AFib causes RA dilation, which stretches the valve ring. The RV may be normal. Rhythm control often helps.
Ventricular functional TR	RV dilation from PHT, LV failure, or prior heart attack stretches the annulus. The leaflets can't reach each other.
TriClip (TEER for TV)	A clip device that repairs the tricuspid leaflets through a catheter. FDA-approved in 2024.
EVOQUE	A device that replaces the tricuspid valve through a catheter — no open-chest surgery. FDA-approved in 2024.
Massive / Torrential TR	The two most severe grades in the Hahn 5-tier scheme. These patients have the highest unmet need.

What Is Tricuspid Regurgitation?

- The tricuspid valve sits between the right atrium and right ventricle. It opens to let blood fill the RV. It closes when the RV squeezes to push blood to the lungs.
- In TR, the valve doesn't close fully. Blood leaks BACKWARD from the RV into the RA with each heartbeat.
- **~80% of significant TR is SECONDARY/FUNCTIONAL** — the valve itself is normal. The heart around it has changed. Causes include RV dilation from pulmonary hypertension, LV failure, or RA dilation from chronic AFib.
- A newer type: **atrial functional TR**. Chronic AFib stretches the right atrium. This stretches the valve ring. The leaflets can't meet. Rhythm control often helps a lot.
- **Primary TR** (~20% of cases) means the valve itself is diseased. Causes include endocarditis, rheumatic fever, carcinoid syndrome, Ebstein anomaly, blunt trauma, or pacemaker lead damage.
- Hahn 2017 expanded severity to 5 tiers: mild, moderate, severe, MASSIVE, TORRENTIAL. This matters for treatment decisions and prognosis.



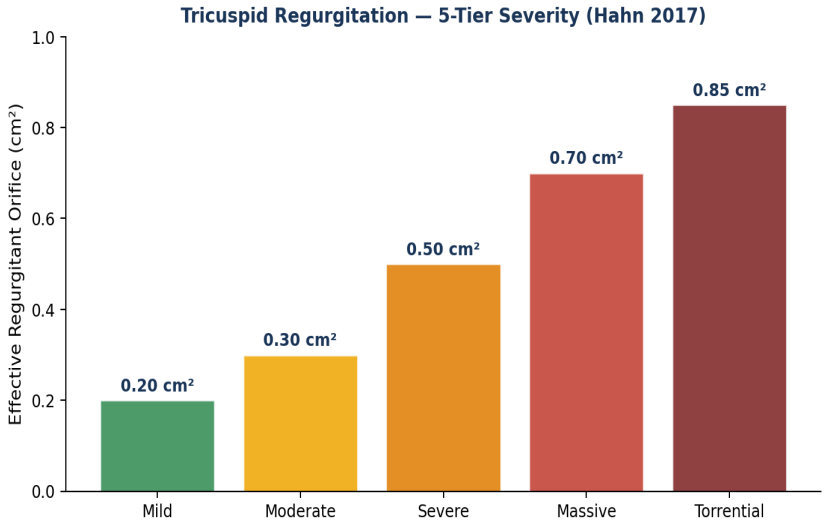
A real echocardiogram showing severe tricuspid regurgitation. Top row (a-c): standard grayscale views of the tricuspid leaflets. Bottom row (d, e): color Doppler in the apical 4-chamber view — the mosaic of red/orange/blue is the regurgitant jet leaking backward into the right atrium. Panel f: a 3D reconstruction of the valve. Image: Nishihara et al., Journal of Medical Ultrasonics 2024 (CC BY 4.0).

The 4 TR Etiology Categories

Primary TR	Ventricular functional	Atrial functional	Pacemaker-lead-related
• Valve itself diseased	• ~50% — most common	• ~25% — increasing recognition	• ~5% — under-recognized
• ~20% of significant TR	• RV dilation from PHT/LV failure	• Chronic AFib leads to annular dilation	• Lead impingement on leaflets
• Endocarditis, rheumatic, congenital	• Treat PHT + LV failure first	• RHYTHM CONTROL is the key	• Lead extraction or repositioning
• Often needs valve intervention	• TriClip if persists	• Often improves dramatically	• Leadless Micra at replacement

Why It Matters

- Severe TR raises mortality risk — INDEPENDENT of the underlying cause. Even when LV function and lung pressures are factored in, severe TR still adds risk.
- The most common symptoms are RIGHT-sided: leg swelling, abdominal bloating, enlarged liver, and neck vein distension (JVD). Many patients are told they have 'water retention' for years before TR is found.
- **The mortality data:** 5-year mortality for severe untreated TR is ~30-40%. This is why new treatments are needed.
- **Cardiorenal and cardiohepatic syndrome:** high RA pressure backs up into the kidneys and liver. This impairs organ function. Treating TR often reverses some of this damage.
- Until recently, surgery was the only fix. But isolated TV surgery had high mortality (~8-10%). Patients often came in late — with an already-weakened RV.
- **2024 transcatheter revolution:** TriClip (TEER) and EVOQUE (TTVR) are both FDA-approved in 2024. They offer lower-risk options for severe symptomatic TR.



The expanded 5-tier scheme (Hahn et al., JASE 2017) recognizes that 'severe' TR spans a wide range — massive and torrential identify the patients who benefit most from emerging transcatheter therapies.

Hahn 2017 expanded the old 3-tier scale (mild/moderate/severe) to 5 tiers. 'Massive' (ERO 0.6-0.78 cm²) and 'Torrential' (ERO 0.79 cm² or higher) are the new top tiers. These patients have the greatest unmet need. They also benefit most from new transcatheter therapies.

Treatment Options

- **For SECONDARY/FUNCTIONAL TR, treat the cause FIRST:** manage AFib with rate or rhythm control. Optimize LV failure with GDMT for HFrEF. Treat pulmonary hypertension if present. Many cases improve a lot without touching the valve.
- **Diuretics** for congestion symptoms — loops like furosemide, torsemide, or bumetanide. Adding an MRA like spironolactone gives extra benefit.
- **If severe TR and symptoms persist after full optimization:** move to transcatheter or surgical treatment.
- **TriClip (TEER):** FDA-approved 2024 for severe symptomatic TR. A catheter delivers 1-4 clips to grasp the leaflet edges. This shrinks the regurgitant opening. TRILUMINATE Pivotal trial supports use.
- **EVOQUE (TTVR):** FDA-approved 2024 for tricuspid valve replacement through a catheter. Used when repair is not possible. TRISCEND II trial. More centers are offering this.
- **Surgical repair or replacement:** best when TR is fixed at the same time as another heart operation (for example, mitral surgery). Isolated TV surgery alone has high historical mortality.
- **Pacemaker-lead-related TR:** if a pacemaker lead is causing TR, consider lead extraction, repositioning, or switching to a leadless pacemaker (Micra).

TR Etiology — The Four Categories Matter for Treatment

Category	Mechanism	First-Line Approach
Primary TR (~20%)	Valve itself abnormal: rheumatic, endocarditis, carcinoid, Ebstein, trauma	Treat infection / consider surgical or transcatheter repair
Ventricular functional TR (~50%)	RV dilation from PHT, LV failure, post-MI	Treat the LV / PH; diuretics; TriClip if persistent
Atrial functional TR (~25%)	RA dilation from chronic AFib leads to annular dilation	Rhythm control; rate control; TR often improves substantially
Pacemaker-lead-related TR (~5%)	Lead impingement on valve / leaflet damage	Lead repositioning or extraction; leadless pacer (Micra) for replacement

Transcatheter Options — The 2024 Revolution

- **TriClip (T-TEER):** FDA-approved April 2024 for severe symptomatic TR. A catheter delivers 1-4 clips through a vein in the leg. The clips grasp the leaflet edges and reduce the backflow opening. The TRILUMINATE Pivotal trial showed major quality-of-life gains at 1 year.
- **EVOQUE (TTVR):** FDA-approved 2024 for tricuspid valve replacement through a catheter. Used when repair is not possible — for example, poor leaflet anatomy or a prior failed clip. Self-expanding bioprosthesis. Supported by the TRISCEND II trial.
- **How they compare to surgery:** isolated surgical TV replacement has high historical mortality (~8-10%). Patients often come in late with a weak RV. Transcatheter options carry lower risk. They also allow earlier treatment.
- **Who is eligible:** severe TR with symptoms despite full medical treatment, suitable anatomy on TEE/CT, and surgery risk that is too high. A multi-disciplinary heart team decides.
- **What to expect:** access through a leg vein — no chest incision. Sedation or general anesthesia. Hospital stay of 1-3 days. After the procedure: short-term blood thinners and antiplatelet drugs per protocol. Lifelong follow-up TEE imaging.

Right-Heart Failure Symptoms — What to Watch For

- **Leg swelling (peripheral edema):** usually starts at the ankles. It moves up the calves and then the thighs. Pressing the skin leaves a 'pit' for several seconds.
- **Abdominal swelling (ascites):** fluid builds in the belly. This causes fast weight gain and a sense of fullness even with small meals.
- **Enlarged liver + right-side belly pain:** the liver swells from venous congestion. It is often tender on exam.
- **Neck vein distension (JVD):** the veins in your neck look engorged. Doctors check this at every visit. It signals high right-sided pressures.
- **Fatigue + reduced exercise tolerance:** the failing RV cannot push enough blood to the lungs. Even light activity feels hard.
- **Poor appetite + early fullness:** from liver and bowel congestion. Weight LOSS despite fluid buildup is a warning sign called cardiac cachexia.

Treat the cause first. About 80% of significant TR is secondary (functional). The first step is almost never the valve. It is the AFib, LV failure, pulmonary hypertension, or pacemaker lead that is causing the problem. Many patients improve from severe to moderate TR — or better — just by treating the root cause. Valve treatment is reserved for severe TR that stays symptomatic after full medical optimization.

Risks, Benefits, and Alternatives

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

Option	Risks	Benefits	Alternatives
Medical therapy + treat underlying cause (functional TR)	Does not directly fix the valve. May not fully relieve symptoms.	Often improves TR a lot. No procedural risk. First-line for ALL functional TR.	Transcatheter or surgical treatment if symptoms stay after optimization.
TriClip / T-TEER (transcatheter edge-to-edge repair)	Complications ~3-5%. Residual TR is common. Long-term durability is still being studied.	Significant symptom relief. Lower risk than surgery. FDA-approved 2024 for severe symptomatic TR.	EVOQUE (TTVR), surgical TV repair, or medical therapy alone.
EVOQUE TTVR (transcatheter tricuspid valve replacement)	Newer device. Long-term outcome data are limited. Anticoagulation is required. Anatomy must be suitable.	Replaces the valve without open-chest surgery. For TR that cannot be repaired.	TriClip (repair), surgical TVR, or medical therapy.
Surgical tricuspid repair (annuloplasty) +/- replacement	Mortality for isolated TV surgery is historically 8-10%. Patients often arrive with advanced disease. Better outcomes when done with another heart procedure.	Durable long-term result. Standard of care when done with other heart surgery.	Transcatheter options (preferred for isolated severe TR in high-risk patients) or medical therapy.
Lead extraction or leadless pacemaker (for p acemaker-lead-r elated TR)	Lead extraction carries ~1-2% major risk. Needs a specialized center.	Removes the cause. Many patients see major TR improvement.	Lead repositioning or valve-directed treatment.

Common Misconceptions

Myth	Reality
TR is harmless — only mitral and aortic regurgitation matter.	Not true. Severe TR carries 5-year mortality ~30-40%. This rivals many cancers. The risk is independent of LV function. New treatments exist because TR is NOT benign.
If my echo says 'mild TR,' I have heart valve disease.	Trace-to-mild TR is normal. Most healthy people have it. It only becomes a problem at moderate or worse — and only when symptoms or anatomic harm appear.
Treating my AFib won't help my TR.	Often the opposite is true. Atrial functional TR comes from chronic AFib stretching the RA. When sinus rhythm returns or rate is well-controlled, TR often improves a lot. Rhythm control is the first step for atrial functional TR.
I need surgery for severe TR.	Not always. Transcatheter options (TriClip, EVOQUE) are often the right answer for isolated severe TR — especially in older or higher-risk patients. Surgery works best when TR is fixed alongside another heart operation.
My pacemaker can't be causing TR.	It can. About 10-30% of patients with transvenous pacemakers develop new or worsened TR from lead impingement. If TR started after pacemaker placement, lead-related damage is on the list — and may be reversible.
Diuretics fix TR.	Diuretics ease CONGESTION symptoms like swelling and shortness of breath. They do not reduce the backflow itself. Diuretics help with comfort but do not change the course of severe TR.

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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
Right-sided heart failure	Chronic severe TR overloads the RV. Over time, the RV dilates and fails. Symptoms include leg edema, ascites, hepatomegaly, and fatigue. Diuretics and treating the TR cause are the main treatments.
Cardiorenal syndrome	High RA pressure backs up into the renal veins. This causes venous congestion in the kidneys. GFR drops. This often improves with diuretics or TR treatment.
Cardiohepatic syndrome / congestive hepatopathy	High pressure in the liver veins causes transaminitis and high bilirubin. Over time it can cause scarring (cardiac cirrhosis). Early damage is reversible. Late damage is not.
Atrial fibrillation	RA dilation from chronic TR raises AFib risk. AFib then makes TR worse by stretching the annulus more. Rhythm control breaks this cycle for many patients.
Pulmonary embolism / DVT	Slow venous flow from high RA pressure raises clot risk. Some patients need long-term anticoagulation.
Sudden cardiac death (rare)	Severe RV dilation can trigger arrhythmias. This is rare but has been reported in advanced disease.

Points to Know

If you remember nothing else, remember these key points.

- ~80% of clinically significant TR is secondary/functional — treat the underlying cause FIRST.
- Newer entity: atrial functional TR from chronic AFib — often improves with rhythm control.
- Severity has 5 tiers now (Hahn 2017): mild / moderate / severe / massive / torrential.
- Severe untreated TR has 5-year mortality ~30-40% — independent of LV function.
- TriClip (TEER) was FDA-approved in 2024 for severe symptomatic TR.
- EVOQUE (TTVR) FDA-approved 2024 for selected severe TR not suitable for repair.
- Pacemaker leads can cause TR — consider leadless options (Micra) at next replacement.
- Symptoms are usually RIGHT-sided HF: leg swelling, abdominal distension, hepatomegaly, JVD.

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.

- Rapidly worsening leg swelling, especially with weight gain > 3 lb in 2 days — call us today.
- New abdominal swelling, right-upper-quadrant pain, or yellowing of the eyes (jaundice from hepatic congestion) — call us this week.
- Shortness of breath with exertion that's getting worse over weeks — call us this week.
- Lightheadedness or fainting — call us today.
- Palpitations or new irregular heartbeat — call us this week (AFib worsens TR).
- Fever + heart murmur or new symptoms after dental work/IV drug use — call us today (rule out endocarditis).
- Dramatic decrease in urine output despite normal fluid intake — call us today (cardiorenal).
- Chest pain at rest or new severe shortness of breath — call 911.

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Trusted Resources

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 — Tricuspid Valve Regurgitation - Patient-friendly overview of TR causes, symptoms, and treatment.
- Mayo Clinic — Tricuspid Valve Regurgitation - Mayo patient guide covering diagnosis + treatment options.
- AHA — Heart Valve Problems and Disease - AHA hub on valve disease including TR.
- MedlinePlus — Tricuspid Regurgitation - NIH/NLM plain-language reference.
- Abbott Structural Heart — TriClip - Manufacturer's professional + patient info on the TriClip TEER device.

Sources Used to Build This Guide

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.

- 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease (Otto et al.) *[Guideline]*
  Primary US guideline framework for TR severity grading, etiology classification, and intervention timing.
- 2021 ESC/EACTS Guidelines for the Management of Valvular Heart Disease (Vahanian et al.) *[Guideline]*
  European VHD framework with TR-specific intervention recommendations.
- TRILUMINATE Pivotal — Transcatheter Repair for Severe TR (Sorajja et al., NEJM 2023; PMID 36876756) *[Clinical Trial]*
  Pivotal trial of TriClip TEER vs medical therapy in severe symptomatic TR — basis for FDA approval 2024.
- TRISCEND II Pivotal — EVOQUE TTVR in Severe TR (NEJM 2024) *[Clinical Trial]*
  Pivotal trial of EVOQUE transcatheter tricuspid valve replacement — basis for FDA approval 2024.
- Proposal for Expanded TR Grading Scheme (Hahn & Zamorano, JASE 2017) *[Guideline]*
  Defines the 5-tier TR severity scheme (mild/moderate/severe/MASSIVE/TORRENTIAL) now used in trials and clinical practice.
- Topilsky et al. — Tricuspid Regurgitation Prevalence and Outcomes (JACC Cardiovasc Imaging 2014) *[Review]*
  Landmark epidemiology + mortality data on TR — establishes the prognostic significance independent of LV function.
- Cleveland Clinic — Tricuspid Valve Regurgitation *[Clinical]*
  Patient-friendly overview.
- Mayo Clinic — Tricuspid Valve Regurgitation *[Clinical]*
  Mayo patient guide.
- AHA — Heart Valve Problems and Disease *[Clinical]*
  AHA patient-facing hub for valve disease including TR.

About This Guide

Rias KS Ali, MD FACC | Board Certified in Interventional Cardiology & Cardiovascular Disease

4740 Mile Stretch Drive, Holiday FL 34690 | Office: (727) 943-5200 | Fax: (727) 943-5201 | RiasAliMD.com

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Reviewer note: Reviewed against AHA, Cleveland Clinic, Mayo Clinic, and Hahn 2017 5-tier classification. Ours adds the modern functional-vs-primary framework, the new transcatheter options (TriClip TEER, EVOQUE valve replacement), and the 5-tier severity scheme including massive + torrential grades.

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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